# UTCC International Journal of Business and Economics

IJBE

Volume 2 Number 2, December 2010




SCHOOL OF BUSINESS

SCHOOL OF ECONOMICS

SCHOOL OF ACCOUNTANCY


**Supported by**

University of the Thai Chamber of Commerce

TMA
Thailand Management Association

Kellogg College, University of Oxford

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# Editorial

Welcome to the fourth 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), as well as the sponsorship of the Kellogg College, University of Oxford 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 fourth 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
Gilbert Nartea
Wuyi Zhang
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, Chacheongsao Province, JWD InfoLogistics, and TKL Logistics.

Dr. Gilbert Nartea is an Associate Professor in the Faculty of Commerce, Lincoln University, New Zealand. Dr. Nartea graduated a Master's Degree from New England and a Ph.D. from Illinois, USA. He is a senior lecturer in Finance. His teaching interests are in the area of investments, futures and options, and finance, futures and options. The area of research interests area asset pricing, investment management, decision-analysis and risk management, and microfinance and poverty alleviation. He has published several papers in such journals as of Property Investment and Finance, International Journal of Managerial Finance, Asian Journal of Business and Accounting, Australian Journal of Agricultural and Resource Economics, Pacific Rim Property Research Journal, Review of Applied Economics, Review of Development Cooperation, American Journal of Agricultural Economics, and Journal of the American Society of Farm Managers and Rural Appraisers.

Dr. Zhang, a Professor of Quality Institute of Kunming University of Science and Technology, teaches the courses on supply chain management, marketing, and modern logistic management. His research has focused on the logistics and supply chain management. Prof. Zhang published more than 20 papers; major works include "Supply Chain and Marketing Research", "Theory and Methods Town Economy Planning", or "The Knowledge Flow Management Model of Supply Chain". He has consulted for several public organizations and industrial firms on supply chain, logistics network, marketing, knowledge management, etc. Prof. Zhang primarily supervises undergraduate, master's, and doctoral students research in the area of modern logistics management, marketing, and other related disciplines.

# Foreword

Welcome to the 2nd edition of the 2nd volume of the UTCC International Journal of Business and Economics (UTCC IJBE), the Editors received a number of papers from different countries such as Australia, Bangladesh, India, Indonesia, Switzerland, Thailand, Uganda, 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 is authored by ***Baris Bicimseven***, and is entitled ***"Organization Wide Customs Risk Management within The Framework of Enterprise Risk Management"***. The paper provides customs practitioners around the world with a framework ready to adapt to establish their own "strategic CRM agenda". Furthermore, the findings of this study contribute to ease the design/application of ERM solutions in public sector. Applying the well established ERM approach on customs administrations to analyze the risk management maturity level opens a new research avenue and practical implication to further develop and improve customs procedures and operations.

Article number two is conducted by ***Benjamin Botchway***. His paper is entitled ***"Critical Factors of Logistics and Distribution Network Redesign in an Indonesian Food Manufacturing and Distribution Group"***. This work investigates distribution network problem in a large food processing and distribution enterprise in Indonesia. The case study reviews the performance of the distribution network so as to inform logistics and distribution network efficiency improvement plans necessary for customer satisfaction and competitive advantage. Field research survey was conducted and both primary and secondary researches used to gather relevant data. Investigation into change processes and related problems at the group and within the distributor units were conducted.

The third article deals with supply chain management issues. This paper is co-authored by ***Benon C. Basheka, Prossy Oluka, Geodfrey Mugurusi, and Fred Ntambi***, entitled ***"Developing an Analytical Framework of the Present and Future Supply Chain Management (SCM) Trends and Developments in Uganda"***. This paper examines the supply chain Management trends and developments in Uganda. A total of 101 respondents from different organizations filled in a questionnaire that measured 41 key supply chain management trends and developments today and in the next five years using a scale ranging from (1) irrelevant to (5) most critical.

The fourth article is co-authored by ***Chiradet Ousawat, Suthawan Chirapanda, and Ekachai Apisakul***, and is entitled ***"Succession Barriers of Family Business: A Case Study from Thailand"***. This paper has provided insight to the perceptions of family business barriers in Thailand. With the sample of 127 family businesses, the result showed that the most important barriers in this study were the number of competitors in their industries, high competition in the business, changes in economic environment. Furthermore, respondents perceived that key decision makers in organization are family members was problematic with the lack of capabilities of family members.

The fifth article, entitled ***"Road Traffic Congestion Cost and Mode Choice Model (Study in Malioboro, Yogyakarta, Indonesia)"***, was conducted by ***Gito Sugiyanto***. This study shows that estimation the amount of congestion cost for private vehicle users in Malioboro Corridor is IDR 2915.00 per trip. Travel attributes which influences mode choice between private vehicle and busTransJogja are travel costs, congestion costs, parking cost, travel time and walking time. Application of congestion cost as IDR 5500.00 per trip for private vehicle user to Malioboro, Yogyakarta will be shift as 11.057% private vehicle to bus TransJogja.

The sixth article is written by ***Deepak Jain and Bhimaraya A. Metri***, and entitled ***"Analytical Modeling of Just-In-Time Convergent and Divergent Supply Chain System"***. The main objective of this paper is to develop an analytical model that represents a real supply chain and gives an optimal solution for the operational level decisions like the inventory, production lot sizes and delivery lot sizes at various stages of supply chain. System where a product is assembled from several raw materials and distributed to many dealers is a convergent and divergent supply chain.

Article number seven is entitled ***"The Determination of the Freight Transport Route Network in Bali and West Nusa Tenggara, Indonesia"***, and is written by ***Leksmono Suryo Putranto, Stevanus Albertus Ayal, and Ratri Parasiddha Winastwanti***. This paper will discuss the determination of freight transport route network in Bali and West Nusa Tenggara, Indonesia. There should be freight transport route networks for container transport, heavy equipment transport and dangerous goods transport. General goods transport is allowed to use general traffic route network. In order to evaluate available alternative of routes, several criterion were used, i.e. road status, road class, road geometry, access control, annual average daily traffic, volume to capacity ratio, land use, and additionally population density and level of public activities.

The eight article entitled ***"Corporate Characteristics, Governance Attributes and the Extent of Voluntary Disclosure in Bangladesh"***, and is written by ***Md. Abdur Rouf***. The aim of this paper is to examine the linkages Corporate Characteristics, Governance Attributes and the Extent of Voluntary Disclosure in Bangladesh. The paper is based on a sample of 120 listed non-financial companies in Dhaka Stock Exchanges (DSE). The study is used ordinary least squares regression model to examine the relationship between explanatory variables and voluntary disclosure.

The ninth paper is examined by ***Rafed Zawawi, Hasan Akpolat, and Ravindra Bagia***, and their paper is entitled ***"Managing Knowledge in Aircraft Engineering"*** In this paper, the authors analyse knowledge management (KM) practices in civil aviation industry and introduce a framework for better management of knowledge in aircraft engineering (AE). After comprehensive review of KM literature, this paper offers insights into the existing KM practices in AE using a case study in the Saudi Arabian Aviation industry (SAAI). The KM research data was collected through discussions and interviews as well as through observations during one of the author's employment as aircraft engineer in the SAAI.

The last but not the least, the article entitled ***"Performance of Family Business and Non Family Business Companies Listed on the Stock Exchange of Thailand"*** is examined by ***Rawida Wiriyakitjar***. This research is aimed at measuring the performance of Family Business listed on Stock Exchange of Thailand. The methodology for this research is Fortune®500 DEA Model which comprises three stages of calculation. With the information taken from 294 listed companies in 2009, the findings are that from the four highest rank companies, there are three Family Business companies that belong to the first definition and two Family Business companies to the third and fourth definitions.

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
Editor-In-Chief

Gilbert Nartea
Associate Editor

Wuyi Zhang
Guest Editor

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# Organization Wide Customs Risk Management within The Framework of Enterprise Risk Management

by

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# Organization Wide Customs Risk Management within The Framework of Enterprise Risk Management

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**Abstract**

Customs Risk Management (CRM) aims to put balance between the growing need for global trade facilitation and, security and control obligations by customs authorities. In this study, Enterprise Risk Management (ERM) framework is used to devise a tentative model for CRM at theoretical level. The researcher reviewed literature on ERM and CRM. The literature included academic publications, various guidelines, and practical business sources. Since CRM literature is scarce, ERM literature was used to identify the commonalities of two concepts. By incorporating the terminologies of both concepts, a model for CRM will be tired to be established. Although ERM is based on a "portfolio" (holistic) view of risk, the CRM approach is mostly focused on "silo" (individualistic) view of risk management. This suggests that risks are managed case-by-case. The comparison between ERM and CRM has been argued at only at a theoretical level. The basic process steps of both approaches are examined and some ERM concepts are tried to be incorporated into CRM methodology. Hence, empirical evidence is still needed to prove that ERM is a convenient tool to address to risk management challenges of modern Customs Administrations. The paper provides customs practitioners around the world with a framework ready to adapt to establish their own "strategic CRM agenda.". Furthermore, the findings of this study contribute to ease the design/application of ERM solutions in public sector. Applying the well established ERM approach on customs administrations to analyze the risk management maturity level opens a new research avenue and practical implication to further develop and improve customs procedures and operations.

**Keywords:** Risk Management, Enterprise, Customer Relationship Management

## 1. Introduction

The current economic environment makes a remarkable impact on Customs administrations due to the exponential increase in global trade volume. Customs have been expected to manage fast mounting international trade load with comparatively fixed resources; both human and technology. Although the new technological developments in inspection technologies help Customs authorities with their daily work, the specific challenge of determining which cargo to control at a specific inspection level (physical inspection, documentary inspection, no inspection etc.) still remains. This "decision making" aspect primarily requires an "intelligent" method to effectively control the flow of trade. One must keep in mind that customs organizations are not only responsible for the management of border crossing goods, but also responsible for struggling against fraud and other illegal activities.

Customs Risk Management (CRM) aims at putting a balance between growing need for global trade facilitation and security and control obligations of customs authorities. These new pressures imposed customs to design better resource allocation schemes. Therefore, customs administrations are expected to adopt a new approach that aims to align risk management practices with their strategic objectives.

Historically, risk management practices in world customs had started as "risk analysis" applications. This modest start was focused primarily on improving customs inspection capabilities by moving the system from "randomly selected" or "assumption of everything controlled" approach to more "smart" and "selective" method using pre-determined risk indicators and profiles. This "classical" approach had very little to do with overall organizational or strategic objectives of customs administrations. Moreover, this approach was far from being organization wide and concentrating only on picking "the bad apples." In other words, risk management has been described as a purely technical process which is not aligned with processes such as strategic decision making, resource allocation and performance measurement.

In order to address to above mentioned concerns, Enterprise Risk Management (ERM) has been chosen in this study as a theoretical frame for proposing a strategically driven organization wide CRM model. ERM has been considered as a process applied in strategy setting and across the enterprise, designed to identify potential risk and opportunities that may affect the entities' achievement of its objectives. Thus, our preliminary suggestion is that ERM should be in the very center of strategic governance of Customs administrations and one of the most important driver in decision making and resource allocation.

## 2. Enterprise Risk Management (ERM)

Several risk definition and risk management frameworks have been proposed by different risk management guides and standards among which ISO 31000 International Risk Management Standard, COSO Framework, Australian/New Zealand Risk Management Standard (AS/NZS 4360:1999), Risk Management Standard by AIRMIC, ALARM, IRM 2002, Risk Management Standard by FERMA, HM Treasuries' Orange Book may be mentioned. Within the scope of this study, we will be examining ISO 31000 and COSO Framework in details to derive some practical insights for customs risk management activities.

## 3. ISO 31000-Risk Management Principles and Guidelines

ISO 31000 defined the risk as "*the effect of uncertainty on objectives."* This objective definition represents the current development level in risk management literature, by not taking sides on negative or positive aspects of the risk. By this new definition, risk refers to "uncertainty", while commonly used risk management literature talks about an "event" that is likely to occur when describing the risk. Although the concept of risk has been traditionally perceived as the probability of a negative event, it also comprises of some benefits contributing positively to the intended objectives when managed in a systematic framework. Hence, risk management can be referred as a process of defining, analyzing, responding and monitoring the risks to minimize or eliminate an unfortunate event and its consequences or taking the most out of opportunities. Another original contribution of the standard is to draw attention to the need for **designing a framework** in which risk management activities take place. It clearly states that even a certain level of diversity in possible users of the

standard it should be expected, efficient risk management implementations require "consistent processes with **comprehensive framework**".

The new standard has been organized in five different components: Scope, Terms and definitions, Principles, Framework and Process. We are going to discuss scope, framework and process in details.

**Scope** mainly refers to the applicability of risk management organization wide by comprising all risks that an organization may face. Additionally, it states that it can be applied in any public or private organization.

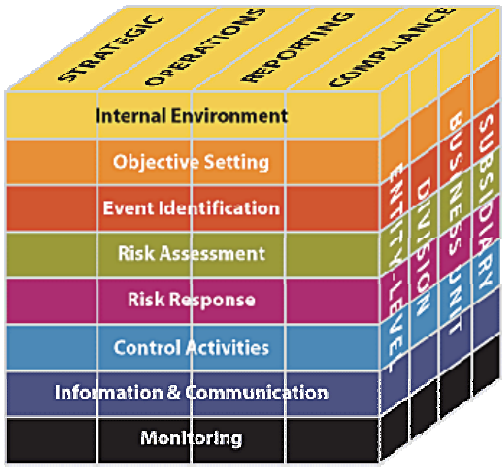
**Framework** is for the objective of the adaptation of risk management systems to the specific needs of different organizations. Before going further with the design of the framework, it highlights once again that the commitment by the management at strategic level is a prerequisite for any risk management system. The design of the framework starts with the understanding of external and internal context in which risk management activities take place. While legal, economic and cultural environment are important parts of external context; organization structures, objectives, strategies and capabilities of the organization composes internal context. Following component of the framework is the establishment of risk management policy. This includes the alignment of objectives with risk management policy, definition of roles and responsibilities, decisions on resource allocation and how performance is measured. Accountability arrangements should also be made properly to make sure that authority and the competence is given to the appropriate people. Risk management should also be integrated to all policy, strategic planning and change management activities, implying that it is required to span all practices and processes. Prior to implementation, establishing communication with both internal and external stakeholders is critical to make sure that all stakeholders have sufficient information about the system and to gain their confidence. The results of the implementation of the framework should be monitored and required modifications in the framework should be made continuingly.

**Process** component starts with communication and consultation with internal and external stakeholders and followed by the establishment of internal and external context which seems to be the iteration of some sub-components of framework design phase that we discussed earlier. Risk assessment includes risk identification, risk analysis and risk evaluation phases. Risk identification tries to understand the sources of risk, its impacts, causes of events and their consequences. Risk analysis refers to the decision on whether to address to the specific risks and the options for risk treatment. Risk evaluation refers to which risks to be treated in which priority. Risk treatment comprises selecting the options to change the consequences of the risks. These options could be avoiding or accepting the risk, removing the risk source, changing the likelihood and/or consequences and transferring the risk to some other party. Final steps of the process are monitoring, review and recording the risk management process.

## 4. Committee of Sponsoring Organizations of the Treadway Commission (COSO) Framework:

COSO describes ERM as *a process, effected by an entity's board of directors, management and other personnel, applied in strategy setting and across the enterprise, designed to identify potential events that may affect the entity, and manage risk to be within its risk appetite, to provide reasonable assurance regarding the achievement of entity objectives."* It suggests that those who lead organizations should take a broad perspective on risks by managing them "*in strategy setting"*, *"across the enterprise"* and aligned with the *"the achievement of entity objectives"*. The emphasis

on strategy and being holistic (as well as the direct reference to objectives) are the most distinctive features of ERM process when compared to prior risk management frameworks.




Source: COSO Framework

**Figure 1** COSO Framework

The famous ERM cube, proposed by COSO framework, in Figure 1 suggests an integrated approach to risk management. The front flat demonstrates eight interrelated components of ERM summarizing the risk management process. The top flat classifies the main objectives of the entity, while the vertical flat indicates at which organizational level ERM could be implemented. This cube suggests that the ERM process (front flat) addresses those four different categories of objectives (top flat) and could be used at different levels of the entity. For instance, some fraud data collected through internal and external resources, normally a part of **information and communication** component, could be used for **reporting** related to **compliance** purposes in a strategy setting to better manage business **operations** of the entity. This clearly indicates how this three-dimensional matrix of COSO and its emphasis on the interrelated and integrated structure should be understood.

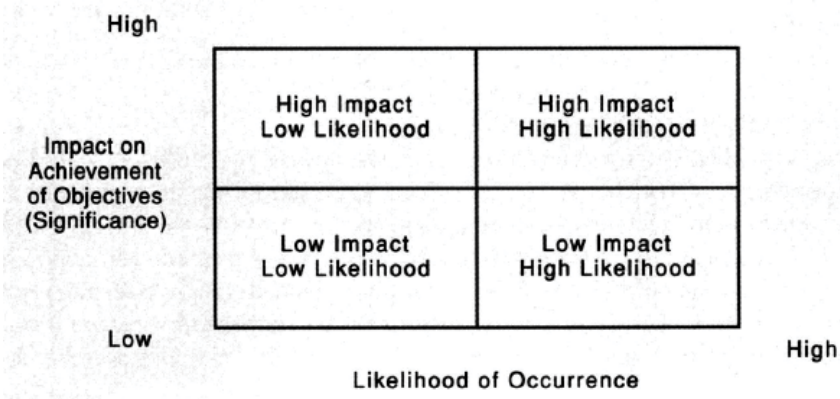
**Internal environment** of an organization is the foundation for ERM and includes the tone of top management related to risk philosophy and appetite. The other parts of the internal environment are mostly related to organizational structure of the entity, including the composition of executive level leadership and how authority and responsibilities are distributed over the organization. However, the essential question is organizational attitude towards risk: How much risk the organization can accept and manage, given its capabilities and stake-holder expectations which shape the cultural environment of the risk in an organization.

**Objective setting** must be set up before analysis of risks. These objectives may be strategic objectives if ERM is being applied to the entity as a whole. Therefore, ERM requires organizations to identify and focus on the objectives which should be aligned with the strategic perspective of the organization.

**Event identification** requires entities to identify possible events that may have a positive or negative impact on the implementation of strategy or achievement of objectives. As a result of any identification process, the organization should have its unique risk language composed of all major

identified risks. In addition, employees at all levels should reach an agreement on the meaning of each risk identified.

**Risk assessment** can be formal or informal; qualitative or quantitative. However, strategic and operational can not be empirically validated, and organizations plot their assessments depending on some judgments from a perspective of likelihood of an event and its impact on the organizations. Some Risk Assessment Grids, as in the figure below, have been used for providing a visual framework to summarize all identified risks enabling all employees to focus on key risk areas. Starting from inherent and residual risk in the activity area of the entity, quantitative and qualitative methods can be used to predict the possible most accurate likelihood and impact matches.




Source: Walker & Shenkir

**Figure 2** Risk Assessment

**Risk response** is the phase in which management should decide what action should be taken for previously identified risks. Possible responses to risk may be accepting, avoiding, reducing, or sharing the risk depending strictly on the level of risk appetite. Evaluating on possible risk responses requires considering appropriate cost-benefit analysis for each likelihood-impact matches. Risk response activities, at the business unit level, are tended to be concerned with the individual objectives of that business unit. Entity level risk response activities, tailored by the higher levels of management, are more likely to be holistic and pay specific attention to the strategic objectives. Considering this aspect, it could be argued that the leadership of an entity should act as a mediator among different risk perceptions across the organization and should be able to select the optimal risk response option.

**Controls activities** help manage the efficiency of risk response actions by introducing new policies and procedures. Performance indicators are a potential control solution that should be seriously considered. This component is for the objective that how the administration supervises the overall performance of the risk management system. In other words, control activities work for ensuring that risk management structure uses the appropriate tools to deal with the potential risks.

**Information and communication** aim at providing managers with necessary information to make informed decisions relative to the objectives for which they are responsible. Information systems gather internal and external data and provide managers with them during enterprise risk management process and help them to take relevant decisions related to strategic objectives. This component also enables organizations to put across the message that enterprise risk management is taken seriously by top management.

**Monitoring** should include periodic reporting and follow-up by risk management committees/boards to identify the changes in the risk structure that an entity faces over time. Also entities' objective may change and control procedures get obsolete. Monitoring activities occurs as ongoing and/or as separate activities. In real life, it is more likely for us to observe them used in a hybrid manner suggesting a combination of both (Banham, 2004).

As Banham pointed out, the main difference between ERM and conventional risk management practices (see the Figure 2 below) is that ERM requires a very broad perspective towards the entire risk portfolio of an entity compared to the conventional practices focusing on specific risks owned by specific overseers leading us to silo based risk management approach (Bowling and Rieger, 2005a).

Another characteristic feature of the ERM framework is that it puts the business strategy in the center of risk management activities and does this in a way that incorporates the whole organization into the process, not single business units. As a result, ERM requires a top-down approach with a strong ownership from executive level, whereas risk management has often been fragmented and driven from bottom up (Bowling and Rieger, 2005b).

**Traditional RM vs. ERM: Essential Differences**

| Traditional risk management | ERM |
|---|---|
| Risk as individual hazards | Risk in the context of business strategy |
| Risk identification and assessment | Risk portfolio development |
| Focus on discrete risks | Focus on critical risks |
| Risk mitigation | Risk optimization |
| Risk limits | Risk strategy |
| Risks with no owners | Defined risk responsibilities |
| Haphazard risk quantification | Monitoring and measuring of risks |
| "Risk is not my responsibility" | "Risk is everyone's responsibility" |

Source: KPMG LLP.

**Figure 3** Traditional RM And ERM

Main success factor of any ERM application in an organization could be listed as:
- Beginning by focusing on strategy and business objectives, which requires a strong support from top management.
- Thinking about different kind of risks your organization may face, which needs sufficient resources.
- ERM is a long term activity and is not likely to have quick results, which puts pressure on the organization to maintain the stamina needed for ERM.

## 5. ERM in Public Sector Management

Two main views on the potential differences between risk management in public and private sector has been observed in literature. Supporters of the argument that no difference between them established their argument on the idea that "management is management" implying that the rules of management universal and could be applied in both settings. Opponents of this view argued that public sector is different from private management and requires special set of skills and knowledge Fone and Young (2005).

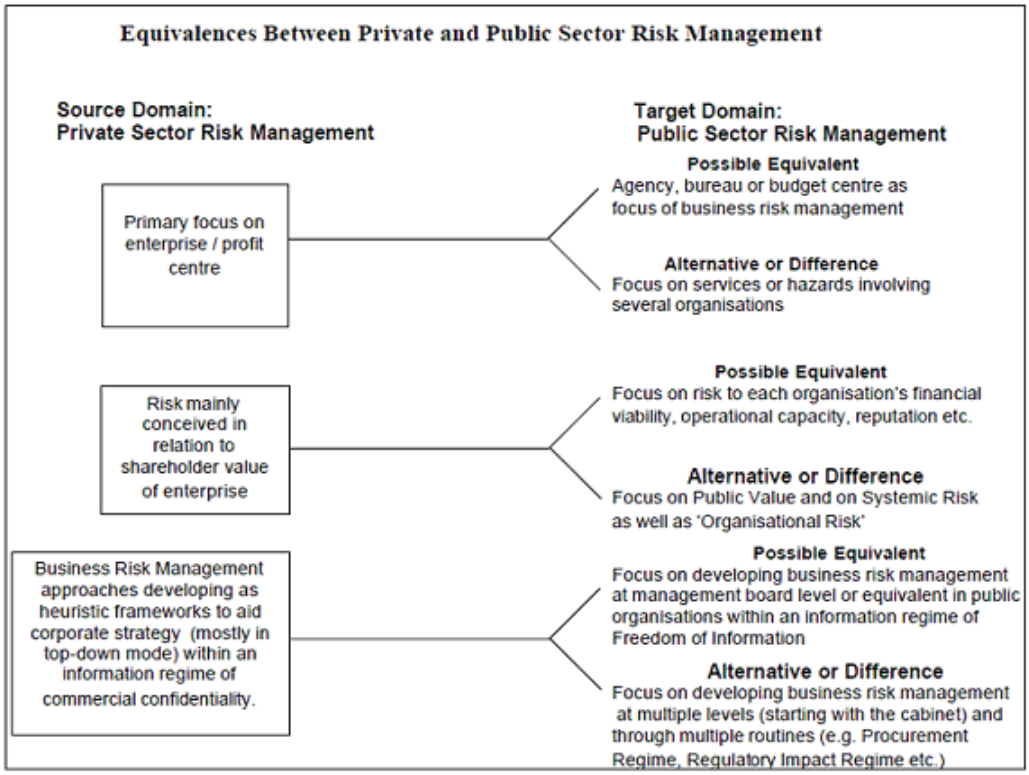
Since a detailed analysis of public and private risks and iterating on "publicness" is far from the objectives of this article, we will settle for drawing a general framework of public risks to better understand its distinctive features from other risks, as follows:

- Benefits of some public services can not be attributed to each citizen, neither public risks can be distributed individually to relevant parties.
- Market pricing assumption fails in capturing the externalities of public risks.
- Exposure is public, implying that governments have almost no ability to avoid these risks. (ibid, p.22)

The risk culture in most public agencies is another important issue, which we believe, must be addressed. Most of the literature agrees on the fact that dominant culture in public administration is risk averse and leaving no margin for possible benefits coming from taking risks. Over emphasis on control and compliance with legislation creates a specific risk management paradigm, called **defensive risk management** that takes us to blame avoidance. Political culture should be changed to enable the open discussion of failures in order to create an opposite alternative to defensive and so-called blame proof culture.

Also, the nature of the risks in public organizations tends to be different. While we refer to strategic, operational, financial and similar risk categories for businesses; social, reputation, systemic, organizational risks are more likely to be relevant to the activities of government agencies.

Hood and Rothstein (2000) analyzed the potential differences between public and private sector risks. They begin with the question of how to tailor a risk management system for public administrations. Their preliminary response to this question is that a "read across" approach, imitating private sector risk management practices for public, may not always be the best option for two main reasons. First, they argue that there is a variety in the perception of risk management by different business domains such as bankers, insurers, etc. Second, translating private sector risk management features into public setting may create faulty results since there are some features which have no equivalences in government (see Figure 4).




Source: Hood&Rothstein

**Figure 4** Equivalences between Private and Public Sector Risk Management

First, risk management in private sector is enterprise or profit center focused and a specific equivalent could be found in public sector for these business units. However, finding the best match in public may be challenging, as in the case of some public services delivered by the participation of several agencies. Second, the main driver of risk perception for businesses is the shareholder value and more concerned with financial, operational and similar risk categories. On the other hand, public risk perception is inclined to be more comprehensive and concerned with systemic and organizational risks. Third, alignment of risk management with strategic process of the organization takes place in different settings for government agencies. Most of the decision making in public sector includes more than one organization and also while confidentiality of strategic decision making in businesses is given; high levels of transparency and accountability is expected from public agencies.

Although potential risks to their citizens are not new to governments, dealing with these risks in a systematic and strategic manner could be quite new. Also, the nature of the risks that the governments have to manage has changed in a great deal. These risks are coming from a broad range of sources now, making the risk exposure of governments much bigger. The global interconnectedness and rapid developments in technology can be mentioned as the main reasons of the expansion of risk exposure. On the other hand, just as rising expectations of stakeholders in private sector, governments are also aware of the increase in the citizen's expectations of government performance (Chapman, 2006).

According to Young, we can describe the public sector risk management environment as one in which:

- There is an emerging idea about ERM,
- There are some practical challenges for public entities to adopt ERM,
- There nevertheless are two important points to connect together:

– Governments exist to manage public risks, and

–ERM is the most rational and comprehensive approach possible to effective risk management.

The same author also argues that the basics of successful ERM in the public sector are:

- The introduction of risk management thinking among top managers and elected officials.
- Rewriting job descriptions.
- Developing appropriate incentives and disincentives for financing the cost of risk.
- Identifying and coordinating current sources of "risk management expertise" within the public organization.
- Recognizing that risk management is an important interface with the community.

The great hope for ERM in the public sector is that ERM offers public entities and institutions an organized and effective way to deliver against their most fundamental promise to manage communities (or society's) key risks (Young, 2005).

However, organizational culture of public agencies should change too. The public sector culture, recognized as being not only risk averse but also keen on blame-avoidance, is likely to be the biggest obstacle in the successful implementation of any risk management policy (Starovic, 2001).

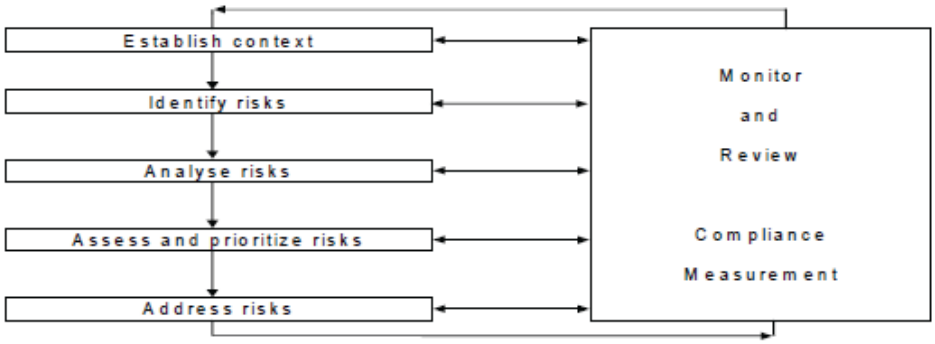
## 6. Customs Risk Management (CRM)

The World Customs Organization (WCO) defines Risk Management as the systematic application of management procedures and practices providing Customs with the necessary information to address movements or consignments which present a risk (Risk Management Guide, 2003).

**CRM Process:**

a) Establish the context: In this step potential areas of risk are identified, criteria and structure of the analysis established. Risk management within Customs can be strategic, operational or tactical.
b) Identify risks: Identification of what, why and how risks appear in customs setting.
c) Analyze risks: Analyze of risks in terms of likelihood and consequence.

d) Assess and prioritize risks: Assigning each risk area a certain level of significance and ranking them in order to clarify priorities.
e) Address risks: Implementing specific management planning to take required measures against risks.
f) Monitor and review - Compliance measurement: Monitoring the working process and making proper changes,
g) Documentation: Setting up a risk register to follow-up all risk incidences (Guidelines for Risk Management in Customs, 2005).




Source: Risk Management Guide, WCO, June 2003

**Figure 5** CRM Process

The benefits of risk management to customs administrations can be categorized in the following way:

- Achieving organizational objectives
- Improved management processes
- Improved public and business profile.

The benefits emanating from these categories include:

- Better use of existing resources, or the capacity to work with fewer resources
- Dedicated resources to the greatest risk areas
- Increased facilitation, flow of goods and inward investment.

The WCO underlines the fact that adoption of risk management as an organizational philosophy is essential because it provides quantifiable improvements in the effectiveness and efficiency of the administration as a whole. This fact suggests that customs administrations need to adopt a holistic approach to risk management. Control focus is also necessary for customs since the fundamental task of the Customs is to control the movements of cross border goods and ensure the compliance. However, this may lead to a very common misunderstanding about CRM by simply appropriating it to control activities. Ideally, risk management should be considered as principal in the entire customs operations and the whole organization should provide support and participation during the process. Especially, in early phases of the establishment of any risk management system in Customs, the risk averse and blame proof mind set is very likely to show itself against project managers in the form of the arguments as some fraud may be left undetected and some revenue may be uncollected. [i] As a result of this mind set; before introduction of CRM, customs officers were assuming or pretending that all declarations had been controlled, even everyone knows that is physically impossible. The main breakthrough with CRM is that it admitted everything can not be controlled as *"de facto"* and introduced an intelligent selectivity in customs controls by incorporating this *"de facto"* phenomenon into related strategic documents and legislation, making it *"de jure"*.

When adopted as a management philosophy, CRM enables Customs to not only carry out its key responsibilities effectively but also organize its resources and deploy them in the greatest areas of risk. It is evident that reallocation of resources has important implications on the management philosophy of the organizations (Risk Management Guide, 2003).

Decision making process for resource allocation requires top-level policy decisions to obtain strategic objectives. Adopting as management philosophy, customs administrations should also adopt strategic management practices taking all strengths, weaknesses, threats and opportunities into account.

Thus, risk management should not be confused with "risk assessment" which comprises a series of technical processes intended to identify and quantify individual risks. Effective risk management will require managers and staff to understand the nature of the risks in their work areas and systematically identify, analyze, evaluate, treat, monitor and review those risks. This process will provide management and staff with a rigorous and defensible tool to assist in decision making.

## 7. ERM for Customs Risk Management

From the previous discussion on ERM and CRM and the comparison of the components of both processes, it can be argued that CRM applications are more likely to be categorized under classical risk management category rather than ERM. Main observation about CRM may be listed as follows:

- The cultural environment in Customs organizations is mainly risk averse as in most government agencies. As a result, the mind set and philosophy in Customs still depend on the defensive risk management practices and undermine the opportunity side that could be brought by positives outcomes by risks. Because, positives risks are also defined as the events that could offset the negative results of potentially hazardous risks.
- CRM practices are mostly operationally oriented and compliance focused. Dealing with individual risks, it is perceived as managerial level duty, static and decentralized (=handled locally).
- CRM is lack of strategic approach and the objectives of customs are not aligned with overall risk management framework and processes. At this point, we should remember that CRM mostly being concerned with compliance, other objectives of customs such as protection and trade facilitation should also be aligned with risk management processes properly.
- Confidentiality requirement of CRM practices prevents the results to be fully communicated to internal and external stakeholders and this emerges as a significant obstacle to gain support of corporate world, other government agencies and other related organizations.
- Customs organization operates in multi-agency environment. Some functions of customs administrations are complemented by other government agencies such as the administrations responsible for standard and quality requirements.

WCO, itself, is practically admitting this fact and the tone of the risk management guide supposedly calls for a holistic view of risk management (=ERM). It is sufficient to look at the executive summary of the guide to see the special emphasize on the points such as achieving organizational objectives, better resource allocation, and increased trade facilitation as a potential opportunity by CRM.

Customs needs ERM-like approach because of some management challenges as well. As stated in WCO guide, senior management of Customs all over the world, has faced a daunting challenge coming from almost "exponential" increase of international trade and, therefore, impossibility of delivering greater outputs with the same, if not fewer resources. Once the urgent necessity of re-allocating the available resources is evident, customs executives faces the second challenge: How to decide to allocate available resources. ERM can help customs policy makers not

only in deciding most risk vulnerable areas in their organization, but also can provide a efficient tool to manage these risk in holistic, strategic setting.

## 8. Conclusion

The main findings of this literature review of ERM and CRM, demonstrated that CRM practices are still far from being strategically driven and, not addressing the problems of customs administrations as public sector enterprises. Although some holistic-strategic "tone" could be seen in the documents like WCO RM Guide, the World Bank RM Guidelines and Customs Modernization Handbook; in reality, CRM practices are exclusively focused on compliance and control activities. By definition, CRM is referred as a tool for allocating scarce resources to the areas bearing the most risk. In practice, CRM seems to be used only for customs control and compliance purposes. When we adopt risk management as a strategic tool, we should be able to propose some modifications in the areas other than controls or compliance. When a new risk emerged in customs; some organizational changes (i.e. introduction of a new task force or department), training programs to create new set of skills, changes in the legislation, etc. may be necessary to cope with the challenge besides enforcement and control activities. There is still no evidence in the literature that customs administrations are using risk management results organization wide, but only in very specific areas.

Among many reasons for that, risk averse culture plays a significant role. Traditionally, customs administrations are tended to be considered as "gate keepers." Due to the inefficiencies in control activities (i.e. quality and standard requirements of goods) within the territory of a country, almost all required controls are tried to be delegated to customs to be executed at the entry point. This fact overburdens customs authorities and create set of cultural values serving as a basis for blame avoidance such pretending "everything controlled." Also, the customs legislation in some countries contributes this culture by still keeping "reasonable doubt" as a vague criterion in control decision for customs authorities. "Reasonable doubt" sometimes serves as exception to risk management findings and leads to put the blame on customs officer. In other words, when some major customs infringement occurred, it is not easy for customs officials to say that the probability of this specific event was not predicted by the risk profile in force and they complied with the information provided by risk management system.

Therefore, CRM is sometimes perceived as "risky business" itself since the **opportunity side** has almost never been take into account. Customs community should think about what kind of opportunities could emerge by using risk management framework in customs. "Opportunities" by the facilitation of trade operations, the simplification of customs formalities and maximizing the speed of the supply chain may be among the results of effective use of risk management methods. Our belief is that CRM would be closer to ERM principles and philosophy, once customs authorities manage to convert their risk averse culture into a new approach focusing on the opportunities by CRM.

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# Critical Factors of Logistics and Distribution Network Redesign in an Indonesian Food Manufacturing and Distribution Group

by

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**Abstract**

This work investigates distribution network problem in a large food processing and distribution enterprise in Indonesia. The case study reviews the performance of the distribution network so as to inform logistics and distribution network efficiency improvement plans necessary for customer satisfaction and competitive advantage. Field research survey was conducted and both primary and secondary researches used to gather relevant data. Investigation into change processes and related problems at the group and within the distributor units were conducted. A series of surveys were conducted at three manufacturing plant sites and seven distribution centres. A 22-statement-five-point-Likert-scale-format questionnaire was used to critical success factors of the logistics and distribution network. Data was analysed using t-Tests, ANOVA, factor and cluster analyses to interpret and get better understanding of the research problem. The research findings showed that five factors namely, cost and cycle time, customer service, quality, inventory management and order management were critical to the success the of logistics and distribution network. Transportation cost is found to be directly related to customer returns and inversely dependent on customer order processing cycle time, whilst customer order processing cycle time is inversely dependent on transportation costs. However, delivery lead time is found to be inversely dependent on order completeness and order processing cost. Although analysis confirm that facilities cost and transportation cost are major predictors of total distribution cost, there is the need to research other components of total distribution cost which may includes facilities costs, inventory costs, transportation costs, handling costs, order processing costs and quality costs. Customer service broadly includes inventory availability, speed of delivery, and order filling speed and accuracy. The costs associated with these factors increase at a higher rate as customer service level is raised. Therefore, distribution costs will be quite sensitive to the level of customer service provided, especially if it is already at a high level. This work seems to be significant step toward our understanding of the enormous challenges facing academics and logistics professionals in food supply chain in emerging economies of South-east Asia. It is work which can be expanded and deepened.

**Keywords:** Cost, Critical Success Factors, Customer Service, Cycle Time, Distribution Network, Inventory Management, Order Management, Logistics

## 1. Introduction

Indonesian businesses are facing severe natural catastrophes and hardships, financial and economic crises, and global competition. The status of the country's logistics does not look good (The World Bank Group, 2010). Government and businesses recognise the domestic connectivity challenge. Arguably, survival and growth of Indonesia's food and fast moving consumer goods (FMCG) industries are dependent on effective and efficient distribution network.

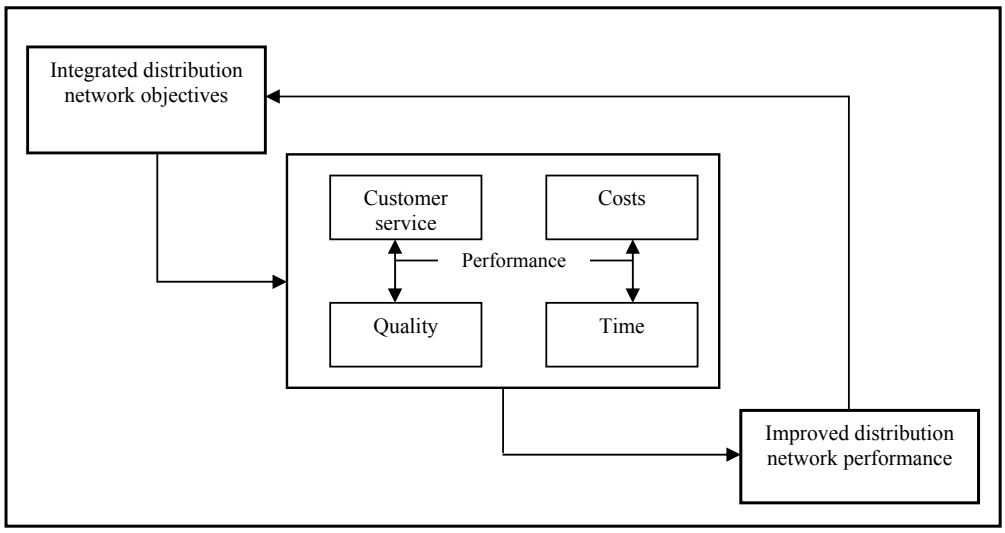
Efficient improved logistics and distribution network can ensure greater competitiveness via enhanced access to inputs, goods, services and markets (The World Bank Group, 2010). There seems to be a dearth of logistics and distribution network research.

## 2. Research Aims

This work concerns distribution network problem in one of the leading food manufacturing and distribution group (*aka* Food Company Indonesia or FC) headquartered in Jakarta, Indonesia. FC's manufactures and distributes instant noodles, wheat flour, branded edible oils and fats, baby foods, snack foods, and food seasonings. Specifically, this work investigates FC's current logistics and distribution network, the underlying critical success factors of its operation, performance gaps and design strategies for improving network performance.

### Research Model

Succinctly, the research model in Figure 1 explains how customer service/satisfaction, cost/price, quality and delivery lead time/flexibility impact distribution network performance.




Abridged Source: Gopal and Cypress (1993)

**Figure 1** Research Model

The assumption behind logistics and distribution network strategy is the more organisations accelerate movement of materials and products through distribution channels, the more products they can sell and the greater their profitability and competitive position.

This work encapsulates a review of logistics and distribution network literature, overview of Indonesian economy and food industry, appraisal of FC's distribution centres and critical success factors (CSFs) of logistics, discussion of findings, implications and conclusions.

## 3. Literature Review

### Logistics

There is no single definition of logistics. Bowersox *et al*. (1986) view logistics as a single logic designed to guide the process of planning, allocating and controlling financial and human resources committed to physical distribution, manufacturing support and purchasing operations (Table 1). Gopal and Cypress (1993) define logistics as the process of planning, implementing and controlling efficient cost-effective flow and storage of materials in-process inventory, finished goods and related information from point of origin to point of consumption for the purpose of conforming to customer requirements.

**Table 1** Some Key Definitions of Logistics

| Author(s) | Definition |
|---|---|
| Bowersox *et al*., 1986. | Logic, guide to process of planning, allocating and controlling financial and human resources committed to physical distribution, manufacturing support and purchasing operations. |
| Gopal and Cypress, 1993. | Process of planning, implementing, and controlling efficient cost-effective flow and storage of materials, in-process inventory, finished goods, and related information from point of origin to point of consumption for the purpose of conforming to customer requirements. |
| Cooper, 1994. | Strategic management of movement, storage, information relating to materials, parts, and finished goods in supply chains, through stages of procurement, work-in-progress and final distribution. |
| Gattorna, 1994; Christopher, 1998. | Process of strategically managing procurement, movement and storage of materials, parts and finished inventory (and related information flows) through the organisation and its marketing channel for cost-effective fulfilment orders and profitability. |
| UK Institute of Logistics and Transport, 1998. | Positioning of resource at the right time, in the right place, at the right cost, at the right quantity. |

Logistics, according to Gattorna (1994) and Christopher (1998) is the process of strategic management of procurement, movement and storage of materials, parts and finished inventory (and the related information flows) through the organisation and its marketing channel in such a way that current and future profitability are maximised through cost-effective fulfilment orders. In a more

encompassing view, The Institute of Logistics and Transport (1998) see logistics as the positioning of resource at the right time, in the right place, at the right cost, at the right quantity.

**Distribution Network**

Robeson (1985) views distribution network as a network of two or more functions moving goods from source of production to the end-customer. Bowersox *et al.* (1986) see it as integration of two or more activities for the purpose of planning, implementing and controlling efficient flow of finished goods from the manufacturer to the consumer (Table 2). Rushton *et al.* (2001) perceive distribution network concerns strategic management of movement, information and storage of finished goods from the end of production line to the consumer, whilst Slack (2001) see it as vital link between an organisation's operations and its customers, and management of inventory and transportation systems.

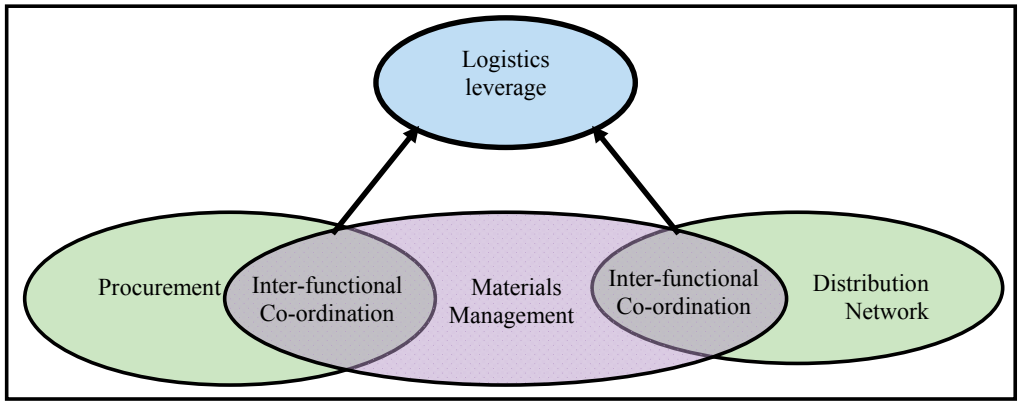
**Table 2** Some Key Definitions of Distribution Network

| Author(s) | Definition |
|---|---|
| Robeson (1985) | An approach to fulfil distribution mission, management, planning, implementation, a control tool that involves two or more functions to move goods from origin of production to the end-user. |
| Bowersox *et al.* (1986) | Integration of two or more activities for the purpose of planning, implementing and controlling the efficient flow of finished goods from the manufacturer to the consumer. |
| Gopal and Cypress (1993) | Movement and storage of all products and management of finished goods, packaging and delivery to the customer. |
| Mulcahy (1994) | The function of moving various products through manufacturing workstation, where products were manufactured, to its facility for storage, picking and delivery to customer's facility. |
| Rushton *et al*. (2001) | The strategic management of goods movement and storage, and information relating to finished goods from end of production line to the consumer. |
| Slack (2001) | Management of inventory and transportation systems that link the operation with its customers. |

Browne *et al.* (1995) call for shift from inward-looking business approach to 'extended-enterprise' and 'extended value chain' collaborations in which logistics and distribution network management assumes significant interface in production process.

Christopher (1998) conceives the vital link between logistics and distribution network management and the marketplace. Furthermore, he (1998) states competition has shifted from head-to-head competition between companies to competition between supply chains, and that competitive success would depend increasingly on the ability to co-ordinate and integrate production activities at geographically dispersed and organisationally distinct locations.

Bowersox *et al.* (1995) argue logistics leverage depends on the ability to achieve marketing advantage through logistics superiority. Similarly, Christopher (1998) believes inter-functional co-ordination of logistics and distribution network is a strategic resource for value creation and competitive advantage (Figure 2).




Source: Christopher (1998)

**Figure 2** Inter-Functional Co-Ordination between Logistics Functions

**Logistics Critical Success Factors**

Rockart and Van Bullen, (1986) see CSFs as pointers to areas where 'things must go right', and argues if these are identified, controlled and managed, they could increase the odds for success.

Table 3 lists some key CSF metrics for logistics and distribution network performance (Gopal and Cypress, 1993; Gattorna and Walters, 1996; Dornier *et al.* 1998; Christopher, 1998; Ross, 1998). Gattorna and Walter (1996) observe that industries view customer service as a key competitive advantage. Ross (1998) believes the fundamental role of logistics and distribution network is to actualise time and place utilities through availability, quality and just-in-time (JIT) delivery and quick response. Christopher (1998), and Gopal and Cypress (1993) expect logistics meet of their customer expectations through simplification of order inquiry, placement and transmission, responsive post-sales support, and accurate and timely generation and transmission of order information among organisations.

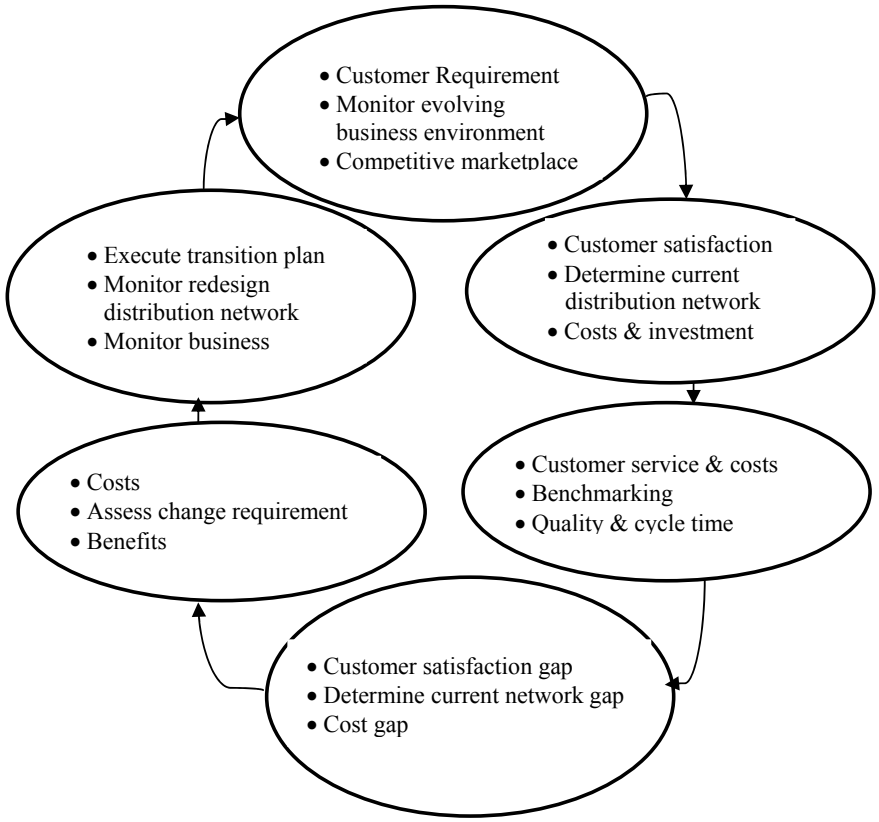
**Table 3** Key Metric of Logistics Critical Success Factors

| Author(s) | CSFs | Metrics |
|---|---|---|
| Gopal and Cypress, 1993; Botchway, 2000. | Quality | Forecasting accuracy, schedule compliance, order errors, loss and damages and customer returns. |
| | Cost | Cost of goods sold (COGS), inbound and outbound transportation costs, quality costs, facility operating costs and order processing costs. |
| | Cycle time | Order cycle times, inventory cycle times, delivery lead times and customer order processing cycle times. |
| | Customer service | Committed delivery date compliance, order completeness, order accuracy, backorders, stock-outs, and fill rates, information and communication reliability and customer complaints. |
| Gattorna and Walters, 1996. | Price | Lower price. |
| | Flexibility | Design flexibility, flexibility capacity, order processing management, augmentation ability, innovative and created product design. |
| | Quality | Dependency, product performance and reliability. |
| | Delivery | Quick response and accurate response. |
| | Service | After sales service, field support, distribution coverage and customised service. |
| Dornier *et al.,* 1998. | Cost | Initial cost and lifecycle cost. |
| | Quality | Design quality and conformance quality. |
| | Service | Delivery speed and delivery reliability. |
| | Flexibility | New product flexibility, customisation and product mix flexibility. |
| Christopher, 1998. | Customer satisfaction /quality | Product quality, delivery to commit date, customer inquiry response time, perfect order fulfilment and customer returns. |
| | Time | Order fulfilment lead time, source cycle time and supply chain response time. |
| | Cost | Transport costs, facilities costs, communication costs, inventory costs, material handling costs, protective packing costs and distribution network management costs. |
| | Assets | Cash-to-cash cycle time, inventory days of supply, asset performance, forecast accuracy, capacity utilisation and inventory obsolescence. |
| Ross, 1998. | Time | Warehousing, order processing, delivery and invoicing cycle time. |
| | Customer service | Product availability, quality, delivery and value added service. |
| | Cost | Total logistics costs. |
| | Quality | Reliability and accuracy. |

Gopal and Cypress (1993) perceive quality as conformance or otherwise to agreed standards in operation of distribution network activities. Quality is more than an order winner; it is an order qualifier (Budiaryani, 2003; Christopher, 1998). Ross (1998) expects reliable quality management system to increase forecast accuracy and schedule compliance.

**Distribution Network Design**

Gopal & Cypress (1993) view distribution network design as a transition cycle involving well-knitted six-stage processes: business environment, company strategies for products, markets, investments, and performance (Figure 3).



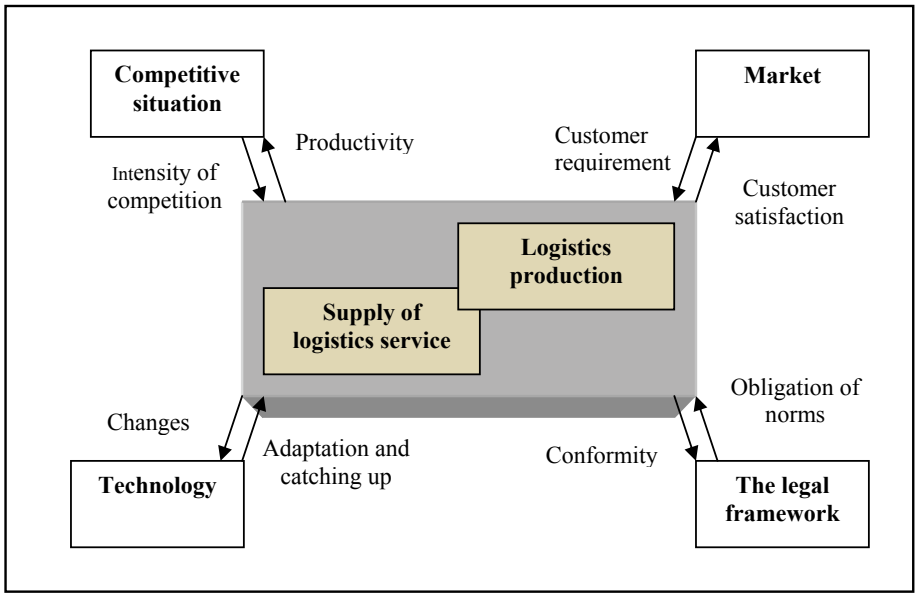

Source: Gopal & Cypress (1993)

**Figure 3** Distribution Network Transition Cycle

Bowersox and Closs (1996) and Dornier *et al*., (1998) identify four drivers of business environment change: market, competition, technology, and government regulation (Figure 4). Changes in consumer goods markets brought about by changes in technology, government regulations, product proliferation, and shorter product life cycles and growing internationalisation of markets necessitate constant re-design of logistics and distribution network.

Changes to logistics and distribution network can be infrastructural or structural (Dornier *et al*., 1998). The infrastructure approach may deal with non-structural features such as organisation, distribution planning and control, transportation policy and customer service policy, whilst the latter may entail bricks and mortar aspects (e.g., facilities and technology).

Distribution network planning and design may seek to: fulfil customer distribution service requirements (Robeson, 1985; Gopal and Cypress, 1993; Rushton et al, 2001); minimise total distribution costs while providing the desired service level (Robeson, 1985; Gopal and Cypress, 1993; Rushton et al, 2001); reduce overall integrated distribution cycle time (Gopal and Cypress, 1993; Russel and Taylor III, 2000); increase quality of distribution service (Gopal and Cypress, 1993; Rushton et al, 2001), and; deploy resource effectively and efficiency were they are needed (Robeson, 1985; Rushton et al, 2001).




Source: Dornier et al. (1998)

**Figure 4** Drivers of Change in Logistics Environment

Deriving from the literature survey and knowledge about CF's business, 22 factors of logistics and distribution network was devised:

*1. Committed to delivery date; 2. Order completeness; 3. Order accuracy; 4.Availability of stock; 5. Customer complaint; 6. Facility cost; 7. Inventory cost; 8. Transportation cost; 9. Handling cost; 10. Order processing cost; 11. Quality cost; 12. Total distribution cost; 13. Forecast accuracy; 14. Schedule compliance; 15. Order error; 16. Loss and damages; 17. Customer returns; 18. Order cycle time; 19. Inventory review cycle time; 20. Customer order processing cycle time; 21. Delivery lead time, and; 22. Frequency delivery.*

Whilst pursuing the aims of research, six interlinked hypotheses were tested (Table 4):

## 4. Methodology

This research is qualitative and quantitative. Both primary and secondary sources of data were utilised in the case study. The survey method of primary data gathering appeared attractive. It is low cost, fast, accurate and effective (Zikmund, 1997). Besides, it permits systematic data collection and interviews (Festinger and Kat, 1953).

**Table 4** Hypotheses

| Hypothesis | Descriptor |
|---|---|
| **$H_10$** | There is no significant difference in perception between headquarters and subsidiaries about critical success factors. |
| **$H_20$** | Transportation cost is directly related to customer returns and inversely related to customer order processing cycle time. |
| **$H_30$** | Customer order processing cycle time is inversely related to transportation costs. |
| **$H_40$** | Delivery lead time is inversely related to order completeness and order processing cost. |
| **$H_50$** | Total distribution cost is directly related to facilities costs and transportation costs. |
| **$H_60$** | There is no significant difference in performance between distributor subsidiaries. |

Multi-stage sampling involved first random selection of three manufacturing sites from amongst FC's five manufacturing sites, and seven regional distribution centres (RDCs) from amongst ten RDCs. Second, two top managers were sampled from the manufacturing sites and RDCs for questionnaire survey.

Structured discussions on distribution and network-specific issues along the lines of focus group were made to generate new ideas and amass data. Semi-structured interview with relevant FC and RDCs' managers was conducted. This primary data gathering device was flexible as it easily accommodated changes in the survey environment (Parasuraman, 1991), offered respondents opportunities to probe reasons for their answers and complemented consequent face-to-face interviews.

Questionnaire instrument consisting 22 statements structured in five-point-Likert-scale format used as measure of logistics and distribution network CSFs was piloted and electronically mailed. The survey response rate was encouraging: FC 67% (2), and; RDCs 100% (14).

SPSS (Statistical Package for the Social Sciences) was used to compute descriptive (Hedderson, 1986; Norusis, 1985) and inferential statistics, test reliability of questionnaire tool via Cronbach alpha test (Cronbach, 1951), and conduct further analyses including factor analysis (Hedderson, 1986; Kinnear and Gray, 1999), cluster analysis, ANOVA (Analysis of Variance) (Hedderson, 1986; Kinnear and Gray, 1999), *t*-test and regression analysis.

This survey focuses on FC and its RDCs in Java Island (including West Java, Central Java, and East Java) alone. Herein lays the limitation of scope of study. Generalisation of research findings may be unsound. Multiple case studies that encompass other industry sectors may be a solution. The small sample size presents validity problem. This can be managed by increasing sample size. Cronbach alpha test confirming reliability of data and questionnaire model seems to compensate for some of the weaknesses of this research.

## 5. Background to Business

Prices of basic material such as wheat flour, fuel and commodities have soared to push up inflation rate to weaken purchasing power of consumers since 2008. Demand for food products including instant noodles have consequently declined to force many producers reduce or stop operation (INC, 2009).

Despite the global economic slowdown, Indonesia's instant noodles production grew 6.9% to 1,544,072 tons in 2008 from 1,443,686 tons in 2007 (INC, 2009). Indofood Group and Wingsfood Group are dominant competitors who account for about 80% share of the instant noodles market.

FC founded in 1990, integrates production, research, packaging and transportation. Currently, it employs about 5,000 people. Its assets are worth about US$1.2 billion. Investments amount to over US$250 million.

Instant noodles contribute 35% of net sales and 37% of operating income. Production hinges on triple-product-strategy: brand equity and loyalty; affordability and cost leadership, and; availability and freshness products delivered countrywide through strategic manufacturing locations and extensive distribution network.

The five-stage production processes of instant noodles include dough preparation, slitting, steaming, cutting, and frying. Sauce sachets of seasonings of different flavours are added to complete packages of boxed noodles cartons for dispatch by trucks. Quality control procedures are inbuilt at each of production stages.

FC's vertically integrated subsidiary companies deliver raw materials and distribute products to consumers. Domestic distribution is done by PT. Domark, PT. Matrim, PT. Tama, PT. Kosoc, PT. Drama, whilst PT. Irip, and PT. Tranusi serve the international market (Figure 5). The logistics challenges are responsiveness, flexibility and agility in operations and delivery to meet customer needs and requirements in cost efficient manner.

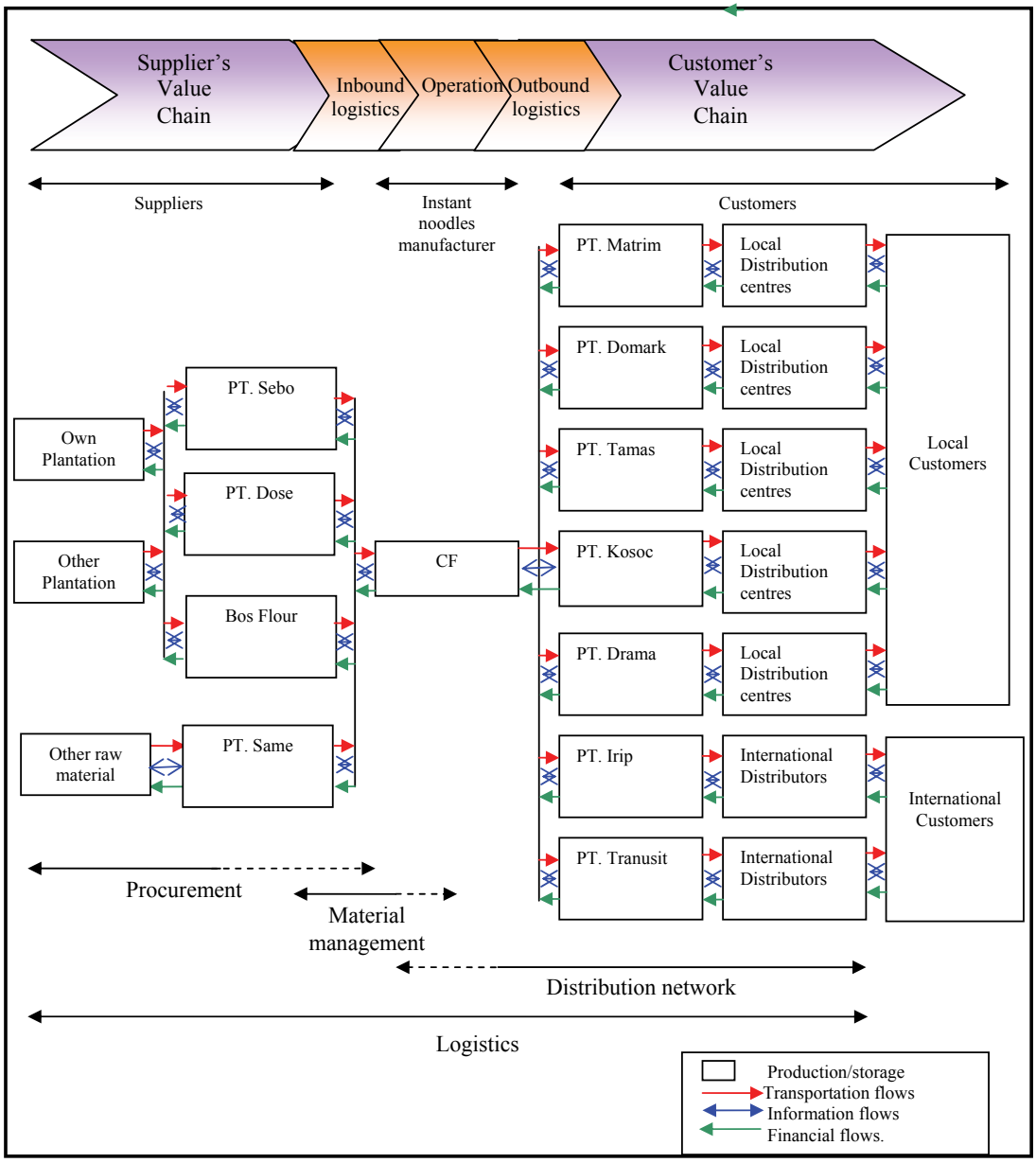



**Figure 5** CF's Logistics Configuration and Value Chain

## 6. Findings and Discussion

### Logistics Critical Success Factors

Cronbach $\alpha$ coefficient (0.6427) gives credence to reliability of questionnaire device. Figure 6 shows status of FC's logistics and distribution network capability as perceived by two manager groups (corporate and subsidiary). Product loss and damages (*variable 16*) seem be major issues.

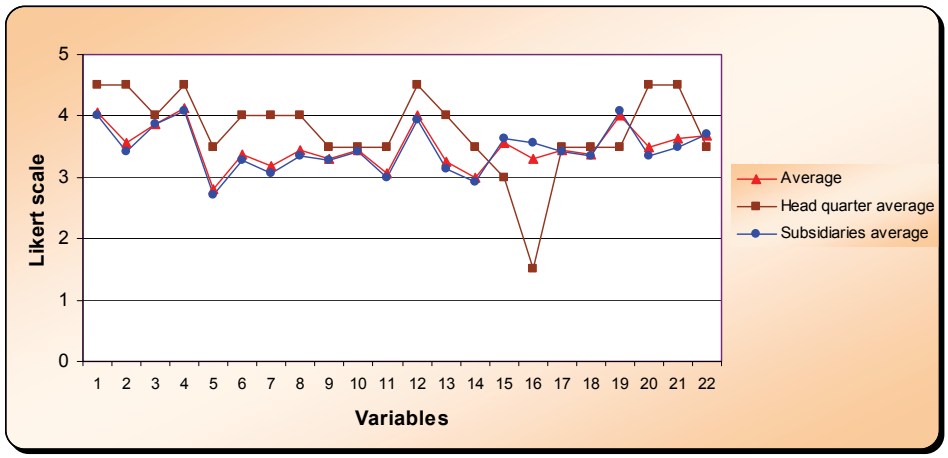



**Figure 6** Manager Questionnaire Result

**Notes:** 1.Committed to delivery date; 2. Order completeness; 3. Order accuracy; 4.Availability of stock; 5. Customer complaint; 6. Facility cost; 7. Inventory cost; 8. Transportation cost; 9. Handling cost; 10. Order processing cost; 11. Quality cost; 12. Total distribution cost; 13. Forecast accuracy; 14. Schedule compliance; 15. Order error; 16. Loss and damages; 17. Customer returns; 18. Order cycle time; 19. Inventory review cycle time; 20. Customer order processing cycle time; 21. Delivery lead time; 22. Frequency delivery.

*T*-test results show *p*-value for 'loss and damages' is less than the significant level (0.01), so $H_0$ was rejected and $H_A$ accepted- there is significant difference in perception amongst headquarters' and subsidiaries' managers about performance regarding lost and damaged goods.

| ***Hypothesis*** | ***Descriptor*** |
|---|---|
| ***Reject $H_10$*** | *There is no significant difference in perception between headquarters and subsidiaries about critical success factors.* |

Almost 70% of respondents thought commitment to deliver on time/date (Rushton *et al.*, 2001) were very important in logistics and distribution business (Table 5). JIT delivery programme initiative in a production plant is bearing fruits of reduced safety stock inventory and delivery time).

Availability of stock maintains customer service levels and minimises stock-out episodes which compel customers to buy from competitors. Inventory is a major investment and tied up capital. Increased inventory levels heighten customer service levels and associated costs. An understanding of relationship between customer service (Botchway, 2000), stock availability and costs is desirable for crafting appropriate inventory management strategies (Christopher, 1998).

Almost 70% of respondent managers agree total distribution cost affects the bottom-line. Increased customer service levels result in increased sales, but also exponentially cost increases. Optimum service level that balances increased sales revenues with cost increases associated with incremental higher service level will have to be established. The option may be a total distribution cost - customer service level trade-off).

**Table 5** Descriptive Statistics

| Variables | Mean | Standard deviation |
|---|---|---|
| 1. Committed to delivery date | 4.063 | 0.998 |
| 2. Order completeness | 3.563 | 1.153 |
| 3. Order accuracy | 3.875 | 0.885 |
| 4. Availability of stock | 4.125 | 0.806 |
| 5. Customer complaint | 2.813 | 1.047 |
| 6. Facility cost | 3.375 | 1.258 |
| 7. Inventory cost | 3.188 | 0.834 |
| 8. Transportation cost | 3.438 | 1.263 |
| 9. Handling cost | 3.313 | 1.078 |
| 10. Order processing cost | 3.438 | 1.153 |
| 11. Quality cost | 3.063 | 1.237 |
| 12. Total distribution cost | 4.000 | 0.894 |
| 13. Forecast accuracy | 3.250 | 1.390 |
| 14. Schedule compliance | 3.000 | 1.095 |
| 15. Order error | 3.563 | 1.263 |
| 16. Loss and damages | 3.313 | 1.448 |
| 17. Customer returns | 3.438 | 1.153 |
| 18. Order cycle time | 3.375 | 1.310 |
| 19. Inventory review cycle time | 4.000 | 0.817 |
| 20. Customer order processing cycle time | 3.500 | 0.966 |
| 21. Delivery lead time | 3.625 | 1.360 |
| 22. Frequency delivery | 3.683 | 1.078 |

Review of inventory at possible short time periods will aid information update essential for on-time delivery and meeting customer requirements. A distributor reviews inventory levels every two days - an inventory review cycle time shorter and better than the group's average. Traditional inventory management seems implausible; it does not assure attainment of optimum inventory levels.

Customer returns and transportation cost were highly interlined ($r$ = 0.730). CF's customer return (reverse logistics) policy provides for free collection and transportation of damaged or defect products. Also, 'Transportation cost', 'Customer order processing cycle time', and 'Delivery lead time' have very strong and positive linkages to as many as four different variables (Figure 7).

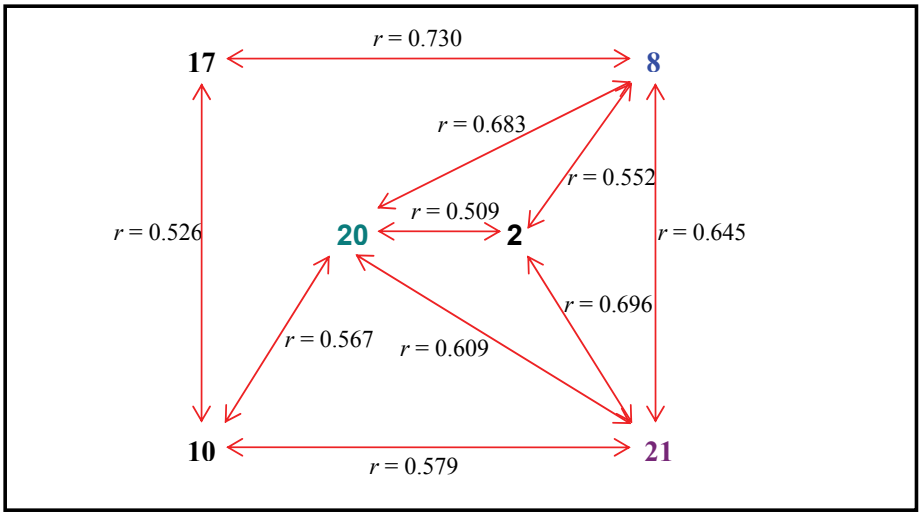



**Figure 7** Correlation Map

**Notes:** 2. Order completeness; 8 Transportation cost; 10 Order processing cost; 17 Customer returns; 20 Customer order processing cycle time; 21 Delivery lead time.

Hypothesis 2 which states that transportation cost is directly related to customer returns and inversely related to customer order processing cycle time is depicted in the stepwise regression equation model:

$$y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4$$

where: $y$ is 'Transportation cost', the dependent variable.
$x_1$ is 'Customer returns';
$x_2$ 'Customer order processing cycle time';
$x_3$ 'Order completeness'; and
$x_4$ 'Delivery lead time', all independent variables.
a is the intercept.
$b_1$, $b_2$, $b_3$, $b_4$ are regression coefficients for the four independent variables.

Solution to the regression equation:

$$y = -0.773 + 0.599x_1 - 0.615x_2.$$

shows that if 'Customer order processing time' improves or becomes shorter, then more delivery runs would be made to satisfy customer demands, thus, increasing 'Transportation costs'. As a result the null hypothesis was accepted:

| ***Hypothesis*** | ***Descriptor*** |
|---|---|
| ***Accept $H_20$*** | *Transportation cost is directly related to customer returns and inversely related to customer order processing cycle time.* |

Hypothesis 3 which states customer order processing cycle time is inversely dependent on transportation costs is tested. It is expressed in the regression model:

$y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4$

where: *y* is 'Customer order processing cycle time', the dependent variable.
$x_1$ is 'Transportation cost';
$x_2$ 'Order completeness';
$x_3$ 'Customer returns'; and
$x_4$ 'Delivery lead time', all independent variables.
a is the intercept.
$b_1$, $b_2$, $b_3$, $b_4$ are regression coefficients for the four independent variables.

The regression solution:
$y = 1.705 + (- 0.522\ x_1)$.

indicates that if more delivery runs are made to satisfy customer demands thus 'Customer order processing time' would become shorter. Hence, the null hypothesis was accepted:

| ***Hypothesis*** | ***Descriptor*** |
|---|---|
| ***Accept $H_30$*** | *Customer order processing cycle time is inversely related to transportation costs.* |

Similarly, Hypothesis 4 – 'Delivery lead time is inversely related to order completeness and order processing cost'- is expressed by regression equation model:

$y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4$

where: *y* is 'Delivery lead time', the dependent variable
$x_1$ is 'Order completeness';
$x_2$ 'Order processing cost';
$x_3$ 'Transportation cost'; and
$x_4$ 'Customer order processing cycle time' , all independent variables.
a is the intercept.
$b_1$, $b_2$, $b_3$, $b_4$ are regression coefficients for the four independent variables.

Solution to the regression equation is:
$y = 0.761 - (0.712\ x_1) + (– 0.538\ x_2)$.

Table 6 lists the beta weight and shows that 'Order completeness' has more effect on 'Delivery lead time' than 'Order processing cost'. The fact that an increase in 'Order completeness' and 'Order processing cost' would shorten 'Delivery lead time' goes to confirm the null hypothesis:

**Table 6** Delivery Lead Time Regression Coefficients[a]

| | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| Model | | B | Std. Error | Beta | | |
| 1 | (Constant) | .699 | .845 | | .827 | .422 |
| | Order completeness | .821 | .226 | .696 | 3.629 | .003 |
| 2 | (Constant) | .761 | .855 | | -.890 | .390 |
| | Order completeness | -.712 | .188 | .603 | 3.789 | .002 |
| | Order processing costs | -.538 | .188 | .456 | 2.867 | .013 |

A Dependent Variable: Delivery lead time.

| *Hypothesis* | *Descriptor* |
|---|---|
| ***Accept $H_40$*** | *Delivery lead time is inversely related to order completeness and order processing cost.* |

Principal Component (PC) analysis shows that five logistics and distribution network factors account 67% of total variance, and the remaining seventeen 33% (Table 7). Hence, a model containing the five factors can adequately represent the CSFs data. PC1 explains the largest variance 22% and registers high loadings on: 'Transportation costs' ($r$ = 0.886); 'Handling cost' ($r$ = 0.511); 'Total distribution costs' ($r$ = 0.781); 'Order cycle time' ($r$ = 0.734); 'Customer order processing cycle time' ($r$ = 0.766); and 'Delivery lead time' ($r$ = 0.825). This gives cause to label Factor 1 as *'Costs and Cycle Time Factor'*.

PC2 accounts 14% of total variance with high positive loadings on 'Committed to delivery date' ($r$ = 0.604), 'Availability of stocks' ($r$ = 0.634), and 'Order accuracy' ($r$ = 0.687). Factor 2 is termed '*Customer Service Factor'*. Markedly, this factor recorded high negative loadings on 'Customer complaints' ($r$ = -0.823). Although managers hinted customer satisfaction was paramount, it was found they cared much less about customer complaints.

Factor 3 is labelled the '*Quality Factor*', Factor 4, the '*Inventory Management Factor*', and '*Order Management Factor*'. Five CSFs of logistics and distribution network can be isolated from the 22 variables: *'Costs and Cycle Time Factor'*, '*Customer Service Factor'*, '*Quality Factor*'', *Inventory Management Factor*', and '*Order Management Factor*'.

**Table 7** Rotated Component Matrix

| | Variables | PC1 | PC2 | PC3 | PC4 | PC5 |
|---|---|---|---|---|---|---|
| 1 | Committed to delivery date | .089 | .604 | .334 | -.025 | .386 |
| 2 | Order completeness | .036 | .130 | -.070 | .025 | .637 |
| 3 | Order accuracy | .186 | .687 | .351 | -.077 | -.021 |
| 4 | Availability of stock | -.023 | .634 | -.061 | -.208 | -.115 |
| 5 | Customer complaint | -.319 | -.823 | .911 | -.253 | .366 |
| 6 | Facilities cost | .097 | -.037 | .300 | -.027 | .064 |
| 7 | Inventory cost | .157 | .126 | .014 | .516 | .221 |
| 8 | Transportation cost | .886 | -.029 | .074 | .255 | -.125 |
| 9 | Handling cost | .511 | .167 | -.074 | .330 | -.372 |
| 10 | Order processing cost | .275 | .211 | .244 | .031 | -.069 |
| 11 | Quality cost | .043 | .226 | .790 | .337 | .204 |
| 12 | Total distribution cost | .781 | -.317 | -.045 | -.029 | .412 |
| 13 | Forecast accuracy | .068 | -.095 | .532 | -.379 | .406 |
| 14 | Schedule compliance | -.062 | -.016 | .089 | -.317 | .334 |
| 15 | Order error | -.193 | -.004 | .781 | .130 | -.070 |
| 16 | Loss and damages | -.043 | .102 | .886 | -.037 | .351 |
| 17 | Customer returns | .168 | -.046 | -.023 | -.061 | -.061 |
| 18 | Order cycle time | .734 | .317 | -.319 | -.016 | .911 |
| 19 | Inventory review cycle time | .247 | -.061 | .097 | .687 | .300 |
| 20 | Customer order processing cycle time | .766 | .106 | .157 | .126 | .014 |
| 21 | Delivery lead time | .825 | .163 | .186 | -.029 | .074 |
| 22 | Frequency delivery | .274 | -.286 | .511 | .167 | -.074 |

| | | | | | |
|---|---|---|---|---|---|
| Percentage Variance | 22.062 | 13.941 | 12.659 | 9.886 | 8.351 |
| Cumulative Percentage of Variance | 22.062 | 36.003 | 48.662 | 58.548 | 66.899 |

**Notes:** PC Principal Component; Extraction Method: Principal Component Analysis; Rotation Method: Varimax with Kaiser Normalization; 5 Components selected.

Once more, five distinct groups of CSFs derived from cluster analysis corroborate the five factors identified in the Factor analysis procedure.

The first two CSFs correspond to the following variables in the Cartesian space shown in Figure 8: 'Committed to delivery date' (1), 'Order accuracy' (3), 'Delivery lead time' (21), 'Order cycle time' (18), and 'Customer order processing cycle time' (20).

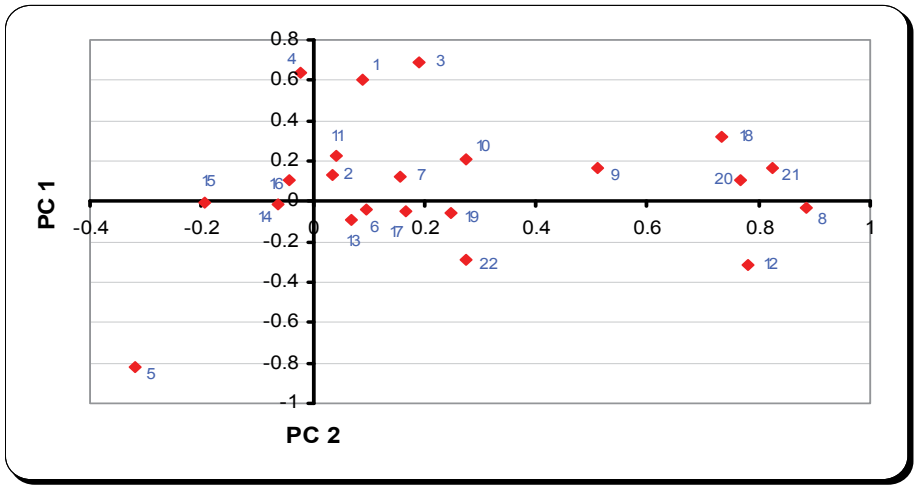



**Figure 8** Scatter Plot PC1 Vs. PC2

**Notes:** 1.Committed to delivery date; 2. Order completeness; 3. Order accuracy; 4.Availability of stock; 5. Customer complaint; 6. Facility cost; 7. Inventory cost; 8. Transportation cost; 9. Handling cost; 10. Order processing cost; 11. Quality cost; 12. Total distribution cost; 13. Forecast accuracy; 14. Schedule compliance; 15. Order error; 16. Loss and damages; 17. Customer returns; 18. Order cycle time; 19. Inventory review cycle time; 20. Customer order processing cycle time; 21. Delivery lead time; 22. Frequency delivery.

Hierarchical clustering of respondent managers by location produced four cluster groups. The first cluster is logistics cost focused. Further study of the spatial clusters can yield effective background information for logistics and distribution network re-design (Table 8).

**Table 8** Five Cluster CSFs

| |
|---|
| **Group 1:** 2. 'Order completeness'; 3. 'Order accuracy'; 6. 'Facility cost'; 8. 'Transportation cost'; 11. 'Quality cost'; 17. 'Customer returns'; 19. 'Inventory review cycle time'; 20. 'Customer order processing cycle time', and; 21. 'Delivery lead time' |
| **Group 2:** 1.'Committed to delivery date'; 3. 'Order accuracy'; 4. 'Availability of stock'; 5. 'Customer complaints'; 7. 'Inventory cost'; 12. 'Total distribution cost', and; 22. 'Frequency delivery'. |
| **Group 3:** 10. 'Order processing cost', and; 13. 'Forecast accuracy'. |
| **Group 4:** 14. 'Schedule compliance' and; 18. 'Order cycle time'. |
| **Group 5:** 15. 'Order error', and; 16. 'Loss and damages. |

## Logistics and Distribution Network Redesign

Figure 9 shows FC's SWOT (strengths, weaknesses, opportunities and threats). Logistics and distribution network is an obvious weak link whose redesign can compensate for weaknesses and capitalise on opportunities.

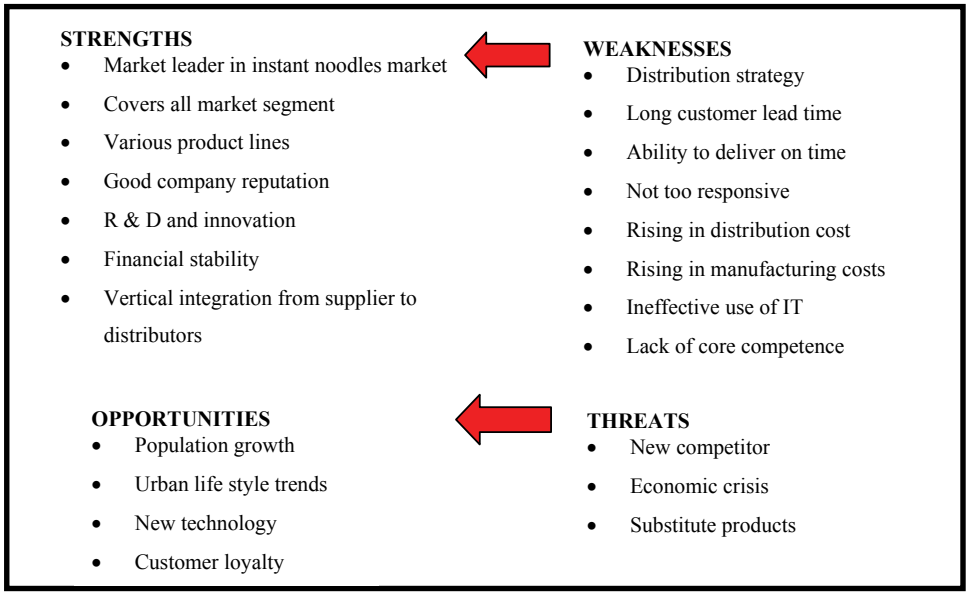



**Figure 9** FC's SWOT Analysis

Strategies are afoot to deny competitors – new or existing - foothold in easily served and profitable markets. The 'blanket coverage' commits FC to product availability virtually anywhere in the country and continuous redesign of logistics and distribution network systems. Warehouse management is being re-organised and specialised delivery equipment and information systems are witnessing improvement. Distributors receive support and training in order to maximum logistics operation efficiencies.

The three manufacturing plants in Cibitung (Jakarta), Solo (Central Java), and Gresik (East Java) are forging ahead with JIT production programmes. The 250,000 square-meter- Cibitung plant is the largest and highly automated facility utilised to over 90% capacity. It produces 3 billion packs of instant noodles annually. The Solo plant produces 1.5 billion packs per year, whilst the Gresik plant has the same capacity, but needs 20% more floor space.

FC distributor companies - PT. Domark, PT. Matrim, PT. Tama, PT. Kosoc, and PT. Drama, all in Java – deliver products from point to point, coordinate distribution activities and manage over 60 sub-distributors who supply more than 150,000 retail outlets throughout Indonesia (Figure 10).

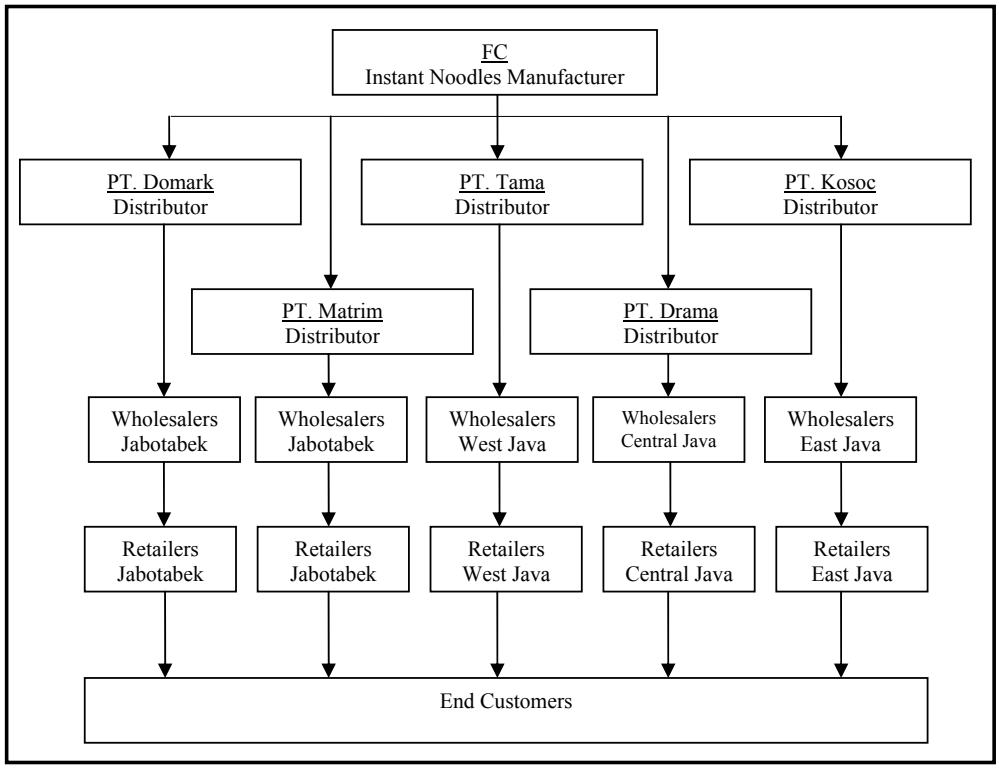



**Figure 10** FC's Distribution Channel Members

PT Domark is one of the largest distributors of instant noodles in Indonesia. It has 34 branches, 157 depots and 196 stock points. Its distribution centre in Jakarta serves 26 depots and customers in Jabotabek area (Jakarta, Bogor, Tangerang, Bekasi). PT. Matrim distributes instant noodles throughout Indonesia and beyond. It has 27 branches, 142 depots and 151 stock points and a distribution centre in Jakarta (Figure 11).

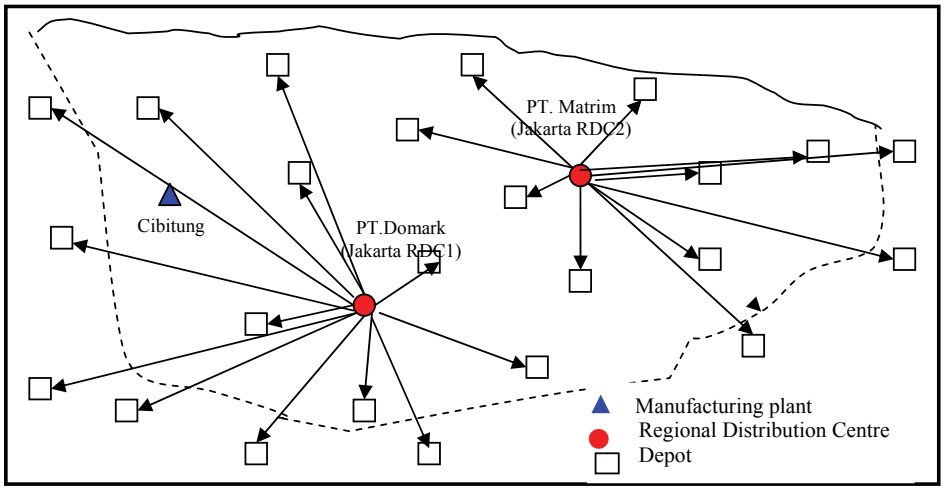



**Figure 11** Distribution Network in Jabotabek

PT. Tama has 14 branches, 123 depots and 126 stock points throughout Indonesia, but has only one distribution centre in Bandung which serves 16 depots and customers in West Java (Figure 12).

PT. Drama has 17 branches, 129 depots, 135 stock points and two distribution centres in Semarang and Yogyakarta which serve 23 depots and customers in Central Java area (Figure 13).

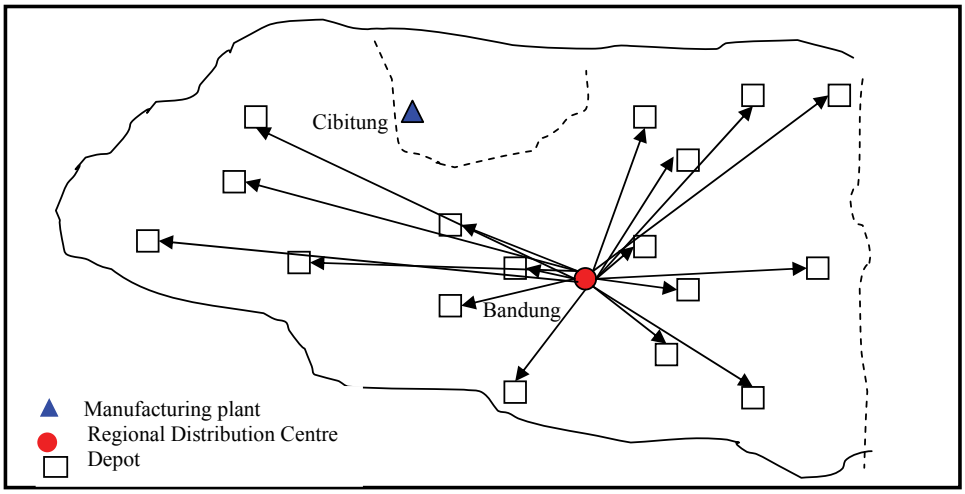



**Figure 12** Distribution Network in West Java

PT. Kosoc has 16 branches, 127 depots and 133 stock points throughout Indonesia. It uses 2 distribution centres in Surabaya and Malang to supply instant noodles to 23 depots and customers in East Java area (Figure 14).

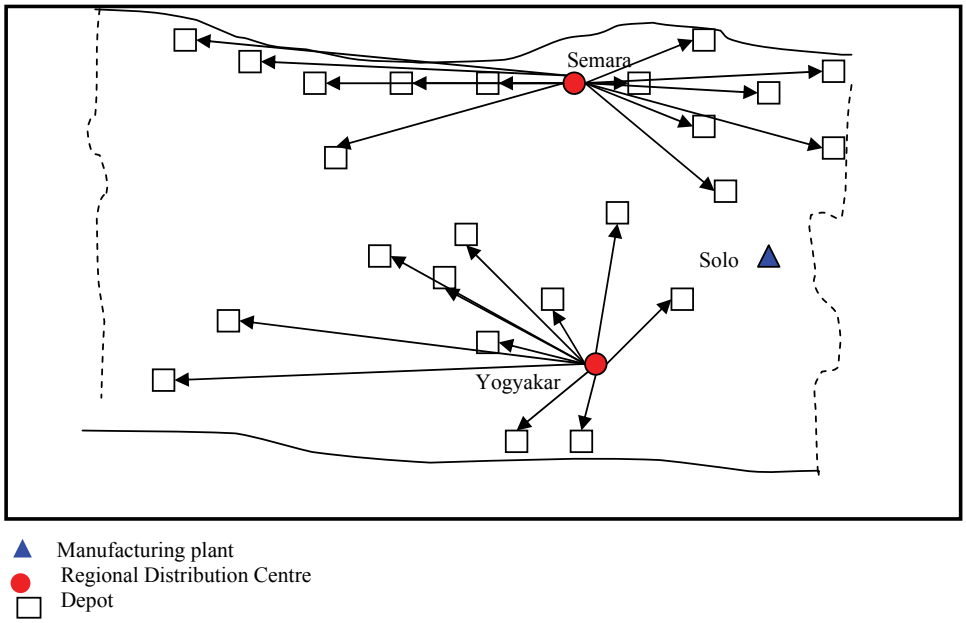



**Figure 13** Distribution Network in Central Java

PT. Tama's RDC in Bandung is the largest (capacity 1,943,400 packs of instant noodles), whilst PT Drama's in Surabaya is the smallest. Capacity utilisation in

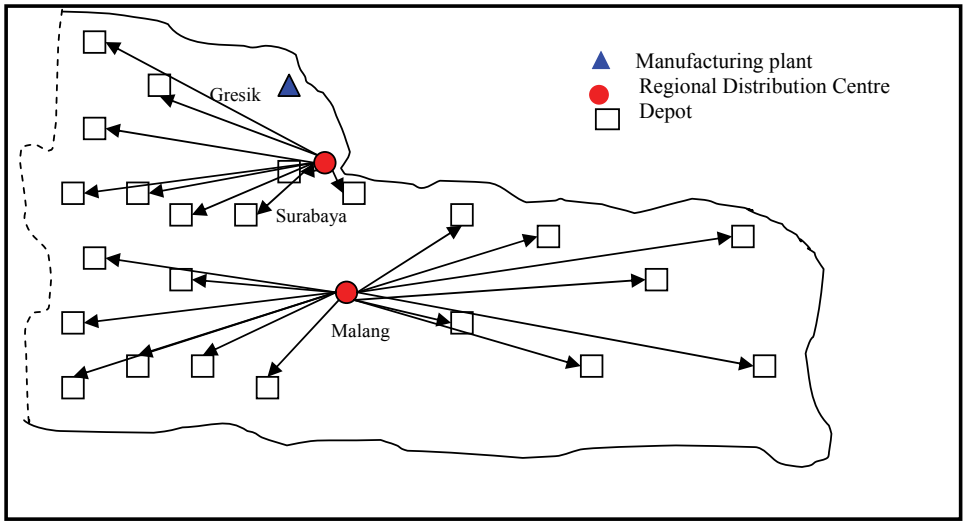



**Figure 14** Distribution Network in East Java

PT. Domark's RDC1 in Jakarta is the highest (Table 9).

**Table 9** Comparison of Distributor Subsidiaries – Capacity Utilisation

| Distributor | Number of warehouse | Location of warehouse | Size of warehouse (m2) | Capacity (packs) | Utilisation (%) |
|---|---|---|---|---|---|
| PT. Domark | 1 | Jakarta | 19,380 | 1,756,800 | 99 |
| PT. Matrim | 1 | Jakarta | 15,800 | 1,497,200 | 96 |
| PT. Tama | 1 | Bandung | 22,650 | 1,943,400 | 98 |
| PT. Kosoc | 2 | Semarang | 11,375 | 1,296,000 | 92 |
| | | Yogyakarta | 10,930 | 1,197,700 | 79 |
| PT. Drama | 2 | Surabaya | 9,260 | 1,095,300 | 93 |
| | | Malang | 12,890 | 1,223,900 | 87 |

Although, Bandung RDC's sales are the highest, its net income is not. Surabaya RDC records the lowest total sales and total net income (Table 10).

**Table 10** Comparison of Distributor Subsidiaries –Total Net Income

| Distributor | Location of warehouse | Total sales (Rp Billion) | Total net income (Rp Billion) | Total distribution cost (Rp Billion) |
|---|---|---|---|---|
| PT. Domark | Jakarta | 416.76 | 2.67 | 44.94 |
| PT. Matrim | Jakarta | 367.89 | 1.92 | 43.25 |
| PT. Tama | Bandung | 467.56 | 2.38 | 41.71 |
| PT. Kosoc (S) | Semarang | 338.71 | 1.87 | 32.57 |
| PT. Kosoc (Y) | Yogyakarta | 296.39 | 1.53 | 25.00 |
| PT. Drama(S) | Surabaya | 169.76 | 1.31 | 26.13 |
| PT. Drama(M) | Malang | 432.89 | 2.87 | 31.47 |

Figure 15 depicts the customer order processing. Investment in information technology seems to impact positively communication between suppliers, distributors and customers, order processing, inventory tracking, work scheduling, and vehicle routing.

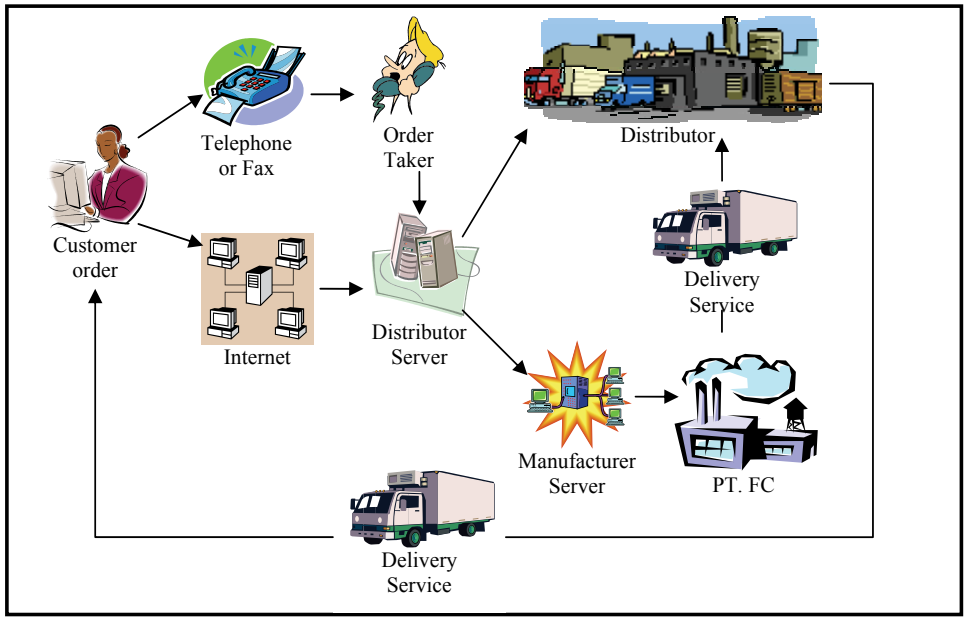



**Figure 15** Order Processing Management

**Internal Benchmarking**

RDCs differ in terms of performance based on the four dominant CSFs identified. Overall, Bandung RDC's are best performers, whilst Malang RDC is the poorest (Table 21).

Total distribution cost is modelled thus:

TDC = FC + IC + TC + HC + OPC + QC
where: TDC = Total Distribution Cost
FC = Facilities Cost
IC = Inventory Cost
TC = Transportation Cost
HC = Handling Cost
OPC = Order Processing Cost
QC = Quality Cost

Hypothesis 5 posits that total distribution cost is directly related to facilities costs and transportation costs. This is modelled in the regression equation:

$$y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6$$

where: $y$ is 'Total distribution cost', the dependent variable
$x_1$ is 'Facilities Cost';
$x_2$ 'Transportation cost';
$x_3$ 'Inventory cost';
$x_4$ 'Handling cost';
$x_5$ ' Order processing cost'; and
$x_6$ ' Quality cost', all independent variables.
a is the intercept.
$b_1$, $b_2$, $b_3$, $b_4$, $b_5$, $b_6$ are regression coefficients for the six independent variables.

The outcome solution:

$$y = -2.688 + 3.843\ x_1 + 0.639\ x_2$$

indicates that, if FC minimises facilities and transportation costs, total distribution cost would be minimise as well. Hence the null hypothesis is accepted:

| Hypothesis | Descriptor |
|---|---|
| ***Accept $H_50$*** | *Total distribution cost is directly related to facilities costs and transportation costs.* |

Benchmark measures in Table 11 seem to confirm result of the regression analysis. The dominant cost elements that contribute to total distribution cost include facilities, inventory and transportation costs.

**Table 11** Cost Elements in Distribution Activities

| RDC | Facilities costs (Rp Billion) | Inventory cost (Rp Billion) | Transportation cost (Rp Billion) | Handling cost (Rp Billion) | Order Processing cost (Rp Billion) | Quality cost (Rp Billion) | Total distribution cost (Rp Billion) |
|---|---|---|---|---|---|---|---|
| 1 | 10.24 | 15.78 | 12.52 | 4.57 | 1.59 | 0.24 | 44.94 |
| 2 | 9.66 | 13.56 | 14.08 | 3.76 | 1.67 | 0.52 | 43.25 |
| 3 | 8.35 | 8.84 | 19.34 | 3.28 | 1.54 | 0.36 | 41.71 |
| 4 | 6.78 | 7.15 | 14.67 | 2.32 | 1.53 | 0.12 | 32.57 |
| 5 | 5.32 | 4.23 | 10.56 | 3.46 | 0.95 | 0.48 | 25.00 |
| 6 | 6.01 | 5.97 | 9.97 | 2.89 | 1.02 | 0.27 | 26.13 |
| 7 | 6.53 | 6.21 | 13.67 | 3.19 | 1.48 | 0.39 | 31.47 |

PT. Drama in Malang which has the smallest total distribution cost to total sales ratio is the most cost-efficient distribution network amongst the lot. PT. Drama in Surabaya is the worst performer needing urgent distribution network redesign.

Overall, Bandung RDC is the best quality RDC in terms of forecast accuracy, schedule compliance, order compliance, product delivery and customer satisfaction, while PT Kosoc in Yogyakarta is the poorest (Table 12).

**Table 12** Benchmarking Quality

| RDC | Forecast accuracy (%) | Schedule compliance (%) | Orders errors (%) | Lost and damage (%) | Customers returns (%) |
|---|---|---|---|---|---|
| 1 | 94 | 91 | 9 | 13 | 11 |
| 2 | 91 | 93 | 7 | 8 | 8 |
| 3 | 96 | 94 | 3 | 5 | 6 |
| 4 | 86 | 89 | 11 | 11 | 15 |
| 5 | 82 | 87 | 13 | 17 | 21 |
| 6 | 87 | 93 | 6 | 15 | 13 |
| 7 | 79 | 89 | 14 | 11 | 10 |

ANOVA test results for Hypothesis 6 which states that there is no significant difference in performance between distributor subsidiaries showed mixed-outcomes. There was no significant difference between distributor subsidiaries in terms of three performance indicators only - 'Availability of stock', 'Order processing cost', and 'Quality cost' - , because their *p*-values were larger than their F ratios. For the rest of the performance variables, the distributors vary. The null hypothesis was thus rejected (Table 13).

| Hypothesis | Descriptor |
|---|---|
| ***Reject $H_60$*** | *There is no significant difference in performance between distributor subsidiaries.* |

Three homogeneous RDC cluster groups emerged from cluster analysis:

Group 1: 1). PT. Domark, Jakarta and 2). PT. Matrim, Jakarta
Group 2: 3). PT. Tama, Bandung; 4). PT. Kosoc, Semarang; 5). PT. Drama, Malang; 6).PT. Drama, Surabaya, and; 7). PT. Kosoc, Yogyakarta.

**Table 13** Analysis of Variance

| | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| Availability of stock | Between Groups | 220.357 | 4 | 55.089 | .423 | .790 |
| | Within Groups | 260.500 | 2 | 130.250 | | |
| | Total | 480.857 | 6 | | | |
| Order processing cost | Between Groups | .225 | 4 | .056 | .410 | .797 |
| | Within Groups | .274 | 2 | .137 | | |
| | Total | .499 | 6 | | | |
| Quality cost | Between Groups | .046 | 4 | .012 | .321 | .847 |
| | Within Groups | .072 | 2 | .036 | | |
| | Total | .118 | 6 | | | |

Group 1 agglomerates in Jabotabek geographic area with distinctive customer behaviour patterns. Cluster information can serve as effective background to strategic logistics and distribution network redesign.

## 7. Implications

Network re-engineering may entail strategy inputs such as service leadership strategy, knowledge about CFSs, cross-docking, milkrun delivery (Burdiaryani, 2003; Botchway, 2009), re-modeling existing facilities, simulation and improving value adding activities, and training and management change.

Co-ordination of logistics functions and JIT production and delivery can improve FC's service leadership position. A good understanding of CSFs of logistics and distribution network appears vital to successful network strategy and reconfiguration.

Routing for multi-drop can ensures cost savings regular smaller size shipment. There is a possibility for Jakarta RDC1 milk run to reduce 13-depot journeys to one, and Jakarta RDC2, 11-depot journeys to one (Figure 16).

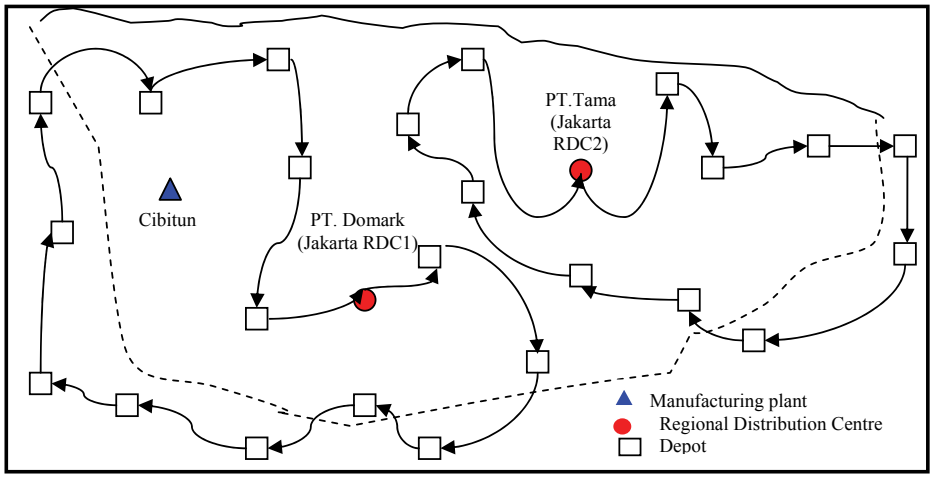



**Figure 16** Milk Run Delivery - Jabotabek

Similarly, Bandung RDC milk run can reduce 15-depot journeys to two (Figure 17).

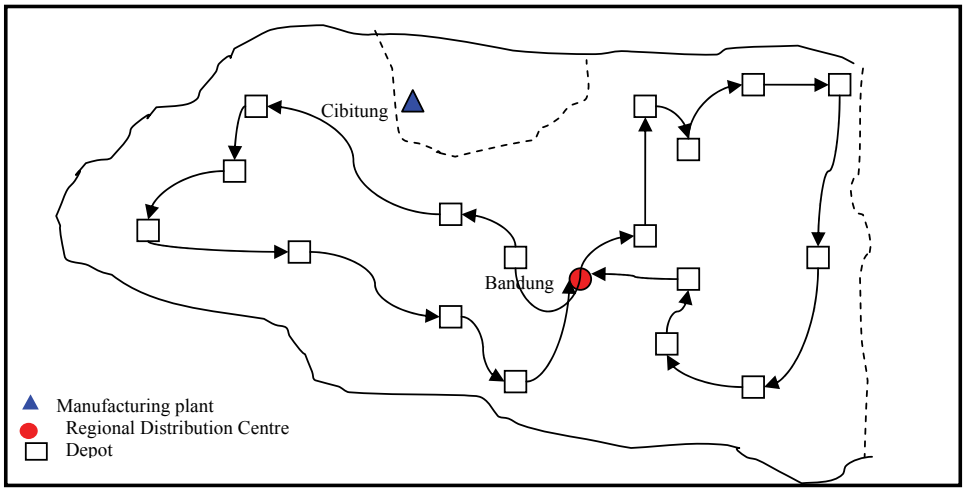



**Figure 17** Milk Run Delivery – West Java

Yogyakarta RDC milk run can reduce 10-depot journeys to one journey, whilst Semarang RDC, 13-journeys to two (Figure 18).

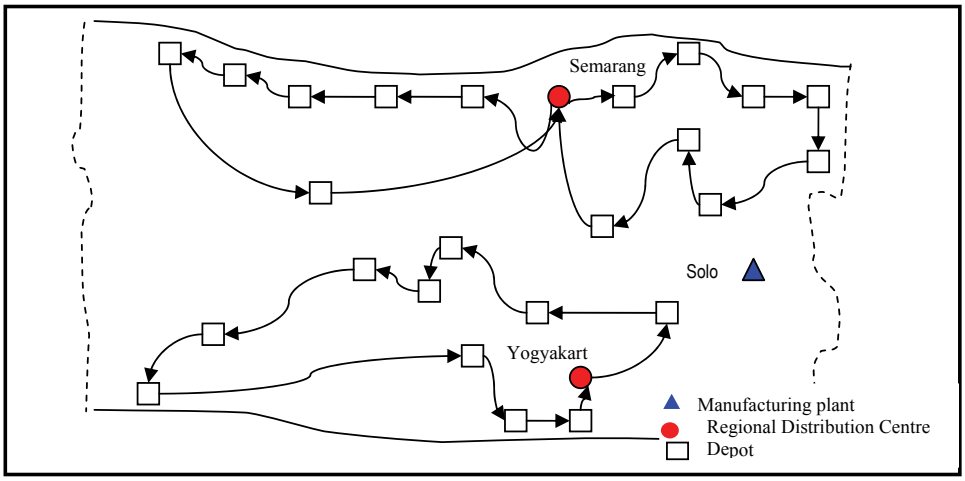



**Figure 18** Milk Run Delivery – Central Java

Surabaya RDC milk run can reduce 8-depot journeys to one, and Malan RDC, 15-depot journeys to two (Figure 19).

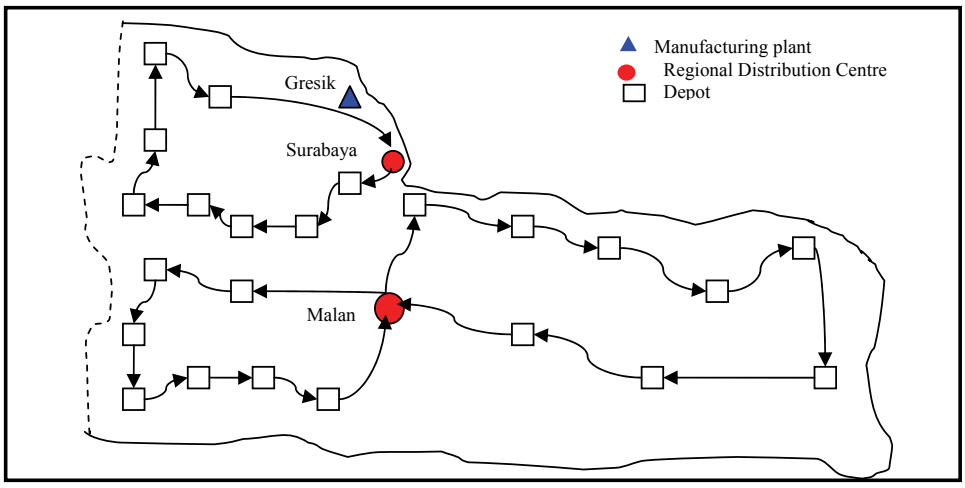



**Figure 19** Milk Run Delivery – East Java

It would be economic to remodel existing facilities. Simulation can assist with evaluation of alternative options whilst planning facilities, obtaining best use options of existing facilities, making floor space utilisation calculations, developing methods of control, materials handling, and human resources management.

Maintaining and upgrading human resource assets through regular employee training lies at the heart of any successful network redesign programme may be needed. So is the management of change. Top management initiative, commitment and leadership drive to envision, set goals, make sense of change, communicate change, pull followers along, implement, monitor and consolidate change are crucial stages in network redesign programme.

## 8. Conclusion

In this study, transportation cost is directly related to customer returns and inversely related to customer order processing cycle time, customer order processing cycle time is inversely related to transportation costs and delivery lead time is inversely related to order completeness and order processing cost. Five factors appear critical to logistics and distribution network efficiency in this study. Composition of total distribution cost seems debatable. Generally, distribution costs will be quite sensitive to the level of customer service provided. RDCs do not differ in terms of performance regarding stock availability, cost of order processing, and cost of quality. Specific problem areas in the distribution network may need further research in order to define appropriate solutions to them. Network re-engineering strategy is usually needed when service levels shift. Cross docking, multi drop (milk run) delivery, re-modelling of existing facilities, simulation, training of employees, and change management are key strategic inputs of logistics and distribution network redesign.

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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.

# Developing an Analytical Framework of the Present and Future Supply Chain Management (SCM) Trends and Developments in Uganda

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**Abstract**

This paper examines the supply chain Management trends and developments in Uganda. A total of 101 respondents from different organizations filled in a questionnaire that measured 41 key supply chain management trends and developments today and in the next five years using a scale ranging from (1) irrelevant to (5) most critical. We first examined the reliability of the survey instrument using Cronbach' alpha which was found to with a co-efficient (r=0.96). We then conducted an exploratory factor analysis to identify the most important SCM trends and developments today and in the next five years. Our study found that in Uganda's context, the most important SCM trends in the next five years will be an emphasis on (1) Product quality, safety, and supply chain delivery and security, (2) Managing fuel and transportation costs, (3) Development of new technologies that impact supply chain efficiency, (4) Managing supplier diversity, and (5) Supply chain flexibility which is seen as the major driver of supply chain strategy. We develop a framework of the most important SCM trends today and in the next five years.

**Keywords:** Supply Chain, Supplier Relationship, Conflict, Disruption, Risk

## 1. Introduction

Recently the area of supply chain management (SCM) has become very trendy when viewed by the increased number of practitioners and academic publications, conferences, professional development programs and university courses in the area (Burgess et al, 2006). Supply chain management; defined by Mentzer et al., (2001) as 'the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purpose of improving the long-term performance of the individual companies and the supply chain as a whole' has gained significant positions in determining the competitiveness of organizations. It is seen as both an evolving field of practice and an emerging academic domain which is dynamic and constantly changing in response to changes in technology, competitive actions, and customer demands. The role of Supply chain managers has moved from being tactical to being strategic. New paradigms in supply chain management have evolved that guide new management strategies in a holistic way.

Melnyk,et. al., (2006) assert that the supply chain initially was viewed as an entity that was primarily concerned with the upstream suppliers and supplier management. Yet by the mid 1990s, there was a change in orientation. Further developments have seen the focus shift from the upstream activities to the entire supply chain (including both upstream and downstream). There is also

evidence that the theory and practice of supply chain management is undergoing a major transformation through substantially redrawing the boundaries of, and the essential nature of, this domain of theorising and practice (Burgess et al, 2006; Storey, et al., 2006). Supply chains are dynamic, constantly changing and evolving as a result of strategic changes taking place within the firm, competitive actions, changes in technology, and shifts in targeted customers or in customers' needs responsiveness (Melnyk,et. al.,2006). Duclos, et al., (2003) identify three crucial drivers for SCM trends: low cost, high quality and improved responsiveness. Key trends in SCM most notably include, cooperation rather than competition, a shift from the antagonistic model to a collaborative model (Carr, 1999; Matthyssens and Van den Bulte, 1994), the increasing use of supplier-performance tools (Carr, 1999), a trend towards supplier management among others. Kemppainen and Vepsalainen, (2003) observe that these trends may be similar, in spite of the different evaluations that are sometimes made.

As the transition in supply chain management continues, there is a strong need for managers across all functional levels, researchers, and academicians to reassess the current and future stages of supply chain management with the goal of identifying, presenting, and implementing a new set of schemas that will target at directing, inspiring, and make easy knowledge dissemination in this area. Whereas this position is consistent with studies conducted in Europe (Giunipero and flint, 2001), little research has been conducted in Sub-Saharan Africa, to corroborate these findings. Worse still Ntayi et al., (2008) argues that the concept of supply chain management in Uganda is yet to be embraced.

## 2. Theoretical Framework

Systems theory views the world in terms of collections of resources and processes that exists to meet subordinate goals (Vrijhoef and de Ridder, 2005). There are two aspects related to systems theory namely; synergy and entropy. Synergy means that the parts of a system must work together in order to achieve more than the sum of achievements that each one would achieve separately. Entropy according to New and Westbrook (2004) refers to the need of feedback across the chain to prevent debilitation of the system. This assertion is also supported by Hassan (2006) who argues that systems thinking should be designed so as to ensure its effective functioning through collaboration, conflict management and use of new technologies In terms of systems typology, supply chains are designed involving human activity and social systems, consisting of actions performed by individuals/leaders and groups of individuals or firms (Checkland, 1981). Instrumental rationality and particularistic social relations between firms characterizes supply chains thus making them associative systems or alliances between firms, which engage in voluntary relationship to produce and deliver a product or service, which are needed to manage the complexity of processes, infrastructure and other support systems (Vrijhoef and de Ridder, 2007).

Supply chain theory suggests that the supply chain should be managed from end-to-end. A more ubiquitous trend has been the conscious assessment and validation of supplier networks and the development of collaborative or partnership relationships between buyers and suppliers (Balakrishan, 2004). Such schemes are of strategic significance than simply of tactical gains (Storey, 2002). Competition has shifted from company versus company to supply chain versus supply chain. Business success is therefore derived from all members of the supply chain adding superior value to their products/ services and delivering these more efficiently than competition (Storey, 2006). In this endavour, objectives like collaboration, customer delight, timely production and delivery of products,

enhancement of consumer value and waste minimization in the supply chain, to mention but a few are some of the trends influencing effective SCM (Cox, 1999).

## 3. Literature Review

### Collaborative relationships and conflict management

The need to be competitive, flexible and efficient has forced companies to enter into collaborative relationships with suppliers and customers (Carr And Smeltzer, 1999; Cousins, 1999; Hines, Lammings et al., 2000). This has been necessitated by today's competitive situations where true competitive battles are fought along a network of cooperating companies. These competitive battles occur to supply chain, implying that a company is as strong as its weakest supply chain partner (Best, 1990; Veludo, et al, 2004**).** However; some firms continue to maintain arm's-length relationships with their suppliers and to use competition and supplier switching as motivations to obtain optimal performance from their supply base (Ntayi, et al., 2008). Collaborative relationships invigorate information flows which contribute to the lowering of enterprise operational expenses and collaborating partners to proactively adjust their operations to the market trends thereby helping to mitigate losses and increase supply chain agility. Whereas this position is consistent with studies conducted in Europe (Giunipero and Flint, 2001), little research has been conducted in Sub-Saharan Africa.

Strategic supplier relationships are more important now than ever because of volatile markets, merger & acquisition trends among others. Hardy et al., (2003) affirms that firms engage in collaboration to develop, maintain and even enhance supply chain capabilities that contribute to enhancing firm performance and, ultimately competitive advantage. Simatupang and Sridharan (2005) enunciated the elements of SC collaboration namely; an appropriate performance system, streamlined inter-company business processes, information sharing, decision synchronization and incentive alignment. The first two elements though necessary for SC collaboration, are essentially internal processes of the SC member operations. The last three elements constitute the structure of coordination and collaboration that can be configured at different levels by participating sc members to increase sc performance.

Collaboration does not, however, come easy because of the embedded conflict of interests among channel members. There are always issues of power and resource control in the supply chain where some members may attempt to push through arrangements that benefit them more than the others. Collaborative relations could be used in resolving such conflicts. The supply chain requires concerted efforts from all participating chain members to reap the benefits accruing from their collaboration. Supply chain collaboration therefore necessitates chain members to be involved in coordinating intra- company activities with the objective of fulfilling end customer needs better than competition (Bowersox, 1990). Simatupang and Sridharan (2005) enunciated the elements of SC collaboration to be characterized by five elements namely: an appropriate performance system, streamlined inter-company business processes, information sharing, decision synchronization and incentive alignment. Spiers (1997) too proposes five principles on which collaborative relationships should be based - behavior should be guided by mutual respect, commitment, openness and focus on group gains; emphasis on involvement all SC members and proactive innovation. However Storey (2006) cited in Lambert et al. (19960 argues that partnership may not always be the right approach in every circumstance.

However, anecdotal evidence from Uganda divulges that organizations tend to suffer from collaborative constraints, and information technology inaccessibility (Uganda National Chamber of Commerce and Industry, 2003). These shortcomings negatively affect their ability to grow, attain economies of scale and minimize cost, which is much needed in supply chain performance. Ntayi et al., (2008) argues that several firms in Uganda are run under the notion of win-lose where the seller must gain and the buyer must lose, that is, the "we win – you lose" type of game. Under this management bias, purchasing and supply chain manager is charged with the responsibility of obtaining the best purchase at the lowest possible price. This is usually achieved by setting of suppliers in the chain to compete on price. The buyer is left with no choice but to adopt an adversarial stance with the ultimate objective of bullying the seller/supplier to accept his / her purchase terms. The adversarial attitude brings power issues into the supply chain for instance: the size of the seller/buyer, business motives, resource envelope etc could influence the outcomes of this power game one-way or the other. The strong ultimately survive while the weak will die.

**Leadership**

It is difficult to achieve results without strong focused leadership. Senior management has to provide the resources for any transition.The policies, procedures and practices that guide the conduct of the organization's activities have to be reviewed by top management to minimize any embedded constraints to collaboration. This view is based on the premise that supply chain relationships have been the adversarial type and this would be reflected in their current policies. The second area of review by top management is the organizational structure. Structure refers to the way various activities that reflect the work of the enterprise are grouped together in order to ensure work is done efficiently and effectively (Pearce and Robinson, 2000) and top management must be involved at the highest level of this effort. There is therefore need to review these to ensure that they contribute to the improvement of supply chain performance. The third area of importance to top management would be in the systems of the enterprise. The Mckinsey framework suggested the six components of structure, systems, culture /shared values, skills, style and staff. Pearce and Robinson (2000) grouped these activities into three namely structure, leadership and culture. These supply chain activities have to be managed in a coordinated manner with a high degree of integration in order to improve its performance.

**Development of New Technologies That Impact Supply Chain Efficiency**

There are numerous IT services, software systems and packages available to business companies that can facilitate company performance such as "Quick Response" (QR) and "Efficient Consumer Response (ECR)" (Abernathy et al., 2000). The major challenges faced by firms regarding the use of IT relate to the costs involved in implementing it and the choice of the most suitable IT systems to use. Use of IT systems to support operations in firms create benefits like improved quality of information, better information sharing abilities, ability to integrate the supply chain, elimination of waste and a lot of paper work, timeliness, reduced business cycle times, better access to information, lower inventory levels, ability to contact customers and business partners wherever they are and responsiveness to market place changes by keeping in touch with the market environment through intelligence systems, to mention but a few. These benefits enhance the performance of a firm through cost minimization. IT supports collaborative relationships through enabling information sharing. This creates value for a firm leading to improved company performance (Gebauer and Segev, 1998; Lee 2000). However, technology should not be seen as the driver but rather as an enabler. The human element of the process should not be underestimated. Successful implementation

of business systems relies on ensuring an appropriate combination of the right technology, people and processes.

IT promotes healthy inter-firm collaborations which are characterized by open communication, accessibility, availability, information flows, a sense of participation and involvement in the relationship. These attributes create transparency in the relationship and signal a mutual willingness to increase vulnerability to each other (Mohr and Nevin, 1990; Mohr et al., 1996). Communication allows exchange of necessary information and reduces misunderstandings and uncertainty (Dwyer et al., 1987; Mohr and Nevin, 1990). However, Hines et al. (2004) cautions that while most trend analysis implies progress in IT usage, Fisher (1997) maintains that despite all the technology and the new techniques, supply chain performance in many instances has never been better due to the fact that managers lack a framework for determining which methods are appropriate. This implies that managers need to be discrete in adopting a far more of a contingent rather than a best practice approach.

Open communication promotes information exchange leading to mutual disclosure (Heide and John, 1992). Further mutual disclosure helps volitional compliance between partners. It highlights shared interests and common goals (Mohr et al., 1996) and thus positively affects collaboration performance (Badaracco, 1991). In other words, participative and frequent exchange of information and maintaining open-door policies to each other result from a willingness of the partners to create transparency in the relationship (Bucklin and Sengupta, 1993). Although many companies will not be able to afford new technologies there are a number of best practices that can be adopted to improve efficiency and reduce cost. There has been an attempt to link information technology and performance through the use of the competitive advantage provided by information technology application model (capita) which measures the firms' competitive benefits gained through the use of information technology application (Li and Ye, 1999; Stratman and Roth, 1999). Their findings revealed that there was a relationship between information technology competences, providing better information faster thus reducing market uncertainty. From the ensuing discussion, we know that the need for higher information technology and supply chain agility is driven by higher levels of uncertainty.

**Supply Chain Performance Measurement**

The predominant method of performance measurement is the use of Key Performance Indicators (KPIs) that cascaded down from top level business objectives and measures, through the organisation into a series of functional measures. Metrics were collected at all stages in the supply chain -daily, weekly, monthly and quarterly. The measurement of supply chain performance should therefore include the entire chain (Van-hoek, 1998). Otherwise individual units that seek to maximize their performance without regard to the broader impact on the supply chain can cause problems (Beamon, 1999; Beamon, 1999 and Easton and Jarrell, 1998; Hendricks and Singhal, 1997; Smith and Reece, 1999; Tan, Kannan and Handfield, 1996).

Whereas there are many ongoing research efforts on various aspects and in the area of SCM, so far little attention has been given to performance evaluation and hence to measures and metrics of supply chains. While companies realize that in order to evolve efficient and effective supply chain, SCM needs to be assessed for its performance. Basu (2001) proposes seven criteria for evaluating the performance of an integrated supply chain namely: networks and collaboration, transparency to customers and partners, externally focused and market centric, strategically agile, knowledge creating and sharing, web enabled and network excellence. Though Basu (2001) exemplifies these

performance criteria we prefer the view suggested by Drucker (1990) that "alliances are where the real growth is." Our concept of growth has two aspects namely: growth of sales with customer and supplier's share of customer's business. Supply chain performance will therefore be evaluated basing on these two aspects of growth. Company performance measures can be financial or non – financial. Non- financial measures include aspects like customer satisfaction and perception while financial aspects include profits / profitability, Return on Investment (ROI), the rate of growth of turnover and market share as well as the size of the firm in terms of portfolio (Business Management Journal, 2005). Much as firms have realized the potential of Supply Chain Management in recent years however, they lack insight for the development of effective and efficient performance measures. According to Kaplan and Norton (1992) while some managers have concentrated on financial performance measures, others have concentrated on operations measures and such inequality does not give a clear organizational performance. Maskell (1991) suggests that for a balanced approach companies should bear in mind that while financial performance measurements are important for strategic decisions, operations is better handled with non financial measures.

Kaplan and Norton, (1996) uses four criteria for company performance measurement: financial, customer, internal process, learning and growth. Though this approach is currently in vogue, difficulties have been met in obtaining quantitative data (Tan et al., 1999) in all the areas under evaluation. Tan et al., (1999) rightly conclude that there is currently "lack of consensus regarding a valid cross-industry measure of corporate performance." The nine criteria for performance measurement are: market share, return on total assets (ROA), average annual market share growth, average annual sales growth, average annual growth in return on total assets, average production costs, overall customer service levels, overall product quality and overall competitive position.

**Supply Chain Disruption and Risk Management**

Covello and Frederick (2009) define risk management simply as a practice of systematically selecting cost effective approaches for minimising the effect of threat realization to the organization. All risks can never be fully avoided or mitigated simply because of financial and practical limitations. Therefore all organizations have to accept some level of residual risks and find ways of managing them effectively. Gaonkar and Viswanadham (2009) argue that most companies lack a strategic approach to supply risk management at a time when supply risks are increasing. However, in Minahan (2007), assets that supply risk has traditionally been put on the weakest players in the supply chain the suppliers whom they expect to take on all the risk.

There are various types of supply chain risks, which extend well beyond simple supply disruptions, hence the need for resilience in daily operations, and the classic strategies for dealing with such risks (Borodzicz, 2005, Alexander and Sheedy, 2005; Moteff,2005). Borodzicz (2005) contends that risks arise at many levels. They can be internal risks that result from daily operations, network risks within supply chain or partner interactions, industrial risks common to all companies operating in the industry, or environmental risks beyond anyone's control. They range in severity from minor deviations in supply and demand through supply chain disruptions that can knock out part of an organization's supply chain to serious disasters that will force a temporary irrecoverable shutdown of (a substantial) part of an organization's supply chain. Lamoureux. (2006) mentioned three main supply risks; deviation, disruption and disaster. Specifically, a deviation is when one or more parameters stray from an expected value without any changes to the underlying supply chain structure. A disruption is when the structure of the supply chain is radically transformed through the unavailability of certain facilities, suppliers, or transportation options. A disaster is when a temporary

irrecoverable shutdown of the supply chain network occurs due to unforeseen catastrophic system wide disruptions.

**Managing Supplier Diversity, Supplier Segmentation and Spend Analysis**

Weele (2005) contends that supplier management should address three core issues: For which commodities should the number of suppliers be reduced? For which commodities should the current number of suppliers be maintained? For which commodities should the number of suppliers be increased? In so doing supplier segmentation is simplified since suppliers can easily be divided into categories: basic, valued, preferred or strategic (Kraljic, 1983). However, the model fails to address middle categories which may be confusing. Aberdeen Group (2004) defines spend analysis as the process of aggregating, classifying, and leveraging spend data for the purpose of reducing costs, improving operational performance, and ensuring compliance. For supply management and businesses to succeed, spend analysis cannot be overemphasized. Unfortunately, most firms lack sufficient, accurate, and timely insight into corporate spending information. Access to timely, accurate, complete, and detailed spend data offers invaluable intelligence on spending patterns, compliance and performance ratings, inventory status, and part attributes to chain partners. Such insight is critical for identifying hard-dollar savings opportunities and developing sourcing, budgeting, planning, and product strategies. Davis (1993) suggests that while good supplier management is good it is not enough. The author advocates for a wider, more integrated, all-encompassing perspective embracing all processes from sourcing through make and transportation and on to merchandising to final customers.

**Governance and Compliance Issues in The Supply Chain**

Regulatory and compliance risk is becoming more and more common around the world especially in the face of increasing corruption. It used to be just Sarbanes-Oxley that an average organization had to worry about, but now there are multiple security related acts and programs such as Customs Trade Partnership Against Terrorism (C-TPAT), the World Customs Organization (WCO) SAFE framework, and the European Union (EU) Authorized Economic Operator (AEO) programs in addition to the Office of Foreign Assets Control (OFAC) regulations, in addition to multiple versions of the European Union's (EU) Restrictions on Hazardous Substances act and the European Commission (EC) Waste Electrical and Electronic Equipment (WEEE) directive popping up all around the world (Alexander and Sheedy, 2005).

The supply chain management function of an enterprise is for example one area that is targeted second most by fraudsters (Plavsic, 2004). Helsby and Kaizer (2003) contend that enterprises should do more to prevent fraud by actively evaluating and estimating their risk exposure and their vulnerability to fraud, and that these measures should be closely supported by the ongoing monitoring of these risks. A research study done by Kramer (2003) indicates that the most significant fraud schemes occur in, or as part of, the process involving millions of shillings of commercial bribery, kickbacks and other fraud arising from the process. KPMG survey report (2005) revealed that in Africa the incidence of fraud occurrences in South African enterprises was extremely high. Despite the mixed results, organizations continue to recognize that, if governance and compliance regulations are adhered to and properly implemented, this could significantly contribute to growth and prosperity of supply chain partners. This could be achieved through: (i) enhanced competition, accountability, transparency thus lowering costs and improving global competitiveness for diversification and growth; (ii) viability as an investment target through "joint commitment" to improved macro-stability and lower country-risk, (iii) greater weight in international negotiations

through more effective collective bargaining in world forums; and (iv) joint commitment to promote and resolve supply chain conflicts.

**Supply Chain Talent, Skills Building**

Supply chain wins or loses are based on quality of the people who manage it. People are the most important asset. It is therefore imperative to find the right people with the right skills and assign them to the right tasks by defining the roles and responsibilities. The organization design should not be static but should evolve with the company. However it should be born in mind that as organizations evolve, technology does not deliver success people do. They plan, source, produce and deliver. Organizations worldwide have started to embrace professional training in purchasing and supply chain in order to enhance the effectiveness of the department (Guthrine, 2005). Cohen and Roussel (2004) stresses that organizations should continue to give professional training in purchasing and supply chain a high priority over other issues because it plays a significant role in improving the effectiveness of supply chain function of an organization. The authors further stress that having skilled, competent and committed workforce in a supply chain function impacts positively on the company's product cost, quality, delivery, flexibility and organizational performance. Morgan (2003) asserts that skills building in SCM are intended to achieve lower supply chain total cost, increase profitability for all supply chain participants, increased product quality and near perfect on-time delivery at each point in the supply chain. However, most departments in many organizations do not do enough to meet these goals due to lack of people with professional training.

Aaronson (2004) contends that the effectiveness of the supply chain depends on people capabilities. Without the right skill sets and competencies, SC departments will be unable to participate in the key activities of the organization and satisfy the needs of users. The quality of the employees has a great impact with the effectiveness of the decision. Hence the need to employ a matrix defining the position and the skills required, which can also be used to define training and development requirements, job descriptions, making hiring or promotion decisions, or developing appropriate training. This assertion is supported by Knott and Geoffrey (2005) who observe that for businesses to operate successfully, they need well trained personnel in supply chain to ensure an uninterrupted supply and flow of requirements to perform all their business activities. This could explain why many institutions of higher learning in Uganda have embraced the course training in purchasing and supply chain management. Oliver (2004) concedes that in each of the functions, the value of the people cannot be overstated, for each function in the business firm requires the use of the human resource and their potential has to be harnessed to get the best out of them. Aaronson (2004) concedes that because right is rarely diametrically opposed to wrong, professionally trained personnel in SCM can provide the organization with: Competence, confidence, courage, clarity, creation, commitment, constructive guidance in managing dual-direction relationships; connected education and training and a Communication strategy to continuously reinforce the message of purchasing principles**.**

**Process Improvements and Waste Reduction (Towards Lean Thinking)**

The principle of lean operations refers to "moving towards the elimination of all waste in order to develop an operations that is faster, more dependable, produces higher quality products & services &, operates at low cost," (Slack, Chambers, and Johnston, 2004). Lean systems focus on elimination of all kinds of waste such as waiting time, transportation, processing, inventory, Product defect and unnecessary motion (Finch 2006). These types of waste form the core philosophy behind lean systems. This calls for the implementation of a typical Kaizen which involves a

multidisciplinary team of a trained facilitators, managers, engineers, & line workers coming together for a number of days to focus on improving an organisation (Askin & Goldberg, 2002). The teams should be focused on questioning of the current methods used in the supply chain. The golden rule of Kaizen according to Askin & Goldberg (2002) is to utilize everyone's knowledge to identify & implement improvements quickly & without significant cost.

**Supply Chain Flexibility**

Flexibility means the agility of a supply chain in responding to marketplace changes to gain or maintain competitive advantage (SCOR 2006). Another definition is the ability to respond to changes in the environment such as customer demand (volume flexibility).The several types of flexibility are explained as below:

- Volume flexibility is 'the ability to effectively increase or decrease aggregate production in response to customer demand' (Cleveland *et al.,* 1989). Volume flexibility may require close coordination between a manufacturer & its suppliers, especially in the face of increasing demand. Volume flexibility directly impacts on the performance of the supply chain by preventing out-of-stock conditions of products that are suddenly in high demand of by preventing high inventory levels (obsolete stock).
- Delivery flexibility is the company's capability to adapt lead times to the customer requirements. An example of high delivery flexibility is just in time, when suppliers deliver the products to the customer at the right quantity, place & time
- Responsiveness: Responsiveness is the velocity at which a supply chain provides products to the customer (SCOR 2006). Responsiveness indicators in the supply chains maybe customer response time, lead time, delivery time, customer returns, order fill rate.
- Efficiency consists of six indicators such as farm cost/plant cost, inventory cost, waste cost, transportation cost, labour cost, profit.

**Managing Increasing Global Demand for Fuel and Transport Costs**

This is causing higher prices for fuel and causing prices to rise in all manner of products. It is also increasing the size of the world's carbon footprint. It is, however, argued that the new supply chain strategies driven by increasing fuel prices will have a positive effect in reducing the world's carbon footprint and in so doing, benefit the environment (Gosier, Simchi-Levi, Wright, and Bentz, 2008).

## 3. Methodology

This study was inspired by the report summarizing the various trends that were generated at a workshop on "Supply Chain Management 2010 and Beyond" that was held at the James B. Henry Center for Executive Development, September 20-21, 2006. A number of these trends which had been subjected were examined in the context of Uganda. Given that diminutive empirical research that has been carried out on SCM trends in Uganda, an exploratory but descriptive design (as recommended by Sekaran, 2003) was deployed to better comprehend the unknown and describe characteristics of the variables of interest/under study.

A total of 101 respondents from a wide range of organizations (to ensure a wide geographical and industrial spread) filled in a questionnaire which measured 41 key supply chain management trends and developments of today and in the next five years using a scale ranging from (1)

irrelevant to (5) most critical. The data collection instrument was developed after an extensive review f literature which was intended to delineate the most important trends which were shaping the supply chain systems today and were likely to be of strategic importance in the next five years.

The data collected and results presented here were from Ugandan organizations, majority of which were manufacturing, government parastatals, construction and retail concerns, or those that provide services to these concerns. The respondents were selected randomly from the organizations where our study was conducted. The organizations themselves were selected purposively on the basis that, according to information in the public domain, these organizations (and players there in) were likely to exhibit leading-edge sector practices.

Responses obtained from the survey instrument where analyzed and tests for statistically significant differences in responses were used. We tested for validity and reliability for the instrument used but also the data that was collected. Validity was confirmed through the use of factor analysis. This technique helped us to confirm both construct and content validity. We examined the communalities among the items that were retained and all items which had a communality of above 5 were retained within a particularly construct. Together with communalities, we carefully examined the factor loadings for each of the items, the anti-image matrices as well as the percentage variance for each of the principal components. Reliability was assessed through cronbach's alpha coefficient where it was found to be with a coefficient (r) of 0.96. Data analysis also used descriptive statistics in form of frequency distributions. In the next section, we present results that emerged from the study.

## 4. Findings and Discussion

The purpose of the study was to examine the trends influencing supply chain management today and in the next five years. Using factor analysis, the important supply chain management today is identified in table 1**.**

**Table 1** Major Supply Chain Trends in Uganda Today

| ***Supply chain trends*** | ***1*** | ***2*** | ***3*** | ***4*** | ***5*** | ***6*** | ***7*** | ***8*** | ***9*** |
|---|---|---|---|---|---|---|---|---|---|
| Managing fuel and transportation costs | *.81* | | | | | | | | |
| Process improvements and waste reduction | *.76* | | | | | | | | |
| Supply chain infrastructure worldwide | *.73* | | | | | | | | |
| Identification and development of alternative materials | *.67* | | | | | | | | |
| Shift from supply chains to value chains | *.62* | | | | | | | | |
| Structural issues in supply chains | *.57* | | | | | | | | |
| Governance within the supply chain | | *.71* | | | | | | | |
| Managing and improving environmental performance | | *.69* | | | | | | | |
| Leadership within the supply chains | | *.68* | | | | | | | |
| Power relationships within the supply chains | | *.63* | | | | | | | |
| Managing and structuring relations in SC | | *.56* | | | | | | | |
| Environmental sustainability | | | *.68* | | | | | | |
| Product quality, safety, delivery and security | | | *.67* | | | | | | |
| Managing timely delivery | | | *.58* | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Collaborating with key stakeholders in the SC | | | | *.68* | | | | | |
| Responding to 'China' Pricing syndrome | | | | *.65* | | | | | |
| Managing product innovation | | | | *.62* | | | | | |
| Protecting intellectual property in SC | | | | *.57* | | | | | |
| Managing supply chain confidentiality | | | | | *.78* | | | | |
| Measuring performance across activities | | | | | *.58* | | | | |
| Sharing rewards and financial risks within SC | | | | | | *.67* | | | |
| Development and implementing strategic segmentation | | | | | | *.51* | | | |
| Managing environmental issues & recycling | | | | | | | *.63* | | |
| Development of new technologies that affect efficiency | | | | | | | *.60* | | |
| Supply chain risks and disruptions | | | | | | | *.51* | | |
| Supply chain talent management | | | | | | | *.50* | | |
| Identifying and managing channel conflicts | | | | | | | | *.82* | |
| Rapid design of supply chains to meet customer needs | | | | | | | | *.60* | |
| Realigning performance measurement across partners and activities | | | | | | | | | *.81* |
| **Total variance explained** | ***39%*** | ***7%*** | ***4%*** | ***3%*** | ***3%*** | ***3%*** | ***2%*** | ***2%*** | ***2%*** |

***KMO=0.870, $X^2$=2621.067, df =820, Sig. 0.000, using Principal component analysis as a method of extraction***

Table 1 indicates results of the exploratory factor analysis conducted on 41 present trends affecting supply chain management in Uganda. Of the 41 items, the analysis extracted 29 items loading on 9 principal components and they all accounted for a total variance of 69%. The first principal component had 6 items and they all accounted for a total variance of 39% followed by component two which had five items all accounting for a total variance of 7%. The remaining principal component had their total variance explained ranging between 2% and 4% as indicated in table 1 above. An examination of factor loadings on each of the components reveals the most important items where those with higher factor loadings indicate their strengths and importance. A ranking order for the components therefore suggests that the most important trends affecting supply chain management in Uganda today include:

(1) Identifying and managing channel conflicts within the supply chain
(2) Managing fuel and transportation costs
(3) Realigning performance measures across critical partners and activities of the supply chain
(4) Managing supply chain confidentiality
(5) Supply chain infrastructure

Our findings support the existing international literature and thus add immensely to the existing body of knowledge destined to understand the context environments of managing efficient supply chains in different regions of the world. Rouse (2005) asserts that supply chains consists of network of firms which in themselves are systems of systems which must be understood if meaningful solutions to supply chains inhibitions are to be addressed. Organizations have long recognized that better relationships lead to better performance (Lambert et al., 1999). Our findings on

some of the most critical trends needed in Uganda point to this collaborative direction.. In Uganda, organizations need to take the importance of strategic partnerships and efficient supply chains as strategic activities that will make the organizations more competitive.

**Table 2** Supply Chain Trends in the Next Five Years

| ***Future trends =64)*** | *Irrelevant* | *Minimal. Importance* | *Some Importance* | *Important* | *Critical* |
|---|---|---|---|---|---|
| Supply chain leadership | - | *3%* | *6%* | *39%* | *51%* |
| Power relationships in SC | - | *3%* | *11%* | *42%* | *44%* |
| Sc disruptions and risk | | *5%* | *14%* | *19%* | *63%* |
| Rapid redesign to meet demands | - | *2%* | *17%* | *45%* | *35%* |
| Identifying and managing conflict | *2%* | *2%* | *30%* | *31%* | *36%* |
| Governance of SC | *2%* | *9%* | *27%* | *39%* | *23%* |
| Managing & structuring relationships | - | *6%* | *22%* | *36%* | *36%* |
| Improving environmental performance | *3%* | *5%* | *13%* | *44%* | *36%* |
| Implementing strategic segmentations | *2%* | *2%* | *27%* | *38%* | *33%* |
| Measuring performance | *2%* | *2%* | *19%* | *39%* | *39%* |
| Sharing rewards & financial risks | - | *14%* | *23%* | *36%* | *27%* |
| Realigning performance measures | - | *16%* | *17%* | *41%* | *27%* |
| *Collaborating with key stakeholders* | *5%* | *2%* | *22%* | *34%* | *38%* |
| *Managing product innovation* | - | *11%* | *19%* | *36%* | *34%* |
| *Responding to china' s price syndrome* | - | *3%* | *30%* | *28%* | *39%* |
| *Managing confidentiality in SCs* | - | *9%* | *25%* | *27%* | *39%* |
| *Protecting intellectual property in SC* | - | *3%* | *33%* | *33%* | *31%* |
| *Managing visibility and control* | - | - | *16%* | *53%* | *31%* |
| *Maintaining and protecting security in SC* | - | *2%* | *27%* | *30%* | *42%* |
| *Using technology* | - | *9%* | *19%* | *30%* | *38%* |
| Maintaining appropriate. Organizational cultures | *2%* | *13%* | *16%* | *28%* | *38%* |
| *Maintaining appropriate. communication* | *2%* | *11%* | *13%* | *22%* | *48%* |
| *Developing trust between SC members* | - | *2%* | *23%* | *30%* | *41%* |
| *Implementing appropriate technology* | - | *11%* | *11%* | *20%* | *53%* |
| *Managing timely delivery* | - | *16%* | *6%* | *30%* | *48%* |
| *Product quality, security etc* | - | *6%* | *14%* | *20%* | *59%* |
| *Environmental sustainability* | *2%* | *2%* | *13%* | *44%* | *41%* |
| *Supply chain flexibility* | - | *2%* | *17%* | *31%* | *50%* |
| *Structural shifts in the SC* | - | *5%* | *14%* | *34%* | *47%* |
| *Shift to value chains* | - | *6%* | *14%* | *38%* | *42%* |
| *SC talent management* | - | *6%* | *8%* | *39%* | *47%* |
| *Managing supplier diversity* | - | *2%* | *17%* | *30%* | *52%* |
| *Managing environmental issues & recycling* | - | *6%* | *16%* | *38%* | *41%* |
| *Development of new technologies* | - | *5%* | *9%* | *44%* | *42%* |
| *Collaborative SC forecasting* | *5%* | *5%* | *11%* | *39%* | *41%* |
| *SC infrastructure worldwide* | *5%* | *11%* | *8%* | *11%* | *66%* |
| *Managing fuel and transport costs* | *5%* | *2%* | *9%* | *27%* | *58%* |
| *Process improvement and waste reduction* | *5%* | *6%* | *5%* | *33%* | *52%* |

There has been a shift over the last ten years or so towards metrics that are specific, measurable, achievable, realistic and timely (SMART). This has led managers (particularly middle managers) to expect targets that are wholly within their span of control. This in turn leads to functionally driven behavior (Storey, 2006). Tracey, Lim and Vonderembe, (2005) argue that enterprises managed as value chains are more capable of lowering costs, increasing efficiency and customer service. All these have a positive impact on a firm's financial performance. Recent approaches in supply chain management place the customer as the starting and end point, providing the target for system creation (Betchel and Jayaram, 1997; Tracey et al 2005). The above findings on the likely trends of supply cain management in the next five years point a sharp figure for organizations to consider a number of supply chain related performance metrics for their survival

In figure 1 below, we summarize the various trends on what the respondents have overtime perceived as the trends that affect supply chain management and include our current results on the likely factors to influence supply chain management in the next 5 years.

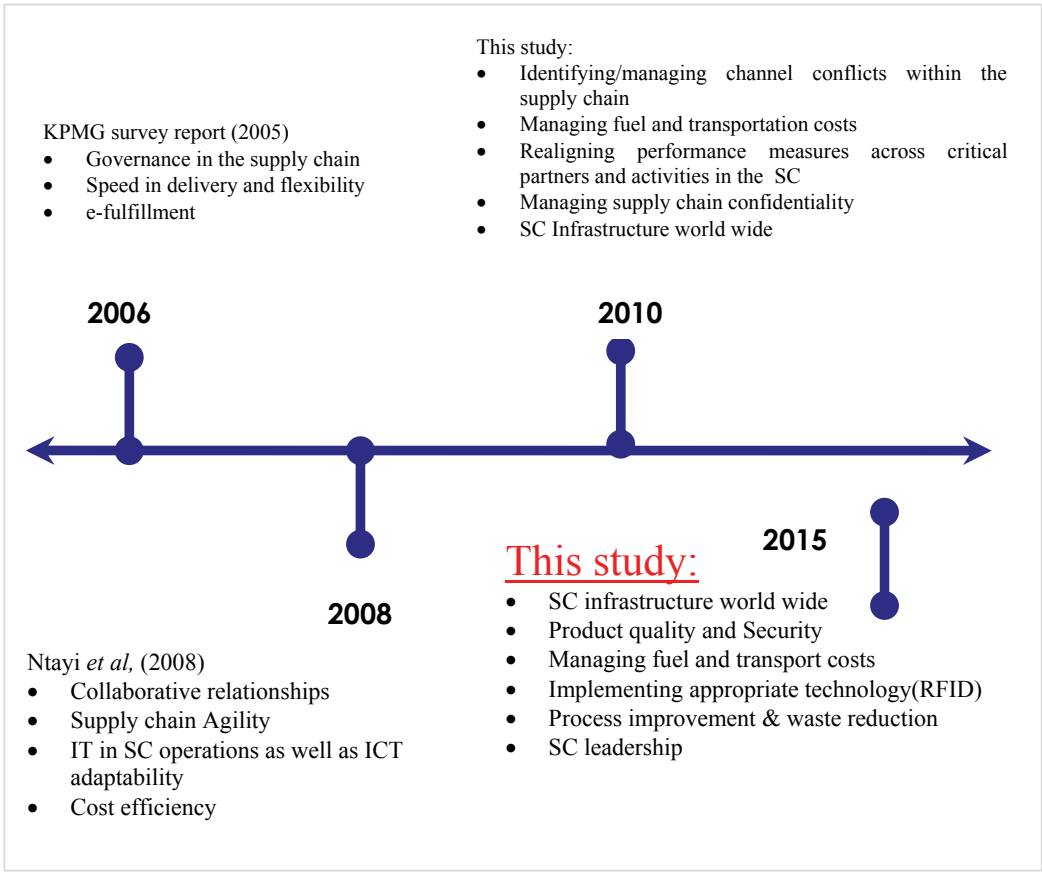


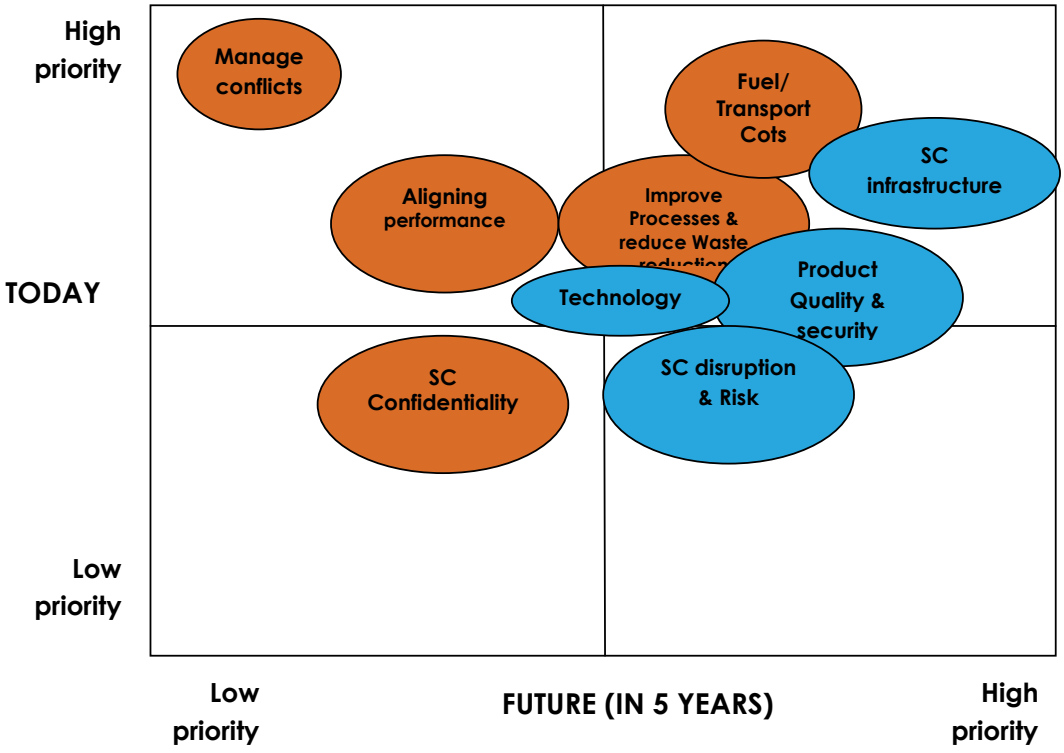

**Figure 1** Today, Tomorrow SC Trends in Uganda

In the past supply chain architecture in Africa, more particularly in Uganda has changed considerably. Market demands have been pushing companies towards collaborative networks with each focusing on its core competencies in bid to build well governed and risk indisposed supply chains (KPMG, 2005). As seen in figure 1 above, the has trend changed with more companies (more

of these SME's) launching immense efforts in expanding collaborative partnerships in, between and across SCs, as well as a drive to be swift and cost efficient (Ntayi, *et al,* 2008). Today most Ugandan companies observe that their success in dense, complex and variable markets/environments is dependent on how best they identify/manage channel conflicts and confidentiality within supply chains they operate. This is further compounded by the ability to managing fuel and transportation costs as well as realigning performance measures across critical partners and activities in the SC.

Five years from today, these organizations observe that; Product quality and Security; managing fuel and transport costs; Implementing appropriate technologies (e.g. FID);Process improvement & waste reduction and SC leadership will be a major trends that are likely to shape the future of SC development in Uganda. We develop a framework for understanding the trends of supply chain management in Uganda today and in the next five years as presented in figure 2 below.

Model based on Cross factor ranking basing on percentage response scores (judged by respondents to either be relevant or critical).




Trends observed to be critical today, with a likely impact in future SC developments

Trends observed to be critical in the next five years, but are influencing SC developments today

**Figure 2** Showing Expected Sc Trends Ranked Across the Continuum

## 5. Conclusion and Implication

The elements of analytical framework of supply chain trends in Uganda based on literature study has been tested & analyzed using empirical or statistical approaches. A ranking order for the components has suggested the most important trends affecting supply chain management in Uganda today which include: (1) Identifying/managing channel conflicts within the supply chain; (2) Managing fuel and transportation costs; (3) Realigning performance measures across critical partners and activities in the SC; (4) Managing supply chain confidentiality and (5) Supply chain Infrastructure worldwide. The same study confirmed that in the next five years the most important trends of supply chain management in Uganda will include: SC infrastructure worldwide, Product quality and Security, Managing fuel and transport costs, implementing appropriate technology(RFID), Process improvement & waste reduction and SC leadership. This, however, does not disregard the other supply chain sub elements such as strategic supplier partnership, customer relationship, information sharing, information quality & a lean system. Moreover, there is antecedent of cooperative behavior such as trust & commitment influencing supply chain practice & supply chain performance indicators such as flexibility, efficiency, food quality & responsiveness. Outcomes of this study are useful not only in the development of future models and benchmarking tools but providing managers and policy makers of supply chain management today with critical parameters of decision making. This implies that organizations have to lay foundation for "strategic readiness" to embrace theses trends and future challenges that they may face to overcome todays and future uncertain times. This should be done without forgetting to be close to the customer. However these companies must have the capability to acquire and borrow best practice, while at the same time should get their own houses in order before venturing forward.

Further research after developing the analytical framework should focus on the analysis of how the antecedents of the sub elements of supply chain practice do affect supply chain performance in Uganda enterprises, how trust & commitment in trading partners affect supply chain performance, how attributes such as flexibility, efficiency, quality & responsiveness influence the sub elements in creating competitive advantage. In addition, the recommendation of further research project would be on how Ugandan firms measure their supply chain performance & what the major difficulties abound when implementing supply chain management in any Ugandan industry of interest & what kind of changes can be made to supply chains to enhance their performance.

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# Succession Barriers of Family Business: A Case Study from Thailand

by

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**Abstract**

Family business has played an important role in global markets. Family business defines as an organization where ownership and management control rests with a family. This paper has provided insight to the perceptions of family business barriers in Thailand. With the sample of 127 family businesses, the result showed that the most important barriers in this study were the number of competitors in their industries, high competition in the business, changes in economic environment. Furthermore, respondents perceived that key decision makers in organization are family members was problematic with the lack of capabilities of family members. It can be seen that family business members concerned about the dynamic changes of external environment. Competitive intensity in the market was very high such as number of competitors both domestic and overseas markets. Although family members have a family control ownership in the firms, capabilities of family business is very important and to achieve the competitors in the market and gain competitive advantage. Training and development programs are essential to family members in order to sustain their growth in the industry. Future research direction in this paper suggested with conceptual framework of succession barriers of family business with the linkage to family business performance and its antecedents.

**Keywords:** Family Business, Succession Barrier, Thailand

## 1. Introduction

Family businesses are very important in many countries. According to McPherson (2010), most family businesses started from small firms. However, many of them became large multinational companies. The reason could be a common goal of family businesses that is their pursuit of trans-generational wealth creation where the choice of a successor is predetermined by bloodline. The wealth creation is a function of a family-based advantage which is founded on family-specific resources and capabilities.

Family businesses have contributed a significant role in emerging and developed economies in terms of GDP growth and employment in many countries (McPherson, 2010). According to Trevinyo-Rodriguez (2009), in the UK and the US, approximately 75 and 80 percent of all firms, respectively, are family-owned or controlled businesses. Similarly, countries in European Union have high percentage of family business contribution include the following: 60 percent in France, 84 percent in Germany, 74 percent in the Netherlands, 70 percent in Portugal, 70 percent in Belgium, 75

percent in Spain, 75 percent in Finland, 75 percent in Sweden, 80 percent in Italy, 75 percent in Greece and 80 percent in Cyprus.

Likewise, in Latin American, in Australia and Asia, the percentage of family business contributes ranging from 70 to 80 percent of the overall business. Moreover, family business generate about 40-45 percent of the Gross National Product (GNP) of North America, between 35-65 percent of GNP of the EU members, between 50 and 70 percent of the GNP of Latin America, and between 65 and 82 percent of the GNP of Asia. However, many researchers found that the survival rate of family business from generation to generation is critical, which about 30 percent (Morris et al., 1996). In this study, barriers in family businesses were examined.

## 2. Literature Review

### Succession in Family Business

Family business need to manage the family network, the business or organizational network and environmental network in order to survive (Trevinyo-Rodriguez, 2009). The first network is the family network, which refers to the family members related either directly or indirectly to the family firm. The second network is the business or organizational network, which includes all people that work in the family firm, excluding family member. The third network is the environmental network, which involves the external stakeholders.

Different views and opinions may occur when family members and non-family members interact. They may cause conflict, not only among employees or between employees and family members, but also among and between family members. In the daily operations with conflict, family business will experience a high turnover rate among non-family employees, which affect company's productivity and survival. Furthermore, when family members behave emotionally, firm can be failed to create economic wealth and finally be sold.

Therefore, family business should consider of taking care of people's interactions and their growth strategy, as well as the development and adaptation of their ownership structure. It is important for family business to consider those issues since family gets bigger and more people are involved in the management of the family business, thus, changes in the ownership structure and the management decision-making configuration must be accomplished in order to organize the firm's growth. Moreover, there are many factors are related to the effective succession such as succession planning, offspring grooming, inter-generational relationships and remuneration of managers (Stravrou and Swiercz, 1998).

Family businesses have to pass through different transitional stages in order to companies' growth. Succession planning of family business is the key to improve the success rate of ownership transition. It can help companies to efficiently and fairly distribute assets from older to younger generations, to pass control of the business in a way that will ensure that will ensure effective business leadership, and to maintain and promote family harmony. Well-developed can increase the co-operation among stakeholders in businesses, therefore enhancing the chance of a smooth and effective succession. There are some differences between successor development in family and non-family businesses. Family businesses prefer more personal, direct, relationship-centered approaches successors, while non-family businesses favor more on formalized, detached, task-centered approaches (Fiegener et al., 1994).

**Family Business Characteristics**

Family business can be defined in many ways. For example, Barnes and Hershon (1976) and Villalonga and Amit (2006) mentioned that family businesses are firms with family controlling ownership. On the other hands, some researchers applied number of family members involved in management and generations present to family business term (Stern, 1986; Ward 1987). Moreover, Gubitta and Gianecchini (2002) defined family business as a company in which two or more key individuals linked by kinship, close affinity or solid alliances hold a sufficiently large share of financial capital or board control to enable them to make decisions regarding strategic management and overall business goals. According to Reid et al. (1999), family business is a business in which 'ownership and management are concentrated in a family unit, and in which individuals within the firm seek to perpetuate or increase the degree of family involvement. Family values and needs alongside business necessities can create significant differences between family and non-family businesses, since family and business objectives are often incompatible.

In family business, family members aim to perpetuate the degree of family involvement, implying therefore, a trans-generational pursuance intention (Trevinyo-Rodriguez, 2009). With the environmental opportunities driven (such as technological development, market expansion and changing in demographic structure), it can be seen that the main challenge for family business survival is growth in competitive globalization environment, adaptation of ownership structure and family conflict.

According to Wang et al. (2004), the most significant difference between family controlled and non-family business concerns the way in which executive succession occurs, and more specifically, unique aspects of the process of intergenerational family business transfer. Researchers found that only about 33 percent of family businesses survive the transition from the founders (first generation) to the second generation of owner-management. Similarly, only one third tend to survive the transition from second generation to third generation and so on. Thus, effective succession within family business has been in attention in the academia. Succession can be viewed as a process. Stravrou and Swiercz (1998) categorized succession process into three distinct stages based on the functions. The first level is called pre-entry stage where successor can learn from the incumbent about business operations. The second is an entry stage where integrating the offspring into the business operations is the main theme. The third stage involves the potential successor's promotion to a managerial position.

**Relationships among Family Business Members**

Inter-generational relationship in family business is another important factor in business development. The nature of family relationships during the transition stage is related to a successful succession process (Fox et al., 1996). The respect, understanding and complementary behavior between the two generations are critical to an effective succession. Moreover, psychological and emotional barriers encountered by family people are obstacles in the succession process.

According to Astrachan and Kolenko (1994), successor training is related to family's commitment to business, and the quality of the relationship between owner-manager and successor. The family's commitment to the business is positively associated with the degree of successor training, and that the quality of the relationship between owner-manager and successor is positively associated with the extent of successor training. Ibrahim et al. (2003) found that training of family members can reduce the death rate of many family businesses.

Furthermore, Goldberg (1996) found that business effectiveness is related to successor grooming by providing evidence that effective successors had more years of experience with the business than that of the less effective group. Thus, it can be implied that successor training is needed in succession process.

**Environmental Factors**

In addition, environmental analysis is essential for all successful firms, both family and non-family businesses, because the environment has become more unstable and its change rate has increased (Zou and Cavusgil, 1996). Therefore, businesses have to examine the environment to gather information that can be used to predict or respond to environmental changes. They cannot control external forces, but can respond in appropriate ways to avoid threats and exploit opportunities. External environment are outside the organization, both at firm-level and market-level. Factors that directly affect companies are called firm-level or task environment, where the external and wider environmental factors beyond the immediate environment that nevertheless determine company operations are called market-level or macro-environment (Balabanis and Katsikea, 2003).

Firm-level environment or task environment includes elements that directly affect and are affected by an organization's major operations. It consists of five elements, which are customer characteristics, market characteristics, supplier characteristics, competitive intensity and product life cycle stage. On the other hand, market-level or macro-environment factors have an effect on companies' activities or on society as a whole (Balabanis and Katsikea, 2003; Zou and Cavusgil, 1996). There are four relevant macro-environmental factors: economic environment, socio-cultural environment, regulatory environment and technological environment such as per capita income, GDP, economic cycle, inflation rate, value system, attitudes, customs and tradition, business law and regulations, government policies and information technology. Therefore, family businesses should monitor the external environment changes and customize their strategy accordingly in order to ensure that performance objectives are being achieved.

**Managerial and Organizational Factors**

According to McPherson (2010), managerial and organizational factors are important factors for every business, both non-family and family businesses. Managerial factor depends on work experience, education and knowledge. Many of these studies agreed that management is critical and decisive in developing successful business. Managerial factors are important in conceptualising the type, content, and impact of the family business barrier. The experience can expose decision marker to information and contacts relating to markets. If there is a less professional and experienced manager, he/ she may lack of the ability in making decision and have difficulties in expandting. Moreover, the better-educated decision makers are more likely to be more open-minded and more willing to participate in the markets.

Organizational factors also may have a discriminating effect on family business barrier perceptions. The variables associated with organizational factors comprise the age and the size of firm, the capital and labour intensity and the difference in industries. For instance, there is evidence that young firms are generally more sensitive to family business barriers, compared to those that have been in the market for a long time. Moreover, the smaller the firm - with size either measured in terms of number of employees and or sales turnover – the more vulnerable it is to barriers associated with resource limitations, operating difficulties, and trade restrictions in which may prevent their ability to compete internationally (McPherson, 2010).

**Conceptual Framework**

Thus, conceptual framework for this research is developed and illustrated in Figure 1. It is essential to assess more comprehensively the nature of succession processes in family firms.

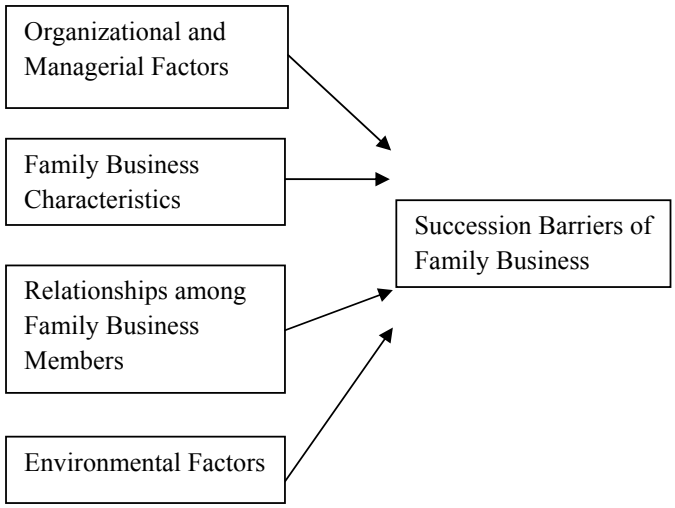


**Figure 1** Conceptual Framework of Succession Barriers of Family Business

**3. Research Methodology**

In order to measure reliability, pre-testing of the questionnaire was utilized in this empirical research. Pre-testing on a small sample of respondents is a useful way to identify and address problems (Zikmund, 2003). A pilot survey or pre-test is a trial run of a larger survey that involves testing the questionnaire wording and its layout, question sequencing, adequacy of instructions, and analysis procedures in an effort to eliminate any general confusion. Moreover, pre-tests can guide the researcher in gaining familiarity with respondents and estimating questionnaire completion times.

In this empirical study, the multi-response scale questionnaire was developed and pre-tested with 30 family businesses prior to the actual survey. This pilot test was useful in testing the accuracy and reliability of the sampling frame. As a result of the high reliability of the pre-test feedback (a Cronbach's alpha coefficient in each construct is higher than 0.7), no change was made to the primary questionnaire in terms of the items used to tap the study constructs. After that, the data of 127 family businesses were collected for the study. Table 1 shows the respondent's characteristics in this study. It shows that most of the respondents are female (57.5%). 31.5% of the respondents' age are between 25-34 years old and 28.25% of them are above 55 years old. Moreover, most of them with the percentage of 51.97 have education background at Master's degree or above level.

**Table 1** Respondents' Characteristics

| Respondents' Characteristics | Number | Percentage |
|---|---|---|
| Gender | | |
| • Male | 54 | 42.5 |
| • Female | 73 | 57.5 |
| Age | | |
| • Below 25 year old | 18 | 14.17 |
| • 25-34 year old | 40 | 31.50 |
| • 35-44 year old | 19 | 14.96 |
| • 45-54 year old | 14 | 11.02 |
| • Above 55 year old | 36 | 28.35 |
| Education | | |
| • Middle school | 10 | 7.87 |
| • High school | 14 | 11.02 |
| • Bachelor degree | 37 | 29.13 |
| • Master's degree or higher | 66 | 51.97 |

With 127 firms of family businesses, Table 2 shows family business characteristics in this study such as years of establishment of family business, years of the respondents of the study joined family business as well as their work experienced before joined family business. Moreover, the respondents were asked about their family characteristics such as numbers of generation in the whole family, numbers of siblings in their own family, total number of family members and number of family members who join family business. Furthermore, the number of employees in family business and number of businesses that family owned were collected.

**Table 2** Family Business Characteristics

| Family Business Characteristics | Mean | Median | Min | Max | S.D. |
|---|---|---|---|---|---|
| Years of family business established | 32.62 | 30 | 10 | 81 | 15.884 |
| Years of joining family business | 16.08 | 12 | 1 | 50 | 13.923 |
| Years of work experienced before joined family business | 4.50 | 2 | 0 | 47 | 7.516 |
| Numbers of generation in family business | 2.27 | 2 | 1 | 4 | 0.896 |
| Numbers of siblings in family | 4.61 | 4 | 1 | 10 | 3.174 |
| Number of family members | 12.69 | 6 | 1 | 65 | 14.745 |
| Number of family members who join family business | 5.57 | 4 | 1 | 20 | 4.340 |
| Number of employees in family business | 868 | 200 | 8 | 7,000 | 1441.352 |
| Number of businesses that family owned | 2.81 | 2 | 1 | 10 | 2.291 |

## 4. Results of the Study

Table 3 shows the perception of family business barriers in this study. In this study, the most important barriers in family business are the number of competitors in their industries (mean= 3.60), high competition in the business (mean= 3.56), key decision makers are family members (mean = 3.55), changes in economic environment (mean= 3.55) and lack of capabilities of family members

(mean= 3.48) respectively. On the other hands, the least important barrier in family business is financial management conflict among family members in organization (mean = 1.77). It should be noted that a considerable variation occurred in respondents' perceptions (standard deviations ranged from .765 to 1.230 on a 5-point scale).

From the result of the study, it can be seen that external environment factors are the main barriers in family businesses. This is because that the level of competition and the number of competitors are increasing dramatically both in domestic and international markets. The most two important barriers factors that family businesses concerned are the number of competitors in their industries and high competition in the business. Those factors can refer to the competition in the market, which include aggressiveness of competition, promotion wars and strength of price competition in the market, as well as pace of new competitive moves in the product area. According to Zou and Cavusgil (1996), intense competition may force companies to engage in extensive product adaptation to gain competitive advantage when products offered in the market, especially consumer products, are numerous. Competitive pressure leads companies to adapt their strategy to acquire an advantage over competitors by adapting to suit customer conditions more precisely.

Moreover, economic environment is very important concern. Companies need to follow up the indications of economic growth, such as gross domestic product (GDP), per capita income, inflation rate, income distribution, foreign exchange rate and household disposal income both domestic and international markets (Zou and Cavusgil, 1996). The economic cycle shows that the consumption of most goods and services increases during the boom period and declines during recessionary periods. Furthermore, analysis of the economic environment can indicate the competitors' activities, in which an oversupply of products in the market sector normally results in a downward pressure on prices and profitability. Moreover, competition for resources can adversely affect the production costs, which in turn influence the production possibilities and pricing decisions. In addition, the economic environment indicates standards of living and employment, and income levels, which impact on company's operations (Balabanis and Katsikeas, 2003). Thus, family businesses should monitor and adjust themselves to the changing economic environment.

In addition, the result of this study perceived that family members who hold high positions in family businesses are obstacle in business operations and growth, if they are lack of capabilities, key person of making decision and responsible of important functions. It is important that companies have certain key attributes in their resources (such as assets, organizational process, information, knowledge and capabilities) in order to improve their effectiveness and efficiency and achieve competitive advantage (Balabanis and Katsikeas, 2003). Therefore, environmental analysis is essential for successful family firms to gather information that can be used to predict and respond to environmental changes and competitive intensity. Capabilities and managerial skills of family members in the family businesses are also important. Thus, company should provide training and skills development to family members, as well as for their employees in order to develop their human resources. On the other hand, respondents perceived that number of family members in family businesses and conflict related works and relationship among kinships and in laws are not problematic. They also have trust to each other. To sum up the result, it can be seen from the result that dramatically environmental changes (especially increasing of competitors and fluctuated economic environment), and capabilities and skills of family members (especially if they are key decision makers and have high position in family business) are key barriers for family business growth and competitive advantage.

**Table 3** Perception of Family Business Barriers

| Perception of Family Business Barriers | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | Mean | Median | S.D. |
|---|---|---|---|---|---|---|---|---|
| 1. Lack of long term strategic plan | 6.4% | 27.2% | 39.2% | 20.8% | 6.4% | 2.94 | 3 | .998 |
| 2. Lack of effective financial management | 14.5% | 46% | 21% | 16.9% | 1.6% | 2.45 | 2 | .991 |
| 3. Lack of effective accounting system | 16.9% | 46% | 21% | 14.5% | 1.6% | 2.38 | 2 | .984 |
| 4. Lack of human resources management and development | 3.2% | 30.4% | 34.4% | 24.8% | 7.2% | 3.02 | 3 | .988 |
| 5. Lack of effective marketing strategy | 7.3% | 31.5% | 37.1% | 21.8% | 2.4% | 2.81 | 3 | .943 |
| 6. High ratio of employee turnover rate | 5.8% | 38% | 31.4% | 18.2% | 6.6% | 2.82 | 3 | 1.017 |
| 7. Lack of return system for family members | 13.9% | 32% | 30.3% | 21.3% | 2.5% | 2.66 | 3 | 1.041 |
| 8. High percentage of family members works in organization | 36.3% | 48.4% | 8.9% | 5.6% | 0.8% | 1.86 | 2 | .859 |
| 9. Family members hold high position in organization. | 9.7% | 24.2% | 25.8% | 24.2% | 16.1% | 3.13 | 3 | 1.230 |
| 10. Key decision makers in organization are family members. | 5.6% | 14.5% | 24.2% | 30.6% | 25% | 3.55 | 4 | 1.178 |
| 11. Lack of clear job description and scope of work | 8.9% | 32.3% | 32.3% | 22.6% | 4% | 2.81 | 3 | 1.018 |
| 12. Lack of capabilities of family members in organization. | 3.3% | 10.6% | 33.3% | 40.7% | 12.2% | 3.48 | 4 | .953 |
| 13. Different educational background of family members in organization | 22.3% | 31.4% | 19% | 21.5% | 5.8% | 2.57 | 2 | 1.217 |
| 14. Difference in business opinion among family members in organization | 3.3% | 28.5% | 45.5% | 17.9% | 4.9% | 2.93 | 3 | .889 |
| 15. Difference in business solution process among family members in organization | 1.7% | 25% | 51.7% | 20% | 1.7% | 2.95 | 3 | .765 |
| 16. Difference in responsibilities among family members in organization | 1.6% | 20.5% | 41.8% | 31.1% | 4.9% | 3.17 | 3 | .869 |
| 17. Difference in expectations among family members in organization | 4.1% | 25.6% | 40.5% | 24% | 5.8% | 3.02 | 3 | .949 |

| Perception of Family Business Barriers | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | Mean | Median | S.D. |
|---|---|---|---|---|---|---|---|---|
| 18. Generation gap among family members in organization | 5.7% | 22.1% | 51.6% | 14.8% | 5.7% | 2.93 | 3 | .911 |
| 19. Lack of trust among family members in organization | 36.9% | 41.8% | 15.6% | 2.5% | 3.3% | 1.93 | 2 | .960 |
| 20. Emotional involvement in decision making among family members in organization | 14.6% | 41.5% | 30.9% | 12.2% | 0.8% | 2.43 | 2 | .915 |
| 21. Lack of harmony among family members in organization | 23.8% | 45.1% | 28.7% | 1.6% | 0.8% | 2.11 | 2 | .811 |
| 22. Lack of equity and justice of family members in organization | 22.5% | 48.3% | 25.8% | 1.7% | 1.7% | 2.12 | 2 | .832 |
| 23. Conflict in related to work among family members in organization | 19% | 45.5% | 28.1% | 5.8% | 1.7% | 2.26 | 2 | .890 |
| 24. Financial management conflict among family members in organization | 43.4% | 37.7% | 17.2% | 1.6% | 0% | 1.77 | 2 | .790 |
| 25. Communication problems among family members in organization | 10.6% | 39% | 30.1% | 12% | 7.3% | 2.67 | 3 | 1.067 |
| 26. Lack of informal meeting among family members in organization | 27% | 40.2% | 21.3% | 9% | 2.5% | 2.20 | 2 | 1.018 |
| 27. Conflict among in-laws of family members in organization | 49.1% | 30.8% | 11.7% | 5.8% | 2.5% | 1.81 | 2 | 1.031 |
| 28. High competition in business | 1.6% | 10.4% | 35.2% | 36% | 16.8% | 3.56 | 4 | .945 |
| 29. Number of competitors in the industries | 4% | 8.1% | 31.5% | 36.3% | 20.2% | 3.60 | 4 | 1.027 |
| 30. Changes in economic environment | 0% | 12.8% | 30.4% | 45.6% | 11.2% | 3.55 | 4 | .856 |
| 31. Competitors from overseas | 14.9% | 26.4% | 26.4% | 21.5% | 10.7% | 2.87 | 3 | 1.224 |

## 5. Implication of the Study for Family Businesses

The main barriers of family businesses in this study are competitive intensity, economic environment, family members as key decision makers and lack of capabilities of family members in family business, which can possibly act as barriers to their growth and development. Therefore, family businesses require a higher level of skills and some new competencies in order to cope with the increasing rate of change in the external environment of organization and the many new challenges. Therefore, they should have problem-solving ability and use standardized mental abilities tests. Moreover, it is essential for family businesses to assess the situation and determine what types of behavior, programs, management systems and structural forms are relevant and mutually compatible. They should have adaptability and flexibility skills in order to deal successfully with the trade-offs, competing objectives, and changing situations. In addition, they should have flexibility to work across cultures and around the world and to deal with environmental uncertainty and change.

Moreover, family businesses could need professionalize and delegate authority because of growth, lack of management skills within the family, preparation for succession, or to change the norms and values of the business. However, they could be reluctant to delegate control because of a lack of formal training, insufficient knowledge of management techniques, fear of losing control, and a belief that professionalization is an unnecessary, expensive overhead. An organizational development, change management and strategic management perspectives can help to guide them to understand the importance of long- term performance of the firm. Consequently, they give importance to trainings and skills development program and reduce resistance of change. By doing this, family members in family businesses can make effective decision and increase their capabilities in the businesses.

## 6. Conclusion and Recommendation

From the result of this study, it is very important to pay attention to environmental issues, which continuously change, in both the home and overseas markets to be survived. Family businesses should monitor the environment and competitive intensity in their markets and respond to possible changes by making suitable adjustments to their strategies, leading to superior performance outcomes and survival of the firms. They can gain to long term profitability through higher sales from better exploitation of different customer's requirement and competitor orientation. Moreover, capabilities of the family members in the businesses can be a critical tool that can adjust practical strategy to cope with both external factors, such as competition and customer expectation, and internal factors, such as workers' attitude toward change and culture within of their family businesses.

It is within this context that training and education can play a constructive role in mitigating these inherent problem and in enhancing continuity, development and growth in family business. Family members in family businesses should attend some training programs focusing on how they can improve their capabilities and play a key role in resolving conflict in the family firms (Sharma et al., 2007). This can also help family members in family businesses to create a healthy environment in the family firm, to avoid taking sides in conflict situations, and to allow family members in family businesses to express their feelings.

Moreover, they can learn how to set aside time to resolve disputes among family and non-family employees.

Furthermore, it is necessary to measure family business performance, which is negatively affected by family business succession barriers. In fact, every business has long searched for ways by which it can reach a competitive advantage in dynamic environments and strive to achieve success. Family businesses have competitive advantages, where non-family owned businesses do not. They are higher employee loyalty, the ability to quickly move in and out of market niches due to their flexible form of organization, their long-term orientation, and the ability to information about the business out of view of public and their competitors. It is determined to increase its sales for survival, growth and perpetuation, to achieve competitiveness in the markets as well as to improve customer satisfaction.

According to Duh et al. (2009), family enterprise's growth and growth ambitions is regarded as a key to economic development and to the creation of wealth and employment. According to Morgan et al. (2004) and Wang et al. (2004), a multi-dimensional evaluation is superior to and more appropriate than single-dimensional measurements. The measurement of performance can be divided into financial-oriented and non-financial-oriented. As for financial-oriented measurement, this is largely associated with financial indicators such as profitability, profit growth, return on investment, growth of sales revenue and return on sales. In contrast, non-financial-oriented indicators include market share, market share growth, customer loyalty and customer satisfaction. For the future research, it is therefore essential to identify both antecedents to and family business performance from successful transition.

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# Road Traffic Congestion Cost and Mode Choice Model (Study in Malioboro, Yogyakarta, Indonesia)

by

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**Abstract**

One of the indicator to measure road traffic congestion is delay. The total amount of delay is measured based on the difference between the actual speed encountered and free-flow speed. The aim of this research is to estimate the amount of road traffic congestion cost for private vehicle and to develop mode choice model between private vehicle and bus TransJogja based on stated preference data. Generalized cost consists of three components of cost vehicle operating cost, cost of pollution and travel time cost. This study shows that estimation the amount of congestion cost for private vehicle users in Malioboro Corridor is IDR 2915.00 per trip. Travel attributes which influences mode choice between private vehicle and busTransJogja are travel costs, congestion costs, parking cost, travel time and walking time. Application of congestion cost as IDR 5500.00 per trip for private vehicle user to Malioboro, Yogyakarta will be shift as 11.057% private vehicle to bus TransJogja.

**Keywords:** Congestion Cost, Traffic Congestion, Generalized Cost, Stated Preference, Mode Choice

## 1. Introduction

Congestion is one of the significant transportation problems in urban area, especially in Central Business District (CBD) during peak hour. This situation happens because of the imbalance between the number of vehicles and the capacity of the road. The congestion becomes worse with the increasing activities in the roadside and bad behavior in driving. Congestions will generate many problems due to inefficiency. With congested roads, vehicle speed will be simultaneously up and down, and the average speed will be lower and hence the cost will increase. Therefore, road users will suffer from increasing vehicle operating cost and loosing more time and environment will be in worse conditions due to pollutions. In other words, transportation costs will increased due to congestions.

Yogyakarta is one of the transportation development regions in Indonesia with specific characteristic. The transportation characteristic in Yogyakarta is mixed traffic and overloaded on some road links (Sugiyanto, 2007). Center for Transportation and Logistics of Gadjah Mada University (2003) has shown that the average growth of private vehicle in Yogyakarta city is 4.04% per year. Meanwhile there was a decrease in public transport users as much as 3% per year. The average load factor of public transport vehicle was 41% and 27.22% in the year 2003 and 2004

respectively (Dishub DIY, 2006). This fact reflected that the service quality was still low. The lack of accessibility for public transport from origin zone to destination zone caused the attractiveness of public transport decreased.

The aim of this paper is to estimate the amount of congestion cost for private vehicle users and to develop the mode choice model between private vehicle and bus TransJogja based on stated preference data in Yogyakarta, Indonesia.

## 2. Literature Review

### Estimation of Congestion Cost

The theoretical background of road-use pricing has relied upon the fundamental economic principle of marginal-cost pricing, which states that road users using congested roads should pay a toll equal to the difference between the marginal-social cost and the marginal-private cost in order to maximize the social surplus (Verhoef, 1996). The amount of the congestion cost represents the difference of marginal social cost (MSC) to marginal private cost (MPC).

Congestion cost is caused by vehicle addition in the same road while the equilibrium is reached at points F with the traffic flow as much as $Q_2$ and cost is $P_2$. The vehicle addition after the optimal traffic flow $Q_2$ must take travel cost as much as $Q_2Q_1HF$ but only enjoy the benefit $Q_2Q_1EF$. There is welfare gain as much as FEH. Therefore, the congestion cost is counted based on the difference between MSC and MPC (Stubs, 1980).

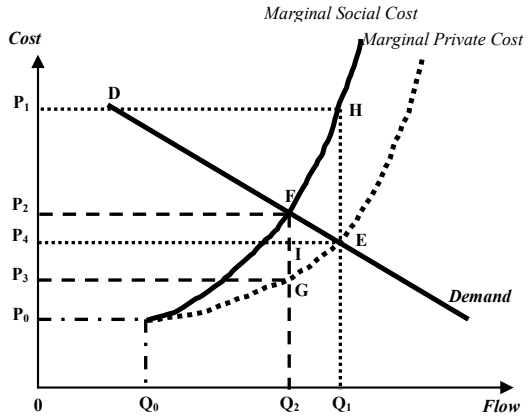


**Figure 1** Congestion Cost Estimation

The amount of congestion cost estimation of mode m from zone i to zone j can be formulated through the equation:

$$CC_{ij}^{m} = C_{ij}^{m}\,MSC - C_{ij}^{m}\,MPC \quad (1)$$

in which $CC_{ij}^{m}$ = the congestion cost,

$C_{ij}^{m}\,MSC$ = the marginal social cost,

$C_{ij}^{m}\,MPC$ = the marginal private cost.

The optimal congestion pricing reflects the difference between marginal social cost and marginal private cost. According to the principle of pricing, congestion cost must be balanced with the marginal social cost, so that traffic flow will decrease from $Q_1$ to $Q_2$. It can be realized if congestion pricing as much as F-G or $P_2$-$P_3$ was applied.

**The Effect of the Application of Congestion Cost**

Olszewski and Xie (2005) studied the effect of Electronic Road Pricing (ERP) rate changes on traffic volumes in Singapore. The traffic pattern at Ayer Rajah Expressway gantry before and after the implementation of toll. The mean coefficient of variation of 15-min volumes which was 3.9% during the week before ERP started has actually decreased to 3.3% after the ERP introduction and then decreased further to 2.8% in the week after the rate revision. This shows that flow equilibrium conditions developed very quickly after a change in pricing and also confirms that traffic was not congested.

The number of passengers by public transit was 6% larger in spring 2006 than 12 months earlier (Stockholm Transport, 2006 in Eliasson et al, 2009). Result of Stockholm trial is that vehicle traffic decreases as driving is made more expensive by road tolls. The trial showed that the tolls resulted in reductions of traffic congestion and travel times that were large compared to the expected effects of other measures that are discussed in Stockholm traffic: a new Eastern bypass is estimated to reduce the number of vehicles passing over inner city bridges by approximately 14% (Markstedt et al, 2005), a new Western bypass is estimated to reduce traffic across inner city bridges by 11% (Eliasson et al, 2006) and if public transport was made free-of-charge in the Stockholm, this is estimated to reduce vehicle kilometres travelled in the county by 3% (Stockholm Transport, 2006 in Eliasson et al, 2009).

The 15-20% reductions in generalized cost are surprisingly small for charge levels which have achieved 15% reduction in overall trip making in Cambridges. It appears that the ability of traffic to reroute reduces the benefits gained from road pricing to levels significantly below those predicted by strategic models which permit only limited rerouting responses (May and Milne, 2000). Application of road pricing in Stockholm, Swedia have a positive impact on reducing the use of private vehicle users and increased the use of public transport almost 10%. If the application of road pricing with improve the public transportation service quality, the use of public transport will be increase 23% (Armelius and Hultkrantz, 2006). Implementation of congestion charging for private vehicle users in urban centres in London increase the use of urban bus 18%, taxi users 17%, and decreased the use of private cars 33% (Santos and Bhakar, 2006).

## 3. Methodology

**Analysis Approach**

The analysis approach is used Stated Preference Technique. Most Stated Preference using design of exsperiments to construct alternatives that presented to respondents. This design is usually made orthogonal, meaning that the combination of attributes that are presented vary independently of each other. The advantage of this method is that the effect of each attribute that responded more easily identified (Pearmain et al, 1991).

The formula of binomial logit different can be arranged:

The probability of private vehicle choice can be formulated as:

$$P_{PC} = \frac{\exp^{U_{PC}}}{\exp^{U_{PC}} + \exp^{U_{BT}}} = \frac{\exp^{(U_{PC}-U_{BT})}}{1+\exp^{(U_{PC}-U_{BT})}} \quad (2)$$

The probability of bus TransJogja can be formulated as:

$$P_{BT} = 1 - P_{PC} = \frac{1}{1+\exp^{(U_{PC}-U_{BT})}} \quad (3)$$

in which $P_{PC}$ is the probability of choosing private vehicle,
$P_{BT}$ is the probability of choosing TransJogja,
$U_{PC}$ is private vehicle utility and $U_{BT}$ is bus TransJogja utility.

While the utility model which is used in (2) and (3) is:

$$U_i = a_0 + a_1x_1 + ... + a_nx_n \quad (4)$$

in which $U_i$ is the utility of choice i,
$x_1, ...., x_n$ is the value of attribute,
$a_0$ is the constants of model,
$a_1, ...., a_n$ is the coefficient of model.

Mode choice model between private vehicles and bus TransJogja in Malioboro, Yogyakarta is affected by five travel attributes are travel cost, congestion cost, travel time, parking cost, and walking time (Sugiyanto, el al, 2009). In this paper, respondents of stated preference reported their choice with rating technique that is divided in five scale of semantic are presented in Table 1.

**Table 1** Point Rating and Semantic Scale

| No. | Semantic scale | Point rating |
|---|---|---|
| 1. | It must choose a private vehicle | 1 |
| 2. | Maybe choose a private vehicle | 2 |
| 3. | The option is balanced | 3 |
| 4. | Maybe choose bus TransJogja | 4 |
| 5. | It must choose bus TransJogja | 5 |

There are five designs of selected travel attributes. Each travel attribute consists of two levels. So, when we combined all of the attributes and their level will be obtained $2^5$=32 alternative combination. This alternative combination is very much and will be difficult for respondents to select the mode. Therefore, the development of the third partial replication of factorial design $2^5$ through confounding. By following the design using Plan 6A.2 (Cochran and Cox, 1957). The design of questionnaire is planned consist of eight alternative of choice as shown in Table 2.

**Table 2** Factorial Combination Treatment $2^5$ in 8 Unit

| Choice | Combination treatment | Different of level attribute | | | | |
|---|---|---|---|---|---|---|
| | | Travel cost | Congestion cost | Parking cost | Travel time | Walking time |
| 1 | (-) | - | - | - | - | - |
| 2 | ab | + | + | - | - | - |
| 3 | cd | - | - | + | + | - |
| 4 | ace | + | - | + | - | + |
| 5 | bce | - | + | + | - | + |
| 6 | ade | + | - | - | + | + |
| 7 | bde | - | + | - | + | + |
| 8 | abcd | + | + | + | + | - |

The different level of five travel attributes for private vehicle users and bus TransJogja are shown in Table 3. Walking time for private vehicles user is time to walk from parking location. While in Table 4 is presented the value of positive and negative conditions of service for every travel attribute in stated preference questionnaire.

**Table 3** Different Level of Travel Attribute

| No. | Travel attribute | Type of mode | |
|---|---|---|---|
| | | Private vehicles | Bus TransJogja |
| 1. | Travel cost | IDR 3500.00-7500.00 | IDR 3000.00 |
| 2. | Congestion cost | IDR 4000.00-8000.00 | - |
| 3. | Parking cost | IDR 2500.00-5000.00 | - |
| 4. | Travel time | 4.00-8.00 minutes | 10.00 minutes |
| 5. | Walking time | 1.50 minutes | 2.00-5.00 minutes |

**Table 4** value Of Travel Attribute In Stated Preference Questionnaire

| No. | Travel attribute | Condition of service | |
|---|---|---|---|
| | | **(+)** | **(-)** |
| 1. | Travel cost | IDR 500.00 (more expensive IDR 500.00) | IDR 4500.00 (more expensive IDR 4500.00) |
| 2. | Congestion cost | IDR 4000.00 (more expensive 4000.00) | IDR 8000.00 (more expensive 8000.00) |
| 3. | Parking cost | IDR (more expensive 2500.00) | IDR (more expensive 5000.00) |
| 4. | Travel time | -6.00 minutes (faster 6.00 minutes) | -2.00 minutes (faster 2.00 minutes) |
| 5. | Walking time | -3.50 minutes (saving time 3.50 minutes) | -0.50 minutes (saving time 0.50 minutes) |

## Data Collection

Stated preference data is obtained from questionnaires distributed to respondents who used the private vehicles that pass through in Malioboro Corridor, Yogyakarta. The respondents were conducted with random sampling techniques to the traveler who uses a private vehicle to Malioboro Corridor, Yogyakarta.

## Study Area

The travel time in actual cost condition is obtained from Moving Car Observer survey in Malioboro, Yogyakarta. Malioboro corridor consist of two lane one-way direction undivided road (2/1 UD) 1.414 kilometers long from Malioboro Street to Ahmad Yani Street. The collection of data in the study area in Malioboro, Yogya, can be seen in Figure 3.


**Figure 3** Study Area in Malioboro, Yogyakarta

## 4. Result and Discussion

The generalized cost of private vehicle consists of three components of cost: (a) vehicle operating cost, (b) cost of pollution in each vehicle, and (c) travel time cost.

## Vehicle Operating Cost (VOC) and Speed Relationship

Vehicle operating cost (VOC) of private vehicles is counted in two conditions, based on travel cost in free-flow speed condition and travel cost in actual condition which potentially cause traffic jam. Figure 4 shows a graph to estimate vehicle operating cost based on LAPI ITB Method in 1996, showing the relationship between vehicle operating cost and speed of private vehicles in Malioboro, Yogyakarta.

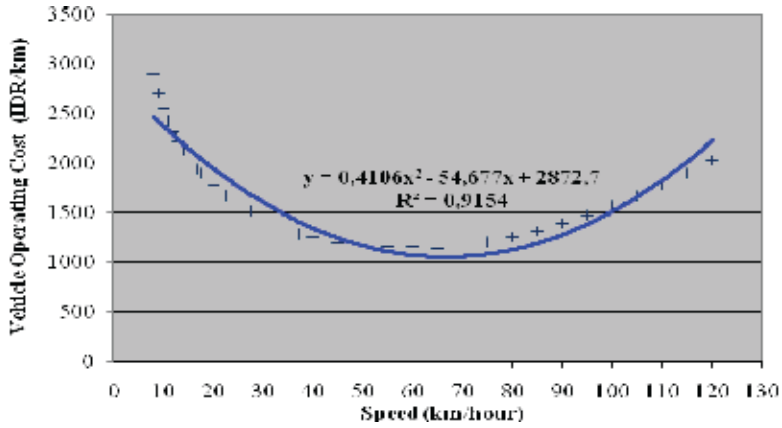


**Figure 4** Relationship between Speed and Vehicle Operating Cost

From Figure 4, it can be seen that the vehicle operating cost model for private vehicles is formulated as:

$$y = 0.4106V^2 - 54.677V + 2872.7 \quad (5)$$

in which V is speed (km per hour) and y is vehicle operating cost (IDR per kilometer).

Based on the survey and analysis of travel time and speed, the average speed of private vehicles in free-flow speed condition is 40.00 km/hour so the vehicle operating cost is IDR 1342.58/km (Figure 4). Based on Moving Car Observer survey, the speed of private vehicles in actual cost condition which potentially cause traffic jam is 9.98 km/hour so the vehicle operating cost is IDR 2367.92/km (Figure 4). The VOC of private vehicles at Malioboro in free-flow speed is IDR 1898.41 per trip and VOC in actual condition is IDR 3348.24 per trip.

**Pollution Cost**

The cost of pollution was calculated based on Marginal Health Cost (Sitorus, 1996) in USD cent/liter. The fuel consumption of private vehicles were counted based on fuel consumption model of LAPI ITB 1996. The marginal health cost can be calculated in actual condition as IDR 384.45 per km and free-flow speed condition as IDR 209.12 per km. Multiplying with 1.414 km, the length of Malioboro, the pollution cost of private vehicles at Malioboro is IDR 295.70 per trip in free-flow speed condition and IDR 543.61 per trip in actual cost condition.

**Travel Time Cost (TTC)**

Value of time of private vehicles users in September 2010 in Yogyakarta city is IDR 11447.52/hour. Based on the survey and analysis of travel time of private vehicles in Malioboro, Yogyakarta, the average of travel time in free-flow speed condition is 2 minutes 8 second. Based on moving car observer (MCO) survey, the average of travel time in actual cost condition is 8 minutes 30 second. Travel time cost of private vehicles in Malioboro was calculated by multiplying travel time with the value of time. Travel time cost of private vehicles at Malioboro is IDR 404.67 per trip in free-flow speed condition and IDR 1621.92 per trip in actual cost condition.

**Generalized Cost**

Generalized cost consists of VOC, travel time cost and pollution cost. The generalized cost of private vehicles in actual condition and free-flow speed condition are presented in Table 5.

**Table 5** Generalized Cost of Private Vehicles in Actual Cost and Free-Flow Speed Condition in Malioboro, Yogyakarta

| Type of condition | VOC (IDR/trip) | Pollution Cost (IDR/trip) | TTC (IDR/trip) | Generalized cost (IDR/trip) |
|---|---|---|---|---|
| Free-flow speed | 1898.41 | 295.70 | 404.67 | 2598.77 |
| Actual cost | 3348.24 | 543.61 | 1621.92 | 5513.77 |

**Congestion Cost**

The amount of congestion cost for private vehicles users is the difference between generalized cost in actual condition with average speed 9.98 km/hour and generalized cost in free-flow speed condition with speed 40.00 km/hour. It is shown in Table 5, that the generalized cost of private vehicles in actual condition is IDR 5513.77 per trip, and generalized cost in free-flow speed condition is IDR 2598.77 per trip, thus the congestion cost of private vehicles in Malioboro is IDR 2915.00 per trip.

**Characteristic of Respondents Stated Preference**

The characteristics of respondents stated preference include: sex, age, education, job, income, travel destination, and the average visit to Malioboro. The general characteristics of respondents stated preference can be seen in Table 6.

**Table 6** General Characteristic of Respondent Stated Preference

| No. | Item | Percentage |
|---|---|---|
| 1. | Sex: Male | 58.67% |
| | Female | 41.33% |
| 2. | Age: 16-20 years old | 6.67% |
| | 21-30 years old | 57.33% |
| | 31-45 years old | 16.00% |
| | 46-55 years old | 18.67% |
| | > 55 years old | 1.33% |
| 3. | Education: Junior High School | 1.33% |
| | Senior High School | 38.67% |
| | Diploma (D1/D2/D3) | 16.00% |
| | Undergraduate Program (S1) | 42.67% |
| | Postgraduate Program (S2/S3) | 1.33% |
| 4. | Job: Student/Graduate | 44.00% |
| | Armed Forces/Police | 4.00% |
| | Government Official | 13.33% |
| | Private Workers | 28.00% |
| | Entrepreneur | 9.33% |
| | House Wife | 1.33% |
| 5. | Income: < IDR 500000.00 | 10.67% |
| | IDR 500000.00 - IDR 1000000.00 | 20.00% |

| | | |
|---|---|---|
| | IDR 1000000.00 - IDR 1500000.00 | 17.33% |
| | IDR 1500000.00 - IDR 2000000.00 | 14.67% |
| | IDR 2000000.00 - IDR 2500000.00 | 16.00% |
| | IDR 2500000.00 - IDR 3000000.00 | 12.00% |
| | IDR 3000000.00 - IDR 4000000.00 | 6.67% |
| | > IDR 4000000,00 | 2.67% |
| 6. | Travel Destination: Studying | 14.67% |
| | Working | 20.00% |
| | Trading | 2.67% |
| | Family affairs | 0.00% |
| | Shopping | 44.00% |
| | Tour/Traveling | 18.67% |
| 7. | Average visit to Malioboro: | |
| | > 3 times per day | 5.33% |
| | 2 times per day | 2.67% |
| | 1 time per day | 6.67% |
| | 3-5 times per week | 14.67% |
| | 2 times per week | 70.67% |

**Distribution of Choice of Respondents**

Distribution of choice of respondents stated preference are presented in Figure 5-Figure 10. Figure 5 presented the main reason of respondents used private vehicles because private vehicles is more flexible and convenient than bus TransJogja. Figure 6 presented distribution of travel time from origin zone to destination zone. The most travel time of respondent is about 20-30 minutes.

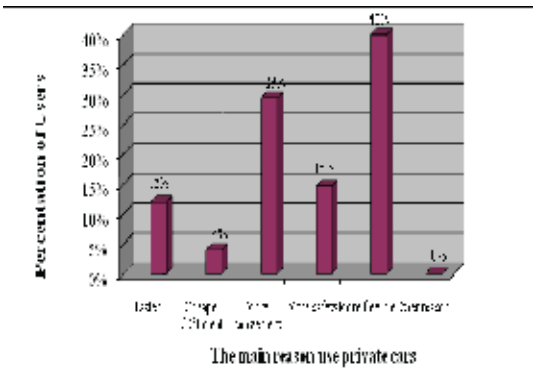

**Figure 5** The Main Reason Respondents Used Private Vehicles

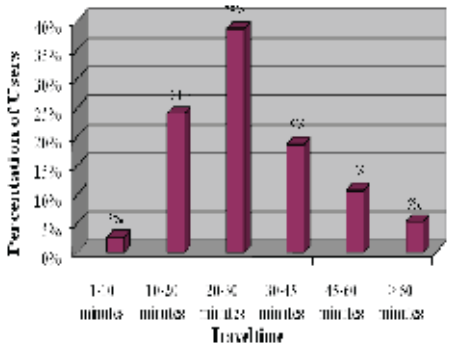

**Figure 6** Distribution Of Travel Time

The main reason of respondents not interested to use bus TransJogja because the travel time is longer than use private vehicles. The distribution of main reason respondent not interested used bus TransJogja are presented in Figure 7. Based on Figure 8, almost 34.67% of private vehicles user to Malioboro choose the application of congestion cost to reduce the traffic congestion in Yogyakarta.

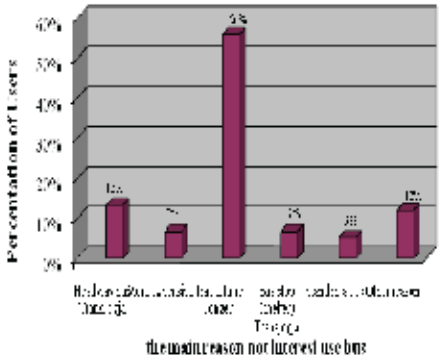

**Figure 7** The Main Reason Respondent Not Interested To Use Transjogja

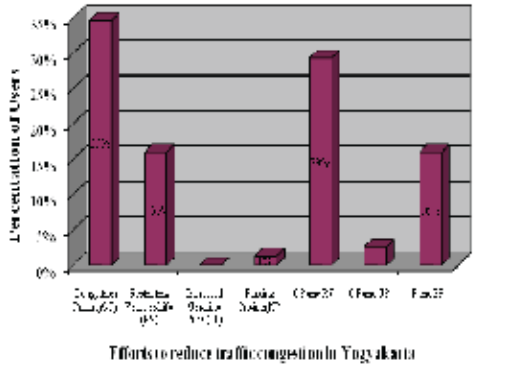

**Figure 8** Efforts to Reduce Traffic Congestion in Yogyakarta

Almost 28% of respondent who used the private vehicles in Malioboro choose the limit of congestion cost for private vehicles user as IDR 10000.00/trip, as presented in Figure 9. Based on Figure 10, 26.67% respondent will change the travel destination if congestion cost is applied for private vehicles in Malioboro, Yogyakarta.

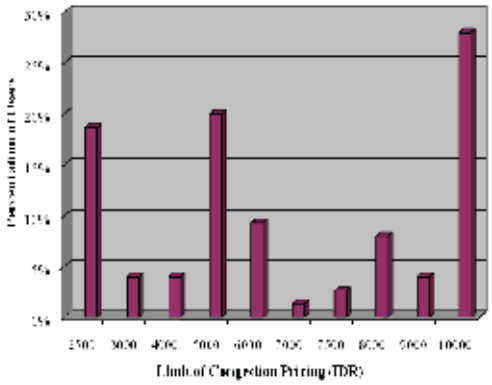

**Figure 9** The Limit of Congestion Cost in Malioboro, Yogyakarta

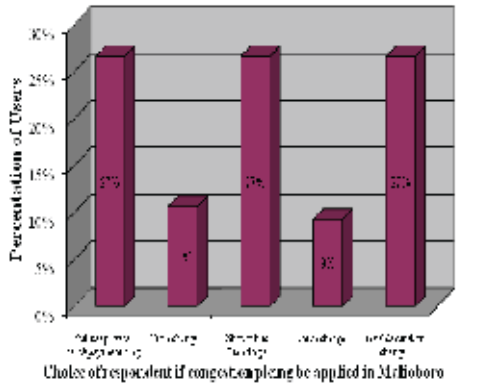

**Figure 10** Distribution of Choice If The Congestion Cost Is Applied in Malioboro

**Alternative of Mode Choice Model**

There are five travel attributes and each attribute consists of 2 levels. So, when we combined all of the attributes and their level will be obtained $2^5$-1=31 combination. Calibration result of 31 alternative utility function in logit binomial model can be seen in Table 7.

**Table 7a** Calibration Result of 31 Alternative Logit Binomial Model of Private Vehicles Users to Malioboro Alt. 1-Alt. 10

| Variable of model | Parameter of model | Constants and coefficient of travel attribute | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Alt-1 | Alt-2 | Alt-3 | Alt-4 | Alt-5 | Alt-6 | Alt-7 | Alt-8 | Alt-9 | Alt-10 |
| Constants | $a_0$ | 10.73428 | 31.68705 | 17.49142 | -29.4954 | -13.56570 | 42.86833 | 28.67270 | -18.3141 | -2.38441 | 49.62547 |
| | $t_{stat}$ | 0.76485 | 1.18854 | 0.60264 | -1.77797 | -0.94577 | 1.51451 | 0.91414 | -1.01056 | -0.13407 | 1.28790 |
| $X_1$ (*Travel cost*) | $a_1$ | -0.00447 | | | | | -0.00447 | -0.00447 | -0.00447 | -0.00447 | |
| | $t_{stat}$ | -1.02028 | | | | | -1.07459 | -0.96973 | -1.26442 | -1.04782 | |
| $X_2$ (*Congestion cost*) | $a_2$ | | -0.00535 | | | | -0.00535 | | | | -0.00535 |
| | $t_{stat}$ | | -1.27050 | | | | -1.28678 | | | | -1.21171 |
| $X_3$ (*Parking cost*) | $a_3$ | | | -0.00478 | | | | -0.00478 | | | -0.00478 |
| | $t_{stat}$ | | | -0.65148 | | | | -0.64823 | | | -0.67642 |
| $X_4$ (*Travel time*) | $a_4$ | | | | -7.26210 | | | | -7.26210 | | |
| | $t_{stat}$ | | | | -1.95771 | | | | -2.05307 | | |
| $X_5$ (*Walking time*) | $a_5$ | | | | | -6.55934 | | | | -6.55934 | |
| | $t_{stat}$ | | | | | -1.14325 | | | | -1.15255 | |
| $R^2$ | | 0.14784 | 0.21199 | 0.06606 | 0.38978 | 0.17887 | 0.35984 | 0.21390 | 0.53763 | 0.32671 | 0.27806 |
| $F_{stat}$ | | 1.04097 | 1.61419 | 0.42442 | 3.83263 | 1.30704 | 1.40529 | 0.68029 | 2.90695 | 1.21316 | 0.96290 |
| $F_{critical}$ | | 3.840 | 3.840 | 3.840 | 3.840 | 3.840 | 3.000 | 3.000 | 3.000 | 3.000 | 3.000 |

**Table 7b** Calibration Result of 31 Alternative Logit Binomial Model of Private Vehicles Users to Malioboro Alt. 11-Alt. 20

| Variable of model | Parameter of model | Constants and coefficient of travel attribute | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Alt-11 | Alt-12 | Alt-13 | Alt-14 | Alt-15 | Alt-16 | Alt-17 | Alt-18 | Alt-19 | Alt-20 |
| Constants | $a_0$ | 2.63865 | 18.56835 | -11.55697 | 4.37272 | -42.6141 | 60.80675 | 13.81993 | 29.74963 | -0.37569 | 15.55400 |
| | $t_{stat}$ | 0.10741 | 0.66633 | -0.40246 | 0.14094 | -2.39556 | 1.52150 | 0.60190 | 1.03102 | -0.01300 | 0.46982 |
| $X_1$ (*Travel cost*) | $a_1$ | | | | | | -0.00447 | -0.00447 | -0.00447 | -0.00447 | -0.00447 |
| | $t_{stat}$ | | | | | | -1.01494 | -1.53688 | -1.13226 | -1.22157 | -0.98687 |
| $X_2$ (*Congestion cost*) | $a_2$ | -0.00535 | -0.00535 | | | | -0.00535 | -0.00535 | -0.00535 | | |
| | $t_{stat}$ | -1.63151 | -1.31915 | | | | -1.21536 | -1.84036 | -1.35585 | | |
| $X_3$ (*Parking cost*) | $a_3$ | | | -0.00478 | -0.00478 | | -0.00478 | | | -0.00478 | -0.00478 |
| | $t_{stat}$ | | | -0.77913 | -0.66142 | | -0.67845 | | | -0.81658 | -0.65969 |
| $X_4$ (*Travel time*) | $a_4$ | -7.26210 | | -7.26210 | | -7.26210 | | -7.26210 | | -7.26210 | |
| | $t_{stat}$ | -2.21228 | | -1.89251 | | -2.12564 | | -2.49547 | | -1.98349 | |
| $X_5$ (*Walking time*) | $a_5$ | | -6.55934 | | -6.55934 | -6.55934 | | | -6.55934 | | -6.55934 |
| | $t_{stat}$ | | -1.21172 | | -1.08834 | -1.43995 | | | -1.24543 | | -1.08550 |
| $R^2$ | | 0.60178 | 0.39087 | 0.45585 | 0.24493 | 0.56866 | 0.42590 | 0.74963 | 0.53871 | 0.60369 | 0.39278 |
| $F_{stat}$ | | 3.77802 | 1.60422 | 2.09433 | 0.81098 | 3.29591 | 0.98917 | 3.99212 | 1.55715 | 2.03109 | 0.86247 |
| $F_{critical}$ | | 3.000 | 3.000 | 3.000 | 3.000 | 3.000 | 2.600 | 2.600 | 2.600 | 2.600 | 2.600 |

**Table 7c** Calibration Result of 31 Alternative Logit Binomial Model of Private Vehicles Users To Malioboro Alt. 21-Alt. 31

| Variable of model | Parameter of model | Constants and coefficient of travel attribute | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Alt-21 | Alt-22 | Alt-23 | Alt-24 | Alt-25 | Alt-26 | Alt-27 | Alt-28 | Alt-29 | Alt-30 | **Alt-31** |
| Constants | $a_0$ | -31.43281 | 20.57707 | 36.50677 | -10.48005 | -24.67567 | 31.75835 | 47.68805 | 0.70123 | -13.49439 | 7.45837 | 18.63965 |
| | $t_{stat}$ | -1.75741 | 0.64003 | 0.93433 | -0.48432 | -0.88366 | 1.11131 | 1.19489 | 0.04688 | -0.51742 | 0.28494 | 2.99591 |
| $X_1$ (*Travel cost*) | $a_1$ | -0.00447 | | | | | -0.00447 | -0.00447 | -0.00447 | -0.00447 | | -0.00447 |
| | $t_{stat}$ | -1.44431 | | | | | -1.55129 | -1.05936 | -2.49071 | -1.42825 | | -7.37875 |
| $X_2$ (*Congestion cost*) | $a_2$ | | -0.00535 | -0.00535 | -0.00535 | | -0.00535 | -0.00535 | -0.00535 | | -0.00535 | -0.00535 |
| | $t_{stat}$ | | -1.59782 | -1.24959 | -1.96623 | | -1.85762 | -1.26855 | -2.98254 | | -2.03699 | -8.83579 |
| $X_3$ (*Parking cost*) | $a_3$ | | -0.00478 | -0.00478 | | -0.00478 | -0.00478 | -0.00478 | | -0.00478 | -0.0047 | -0.00478 |
| | $t_{stat}$ | | -0.89196 | -0.69757 | | | | -0.70815 | | -0.95474 | | -4.93246 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | -0.85056 | -1.03699 | | | | 8 -1.13712 | |
| $X_4$ (*Travel time*) | $a_4$ $t_{stat}$ | -7.26210 -2.34515 | -7.26210 -2.16659 | | -7.26210 -2.66614 | -7.26210 -2.06602 | -7.26210 -2.51887 | | -7.26210 -4.04422 | -7.26210 -2.31908 | -7.2621 -2.76208 | -7.26210 -11.98101 |
| $X_5$ (*Walking time*) | $a_5$ $t_{stat}$ | -6.55934 -1.58866 | | -6.55934 -1.14783 | -6.55934 -1.80611 | -6.55934 -1.39956 | | -6.55934 -1.16524 | -6.55934 -2.73964 | -6.55934 -1.57099 | -6.55934 -1.8711 | -6.55934 -8.11621 |
| $R^2$ | | 0.71650 | 0.66785 | 0.45693 | 0.78065 | 0.63472 | 0.81569 | 0.60478 | 0.92850 | 0.78257 | 0.84672 | 0.99456 |
| F-$_{stat}$ | | 3.36988 | 2.68091 | 1.12187 | 4.74549 | 2.31689 | 3.31934 | 1.14768 | 9.74015 | 2.69940 | 4.14313 | 73.25281 |
| F-$_{critical}$ | | 2.600 | 2.600 | 2.600 | 2.600 | 2.600 | 2.370 | 2.370 | 2.370 | 2.370 | 2.370 | 2.210 |

**Mode Choice Model**

From the analysis of 31 alternative mode choice model, interpretation and statistical tests (t-$_{test}$ and f-$_{test}$) and calibration, alternative 31 is the best. Utility differential of binomial logit model between private vehicles dan bus TransJogja is presented:

$U_{MC}$-$U_{BT}$ = 18.63965 - 0.00447$X_1$ - 0.00535$X_2$ - 0.00478$X_3$ - 7.26210$X_4$ - 6.55934$X_5$

(2.99591) (-7.37875) (-8.83579) (-4.93246) (-11.98101) (-8.11621)

with coefficient determination ($R^2$) = 0.99456

in which:

$X_1$ = the different of travel cost between private vehicles and bus TransJogja,
$X_2$ = the different of congestion cost between private vehicles and bus TransJogja,
$X_3$ = the different of parking cost of private vehicles,
$X_4$ = the different of travel time between private vehicles and bus TransJogja,
$X_5$ = the different of walking time to the bus stop of TransJogja.

The validation of choosen model using statistical analysis. The result is the following:

a. The choosen model has the largest of coefficient determination ($R^2$) 0.99456. It means that the influence of all the travel attributes which changes in the utility of this model amounts to 99.456% and the remaining 0.544% is influenced by the other attributes that are not considered in this model.
b. The choosen model has F-$_{stat}$ value is 73.25281 > F-$_{critical}$ = 2.210. This means that all travel attributes simultaneously and significantly affects in the utility of mode choice at the level of significance ($\alpha$) = 0.05.
c. The choosen model has five attributes with t-$_{stat}$ value > t-$_{critical}$ value (1.910): travel cost, congestion cost, parking cost, travel time and walking time. It means that all travel atrributes by individually, significant in the utility of mode choice at $\alpha$ = 0.05 and parking cost by individually is not significant at the level of significance ($\alpha$ ) = 0.05.

**Proportion of Private Vehicles Users Shift to Bus TransJogja**

The different utility value of private vehicles users to Malioboro, Yogyakarta and bus TransJogja is 2.08498 so that the probability of choosing private vehicles is 88.943% and the probability of choosing bus TransJogja is 11.057%. It means that the proportion of private vehicles users to Malioboro which will shift to bus TransJogja after the implementation of congestion cost IDR 5500.00 per trip is 11.057%.

## 5. Conclusion

The effect of application of congestion cost for private vehicles and bus TransJogja in Malioboro, Yogyakarta includes the amount of congestion cost can be concluded as follows:

1. Congestion cost in Malioboro, Yogyakarta for private vehicles is IDR 2915.00 per trip.
2. Travel attributes that influences mode choice between private vehicles and busTransJogja are travel costs, congestion costs, parking cost, travel time and walking time.
3. The application of congestion cost as IDR 5500.00 per tirp for private vehicles user to Malioboro, Yogyakarta will be shift as 11.057% private vehicle user to bus TransJogja.

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# Analytical Modeling of Just-In-Time Convergent and Divergent Supply Chain System

by

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**Abstract**

Supply chain design is to deliver products in the right quantities, to the right location and at the right time for total cost optimization. The main objective of this paper is to develop an analytical model that represents a real supply chain and gives an optimal solution for the operational level decisions like the inventory, production lot sizes and delivery lot sizes at various stages of supply chain. System where a product is assembled from several raw materials and distributed to many dealers is a convergent and divergent supply chain. Optimization of a part of supply chain as an independent system gives sub-optimal results while the optimal total cost is obtained by the analysis of the integrated supply chain. A quantative analytical approach has been followed to develop this Non-linear Integer Program (NLIP) for the convergent and divergent supply chain system under JIT. The model facilitates integrated supply chain optimization for system wide inventory, logistic and production setup costs. A generic LINGO program has been developed for NLIP using branch and bound method for optimization. The model has been validated using automotive supply chain data. However it can be applied to any industry. Generic LINGO program model with data input tables in Microsoft Excel eliminates the need of heuristics for manual solutions and enables quick solution of larger problems by practitioners.

**Keywords:** Supply Chain System, Kanban, Divergent, JIT, Lean/Agile Operations, Logistics, Order Fulfillment and Distribution, Operation Planning & Scheduling

## 1. Introduction

Supply chain system consists of a series of manufactures, distributors and retail outlets to produce and distribute a product or products till they reach the final customers. The product and information flow through the supply chain. Supply chain includes the raw material, Work-in-process (components) and final product flowing through the supply chain. Total inventory in supply chain consists of the raw material inventory, WIP and finished goods inventory at all stages of the supply chain system.

Various studies (Khouja & Kumar, 2002; Zhao & Xie, 2002; Lau et al., 2004; Ganeshan et al., 2001; Jing et al., 2005) have shown that information sharing among the various stages of supply chain helps to improve performance. Cooperation and coordination helps to improve supply chain performance (Allwood & Lee, 2005; Hwarng et al., 2005; Shang et al., 2004; Gnoni et al., 2003; Nair & Closs, 2006). Rau & Ouyang (2008) conclude that the performance of the integrated solution is better than the performance of any independent decision from either the buyer or the vendor. De Boeck & Vandaele (2008) stress that the coordination of joint material flow is a key element in supply chain management and analytical models for the coordination of materials are of great practical value but literature analyzing those remains scarce. Optimization of a part of the supply chain as an independent system gives sub-optimal results and the optimal total cost can be obtained only by the analysis of the integrated supply chain.

The model developed here is for a convergent and divergent supply chain where a product is assembled from several raw materials supplied and distributed to many dealers. The model has been developed with a fresh, integrated approach, and the total quantity of raw material between manufacturer and suppliers has been considered together to model the total inventory. Input side inventory has also been considered. The raw material supplier is also included in modeling. The kanban size, number of kanbans and total quantity are also synchronized with the main supply chain. The NLIP model developed has been optimized using Lingo software, with data input tables in Microsoft Excel for easy entry and quick results using branch and bound method.

## 2. Literature Review

Wang & Wang (1991) developed models for adjacent stages and convergent supply chain system using a Markov process approach for stochastic demand and stochastic processing times with exponential distribution. Nori and Sarker (1998) presented an adjacent stage model for optimum no. of kanbans with Poisson demand rate and production rates. These models consider the inventory and shortage cost and do not consider the production setup and kanban setup cost in the models. Model developed by Nori & Sarker (1996) is only for a single stage supply chain system operating under fixed quantity and periodic delivery policy, though it considers production setup and kanban setup cost in the models. Similarly model developed by Rau & OuYang (2008) is only an adjacent stage model with a linear trend in demand.

Wang & Sarker (2004), Wang & Sarker (2005) and Wang & Sarker (2006) have modeled a single stage, convergent and multi stage supply chain systems controlled by kanban as a mixed integer nonlinear programming (MINLP) problem and developed a heuristic for solving large size MINLP

problems by branch and bound algorithm. The inventory at the input side has not been considered except for the raw material in stage one. It cannot be ignored as it may be few days inventory costing few millions for a large size manufacturing supply chain. Similarly model developed by Rabbani et al. (2008) is only a multi stage supply chain system model and is solved using a heuristic method via memetic algorithm. Sarker et al. (2008) model for a multistage supply chain system allows for rework to determine the optimal batch size to minimize the production setup costs, penalty cost of rework, inventory cost but does not consider kanban setup cost. Similarly, Sarker & Balan (1999) have developed a model for multi stage supply chain system controlled by kanban for linearly varying demands but have not considered the kanban setup cost. Convergent supply chain system models developed by Anwar et al. (2007) and Xiaobo et al. (2007) are not multi stage and consider only preprocessing of raw materials with raw material suppliers.

The model for the divergent supply chain system developed by Kim et al. (2006) does not consider the raw material inventory at raw material supplier stage and assumes a single lot delivery from the raw material supplier for a cycle. If the numbers of deliveries are increased the inventory cost will come down though the delivery cost will increase.

## 3. Analytical Model for Convergent and Divergent Supply Chain

A quantative analytical approach has been followed to develop this NLIP for the convergent and divergent supply chain system under JIT where a product is assembled from many raw materials and distributed to many dealers. Notation followed in the model is as follows.

R is the raw material stage

r an index for no. of raw material suppliers, r = 1,2.....R for R numbers of suppliers.

M is the manufacturing stage

D is the dealer stage for finished product distribution

k an index for no. of dealers, k = 1,2.....K for K dealers.

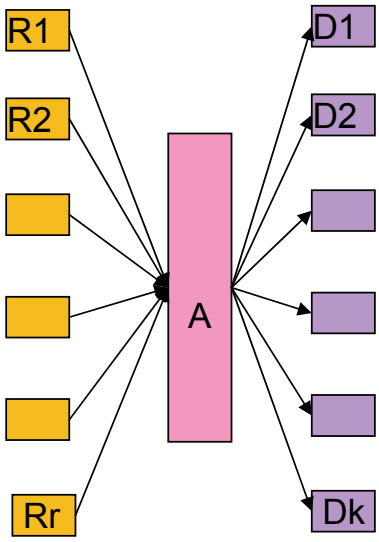


**Figure 1** Convergent and Divergent Supply Chain System

**Assumptions**

- Demand for the supply chain system is constant for a period.
- Production rate at manufacturing stage is equal to or greater than demand.

The various variables used in the model are as follows:

**Variables**

Decision Variables

$Q$ Total production of product p at manufacturer M for time period $T$

$Q_r$ Total production of raw material at stage r for time period $T$

$K_r$ Number of shipments between raw material stage r and manufacturer M for time period $T$

$K$ Number of shipments between manufacturer M and dealers for product p for time period $T$

$K_k$ Number of shipments between manufacturer M and dealer k for product p for time period $T$

Parameters

$P_r$ Production rate of raw material at raw material stage r - units per year

$P$ Production rate of finished product p at manufacturing stage M - units per year

$D_k$ Demand rate of finished product p at dealer k - units per year

$D = \sum_{k=1}^{K} D_k$ Demand rate of finished product p - units per year

$C_r$ Unit cost of raw material at raw material stage r

$C$ Unit cost of finished product at manufacturing stage M

$C_k$ Unit cost of finished product at dealer k

$H_r$ Holding cost (warehousing/interest/rejection) Rs/unit/year for raw material at stage r

$H$ Holding cost of finished product at manufacturing stage M

$H_k$ Holding cost of finished product at dealer k

$A_r$ Production setup cost Rs./setup for raw material at raw material stage r

$A$ Production setup cost of stage M

$S_r$ Shipping & ordering setup cost Rs/shipment for raw material at stage r

$S_k$ Shipping & ordering setup cost for dealer k

Dependent Variables

$TC_r$ Total cost for raw material at stage r

$TC_m$ Total cost for finished product at manufacturing stage M including dealers

$TC$ Total Cost at all stages including raw material and dealers

$T$ Time period for manufactur ing stage for finished product $p$

$UT$ Uptime of stage $M$ for finished product $p$

$I_r(t)$ Inventory of raw material at raw material stage $r$ at time $t$

$I_{rm}(t)$ Inventory of raw material at manufactur ing stage $M$ at time $t$

$I$ (t) Inventory of finished product $p$ at stage $M$

$I_k(t)$ Inventory of finished product $p$ at dealer $k$

$I_r(avg)$ Average inventory of raw material at stage $\boldsymbol{r}$

$I_{rm}(avg)$ Average inventory of raw material at manufactur ing stage $M$

$I$ (avg) Average inventory of finished product $p$ at stage $M$

$I_k(avg)$ Average inventory of finished product $p$ at dealer $k$

$QK_r$ Units per shipment of raw material for raw material stage $r$

$QK$ Units per shipment of finished product at stage M

$QK_k$ Units per shipment of finished product at stage $M$ for dealer $k$

$UK_k$ Number of shipments between stage $M$ and dealer $k$ for period $T$ during uptime of the stage $M$

**Holding cost of raw material 'r' between raw material supplier 'r' and manufacturer 'M'**

The cost can be determined by finding the average inventory as cost of the holding inventory is known. The inventory of raw material 'r' at supplier 'r' can be represented by Fig 2. It is assumed that the system is operating under JIT and raw materials are dispatched as soon as the required kanban quantity has been processed.

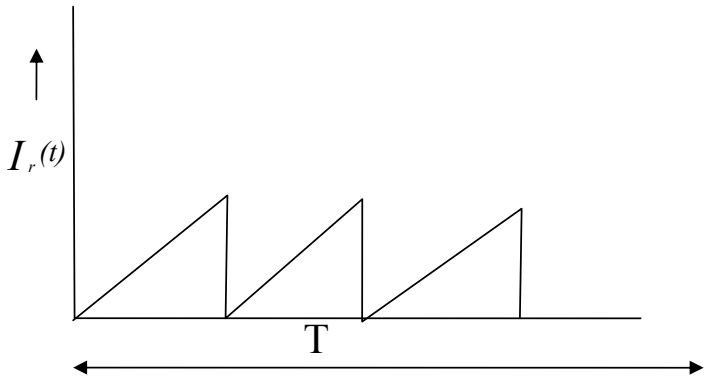


**Figure 2** Inventory of Raw Material 'r' at Supplier 'r'

Average raw material inventory at raw material suppler 'r' = $I_r(avg) = \frac{QK_r}{2}$

The raw material 'r' inventory at manufacturer 'M' can be represented by Figure 3

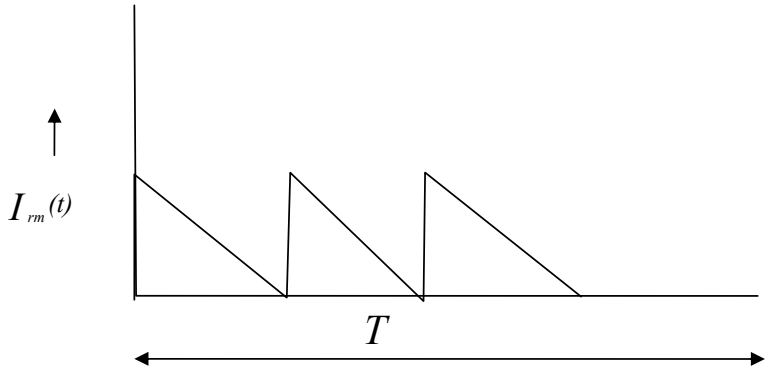


**Figure 3** Raw Material 'r' Inventory at Manufacturer 'M'

Average raw material 'r' inventory at manufacturer 'M' = $I_{rm}(avg) = \frac{QK_r}{2}$

The total raw material 'r' inventory at stage 'r' & 'M' can be represented by Figure 4

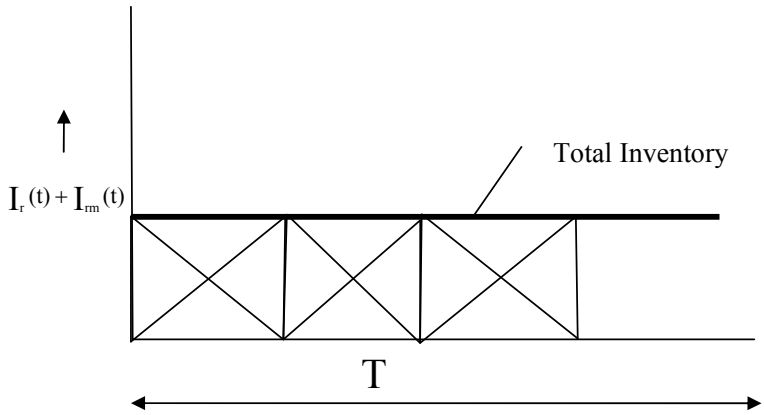


**Figure 4** Total Inventory of Raw Material 'r' at Suppler 'r' & Manufacturer 'M'

We observe that the total inventory is constant. So, total inventory of raw material 'r' at stage 'r' & 'M' will be = $I_r(avg) + I_{rm}(avg) = QK_r$

As , $QK_r = \frac{Q}{K_r}$ …… (1)

Substituting $QK_r$ from (1)gives

$$I_r(avg) + I_{rm}(avg) = \frac{Q}{K_r}$$

Holding cost = $\left(I_r(avg) + I_{rm}(avg)\right) \times H_r$

Holding cost= $H_r \times \frac{Q}{K_r}$ …… (2)

**Production setup cost of raw material supplier 'r'**

Total number of production setups at stage 'r' = $\frac{D}{Q}$

So, production setup cost = $A_r \times \frac{D}{Q}$ …… (3)

**Shipping setup cost of raw material supplier 'r'**

Total number of shipments at raw material supplier stage= $\frac{D}{QK_r}$

Shipping setup cost= $S_r \times \frac{D}{QK_r}$

Substituting $QK_r$ from (1)

Shipping setup cost= $S_r \times \frac{D}{Q} \times K_r$ ……..(4)

**Total cost of raw material supplier 'r'**

Total cost = Production setup cost + Shipping setup cost + Holding cost
Equations (2), (3) & (4) give

$$TC_r = A_r \times \frac{D}{Q} + S_r \times \frac{D}{Q} K_r + \frac{Q}{K_r} \times H_r$$

$$TC_r = \frac{D}{Q}\left[A_r + S_r K_r\right] + \frac{Q}{K_r} \times H_r \qquad \text{.....(5)}$$

**Total cost of all raw material suppliers**

Total cost of all raw material suppliers will be the sum of total cost of all raw material suppliers.
Equation (5) gives

$$\sum_{r=1}^{R} TC_r = \sum_{r=1}^{R}\left[\frac{D}{Q}\left[A_r + S_r K_r\right] + \frac{Q}{K_r} \times H_r\right]$$

$$\sum_{r=1}^{R} TC_r = \frac{D}{Q}\left[\sum_{r=1}^{R} A_r + \sum_{r=1}^{R} S_r K_r\right] + Q \sum_{r=1}^{R} \frac{H_r}{K_r} \qquad \text{.....(6)}$$

**Holding cost of finished products between manufacturer 'M' and dealers**

The cost can be determined by finding the average inventory as cost of the holding inventory is known. There are two cases

Case 1: If production at manufacturer 'M' is equal to demand rate i.e.

If $P = D$

The inventory at manufacturer 'M' can be represented by Fig 5. It is assumed that that the system is operating under JIT and the finished product is dispatched as soon as the required kanban quantity has been processed

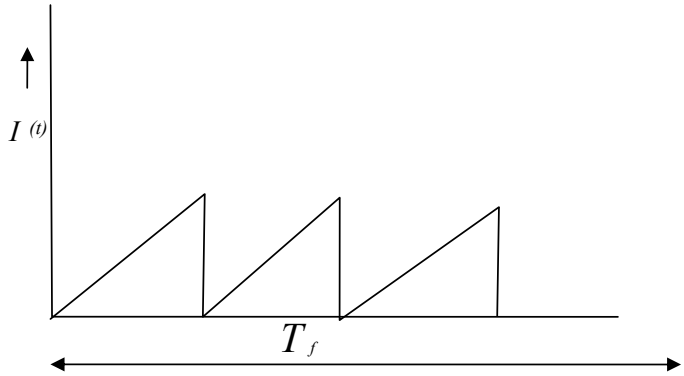


**Figure 5** Inventory of Finished Product at Manufacturer 'M'

Average inventory of finished product at manufacturer 'M' = $I\ (avg) = \frac{QK}{2}$

The inventory at dealer 'k' can be represented by Figure 6

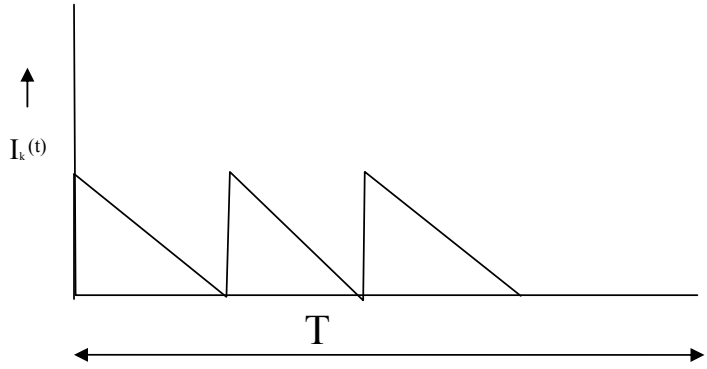


**Figure 6** Inventory of Finished Product at Dealer 'k'

Maximum inventory of finished product at dealer k will be $QK_k$

Average inventory will be $I_k(avg) = \frac{QK_k}{2}$

Average inventory at dealers = $\frac{\sum_{k=1}^{K} QK_k}{2}$

Total average inventory at manufacturer 'M' and dealers

$$I(avg) + \sum_{k=1}^{K} I_k(avg) = \frac{QK}{2} + \sum_{k=1}^{K} \frac{QK_k}{2} \quad \text{..... (7)}$$

If number of dealers goes up, the inventory also goes up.

Case 2: If $P > D$, then inventory will accumulate and maximum inventory will be when production stops at manufacturer 'M' and leftover quantity will be whatever is not shipped.

$$\text{I (max)} = QK\left[K - UK\right] + QK$$

$$\text{I(avg)} = \frac{QK}{2}\left[K - UK\right] + \frac{QK}{2} \quad \text{.....(8)}$$

As the proportion of kanban made in uptime will be proportional to the production rate at that stage to the demand rate $\frac{UK}{K} = \frac{D}{P}$

So,

$$UK = \frac{D}{P} \times K \quad \text{.....(9)}$$

Substituting $UK$ gives

$$\text{I(avg)} = \frac{QK}{2}\left[K - \frac{D}{P} \times K\right]$$

Average inventory at dealers will be same as in case 2

$$\text{Average inventory at dealers} = \frac{\sum_{k=1}^{K} QK_k}{2}$$

So total inventory between manufacturer 'M' and all dealers will be

$$I(avg) + \sum_{k=1}^{K} I_k(avg) = \frac{QK}{2} + \frac{QK}{2}\left[K - \frac{D}{P} \times K\right] + \sum_{k=1}^{K} \frac{QK_k}{2} \quad \text{.....(10)}$$

As Quantity per kanban is equal to total quantity divided by number of kanbans

$$QK_k = \frac{Q_k}{K_k} \quad \text{and} \quad QK = \frac{Q}{K} \qquad \text{.....(11)}$$

As quantity shipped in the period will be proportional to the demand

$$\frac{Q_k}{Q} = \frac{D_k}{D}$$

Substituting $Q_k$ in equation (11)

$$QK_k = \frac{Q}{K_k} \times \frac{D_k}{D} \quad \text{and} \quad QK = \frac{Q}{K} \qquad \text{.....(12)}$$

Substituting $QK_k$ and $QK$ from equation (12), total inventory between manufacturer 'M' and all dealers is

$$I(avg) + \sum_{k=1}^{K} I_k(avg) = \frac{Q}{2 \times K} + \frac{Q}{2}\left[1 - \frac{D}{P}\right] + \sum_{k=1}^{K} \frac{\frac{Q}{K_k} \times \frac{D_k}{D}}{2}$$

$$I(avg) + \sum_{k=1}^{K} I_k(avg) = \frac{Q}{2}\left[\frac{1}{K} + \sum_{i=1}^{m} \frac{1}{K_k} \times \frac{D_k}{D} + \left[1 - \frac{D}{P}\right]\right]$$

Assuming holding cost at stage M and dealers is same

$$H = H_1 = H_2 - - - - H_K$$

Total holding cost will be

$$H \times \frac{Q}{2}\left[\frac{1}{K} + \sum_{k=1}^{K} \frac{1}{K_k} \times \frac{D_k}{D} + \left[1 - \frac{D}{P}\right]\right] \qquad \text{.....(13)}$$

**Production setup cost of manufacturing stage M**

Total number of production setups $= \frac{D}{Q}$

So production setup cost $= \frac{A}{Q} \times D$ …… (14)

**Shipping setup cost of plant A**

Shipments to dealer k $= \frac{D_k}{QK_k}$

Shipping setup cost $= S_k \times \frac{D_k}{QK_k}$

Total shipping setup cost $= \sum_{k=1}^{K} \frac{S_k}{QK_k} \times D_k$

So, substituting $QK_k$ from equation (12) gives

Total shipping Cost $= \sum_{k=1}^{K} S_k \times D_k \times \frac{K_k}{Q} \times \frac{D}{D_k}$

Total shipping cost $= \frac{D}{Q} \times \sum_{k=1}^{K} S_k K_k$ ……(15)

**Total cost of divergent stage including dealers**

Total cost = Holding cost +Product setup cost + Shipping setup cost
Substituting from (13), (14) & (15) gives

$$TC_m = H \times \frac{Q}{2}\left[\frac{1}{K} + \sum_{k=1}^{K} \frac{1}{K_k} \times \frac{D_k}{D} + \left[1 - \frac{D}{P}\right]\right] + \frac{A}{Q} \times D + \frac{D}{Q} \sum_{k=1}^{K} S_k K_k$$

$$TC_m = \frac{D}{Q}\left(A + \sum_{k=1}^{K} K_k \times S_k\right) + \frac{Q}{2}\left(\frac{H}{K} + H \sum_{k=1}^{K} \left(\frac{D_k}{K_k \times D}\right) + H\left(1 - \frac{D}{P}\right)\right) \ldots\ldots(16)$$

**Total cost of supply chain system**

Equations (7) & (16) give

$$\text{Total Cost} = \sum_{r=1}^{R} TC_r + TC_m$$

$$TC = \frac{D}{Q}\left[\sum_{r=1}^{R} A_r + \sum_{r=1}^{R} S_r K_r\right] + Q \sum_{r=1}^{R} \frac{H_r}{K_r} \quad +$$

$$\frac{D}{Q}\left(A + \sum_{k=1}^{K} K_k \times S_k\right) + \frac{Q}{2}\left(\frac{H}{K} + H \sum_{k=1}^{K} \left(\frac{D_k}{K_k \times D}\right) + H\left(1 - \frac{D}{P}\right)\right)$$

## 4. Optimization of Supply Chain by LINGO Program

Wang & Sarker (2006) have developed a heuristic for solving large size MINLP problems manually. Rabbani et al. (2009) has developed heuristic method for solving MINLP by via Memetic algorithm (MA) instead of algorithm such as branch and bound (B&B) as it takes a less time manually. Even after model and heuristic development, optimization manually by heuristics will greatly limit the application of model due to time constraints. Use of computer software eliminates the tedious and time consuming manual calculations and gives accurate results as approximations have been done. LINGO was selected as demo software of LINGO was available on the website of the company and limits on number. of nonlinear and integer variables were 30 and it had a graphic user interface. A lingo program has been developed for minimization of the above cost objective MINLP function for solution by Branch and bound method with data input tables in Microsoft Excel for easy entry and quick results.

**Table 1** Raw Material Supplier Costs

| | Supplier 1 | Supplier 2 | Supplier 3 | Supplier 4 |
|---|---|---|---|---|
| Holding Cost | 1000 | 200 | 20 | 500 |
| Production setup cost | 500 | 20000 | 2000 | 10000 |
| Kanban setup cost | 1500 | 10000 | 200 | 5000 |

**Table 2** Costs at Manufacturing Stage ‘M’

| | Stage ‘M” |
|---|---|
| Production rate | 70000 |
| Holding Cost | 2000 |
| Production setup cost | 500 |

**Table 3** Dealer Costs

| | Dealer 1 | Dealer 2 | Dealer 3 | Dealer 4 |
|---|---|---|---|---|
| Demand | 10000 | 20000 | 10000 | 10000 |
| Holding Cost | 2000 | 2000 | 2000 | 2000 |
| Kanban setup cost | 2000 | 2500 | 3000 | 4000 |

**Table 2** LINGO Result

The results from the Lingo are presented in Table 4

| | |
|---|---|
| Q - Total quantity in a cycle | 2625 |
| Number of kanbans for raw material supplier 1 to manufacturer 'M" | 10 |
| Number of kanbans for raw material supplier 2 to manufacturer 'M" | 2 |
| Number of kanbans for raw material supplier 3 to manufacturer 'M" | 4 |
| Number of kanbans for raw material supplier 4 to manufacturer 'M" | 4 |
| Number of kanbans for finished product from manufacturer 'M' to dealer 1 | 4 |
| Number of kanbans for finished product from manufacturer 'M' to dealer 2 | 5 |
| Number of kanbans for finished product from manufacturer 'M' to dealer 3 | 3 |
| Number of kanbans for finished product from manufacturer 'M' to dealer 4 | 3 |

## 5. Conclusion

Optimization of a part of supply chain as an independent system gives sub-optimal results while the total optimal cost is obtained by the analysis of the integrated supply chain. The model developed here is for a convergent and divergent supply chain where a product is assembled from the raw material supplied and distributed to many dealers and represents the supply chain more realistically and enables integrated supply chain optimization for system wide inventory, logistic and production setup costs. Model presents a fresh integrated approach of inventory control by considering the inventory between the two stages of supply chain together and considers the inventory at input side also which is ignored by previous analytical models developed. The raw material supplier is also included in modeling and the kanban size; number of kanbans and total quantity are also synchronized with the main supply chain.

A generic LINGO program has been developed for MINLP using branch and bound method for optimization. Use of Lingo program has eliminated the tedious and time consuming calculations by manual calculations and gives accurate results as no approximations are used. The Lingo program enables the solutions of large problems using the model. The model developed can be further customized for the real situation by building additional constraints in the Lingo program.

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# The Determination of the Freight Transport Route Network in Bali and West Nusa Tenggara, Indonesia

by

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**Abstract**

Freight transport route network should be determined in every area for three purposes. Firstly, it is required for the purpose of maintaining appropriate infrastructure for the freight transport itself in terms of suitable road geometry, road pavement structure and road environment. Secondly, it is required for the purpose of maintaining general traffic in an acceptable level of service. Thirdly, it is required to protect road site activities and environment from any potential hazard generating from freight transport. In order to determine freight transport route network in an area, there are several factors that should be considered, e.g. freight transport demand, land use master plan, sustainability of the environment, etc. This paper will discuss the determination of freight transport route network in Bali and West Nusa Tenggara, Indonesia. There should be freight transport route networks for container transport, heavy equipment transport and dangerous goods transport. General goods transport is allowed to use general traffic route network. In order to evaluate available alternative of routes, several criterion were used, i.e. road status, road class, road geometry, access control, annual average daily traffic (AADT), volume to capacity ratio (V/C), land use (for container, heavy equipment transport and dangerous goods routes) and additionally population density and level of public activities (for dangerous goods transport routes only). Selected route for each type of freight transport was alternative route having best score in analytic hierarchy process (AHP).

**Keywords:** Freight Transport, Alternative Route, Analytic Hierarchy Process

## 1. Introduction

Freight transport route network should be determined in every area for three purposes. Firstly, it is required for the purpose of maintaining appropriate infrastructure for the freight transport itself in terms of suitable road geometry, road pavement structure and road environment. Secondly, it is required for the purpose of maintaining general traffic in an acceptable level of service. Thirdly, it is required to protect road site activities and environment from any potential hazard generating from freight transport. In order to determine freight transport route network in an area, there are several factors that should be considered, e.g. freight transport demand, land use master plan, sustainability of the environment, etc. This paper will discuss the determination of freight transport route network in Bali and West Nusa Tenggara, Indonesia.

## 2. Literature Review

According to the Government Regulation No. 41/1993, freight transport is classified into general goods transport, container transport, heavy equipment transport and dangerous goods transport. According to the Government Regulation No.43/1993 and several subsidiary regulations, general goods transport is allowed to use general traffic route network, whilst other goods transport should only use a pre-determined route. In order to evaluate available alternative of routes, several criterion can be used (Nelson et al, 2006; Dilgir et al, 2005; Pinella County, 2008), e.g. road class, road geometry, access control, traffic performance, land use, population density, level of road side public activities, etc.

One of suitable method to evaluate the alternative routes is analytic hierarchy process (AHP). There are three principals of AHP (Saaty, 1994), i.e.:

- Decomposition, i.e. breaking up the problems into its elements. This process should be continuously carried out until no further fragmentation could be made (Figure 1).
- Comparative Judgment, i.e. conducting evaluation on relative importance of a pair of elements on a certain level related to the higher level.
- Synthesis of Priority, i.e. sorting the elements based on relative importance through synthesis procedure (priority setting). The magnitude of the priority is expressed in eigenvector value. The higher the eigenvector value, the more important the element.

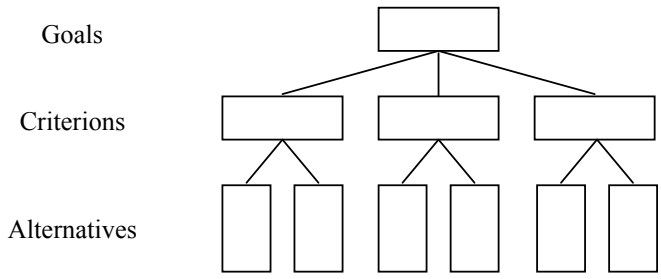


**Figure 1** Decision Hierarchy

## 3. Methodology

In the determination of network route of container transport, heavy equipment transport and dangerous goods transport, the following approaches have been made:

- The freight transport demand was projected from the 2006 Indonesian National Origin-Destination Survey.
- Based on the above freight transport demand and the existence of centers of freight transport and centers of activity along with the pattern of studied area development, the pattern of freight transport was predicted.
- In order to facilitate the freight transport demand and pattern, several alternative routes were chosen based on the criterions shown in Table 1.

**Table 1** Alternative Routes Criteria

| Criteria | Rate | Evaluate | Reject |
|---|---|---|---|
| Route Purpose | Route serves many focal points | Route serves some focal points | Route serves no focal points |
| Part of Truck Routes | Yes | Could be | No |
| Alternative | No alternative route available | Limited alternate route | Better routes to choose from |
| Network Completion | Improves the network grid by joining one or more existing routes | Limited value in grid completion | Dead end route |
| Route Length | Significantly shortens normal travel distances | Limited improvement to travel distance | No distance reduction over existing routes |
| Coverage | Significantly reduces trips off the freight network | Marginally decreases trips off the freight route | No reduction in trips off the freight route |

- Route selection was carried out using AHP based on several criterions, i.e. road status, road class, road geometry, access control, annual average daily traffic (AADT), volume to capacity ratio (V/C), land use (for container, heavy equipment transport and dangerous goods routes) and additionally population density and level of public activities (for dangerous goods transport routes only).
- In the selected route, some improvement might be required such as upgrading of road class, improvement on road geometry, etc.

## 4. Results

Figure 2 shows the freight transport demand and pattern in Bali and West Nusa Tenggara in 2008 (20 years from the study year in 2008). This was resulted from standard four steps transport modeling.

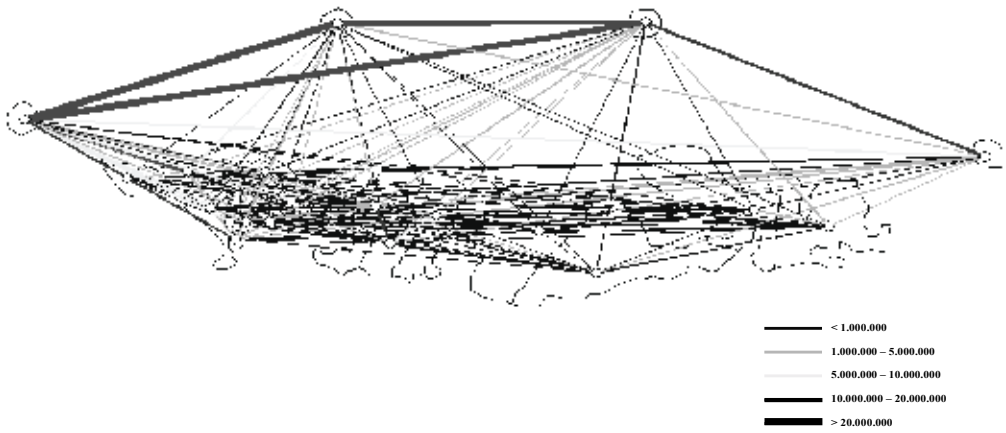


**Figure 2** Desired Lines of Freight Transport In Bali And West Nusa Tenggara (2028)

It can be seen that Bali and West Nusa Tenggara were not quite important in terms of national freight transport. Thickest desired lines were connecting external zones. However some significant freight transport movements were found in movements related to the capital city of Bali (Denpasar) and capital city of West Nusa Tenggara (Mataram).

Alternative routes for Bali is presented in Table 2 and Figure 3. There were only two alternative routes, i.e. North corridor and South corridor. Starting from Ubung (a freight terminal near Denpasar), the South Corridor was divided into two sub routes, i.e. a route serving to Padang Bai (ferry terminal) and another route serving to Tanjung Benoa (ocean harbour).

Alternative routes for West Nusa Tenggara is presented in Table 3 and Figure 4. There were only two alternative routes, i.e. mainly road transport corridor and road transport corridor with significant role of ferry transport. Both corridors in fact was still disconnected between Sumbawa Besar and Banggo due to very poor road condition between those cities and lack of ferry service between those cities. Current freight transport to most areas in the East of Sumbawa Island was dominated by ship transport directly connected to Lombok Island or other islands. As some parts of the alternative routes could not be evaluated using the previously discussed criterions, it was impossible to apply AHP for evaluating alternative routes in West Nusa Tenggara. However some suggestion for improvement will be discussed later.

**Table 2** Alternative Routes for Bali

| Corridors | | Routes |
|---|---|---|
| North | North | Gilimanuk - Cekik – Celukan Bawang – Seririt – Singaraja – Kubu Tambahan – Bondalem – Abang – Amlapura – Candidasa – Padang Bai |
| South | South 1 | Gilimanuk – Cekik – Negara – Pekutatan – Antosari – Selemadeg – Tabanan – Sempidi – Ubung – Denpasar (By Pass) – Tohpati – Kusamba – Padang Bai. |
| | South 2 | Ubung – Denpasar (Imam Bonjol/By Pass Ngurah Rai) – Mumbul – Peken – Nusa Dua-Tanjug Benoa |

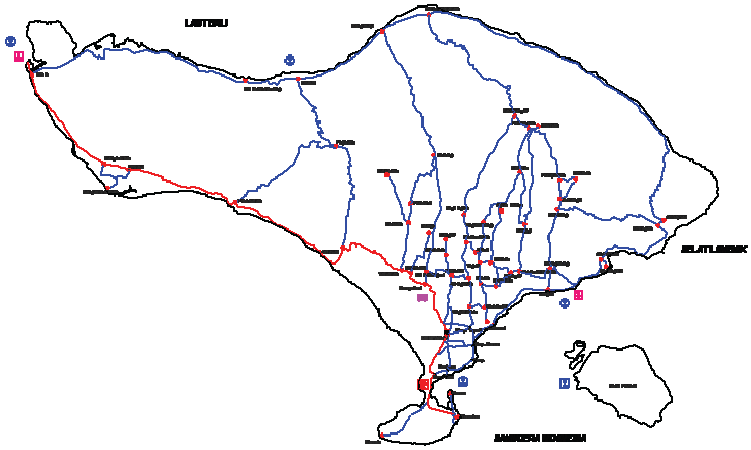

**Figure 2** Alternative Routes for Bali

**Table 3** Alternative Routes for West Nusa Tenggara

| Corridors | Routes |
|---|---|
| Mainly Road Transport | Lembar-Mataram-Narmada-Mantang-Kopang-Terara-Masbagik-Pringgabaya-Kayangan-Ferry Transport to Sumbawa Island-Labuhan Tano-Alas-Utan-Sumbawa Besar-Lape-Plampang-Empang-Banggo-Sawele-Dompu-Sila-Palibela-Bima-Wawo-Sape-Bugis |
| Road Transport with Significant Ferry Transport | Lembar-Mataram-Narmada-Mantang-Kopang-Terara-Masbagik-Pringgabaya-Kayangan-Ferry Transport to Sumbawa Island-Labuhan Tano-Alas-Utan-Sumbawa Besar-Ferry Transport to Cruise through Saleh Bay-Banggo-Sawele-Dompu-Sila-Palibela-Bima-Wawo-Sape-Bugis |

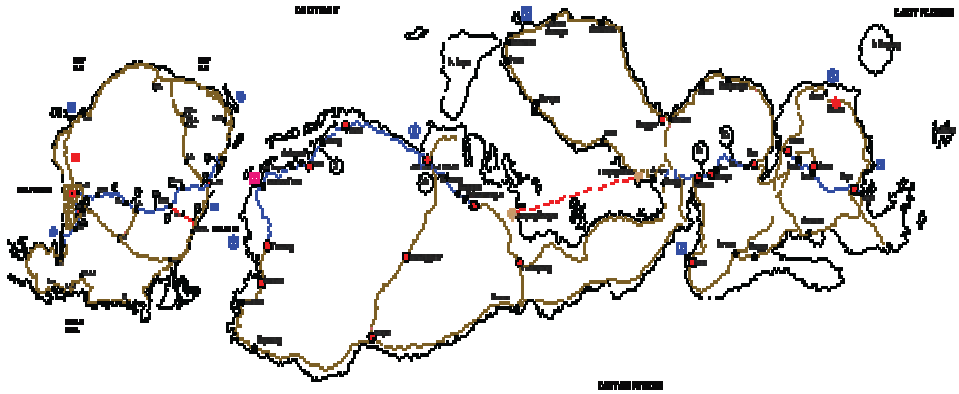

**Figure 4** Alternative Routes for West Nusa Tenggara

Figure 5 shows the comparison between North corridor and South corridor of Bali using AHP. It can be seen that in terms of road status, AADT, V/C, population density and level of public

activities, north corridor was better than south corridor. Meanwhile in terms of road class, road geometry, road condition, access control, and land use, south corridor was better than north corridor. Table 4 shows the eigenvector value for north corridor and south corridor for container and heavy equipment transport route and for dangerous goods transport route. Based on the result south corridor was suggested for container and heavy equipment transport route whilst the north corridor was suggested for dangerous goods transport route.

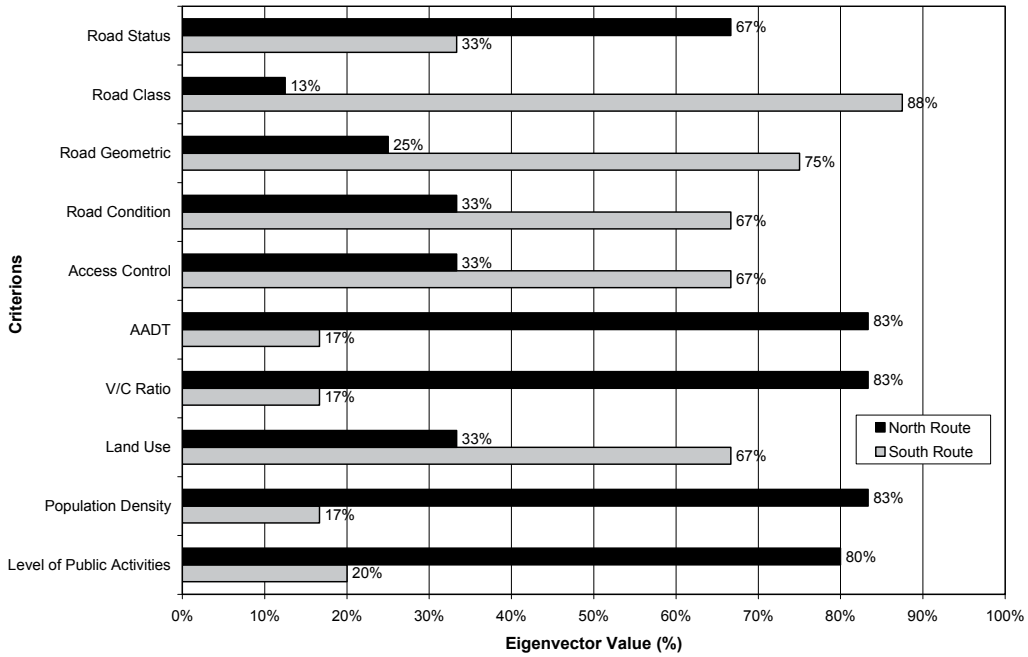


**Figure 5** Comparisons between North Corridor and South Corridor of Bali Using AHP

**Table 4** Eigenvector Value for Each Corridor and Each Type of Freight Transport

| Route | Eigenvector Value | |
|---|---|---|
| | Container and Heavy Equipment | Dangerous Goods |
| North Corridor | 0.30 | 0.54 |
| South Corridor | 0.70 | 0.46 |

## 5. Discussion

From the results of alternative routes evaluation, some improvements are still required in order that the selected route can perform optimally. For Bali freight route, the required improvements are as follows:

- The road classes for some links such as Ngurah Rai By Pass and Tohpati-Kusamba By Pass have not yet determined. This should be overcame because one of the requirements for a freight transport route is that it should consists of series of road links with same or higher road classes than the required road class.
- Some part of the South route has not yet been installed with appropriate road safety equipments. This was especially true for Selemadeg area and Kusamba-Angentelu link.

- In general access control in South route was satisfactory in urban area. However in inter-urban area access control should be improved in order to increase road user safety.
- In a freight transport route, routine maintenance of road condition is very important. Although road betterment has been carried out in Bali but Gilimanuk-Cekik link requires attention for road betterment.
- The location of Ubung freight terminal is recommended to be moved to Tohpati-Kusamba By Pass to avoid potential conflict with the general traffic.
- In the North route, it is recommended to develop Singaraja freight Terminal.
- To avoid overloading, Cekik dan Seririt weighing bridges should be reactivated whist Batubulan weighing bridge is recommended to be moved to Tohpati-Kusumba By Pass.

For West Nusa Tenggara freight route, the required improvements can be listed as follows:

- The road classes for some links such as Sumbawa Besar-Banggo and Talabiu-Bima-Raba need to be determined.
- In Sumbawa Besar-Dompu link, road widening and road betterment is required.
- Road safety equipments such as guard rail, sign and marking are required to be installed in some spots.
- In Lombok Island with limited length of the West-East corridor might not justify a dedicated freight transport terminal. Instead, it can be integrated with the ferry terminals (Lembar and Kayangan). If in the future a dedicated freight terminal is required the proposed location is Cakranegara (in the border of Mataram city).
- In Sumbawa Island, Sumbawa Besar can be functioned as a freight terminal in West of Sumbawa, whilst Dompu is proposed to be a freight terminal in the East of Sumbawa.
- Kediri weighing station shoud be removed to Rumak. New weighing bridge needs to be provided in Eastern area of Lombok Island such as in Simpang Negara and Sape.

## 6. Concluding Remarks

Freight transport is a very important for economic development of a nation. Therefore the determination of freight transport network route is essential. For this purpose affecting factors need to be identified and a suitable evaluation and selection procedure needs to be implemented. AHP can be used as a reasonable method to carry out such task.

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## About The Author

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# Corporate Characteristics, Governance Attributes and the Extent of Voluntary Disclosure in Bangladesh

by

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**Abstract**

The aim of this paper is to examine the linkages Corporate Characteristics, Governance Attributes and the Extent of Voluntary Disclosure in Bangladesh. The paper is based on a sample of 120 listed non-financial companies in Dhaka Stock Exchanges (DSE). The study is used ordinary least squares regression model to examine the relationship between explanatory variables and voluntary disclosure. Using an unweighted relative disclosure index for measuring voluntary disclosure, the empirical results indicate that a positive association between board size and voluntary disclosure, board leadership structure and voluntary disclosure and between board audit committee and voluntary disclosure. In contrast, the extent of voluntary disclosure is negatively related to proportion of INDs, ownership structure and net profitability.

**Keywords**: Corporate Characteristics, Governance Attributes, Voluntary Disclosure

## 1. Introduction

Corporate voluntary disclosure refers to information made available at the discretion of the corporation. The extent of voluntary disclosure is influenced by changes in the attitudes in society, economic factors and behavioral factors such as the particulars corporate culture. Voluntary disclosure items may be classified into historical, current and predictive items, depending on the past, present or envisaged performance of the company. In Bangladesh, both company law and securities and Exchange Rules govern corporate disclosure by listed non-financial companies in DSE. In Bangladesh, Company Act of 1994 and Securities and Exchange Rules of 1987 are two important legislations for corporate disclosure. The Companies Act 1994 provides the basic requirements for disclosure and reporting applicable to all companies incorporated in Bangladesh (Government of Bangladesh, 1993). The Act requires companies to prepare financial statements in order to reflect a true and fair view of the state of affairs of the company. The Securities and Exchange Commission (SEC), another regulatory body, requires all listed companies to comply with accounting standards promulgated by the Institute of Chartered Accountants of Bangladesh (ICAB), in addition to its own disclosure provision (Government

of Bangladesh, 1993). Disclosure provisions of the Security Exchange Rules are, in fact, restricted only to companies listed on the stock exchanges. It is often alleged, however, that company annual reports do not comply with the disclosure requirements stipulated by the regulatory agencies, resulting in poor disclosure compliance by the listed company (Akhtaruddin, M.(2005).

In addition, the Company Act requires companies to maintain proper books of account and to prepare and submit audited annual financial statements to their shareholders in order to reflect a "true and fair view" of the company's state of affairs. In terms of auditing, listed companies must prepare accounts in accordance with internationally accepted accounting principles and have them audited by independent auditors. Indeed, independent auditors' report has to be submitted in the company's annual general meeting (AGM) to the shareholders. The auditors shall report as to whether the relevant accounts show a true and fair view of the financial affairs of the body in question during the financial year in question and its assets and liabilities at the end of the year in question. Moreover, the auditor must audit the accounts of companies in light of generally accepted auditing standard (GAAS).

## 2. Statement of the Problem

The demand for published corporate disclosure of companies has increased worldwide as users of the information become more attentive. But frequently disclosure does not serve the need of the users because managers are likely to consider their own interests when exercising managerial judgment. In fact, this increases the disclosure gap-the difference between expected and actual disclosures. In other words, improved disclosure reduces the gap between management and the outside, enhances the value of stock in the capital market, increases liquidity, reduces cost and so on (Apostolos, K. et al.2009; McKinnon and Dalimunthe, 2009; Karim, 1996).One great characteristic in corporate reporting is that a company generally provides information to release specific obligations: to society, investor, supplier, creditors and legal authorities. However, the decision to provide or not provide certain information is likely to be influenced by a variety of factors like independent directors, size, profitability, audit committee, board size, board leadership structure, ownership structure, leverage, family control and listing status to find out their links with disclosure. Earlier research examines various company attributes and their association to the level of voluntary disclosure Aktaruddin, M., et al (2009) in Malaysia; Hossain, M. & Hammami, H.(2009) in Qatar; Ho & Wong (2001) in Hong Kong; Barako, D.G.(2007) in Kenya; Chau & Gray(2002) in Hong Kong and Singapore; Lim, S. et al. (2007) in Australia; Myburgh, JE (2001) in South Africa; Hongxia, Li& Ainian, Qi(2008) In China; Bradbury(1992) in New Zealand; Hossain, Perera, & Rahman (1995) in New Zearland; Hossain, Tan, & Adams(1994) in Malaysian; Ferguson et al.,(2002) in Hong Kong; Hossain & Reaz(2007) in India; Alsaeed(2006) in Saudi Arabia; Naser et al.(2006) in Qatar; Al- Shammari(2008) in Kuwait. No such study was carried out with special reference to Bangladesh. Here, the study focuses the level of disclosure linking to firm size, profitability, independent non-executive director, board leadership structure, board audit committee, board size and ownership structure.

## 3. Objectives of the Study

The aim of this study is to examine the factors that influence companies to disclosure voluntary information in their annual reports of Bangladesh. The specific objectives of the proposed study are:

1. To measure the level of voluntary disclosure of information made by the listed companies in Bangladesh.
2. To examine the association between corporate characteristics, governances attributes and corporate voluntary disclosure levels of listed companies in Bangladesh.

## 4. Justification of the Study

In the present situation of world, Industrialization is a key factor for achieving overall economic development of a country. Additionally, Investor's and stakeholder's confidence if the any country can be taken mainly two steps. First step is to ensure a smooth flow of adequate, reliable, relevant and neutral information regarding the company's operating activities. It is possible only by establishing a sound corporate disclosure system. Second step is to implement good corporate governance practices in the corporate sectors.

Corporate voluntary disclosure system that prevalent in the corporate sectors of Bangladesh is not suitable at all to meet the users' information need. Most of the companies cover up their voluntary disclosure as far as possible. They submit with legal provision relating to the voluntary disclosure in window dressed as well as cooked-up their accounts.

Consequently, investor have lost their confidence about companies and abstained from more investment in the stock market, other stakeholders were also abstained from corporate behavior with the company. Similarly, good corporate governance is a vital issue for corporate success. But good governance is totally absent in the corporate sector of Bangladesh; rather there is a family culture in the governing activities of the joint stock company. As a result most of the users and all other the concern parties are not satisfied at all about the voluntary disclosure practices and governance activities in the corporate sector of Bangladesh.

So for achieving economic development and surviving in the competitive business world, the above problem must be overcome as early as possible. It required through investigation of the causes responsible for improper voluntary disclosure and poor governance in the corporate sector of Bangladesh. However, some policy implication would be suggested so as restore the confidence of the investor and other stakeholder. Moreover, it is expected that finding of this study would be of great use of policy mater, planners, researcher and decision maker as well.

## 5. Literature Review and Hypothesis Develop

### Corporate Characteristics

**(a)Firm Size**

Most of these studies found that size of firm does affect the level of disclosure of companies. New.D.,et al.,(1998); Ahmed & John,1999; Adams,C.A., et al.,(1998) Barako et al.(2006) Brammer and Pavelin (2006) investigated that the larger the firm, the more likely they will make voluntary disclosures. Based on the study done world wide, for example (Aripin, N., et al.,2008;Watson et al., 2002; Da-Silva & Christensen, 2004; Wallace et al.,1994; Samir, M. et al.,2003; Ho and Wong, 2001); they suggested

the underlying reasons why larger firms disclose more information. The reasons proposed are that managers of larger companies are more likely to realize the possible benefits of better disclosure and small companies are more likely to feel that full disclosure of information could endanger their competitive position. Thus, the impact of firm size is expected to be positively associated with the extent of social responsibility disclosures. (Barako, D.G., 2007; Hossain et al., 2006) suggested that firms size does not affect the level of corporate voluntary disclosure. In this study, total sales and total assets will be used as the measures of company size. The following specific hypotheses have been tested regarding size of the firm:

$H_1$: ***The extent of voluntary disclosures is positively associated with the total assets.***

$H_2$: ***The extent of voluntary disclosures is positively associated with the total sales.***

**(b)Profitability**

Managers are motivated to disclosure more detailed information to support the continuance of their positions and remuneration and to signal institutional confidence. Apostolos, K. et al., 2009; Karim, A.K.M.W.,1996; Simir, M., 2003; Meek, et al.(1995) suggest that profitability of the companies are expected to disclose more information about their performance. Bujaki and McConomy (2002) show that firm facing a slowdown in revenues tends to increase their disclosure of corporate governance practices. Moreover, firms suffering serious corporate governance failures tend to provide extensive disclosure of governance guideline implemented in the period after such failures. Haniffa and Cooke (2002) find a positive and significant association between the firm's profitability and the extent of voluntary disclosure, which is consistent with the earlier (Leventis and Weetman, 2004; Kusumawati, D.N., 2006). Since the studies supporting positive relationship between profitability and disclosure are conducted in corporate disclosure field, the hypothesis of this study will be in the form of positive relationship. In this study, profitability as measured by return on assets; that is, net income divided by total assets. The following specific hypotheses have been tested regarding profitability of the firm:

$H_3$: ***The extent of voluntary disclosures is positively associated with the profitability of the firm.***

**Corporate Governance Attributes**

**(a)Independent non-executive directors**

A board is generally composed of inside and outside members. Inside members are selected from among the executive officers of a firm. They either belong to the management group or are the family that owns the firm. Outside directors are members whose only affiliation with the firm is their directorship. Empirical evidence on the importance of non-executive directors on board has been mixed. The outside directors are more effective than inside directors in maximizing shareholders' wealth. In contrast, the inside directors can contribute more to a firm than outside directors due to their firm-specific knowledge and expertise. Patelli, L., and A. Prencipe (2007), reported that composition of the board is one of several factors that can mitigate agency conflicts within the firm. Ros, H. & Terry, C. (2000) argument is that independent directors are needed on the boards to monitor and control the actions of executive directors who may engage in opportunistic behavior and also to ensure that managers are working in the best interest of the principal.Cheng and Courtenay (2006) found that boards with a larger proportion of independent directors are significantly and positively associated with higher levels of voluntary disclosure in Singapore. In addition, Chen and Jaggi (2002) examined the association between independent directors and corporate disclosure. They found a positive relationship between a board with a higher proportion of independent directors and comprehensive financial disclosure. These findings are consistent with agency theory tenets where a higher proportion of

independent directors enhance voluntary financial reporting (Barako, et al., 2006). The reason for this is that the presence of independent directors reduces the cost of voluntary disclosure because directors are generally independent of the day-to-day business operations of the firm (Patelli and Prencipe, 2007).
Haniffa and Cooke (2002) argue that an independent board serves as an important check and balance mechanism in enhancing boards' effectiveness. Support for these assertions is further provided by Barako, D.G. et al.(2006); Simon and Kar (2001); Pettigrew and McNulty (1995) and Eng and Mak (2003). Ho and Wong (2001) do not find association between the proportion of outside non-executive directors and the extent of voluntary disclosure. Aktaruddin, M. et al.(2009) and Obeua S Persons (2009)find that firms can expect more voluntary disclosure with the inclusion of a larger number of independent non-executive directors on the board. A firm may have higher level of disclosure if the boards consist of more outside directors. These observations suggest the following hypothesis:
$H_4$: ***A higher proportion of independent non-executive directors on a board are positively related to the level of voluntary disclosure.***

**(b)Audit committee**

Previous researches provides evidence of a positive association between the presence of an audit committee and corporate disclosure practices (Barako, D.G. et al., 2006; Rosario, M. and Flora, M. ,2005; Ho and Wong, 2001; McMullen,1996). In additionally reported that the presence of an audit committee is associated with reliable financial reporting, such as, reduced incidence of errors, irregularities, and other indicators of unreliable reporting and audit committees are commonly viewed as monitoring mechanisms that enhance the audit attestation function of external financial reporting. The board usually delegates responsibility for the oversight of financial reporting to the audit committee to enhance the breadth of relevance and reliability of annual report (Wallace et al., 1995). Thus, audit committees can be a monitoring mechanism that improves the quality of information flow between firm owners (shareholders and potential shareholders) and managers, especially in the financial reporting environment where the two have disparate information levels. Given the influence of audit committees on the context and content of corporate annual reports, the following hypothesis is tested
$H_5$: ***The level of voluntary disclosure is associated positively for firms that have an audit committee.***

**(c)Board leadership structure**

Within the context of corporate governance, the central issue often discussed is whether the chair of the board of directors and CEO positions should be held by different persons (dual leadership structure) or by one person (unitary leadership structure). According to agency theory, the combined functions (unitary leadership structure) can significantly impair the boards' most important function of monitoring, disciplining and compensating senior managers. It also enables the CEO to engage in opportunistic behavior, because of his/her dominance over the board. Forker (1992) empirically studied the relationship between corporate governance and disclosure quality, and presented evidence of a negative relationship between disclosure quality and 'dominant personality' (measured as CEO and board chair combined). Hence, to the extent that the combined chair/CEO positions "signals the absence of separation of decision management and decision control" (Dulacha.G.B (2007) , the following hypothesis is examined:
$H_6$: ***The extent of voluntary disclosure is positively related for firms with a dual leadership structure.***

**(d)Board Size**

Board size may influence the level of voluntary disclosure. The level of disclosure is a strategic decision made of the board of directors. As a top-level management body, the board of directors formulates policies and strategies to be followed by managers. It has been argued that a greater number of directors on the board may reduce the likelihood of information asymmetry (Chen and Jaggi, 2000). Research emphasizes the importance of strategic information and resources in a highly uncertain environment. The size of the board is believed to affect the ability of the board to monitor and evaluate management and small board encourages faster information processing (Zahra, et al., 2000). Aktaruddin, M. et al., (2000) finding of their study is a positive association between board size and level of corporate voluntary disclosure. Further, the ability of directors to control and promote value-creating activities is more likely to increase with the increase of directors on the board. With more directors, the collective experience and expertise of the board will increase, and therefore, the need for information disclosure will be higher. The following hypothesis is examined:

$H_7$: ***The number of directors on a board is positively related to the level of voluntary disclosure.***

**(e)Ownership structure**

Ownership structure is another mechanism that aligns the interest of shareholders and managers (Wang, K. et al., 2008; Eng and Mak, 2003; Haniffa and Cooke, 2002; Chau and Gray, 2002). The agency theory suggests that where there is a separation of ownership and control of a firm, the potential for agency costs arises because of conflicts of interest between contracting parties. It is believed that agency problems will be higher in the widely held companies because of the diverse interests between contracting parties. By utilizing voluntary disclosure, managers provide more information to signal that they work in the best interests of shareholders.

In this study, ownership structure is proxied by management ownership. Using agency theory, it is argued that firms with higher management of ownership structure may disclose less information to shareholders through voluntary disclosure. It is because the determined ownership structure provides firms lower incentives to voluntarily disclose information to meet the needs of non-dispersed shareholders groups. In Australia, McKinnon and Dalimunthe (1993) note that companies with a single ownership structure disclose more voluntary information. Hossain et al. (1994) suggested a negative association between management ownership structure and the level of voluntary disclosure by Malaysian listed firms. In addition, Hongxia, Li & Ainian, Qi (2008) shown that higher managerial ownership have high level of voluntary disclosures. Oliveira et al.(2006) also reported that firms with a lower shareholder management voluntarily disclose. Eng and Mark (2003) reported that lower management ownership and significant government ownership are associated with higher disclosure among listed firms in Singapore. Haniffa and Cooke (2002) indicate that the extent of family control in a firm is negatively associated with the amount of voluntary disclosure. Their evidence suggests that family controlled firms do not require additional information because the owner managers could access the information easily, thus leading to low agency costs and low information irregularity. The management entrenchment hypothesis could also explain the negative association and its effects could negate the positive effects of the agency cost explanations. The significant role of management ownership in influencing voluntary disclosures practices of firms from the prior researcher. So it is expected that ownership structure will influence the voluntary disclosure information. The hypothesis is formally stated as:

$H_8$: ***The extent of voluntary disclosures is negatively associated with a higher management ownership.***

## 6. Research Methodology

### Sample Selection and Data Sources

Sample is taken from annual reports of listed companies on Dhaka Stock Exchange (DSE), all companies were considered for inclusive in the survey. The main criteria used for sampling the firms were: (i) annual reports must be available at the stock exchange and (ii) the firm must have been listed for the entire period of the study 2008.The companies listed on the DSE are classified into thirteen categories, just have taken here seventh categories i.e. engineering, food& allied, fuel & power, textile, pharmaceuticals & chemicals, tannery & paper and cement & ceramics and total sample companies is 120. The annual report of the sample companies is collected from the DSE seminal library by paying money. Corporate-governance attributes was collected from the annual reports of listed companies of DSE. The comparative distribution of the companies in the population and the sample are given in Table-1.

### Analysis of Data

In order to obtain the objectives of the research study, statistical tools like average, standard deviation, co-efficient of variance, correlation, regressions &, T tests, F tests have been used to analyze and interpretation of the data through the Statistical Packages for Social Science(SPSS)14.0 for windows and Statistical Graphs, Tables and Charts have been used for data presentation.

### Development of a Voluntary Disclosure Index

Previous research has examined the disclosure behavior of firms using a disclosure checklist. The disclosure checklist developed by Meek, Roberts and Gray (1995) was used to examine the voluntary disclosure of firms in developed countries. Chau and Gray (2002), and Ho and Wong (2001) have also used this disclosure checklist with some modifications to examine the voluntary disclosure of Hong Kong and Singapore firms. The level of voluntary disclosure of the sample firms in this study was measured using a disclosure index that was developed in consideration with the disclosure checklist used by Akhtaruddin, M. (2009), Chau and Gray (2002), Ho and Wong (2001), and Ferguson, Lam and Lee (2002).

A total of 91 items were identified in compliance with voluntary disclosure items provided by listed firms in Bangladesh. These items were then compared with listing requirements for Dhaka stock exchange (DSE) and a mandatory disclosure checklist prepared by Akhtaruddin, M. (2005) in Bangladesh. Since the focus of this research is voluntary disclosures, the preliminary list of 91 items was subjected to a through selection to eliminate those that are mandated. This list was sent to various experts (professor, Professional Chartered accounted & Cost and Management accounted etc.) for selection and as a result of their feedback, the initial list of 91 items was reduced to 68 items. The disclosure items are classified into thirteen categories: general corporate information, corporate strategic information, corporate governance information, financial information, financial review information, foreign currency information, segmental information, employee information, research & development information, future forecast information, share price information, social responsibility information and graphical information.(A list of the final 68 items is included in Appendix-1)

I employed an unweighted approach for this study. This approach is most appropriate when no importance is given to any specific user-groups (Cooke, 1989; Hossain et al., 1994; Akhtaruddin, M. et al., 2009; Hossain, M. and Hammami, H.,2009). The items of information are numerically scored on a dichotomous basis. According to the unweighted disclosure approach, a firm is scored "1" for an item disclosed in the annual report and "0" if it is not disclosed. The total voluntary disclosure index (TVDX) is then computed for each sample firm as a ratio of the total disclosure score to the maximum possible disclosure by the firm. The disclosure index for each firm is then expressed as a percentage.

**Table 1** Distribution of Sample by Industry Types

| Industry Types | Population | | Sample | |
|---|---|---|---|---|
| | Number | % | Number | % |
| Engineering, | 23 | 13.77 | 17 | 14.17 |
| Food& allied, | 35 | 20.96 | 24 | 20 |
| Fuel & power, | 10 | 5.99 | 8 | 6.67 |
| Textile, | 38 | 22.75 | 22 | 18.33 |
| Pharmaceuticals & chemicals, | 24 | 14.37 | 20 | 16.67 |
| Tannery & paper& Service | 18 | 10.78 | 13 | 10.83 |
| Cement & ceramics& IT | 19 | 11.38 | 16 | 13.33 |
| Total | 167 | 100 | 120 | 100 |

**Hypothesis Test**

The following is the general form of the Ordinary Least Square (OLS) regression model which has been fitted to the data in order to assess the effect of each variable on the disclosure data associated with the aggregate disclosure index and to test the associated hypothesizes:

$$TVDE_{i\,j,t} = \sum_{t-1}^{Nij} Xij$$

Where,

TVDE = total voluntary disclosure score for $j^{th}$ firm at the time t,

$N_{i\,j}$ = $i^{th}$ item for $j^{th}$ firm

t = year

$$TVDE = a + \beta_1 PIND + \beta_2\, BSZE + \beta_3\, BLS + + \beta_4\, BAC + \beta_5\, TA + \beta_6\, TSE + \beta_7\, PEOI + \beta_8\, NPA + \varepsilon$$

Expected sign (+) (+) (+) (+) (+) (+) (-) (+)

TVDE = Total voluntary disclosure score received from each company

*PIND =Percentage of independent non-executive directors to directors on board.*

*BLS = Board leadership structure, 1 for duel or 0 non-dual*

*BSZE = Total number of member on each board.*

*BAC = Board audit committee, 1 for yes or 0 No*

*TA = Total assets of the firm.*

*TSE = Total Sales of the firm.*

*PEOI =Percentage of equity owned by the insiders to all equity of the firm.*

*NPA =Net Profit ability of the firm*

a = total constant, and
ε = the error term

## 7. Result and Discussion

**Table 2** Voluntary Disclosure Level

| Disclosure Score (%) | No. of Companies, N=93 |
|---|---|
| < = 20 | 3(3.23%) |
| 21-30 | 11(11.83%) |
| 31-40 | 34(36.56%) |
| 41-50 | 14(15.05%) |
| 51-60 | 11(11.83%) |
| 61-70 | 14(15.05%) |
| 71-80 | 4(4.30%) |
| >80 | 2(2.15%) |

The table-2 shows the number and percentages of companies whose disclosure score is within the specified range. 3.23% companies disclose Directors Information less than of 20 %; 36.56% companies disclosure in the range of (31-40)% and 15.05% companies disclose directors information in the range of (41-50)% and (61-70)% respectively. 2.15% companies disclose more than 80% director's information in the annual reports of listed companies of Bangladesh. On aggregate, the voluntary disclosure of director's information is medium.

### Descriptive Statistics

**Table 3** Descriptive Statistics for Independent Variables

| Variables | Mean | Minimum | Maximum | Std. Deviation |
|---|---|---|---|---|
| VDI | 47.74 | 18 | 72 | 12.013 |
| PIND | 9.72 | 0 | 38 | 8.613 |
| BLS | 0.71 | 0 | 1 | 0.456 |
| BSZE | 6.68 | 3 | 13 | 2.054 |
| BAC | 0.68 | 0 | 1 | 0.470 |
| TA | 27020.80 | 56.95 | 378056.50 | 66374.16 |
| TSE | 18318.83 | 0000 | 441016.71 | 58766.09 |
| PEOI | 21.71 | 0 | 66 | 19.76 |
| NPA | -1.14 | -258.96 | 64.09 | 38.38 |

* PIND = Percentage of Independent Directors; BLS = Board Leadership Structure; BSZE = Board Size; BAC = Board Audit Committee; TA= Total Assets; TSE= Total Sates; PEOI =Percentage of equity owned by the insiders to all equity of the firm; NPA = Net Profitability

Table–3 presents descriptive statistics for the sample firms. The results from the disclosure index indicate (TVD) that the level of average voluntary disclosure in the sample companies is 47.74% the highest score achieved by a firm is 72% and the lowest score is 18% with a standard deviation of 12.013%. So the firms are widely distributed with regard to voluntary disclosure. It is consistent with Haoosain, M. and Hammami, H. (2009) in Qatar (36.84%), Akhtaruddin, M. *et al.,* (2009) in Malaysia (53.20%) and Al-Shammari (2008) in Kuwait (46%). The mean of the proportion of independent non-executive directors (PIND) to the directors on the board is 9.72% with standard deviation is 8.61%.The average board size (BSZE) is 6.68 with minimum and maximum sizes of 3 and 13 respectively. The average firm size is (Taka Bangladeshi) Tk.27020.80 lakh and Tk.18318.83lakh respectively in terms of total assets (TA) and total sales (TSE).The average ownership structure is 21.71% with standard deviation is19.76%.The statistics on the net profitability (NPA) indicate that a small portion of sample firms show negative returns.

**Pearson Correlation analysis**

**Table 4** Pearson Correlation Analysis Results (N=120)

| Variable | TVD | PIND | BLS | BSZE | BAC | TA | TSE | PEOI | PA |
|---|---|---|---|---|---|---|---|---|---|
| PIND | .232* | 1.000 | | | | | | | |
| BLS | .482** | .225* | 1.000 | | | | | | |
| BSZE | .339** | .131 | .212* | 1.000 | | | | | |
| BAC | .468** | .399** | .319** | .094 | 1.000 | | | | |
| TA | .352** | .043 | .205* | .295** | .197 | 1.000 | | | |
| TSE | .199 | .134 | .168 | .232* | .181 | .580** | 1.000 | | |
| PEOI | -.718** | -.202 | -.371** | -.248* | -.376** | -.281** | -.005 | 1.000 | |
| NPA | .075 | .055 | .247* | .210* | .000 | .149 | .521 | -.258* | 1.000 |
| ** Correlation is significant at the 0.01 level (2-tailed).<br>* Correlation is significant at the 0.05 level (2-tailed). | | | | | | | | | |

Table-4 provides the Pearson product-moment correlation coefficients of the continuous explanatory variables as well as the dependent variable included in the survey. The result of Pearson product-moment correlation exposed that board leadership structure, board size, board audit committee, total assets are positively related with voluntary disclosure (P<0.01, Two- tailed), but Percentage of equity owned by the insiders to all equity of the firm is negatively related with voluntary disclosure(P<0.01, Two- tailed). Percentage of Independent Directors is positively related with voluntary disclosure (P<0.05, Two- tailed). Board audit committee is positively related with PIND and BLS at the level of (P<0.01, Two- tailed).Total assets is positively related with BLS (P<0.01, Two- tailed) and BSZE (P<0.05, Two- tailed). Total Sales is also positively related with BSZE (P<0.01, Two- tailed) and TA (P<0.05, Two- tailed). Percentage of equity owned by the insiders to all equity of the firm is negatively related with BLS, BAC, TA (P<0.01, Two- tailed) and BSZE (P<0.05, Two- tailed).Net profitability is

positively related with BLS, BSZE and negatively related with PEOI at the level of (P<0.05, Two-tailed).

**Multiple Regression Analysis**

**Table 5** Multiple Regression Results (N=120)

| Variables | Coefficient | Standard Error | Bata t Values | Significance |
|---|---|---|---|---|
| PIND | -0.016 | 0.101 | -0.214 | 0.831 |
| BLS | 0.209 | 1.962 | 2.756 | .007*** |
| BSZE | 0.137 | 0.419 | 1.867 | .065* |
| BAC | 0.155 | 1.994 | 1.947 | .055* |
| TA | 0.057 | 0.000 | 0.628 | 0.532 |
| TSE | 0.087 | 0.000 | 0.986 | 0.327 |
| PEOI | -0.576 | 0.049 | -7.068 | .000*** |
| NPA | -0.167 | 0.022 | -2.288 | 0.025** |
| R Square = 0.623 ; Adjusted R squire = 0.586<br>F value =16.94 ; F significance = 0.000 | | | | |
| * P<0.1, two-tailed, ** P<0.05, two-tailed, *** P<0.01, two-tailed | | | | |

Table-5: shows the results of the multiple regression analysis in our study. Regression has been used in much previous research (Aktaruddin, M. et al., 2009; Apostolos, K. et al., 2009; Hossain and Hammami, 2009 HongxiaLi & Ainian Qi, 2008; Lim, S. et al., 2007; Barako, D, G. et al., 2006; Da-Silva and Christensen, 2004; Gerald and Sidney, 2002; Owusa-Ansah, 1998; Wallace & Naser, 1995; Wallace et all., 1994).The table shows the association between voluntary disclosure index and experimental variables. The coefficient of coordination R-square, F ratio, beta coefficients and t-statistics for the regression model and summarized results of the dependent variable on the explanatory variables can be seen in the table-5. The result indicates an R-square of 0.623, and an F value of 16.94, which is significant at the 0.000 levels. Both of these values suggest that a significant percentage of the variation in voluntary disclosure can be explained by the variations in the whole set of independent variables.

If the independent variable PIND is one unit increased then this situation the dependent variable is decreased -0.016 with SE = 0.101, Bata t value = -0.214 and significance at the 0.831. The result suggests that firms have a higher proportion of INDs disclose is not associates with voluntary information. This result is similar to that of Barako, D.G. et al., 2006; End and Mak, 2003 Ho & Wong, 2001; Simon and Kar, 2001; Ros & Terry, 2000; Forker, J.J.,1992; who reported a negative association between the board composition variable and the extent of voluntary disclosure.

The significant corporate governance variable is board leadership structure. The regression coefficient for the variable is 0.209, which is positive and statistically significant at the 0.007 level (P<0.01, two-tailed). This provides support for hypothesis $H_6$ that the extent of voluntary disclosure is positively related for firms with a dual leadership structure. This result is similar with Forker, 1992. This is consistent with Barako, D.G. et al., 2006.

The next significant corporate governance variable is board size. The coefficient for board size is 0.137 and positive. It is statistically significant at the 0.065 level (P<0.1, two-tailed) which suggests that a larger board is positively related to the level of voluntary disclosure. This result is similar to Akhtaruddin. M. et al., (2009), Zahra et al. (2000).

The most significant corporate governance variable is ownership structure. The regression coefficient for the variable is -0.576, which is negative and statistically significant at the 0.000 level (P<0.01, two-tailed). This result suggests that the hypothesis $H_8$ the extent of voluntary disclosure is negatively associated with a higher management ownership which is similar with Hossain, et al.(1194);Haniffa and Cooke,(2002); Akhtaruddin, M. et al.(2009);Chau and Gary,(2002)Ho and Wong,(2001)Forker, 1992. This is opposite with Hongxia and Ainian,(2008); Gerald and Sidney,(2002);Richard Pike, et al.,(2008).

The board audit committee is positively associated with company's voluntary disclosure practices. It is the important hypothesis of the extent of voluntary disclosure, with the coefficient of 0.155 significant at the 0.055 level (P<0.1, two-tailed). This result is similar to that of Ho& Wong (2001) who reported a positive significant relationship between the existence of an audit committee and the extent of voluntary disclosure by the Hong Kong listed companies. This result is also similar to Richard Pike, et al., 2008; Barako, D.G. et al.,2006; Simon and Kar, 2001; McKinnon and Dalimunthe ,1993; Forker,1992.

With regard to Corporate Characteristics variables, this study suggests that firms that are larger in size in respect to total assets. The hypothesis of the variable: The extent of voluntary disclosures is positively associated with the total assets. The regression results for firm size by total assets are insignificant which similar with Chow and Wong (1987). This is significant with Hossain and Mitra,(2004); Hossain and Hammami,(2009).

With regard to another Corporate Characteristics variable, this study suggests that are larger in size in respect to total sales. The hypothesis of the variable: The extent of voluntary disclosures is positively associated with the sales turnover. The regression result for nature of the firm is insignificant which opposite with Bruce and Merridee, (2006).

The significant corporate governance attribute is net profitability. The regression coefficient for the variable is -0.167 with SE = 0.022, Bata t value = -2.288 and significance at the 0.025 (P<0.05, two-tailed). The result suggests that the extent of voluntary disclosure is not positively associated with the profitability of the firm. This result is similar to that of Hossain and hammami,(2009); Kusumawati, D.N,(2006); Leventis and Weetman,(2004).

## 8. Conclusion

This research is an extension of previous research where a set of corporate governance variables is considered to examine their association with the level of voluntary disclosure. The objective of this study was to examine corporate governance factors and their influence on voluntary disclosure. These factors include Proportion of independent non-executive directors on the board, board leadership structure, board size , board audit committee, firm's size, Percentage of equity owned by the insiders to

all equity of the firm and Profit ability of the firm. In particular, the study aimed to determine which of these factors were significantly related to increased disclosure. The study used the disclosure index to measure voluntary disclosure on a sample of 120 listed non financial companies of Bangladesh. The first hypothesis of the study was a higher proportion of independent non-executive directors on a board is positively related to the level of voluntary disclosure. But findings of my result show that it is negatively related to proportion of independent non-executive directors. The results of the study show that the extent of voluntary disclosure is positively related for firms with a dual leadership structure. The findings of this research support it more that higher number of directors on a board is higher voluntary disclosure and the level of voluntary disclosure is associated positively for firms that have an audit committee. The result of the study also support that firms with higher proportion of internal management ownership structure disclose less information to shareholders through voluntary disclosure which is similar to my hypothesis.

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**Appendix 1** Voluntary Disclosure Check List in Annual Reports of Bangladesh

| | |
|---|---|
| **1. General Corporate Information** | **6. Foreign Currency Information** |
| 1. Company's mission statement | 37. Effects of foreign currency fluctuations on future operation-qualitative |
| 2. Brief history of the company | 38. Effects of foreign currency fluctuations on current results-qualitative |
| 3. Corporate structure / chart | **7. Segmental Information** |
| 4. Description of major goods/services produced | 39. Competitor analysis- quantitative |
| 5. Stock exchanges on which shares are held | 40. Competitor analysis- qualitative |
| **2. Corporate Strategic Information** | 41. Market share analysis- quantitative |
| 6. Statement of corporate strategy and objectives – general | 42. Market share analysis- qualitative |
| 7. Statement of corporate strategy and objectives – financial | **8. Employee Information** |
| 8. Statement of corporate strategy and objectives – marketing | 43. Total number of employees for the company |
| 9. Statement of corporate strategy and objectives – social | 44. Average compensation per employee costs |
| 10. Impact of strategy on current performance | 45. Category of employees by sex |
| **3. Corporate Governance/Directors Information** | 46. Number of employees trained |
| 11. Name of principal shareholders | 47. Welfare information |
| 12. List of Directors | 48. Policy on employee training |
| 13. Shares held by directors of the company | 49. Data on accidents |
| 14. Meeting held and Attendance | **9. Research and development Information** |
| 15. Educational qualifications of the directors | 50. Description of Research and development projects |
| 16. Experience of the directors | 51. Corporate policy on Research and development |
| 17. Position or office held by executive directors | **10. Future Forecast Information** |
| 18. Other directorship held by executive directors | 52. Market share forecast |
| 19. Remuneration of the directors | 53. Future cash flow forecast |
| **4. Financial Information** | 54. Sales forecast |
| 20. Amount and sources of revenue | 55. Profit forecast |
| 21. Sources of raw materials | 56. Compared former earnings forecast date |
| 22. Dividend payout policy | 57. Compared former sales forecast date |
| 23. Retained earnings | 58. Capital expenditure and R &D expenditure forecast |
| 24. Unit selling price | **11. Share price Information** |
| 25. Growth in units sold | 59. Sales amount changes and explanations |
| 26. Foreign currency information | 60. Operating income changes and explanations |
| 27. Intangible assets break-down | 61. Gross profit changes and explanations |
| 28. Policies regarding the amortization of intangible assets | 62. Accounts receivables changes and explanations |
| **5. Financial Review Information** | 63. Inventory changes and explanations |
| 29. Liquidity ratios | **12. Social Responsibility Information** |
| 30. Debt / equity ratio | 64. Information on safety measures |
| 31. Return on capital employed | 65. Environmental protection programs |
| 32. Return on shareholders' equity | 66. Information on community services |
| 33. Net tangible assets per share | **13. Graphic Information** |
| 34. Dividend per ordinary share for the period | 67. Graphic presentation of financial information |
| 35. Effects of inflation on future operations- qualitative | 68. Graphic presentation of non- financial information |
| 36. Effects of interest rates on results | |

# Managing Knowledge in Aircraft Engineering

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**Abstract**

In this paper, the authors analyse knowledge management (KM) practices in civil aviation industry and introduce a framework for better management of knowledge in aircraft engineering (AE). After comprehensive review of KM literature, this paper offers insights into the existing KM practices in AE using a case study in the Saudi Arabian Aviation industry (SAAI). The KM research data was collected through discussions and interviews as well as through observations during one of the author's employment as aircraft engineer in the SAAI. Synthesis of these results with the KM literature was used to identify the gaps between the KM theory and current practices in AE. Finally, an operations-based knowledge management (OBKM) system framework was developed to address these gaps and overcome ineffectiveness in current practices.

**Keywords:** Knowledge Management, Operations-Based Knowledge Management, Aircraft Engineering, Saudi Arabian Aviation Industry

## 1. Introduction

Civil aviation industry one of the toughest industries fighting for survival (Shaw and Smith 2003; Harvey and Holdsworth 2005). Rising oil prices, intense competition and safety concerns are some of the key factors that put constant pressure on bottom-line performance of the organisations this industry. Maintenance costs make up a major portion of the expenses. Consequently, sound knowledge management practices become crucial for success (Harvey and Holdsworth 2005), and luckily, organizations increasingly realize the importance of aircraft engineering knowledge as an asset which has initiated the need for retaining the critical knowledge within the organization (Tat and Stewart 2007; McNichols 2008; Allen 2010).

Most organisations in civil aviation industry including aircraft manufacturers, airlines and maintenance providers suffer from a loss of engineering knowledge due to job rotation, jobs reduction and retirements (Shaw and Smith 2003). Training and retaining an aircraft engineer can be very costly. A freshly graduated or recruited engineer may require a lot of experience before they can fully function as an aircraft engineer. This may take up to two or more years of on the job training and mentoring (Shaw and Smith 2003; Emara 2009; AlGhalbi 2010). Moreover, incorrectly performed aircraft engineering activities can lead to high level of risks and are, therefore, constrained by the intensive safety regulations (Harvey and Holdsworth 2005). As a result, there is a need for effective knowledge management in the aircraft engineering field.

## 2. Operations-Based Knowledge Management

The knowledge management literature mostly refers to KM solutions primarily based on IT-based tools and systems (Swan, Newell et al. 2000; Freke 2006). However in the past, a significant proportion of KM initiatives and projects have failed partly due to their single focus on IT-based solutions (Tsui 2005; BenMoussa 2009). A growing number of researchers argue that new approaches are needed to reduce the risk of failure of a KM initiative (Davenport and Glaser 2002; Tsui 2005; Keen and Tan 2007; BenMoussa 2009). By placing the main focus on the IT-based solutions, insufficient attention is given to the other aspects of KM which, for example, neglects the impact of employees' willingness to share their knowledge (Swan, Newell et al. 2000).

According to a study by Edwards, Shaw & Collier (2005), many organizations tend to utilize generic IT tools rather than dedicated IT-tools for their KM approaches. This appears to be due to the insufficient consideration of contextual situations in the design of those tools. Whereas IT solutions should be tailored to carefully consider KM processes and contexts (Freke 2006).

Successful KM initiatives ought to achieve balance between management leadership, process management and people management and supported by IT solutions (Swan, Newell et al. 2000; Tsui 2005; Freke 2006; BenMoussa 2009). Recent research has confirmed that leadership, process and people aspects are critical success factors for KM initiatives (Holsapple and Joshi 2000; Tsui 2005; Wong 2005; Allen 2010).

One could argue that the current gap between IT-based KM approaches and people/process-based KM approaches is merely a result of different views shared the group of KM practitioners and KM theorists (Swan, Newell et al. 2000; BenMoussa 2009). Many researchers view IT-based KM

tools as a vehicle for KM initiatives while leadership, process and people management build the foundations (Swan, Newell et al. 2000; Tsui 2005).

**Leadership Aspect**

The effect of leadership activities on KM performance has been the focus of recent studies. For example, Politis (2001) suggested that a "Knowledge-Enabled leader" is critical to an effective KM system. Likewise, Allen (2010) identified the effect of the front-line management behavior on willingness of aircraft engineers to share their tacit knowledge. He found that positive management behavior (attitude) increased employees' willingness to share their knowledge during situations of job transfer.

**Process Aspect**

Process management has also been of interest of recent research into KM. Tat and Stewart (2007) studied KM implementation processes in Malaysian Aviation Industry. They proposed a model to implement KM in that industry. This model consists of four stages; awareness cultivation, objective definition, strategy adoption and action implementation. Such research suggests that during implementation of KM initiatives, any necessary IT-tools should be designed based on needs of the KM processes, and the context of KM systems. Without the proper understanding of the current context of the organization and the KM processes, the design of any technology tools to support KM is prone to failure.

**People Aspect**

KM systems relay for their successes on the involvement of, interaction with, and acceptance by people. Neglecting the people aspects will increase the chances of failure (Swan, Newell et al. 2000; Harvey and Holdsworth 2005). This is evident by the recent increases of the number of researchers focusing on the people aspect of the KM systems. McNichols (2008) examined the inter-generational tacit knowledge transfer within aircraft engineering community. The researcher found two major themes that influence the knowledge transfer: (a) the relationship quality between the sender and receiver and (b) the knowledge transfer enabling conditions. She recommended three strategies to maximize aircraft engineering knowledge transfer, consisting of building knowledge-sharing culture, establishing mentoring program and initiating team work.

**Summary**

The above discussion highlights the need for a multi-disciplinary KM approach for deeper understanding of all KM aspects (Kakabadse, Kakabadse et al. 2003). These aspects should be considered holistically in the design of KM systems.

A sound KM system design must incorporate the leadership, process and people aspects. The holistic Operation-Based Knowledge Management (OBKM) model suggested by the authors, in Figure 1, facilitates such a design. This approach consists of three layers: approaches to KM, aspects of KM, and the elements of these aspects.

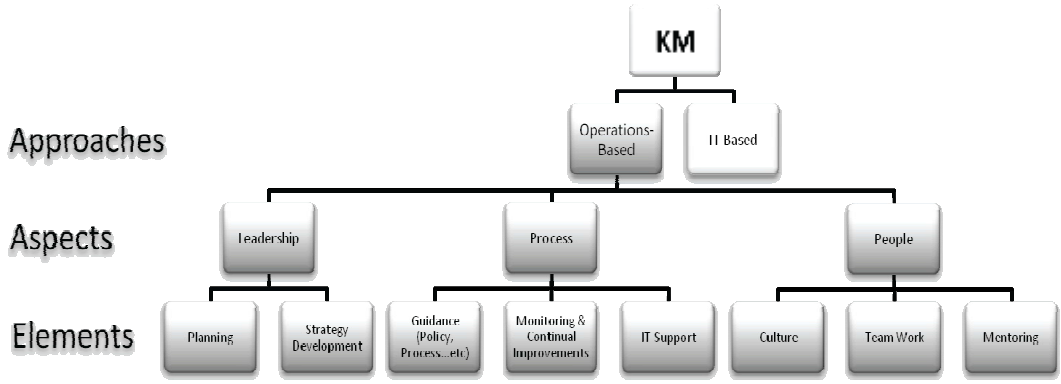


**Figure 1** Holistic OBKM Model

## 3. Knowledge Management Current Practices in Aircraft Engineering

This section discusses KM current practices in aircraft engineering field in the Saudi Arabian aviation industry. Preliminary research data was obtained through discussions and interviews with senior aircraft engineers, and personal observations of one of the authors during his six years of work experience as an aircraft engineer with one the companies in the Saudi Arabian aviation industry. This organization is not only the largest private airline operator in the country but also represents the aircraft engineering best practices in the aviation industry. Accordingly, this organization will be used as a representative example of the Saudi Arabian aviation industry. The findings from this preliminary study highlight the main characteristics of the KM in the aviation industry.

The main objective of the preliminary data analysis was to find out how aircraft engineers comprehend, explore, and deal with KM concepts and ideas, and how they manage aircraft engineering knowledge in practice. This is discussed in following sub-sections KM Awareness, KM Perception, and KM Culture.

### KM Awareness

As in other countries, Saudi Arabian aviation industry faces the challenges of an aging work force. There is an increasing awareness that this will cause a problem due to a widening skills gap and knowledge loss. However, this does not seem to be complemented by the awareness that knowledge management concepts and methods may help mitigate the negative impact on the organization of such issues. Furthermore, knowledge management is mostly confused with information management. This appears to be the result of insufficient understanding of the KM concepts (Harvey and Holdsworth 2005; Tat and Stewart 2007; McNichols 2008). More importantly, it is becoming increasingly manifest that the aviation industry has failed to implement systems to successfully source, capture and share aircraft engineering knowledge. Consequently, sources of aircraft engineering knowledge are less obvious and its importance as a competitive advantage less apparent.

**KM Perception**

While there is insubstantial awareness of the KM concepts in the industry, it is commonly believed that knowledge management is beneficial for the industry. The perceived benefits of better knowledge management include:

- Reduction of aircraft maintenance downtimes through knowledge sharing. Engineers will have broader knowledge base to perform their tasks and as a result the time needed to accomplish the task will be reduced.
- Reduction or elimination of silo behavior in handling expert knowledge. Consequently, this will mitigate the impact of experts retiring.
- Reduction of the learning curve of a new graduate or recruit to fully function as an aircraft engineer.

**KM Culture**

The aviation industry is a highly regulated industry. It follows rigorous guidelines for data recording and reporting for any maintenance action, incident and accident (Shaw and Smith 2003; Harvey and Holdsworth 2005) to ensure the airworthiness of the aircrafts and for monitoring the quality of the outcome. This data is required to be accurate and readily available and accessible to operators, engineers and maintainers (Harvey and Holdsworth 2005). Therefore, every organization in the industry needs to have systems to manage and distribute this recorded (explicit) knowledge.

In SAAI, such explicit knowledge is managed by IT systems which keep records and store aircraft engineering documentation. It is widely accepted that aircraft engineering explicit knowledge is relatively well managed in the aviation industry. In contrast, aircraft engineering tacit knowledge management seems to be rather underdeveloped. The learning environment in the aviation industry, especially between aircraft engineers, depends on a mentor-apprentice relationship or "tribal learning" (2003). This unique learning behavior where engineers learn tacit knowledge through experimenting, i.e. by following and imitating experienced engineers, "the tribal elders" (Shaw and Smith 2003) is also called on-the-job training. The absence of a senior engineer may endanger the whole process and will increase the learning curve, time and cost of such training. Rehiring retired engineering experts, for instance, as consultants is a reactive practice to mitigate the problem.

As described by Collison and Parcell (2001), a knowledge sharing culture is a focal point in KM initiatives. In SAAI, it seems to be a norm to reward individual performance rather than team performance. This imposes a challenge to promoting a knowledge sharing culture. Another challenge is due to the wide-spread perception in SAAI that knowledge is a source of power. Thus, sharing knowledge means sharing power.

Finally, there are some additional points relevant to the consideration of KM culture in the SAAI. For example, like many other industries SAAI is male dominant. Perception of KM initiatives and systems by different genders may impose some challenges. For instance according to Ong and Lai (2006), male and female employees may perceive e-learning systems differently. Therefore, any research must consider such possible gender-based defense mechanisms. In addition, Saudi Arabian culture is highly influenced by Islam. The effect of religious influence on KM, if any, needs to be taken into consideration and will explored further in this research in the future.

**Summary**

From the above discussion we can conclude that knowledge management appears to be immature in SAAI. Furthermore, aircraft engineering knowledge seems to be implicitly managed, in a more or less ad hoc manner. Through a comparison of the current practices in SAAI and KM theories, the following gaps have been identified:

- The level of knowledge management awareness among aircraft engineers is low.
- There is a perception that KM is beneficial. However, there is no common agreement on what are the KM intentions and objectives ought to be.
- The current modest KM practices, if they exist, are merely incidental to everyday operations, and not due to any deliberate focus on knowledge management.

## 4. The Proposed Operations-Based Knowledge Management System Framework

Based on recent operations management system literature (Pitinanondha 2008; Jayamaha, Grigg et al. 2009; Akpolat 2010) a management system framework was developed and proposed to overcome the gaps identified in the previous sections (Figure 2). This framework includes the leadership, people and process aspects which are further divided into several elements consisting of leadership, process and people aspects.

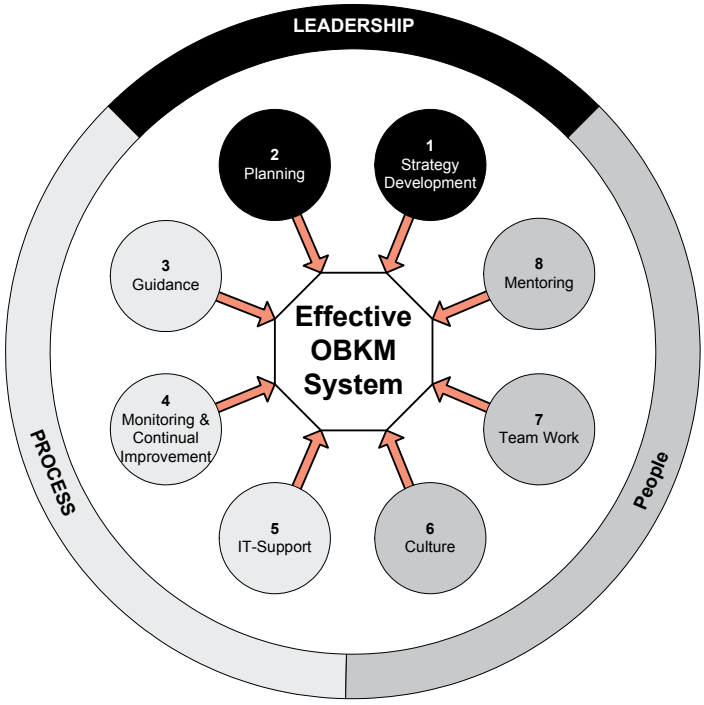


**Figure 2** The Proposed OBKM System Framework

**Leadership Aspect**

This aspect entails the role of management in implementing and supporting KM initiatives. Planing and strategy development are the two main elements in this aspect. Those elements will drive the whole KM system toward business goals. This is achieved by aligning the KM strategies with the business strategies while providing the leadership support.

1. Strategy development: in this element, the relevant strategic actions need to be addressed for implementing and practicing KM initiatives. Moreover, KM strategies should be aliened with the organization strategy. Thus, the intended product of those initiatives is to achieve the organizational objectives (Akpolat 2004).

2. Planing: management should design and plan the KM initiatives based on the organization goals and needs. Top management commitment ought to be visible in those plans. Also, employees' involvement in the plan developing process is essential. In addition, the plans and strategies should be well communicated with the employees to encourage their commitment and realization of the KM initiatives.

**Process Management Aspect**

The process management aspect is included to ensure better process management to overcome KM challenges embedded in the organization's systems. Guidance, monitoring and continuance improvement, and IT-support systems form the main elements of this aspect.

1. Guidance: of the KM system is done through policy, procedures and work instructions. Guidance is needed to provide main processes of the KM initiatives. This includes the day to day activities and course of actions.

2. Monitoring and continual improvement: to insure that the system operates as expected. One of the main goals of this element is to monitor the performance and perform system maintenance to meet the intended goals and targets. The system goals can be defined as key performance indicators. These indicators are used to plane for system improvement.

3. IT-support: systems are needed to provide the platform in which the KM activities and processes take action. The contextually sensitive IT-support systems will serve the main OBKM needs. It includes systems to support explicit and tacit knowledge sharing. Moreover, it should be tailored to achieve the KM initiatives' goals and objectives.

**People Management Aspect**

This aspect serves as a mechanism to highlight the OBKM influences and challenges from the perspective of the knowledge sender and receiver. Its elements are culture, teamwork and mentoring, and due consideration of these elements will ensure that the effectiveness of knowledge transfer between aircraft engineers is maximised (McNichols 2008).

1. Culture**:** is considered one of the main elements that control the KM initiatives' success or failure. KM initiatives should nurture knowledge sharing culture between the employees. Their willingness to share their knowledge will increase when they feel emotionally committed to the

organizational vision and mission. Thus, management actions and behaviours need to establish a reason to care between employees. Also, they need cultivate the feeling that employees belong to something bigger than they are.

2. Teamwork: is another strategy management need to peruse. They should facilitate and encourage team work environment in the organization. Furthermore, management ought to reward team achievements rather than individual achievements. Team work is a cheaper and easier way to share employees' knowledge.

3. Mentoring is an effective way to share employees' knowledge. Management should support a structured mentoring program. This is by, providing adequate funding and show visible dedication to mentoring program.

**Summary**

The proposed framework, with its three layers and aspects, provides a holistic way to design effective knowledge management systems. While proposed within the context of the aircraft industry, the framework is generic enough to be of use within other industries as well.

## 5. Conclusion

This paper has presented some results of a study of knowledge management within SAAI, contracted the practices therein with best practice as evident in the KM literature, and has proposed a holistic framework to address the gaps that have been identified between the practice and the theory. This framework, called the OBKM, enables consideration of all the aspects that have been identified as contributing to potential or actual failures of knowledge management initiatives within SAAI. The framework itself is generic enough for application within industries other than the aircraft industry. Future steps of this research will include a validation of the framework through workshops, interviews and possible applications within SAAI.

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# Performance of Family Business and Non Family Business Companies Listed on the Stock Exchange of Thailand

by

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**Abstract**

There are few studies about Family Business in Thailand. Consequently, there is no research about Family Business Performance in Thailand. This research is aimed at measuring the performance of Family Business listed on Stock Exchange of Thailand. The definitions of Family Business are categorized by Wonglorsaichon and Bangchuenvijit(2008) with three perspectives of Family Business. The methodology for this research is Fortune®500 DEA Model which comprises three stages of calculation. With the information taken from 294 listed companies in 2009, the findings are that from the four highest rank companies, there are three Family Business companies that belong to the first definition and two Family Business companies to the third and fourth definitions.

**Keywords:** Family Business, Fortune®500, DEA, Stock Exchange of Thailand

## 1. Introduction

Family is a fundamental element of a society as well as in the world of business. It is often said that Family Business (FB) is the starter point of large and successful business firms and plays a significant role in the world's economy. Sixty four percent of the U.S. gross domestic product (GDP) is consisted of family businesses (Astrachan and Shanker, 2003). Moreover, half of the world's workforce is employed by family businesses (Klein, 2000, Heck & Stafford, 2001, and Morck & Yeung, 2003). Recent capital market research papers advise that several public companies worldwide are characterized by controlling stockholders who are family members (Mroczkowski and Tanewski, 2004). According to Family Business's prominence, there have been a large number of research and studies on Family Business in Europe, America, and Australia. However, only a few papers in Thailand about this interesting topic related have been published. One of the few recent researches about Family Business inspires this research contribution. It is "Family Business Companies Listed on SET – Stock Exchange of Thailand" (Wonglorsaichon and Banchuenvijit, 2008) which set four definitions of family business. It is found that 52.34 percent of all companies listed are family businesses. It is 23.08 percent of the whole market capitalization. From this result, there is an interesting enigma whether family business or non-family business perform better. Family business firms surpass non-family ones, in general (Anderson and Reeb, 2003) with respect to many criterion. Following Anderson and Reeb's study, Frank et al (2003) has found out that United Kingdom family business Public Limited Companies (PLC)

outperforms especially in financial criteria. In six major stock markets in Europe, family controlled quoted companies beat their rivals (Miller, 2004). According to the objectives of this paper below, this research will provide some guideline for the public to investigate the performance of listed companies in the Stock Exchange of Thailand. The study is aimed to show the performance of these two business groups, which will be basic information for future research related to Family Business topics. In addition, the study will benefit all stakeholders of both types of the firm, family and non-family business firm, in the respect that they can use these results as fundamental practical information for better investing, competing others, and improving their business. Moreover, the study will also point out the significance of Thai Family Business in Thai economy system in order to enhance Family Business management in Thailand.

## 2. Literature Review

Many scholars determine family business in many ways. Chrisman, Chua and Steier (2002) find that a foundation for differentiating between family and non-family business firms is provided by ownership, management, and intention for family succession. These three dimensions; Family System, Business System, and Ownership System, are related with Family Business (Gersick et al, 1997). According to Australian Family and Private Business survey (2003), 67% of companies in Australia are family business (Smyrnois et al, 2003). In Thailand, there are barely any studies about family business definition. Hence, Wonglorsaichon and Banchuenvijit started to study about Family Business in Stock Exchange of Thailand in 2008.

Wonglorsaichon and Banchuenvijit (2008) research and they define family business term using from four criteria below.

The first definition: *Have at least two same last name persons who are Board of Directors (excluding independent board and auditors).* Boards of Directors play a vital role for a company. Numbers of Board of Directors vary by each company. These positions are comparable with family members who are the leaders of the family. Therefore, this definition defines family business as a company which has at least two same last name persons who are Board of Directors.

The second definition: *Have the same last name share holders whose stock value over 20% (only for the share holders who have over 0.5%).* Holding stocks is one of key factors for defining as a family business. The company which appears same last name share holders who have over 20% value and each must have 0.5% value is a family business.

The third definition: *Have at least three same last name persons existed on the shareholder list and/or board of directors list.* Proportion of shareholders and boards must be well planned. This will affect the decision made. This definition can be divided into two cases.

- At least one shareholder who has the same last name as at least two boards of director persons.
- At least two shareholders who has the same last name as at least one boards of director person.

The fourth definition: *Chief Executive Office's last name matches the last name of board of directors' one or shareholders' one at least two persons*. The company which has highest position on

boards which has the high authorization has the same last name as any two shareholders is a family business.

Wonglorsaichon and Banchuenvijit find that 235 of 449 companies listed on Stock Exchange of Thailand are family businesses having market value of 1,079,193,424,991 Baht or 30,834,097,856 US Dollars. It is 23.08% of all the value. Categorized by industries, the numbers and values of family business are varied. All companies in Paper & Printing Material group are family business. More than 50% of the companies in; Personal Products & Pharmaceuticals, Industrial Materials and Machinery, Home & Office Products, Agribusiness, Tourism and Leisure, Foods & Beverages, Packaging, Health Care Services, Commerce, Automotive, Transportation & Logistics, Media and Publishing, Fashion, Property Development, and Professional Services, are family business companies while there is no family business in mining sort. However, less than half of the companies in each category; Banking, Finance and Securities, Energy and Utilities, Information and Communication Technology, Insurance, Electronic Components, Petrochemicals & Chemicals, and Construction Materials are family business companies.

Although the market value of the family business companies in the stock market is high but there is no study devoted to one measuring performance family business in Stock Exchange of Thailand. However, there are many studies about the performance of companies listed on Stock Exchange of Thailand. For example, Acaranupong (2007) measures the performance of companies in Rehabilitation sector and finds the performance measures. T-test differ financial ratios between the samples. The result shows that the factor score of component, consisting with total liabilities to total assets, gross profit margin, return on assets, has the most impact differ from the rest components. Nevertheless, Montgomery and Sinclair (2000) advise that family business firms enjoy advantages such as a greater focus on building customer loyalty, an emphasis on playing a more active role in community and a reliance on a culture of shared values. From the Standard and Poor 500, Anderson and Reeb (2003) investigate the relation between founding-family ownership and firm performance. They find that family firms perform better than non-family firms and their analysis reveals that family ownership is an effective organizational structure. Poutziouris (2005) still confirms Anderson and Reeb by his research on UK Family companies' performance measured in terms of shareholder returns. Its results are similar to recent empirical studies on the role and performance of family-controlled firms in stock markets across leading economies of the US, France, and Germany.

Beside the above measurement tools for organization performance, Data Envelopment Analysis (DEA) is widely accepted for measuring efficiency. It is a Non-Parametric Approach or Function Form which is able to measure the relative efficiency in the case of multi inputs and outputs. Charnes, Cooper and Rhodes (1978) implement a linear program in order to make an objective function accomplish. Pasunon (2005) suggests that Data Envelopment Analysis (DEA) is a tool for efficiency measurement for organizations by considering many inputs and outputs

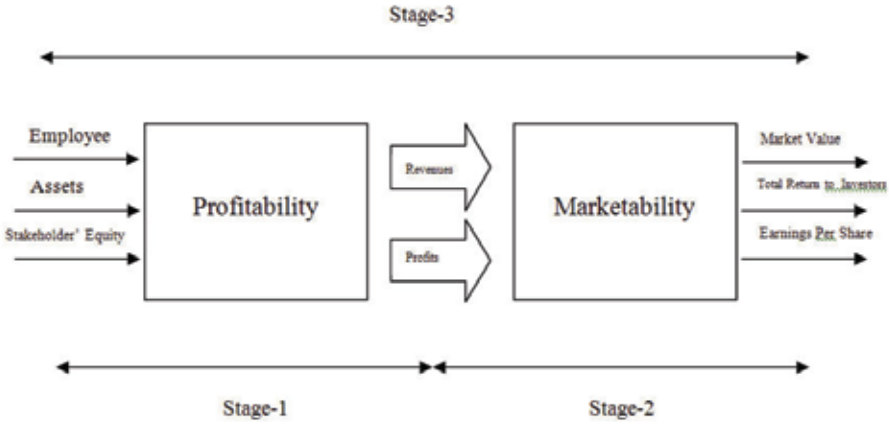
SaeTung and Pasunon(2008) measure the efficiency of Thai Airports between 2006-2007 by Data Envelopment Analysis(DEA) with two models; CCR and BCC as well as Scale Efficiency. They found that there are three efficient airports measured by CCR and BCC in 2006 and there are efficient four airports by CCR and BCC in 2007. This technique is widely used. As well as Al-Khoury and Al-Dahab(2009) study about Industrial companies Jordan in 2009. They measure the relative performance of Industrial companies from 2001-2005 by CRS and CCR model. They also rank the company with

Andersen and Petersen's model (1993). Not only is the stated industry, Data Envelopment Analysis (DEA) also used for measure performance of University Departments. Moosavi Rad, Naderi, and Moosavi Rad(2010) apply Data Envelopment Analysis with the model of Andersen and Petersen(1993) to Shahid Bahonar University of Kerman, Iran Performance measurement.

One of well known business organization performance measuring and ranking models is Fortune 500 which is applied with DEA. Zhu (2000b) explains that Fortune Magazine analyzes the financial performance of companies in the two main aspects. The first one is identification of best practice frontier and the second one is factor-specific efficiency measure.

Zhu, J. (2000b) develops tools which characterize the financial performance of the Fortune 500 companies. His paper reveals that not every revenue-top-ranked company is not necessary top-ranked performance. The technology of data envelopment analysis (DEA) is implemented to indentify a multi-factor financial performance model in this paper. Data envelopment analysis (DEA) is a widely used as an efficiency measurement tool because it is a mathematical method which is able to measure the efficiency of multi inputs and outputs. It is formally developed by Charnes, Cooper and Rhodes in 1978. They apply linear programming to estimate an empirical production technology frontier. In the efficiency analysis for considering a Decision Making Unit (DMU), the output will be divided by the input. In case of relative efficiency, the weighted sum of output will be divided by the weighted sum of input. Charnes, Cooper and Rhodes (1998) bring out the linear programming which measures the relative efficiency of the DMUj = DMUo.

For the identification of best practice frontier section, the data will be analyzed by Technical Efficiency for ranking efficient companies and inefficient company. These measures will be conciliated by data envelopment analysis (DEA) via three stages as figure 1.




Source: Zhu, J. (2000) European Journal of Operational Research 123

**Figure 1** Input-Output System for Fortune 500 Companies

In each stage, inputs and outputs are grouped by different perspective. The first stage is about profitability which studies income and profit performance. The inputs are the number of employees, assets, and stakeholders' equity. The second stage will consider about the marketability view. The inputs are the previous revenues and profits while the outputs are market value, total return to investors, and earnings per share. The last stage is the overall performance of a company by determining the inputs of the first stage as its inputs and determining the outputs of the second stage as its outputs. After that, compare with Scale Efficiency scores and rank. For the second section, factor-specific efficiency one, measure-specific model for evaluating performance of the inefficient companies will be determined according to unable accessed information.

## 3. Methodology

The first step of this study is to obtain the related information such as the prior research and document about family business especially about the latest one who defined the family business in Thailand as well as Fortune 500 model and DEA software. Then, gather all information of all companies listed on Stock Exchange of Thailand during 2009 and sort data by four family business definitions stated and sort the Fortune 500 model data sets quarterly; Employees, Assets, Stakeholder' Equity, Revenues, Profits, Market Value, Total Return of Investors, and Earnings Per Share. All data sets are pulled in March 2010 because Stock Exchange of Thailand would feed the 2009 information onto Stock Exchange of Thailand Market Analysis and Reporting Tool (SETSMART) completely around March 2010. The data sets will be run by DEAP 2.1 three stages. The first stage inputs are Employees, Assets, and Stakeholder' Equity, while the outputs are Revenues and Profits. The second stage inputs are Revenues and Profits while the outputs are Market Value, Total Return of Investors, and Earnings Per Share. The last stage inputs are Employees, Assets, and Stakeholder' Equity while Market Value, Total Return of Investors, and Earnings Per Share. There are three results of efficiency scale. The average of three results will be solved. The outcome values can be ranked and filter by Family and Non Family category then compare and contrast. Separate with Industries and Sectors then compare and contrast again. The performance will be showed by category. Conclude the overall results and by Industries and Sectors ones.

## 4. Results

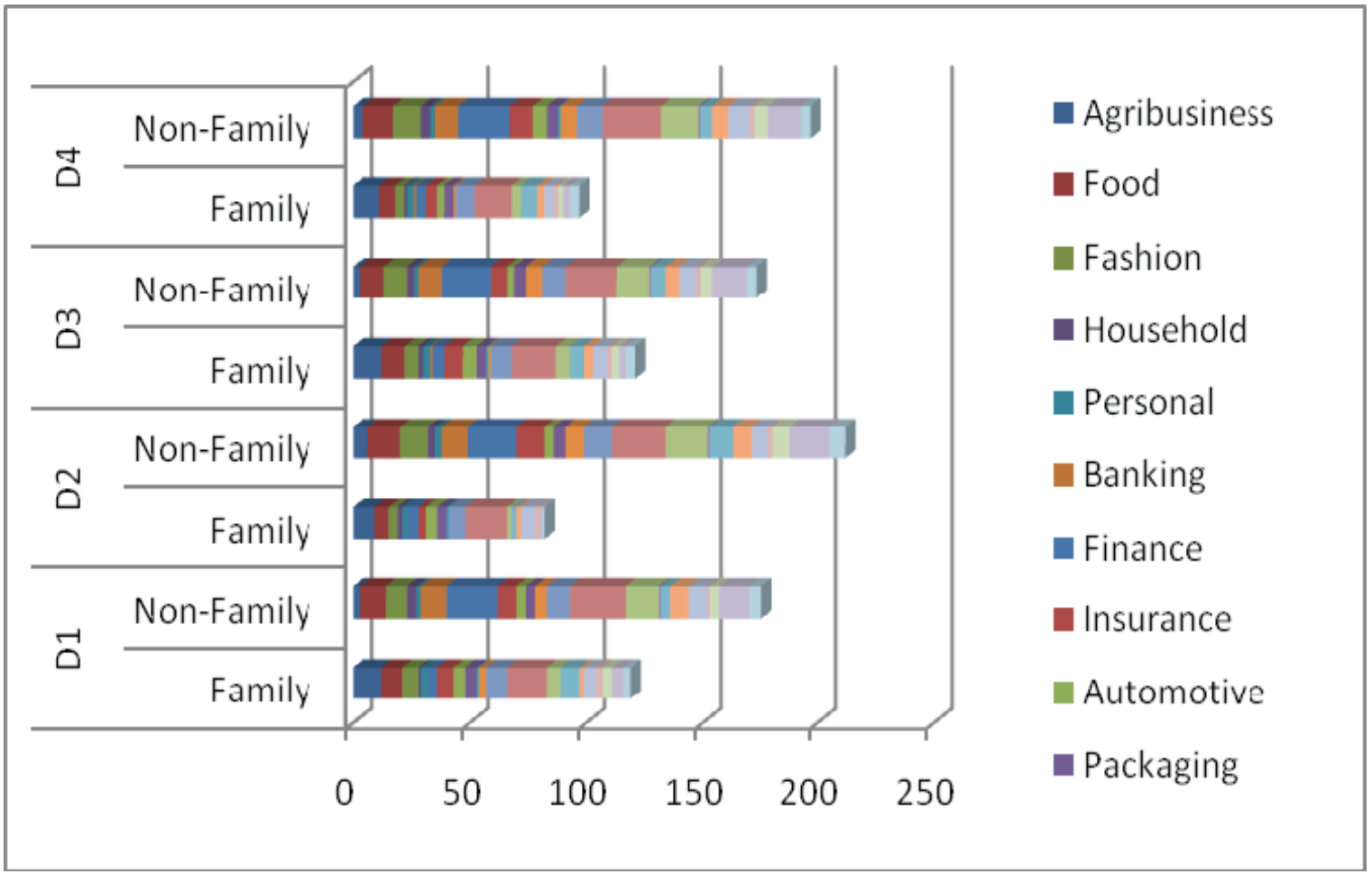
As the below table, the study shows that there are 119 family business companies classified by the first definition, 82 family business companies classified by the second definition, 121 family business companies classified by the third definition, and 97 family business companies classified by the fourth definition.

**Table 1** Total of Family Business Companies Classified by Four Definitions

| Number | 1 | 0 | Total |
|---|---|---|---|
| **D1 =** | 119 | 175 | 294 |
| **D2 =** | 82 | 212 | 294 |
| **D3 =** | 121 | 173 | 294 |
| **D4 =** | 97 | 197 | 294 |

Figure 2 presents the whole quantity of family business companies listed on Stock Exchange of Thailand. With the number of family business classed by four definitions of Wonglorsaichon and Banchuenvijit(2008)'s research.

Only the companies which provided completed inputs and outputs are the samples. All data sets are preceded. The first stage inputs are Employees, Assets, and Stakeholder' Equity, while the outputs are Revenues and Profits. The second stage inputs are Revenues and Profits while the outputs are Market Value, Total Return of Investors, and Earnings Per Share. The last stage inputs are Employees, Assets, and Stakeholder' Equity while Market Value, Total Return of Investors, and Earnings Per Share. The highest available score is "1". So, the more score, the more efficiency.


D4
Non-Family
Family
D3
Non-Family
Family
D2
Non-Family
Family
D1
Non-Family
Family
0
50
100
150
200
250
Agribusiness
Food
Fashion
Household
Personal
Banking
Finance
Insurance
Automotive
Packaging

The outcome scores are arranged into family business definition groups and compare with the non family business one. The summary comparison report is presented on table 2.

**Table 2** Comparison of Family and Non-Family Business Categorized by Industries and Sectors

| Industry | Sector | D1 | | D2 | | D3 | | D4 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Family | Non-Family | Family | Non-Family | Family | Non-Family | Family | Non-Family |
| Agro and Food | Agribusiness | □ | | □ | | □ | | □ | |
| | Food&Beverage | | □ | | □ | | □ | | □ |
| Consumer Products | Fashion | □ | | | □ | | □ | | □ |
| | Home & Office Products | | □ | | □ | | □ | | □ |
| | Personal Products & Pharmaceuticals | | □ | N/A | N/A | N/A | N/A | N/A | N/A |
| Financials | Banking | N/A | N/A | N/A | N/A | | □ | | □ |
| | Finance and Securities | □ | | □ | | □ | | □ | |
| | Insurance | □ | | □ | | □ | | □ | |
| Industrials | Automotive | □ | | □ | | □ | | | □ |
| | Industrial Materials & Machinery | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | Paper & Printing Materials | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | Petrochemicals & Chemicals | | □ | N/A | N/A | | □ | □ | |
| | Packaging | □ | | □ | | | □ | | □ |
| Property & Construction | Construction Materials | | □ | | □ | | □ | | □ |
| | Property Fund | | | □ | | □ | | | □ |
| | Property Development | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

**Table 2** Comparison of Family and Non-Family Business Categorized by Industries and Sectors (Cont.)

| Industry | Sector | D1 | | D2 | | D3 | | D4 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Family | Non-Family | Family | Non-Family | Family | Non-Family | Family | Non-Family |
| Resources | Energy & Utilities | | □ | | □ | | □ | | □ |
| | Mining | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Services | Commerce | | □ | | □ | | □ | | □ |
| | Health Care Services | | □ | □ | | □ | | | □ |
| | Media & Publishing | □ | | | □ | □ | | □ | |
| | Professional Services | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | Tourism & Leisure | □ | | | □ | □ | | □ | |
| | Transportation & Logistics | □ | | N/A | N/A | □ | | □ | |
| Technology | Electronic Components | □ | | | □ | | □ | | □ |
| | Information & Communication Technology | | □ | | □ | | □ | | □ |

Remark: □= Outperform, N/A = Unable to compare

Agribusiness Sector Family Business organizations in Agro and Food Industry show better performance for all four definitions. Like Agribusiness Sector, Fashion Sector in Consumer Products Industry Family Business has better performance. Finance&Securities and Insurance Sector Family Business companies for all definitions outperform. Automotive Sector Family Business companies for D1, D2, and D3 have higher efficiency. Packaging Sector Family Business companies for two first definitions, D1 and D2, are more efficient. Property Fund Sector Family Business companies for the second and third definition outperform. Healthcare Service Sector Family Business companies in the second and third definition show better score. Media and Publishing Family Business companies for D2, D3, and D4 work more efficiently. Tourism& Leisure and Transport&Logistics Sectors Family Business companies for D1, D3, and D4 outperform. The last better score point is Electronic Components Sector for the first definition.

## 5. Conclusion

The performance of family business and non-family business companies listed on the Stock Exchange of Thailand are measured by DEA methodology of Zhu (200b) model as Fortune®500 and the performance of both types of companies are compared. The scope of the research data covered the data of companies which are listed on the Stock Exchange of Thailand during 2009 and sorted to be Family or Non Family Business by Wonglorsaichon and Banchuenvijit (2008)'s four definitions. The data are pulled from SETSMART in March 2010. The samples are 294 companies because uncompleted

information companies and minus profit are eliminated due to DEA technique. From the research data run by DEAP program, family and non-family business companies show different efficiency varied by each sector and each industry. The comparison of both types of business is hard to find out the exact results as can be seen on table 23. Some industry and sector cannot be defined family and non-family. Due to the four definitions of Wonlorsaichon and Banchuenvijit(2008), it is complicated to categorize real family business. Some company shareholders or boards of director who has different last name might be the same family but they changed their last name because of marriage. Some information of shareholders is hidden by juristic persons or corporations. Thus, family business definitions should be revised for in-depth detail.

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**About the Author**

Miss Rawida Wiriyakitjar is a full-time lecturer at School of Business, University of the Thai Chamber of Commerce. She graduated a MSc International Hotel Management from University of Surrey, United Kingdom, and a BBA Hotel and Tourism Management First Class Honor from University of the Thai Chamber of Commerce. Not only hotel and tourism research areas but Miss Wiriyakitjar's initial acadmic interest is in Family Business also. She has extensive experience of undertaking Family Business trainings and seminars as well as Family Business Projects of Family Business and SMEs Study Center and School of Business, University of the Thai Chamber of Commerce. Miss Wiriyakitjar has been granted a scholarship for a PhD study at University of Central Lancashire, United Kingdom. Her research project area is Family Business in Hospitality and Tourism context.

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