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"ASIA-EUROPE Connectivity for Sustainable Competitiveness"

NOVEMBER 17-20, 2015
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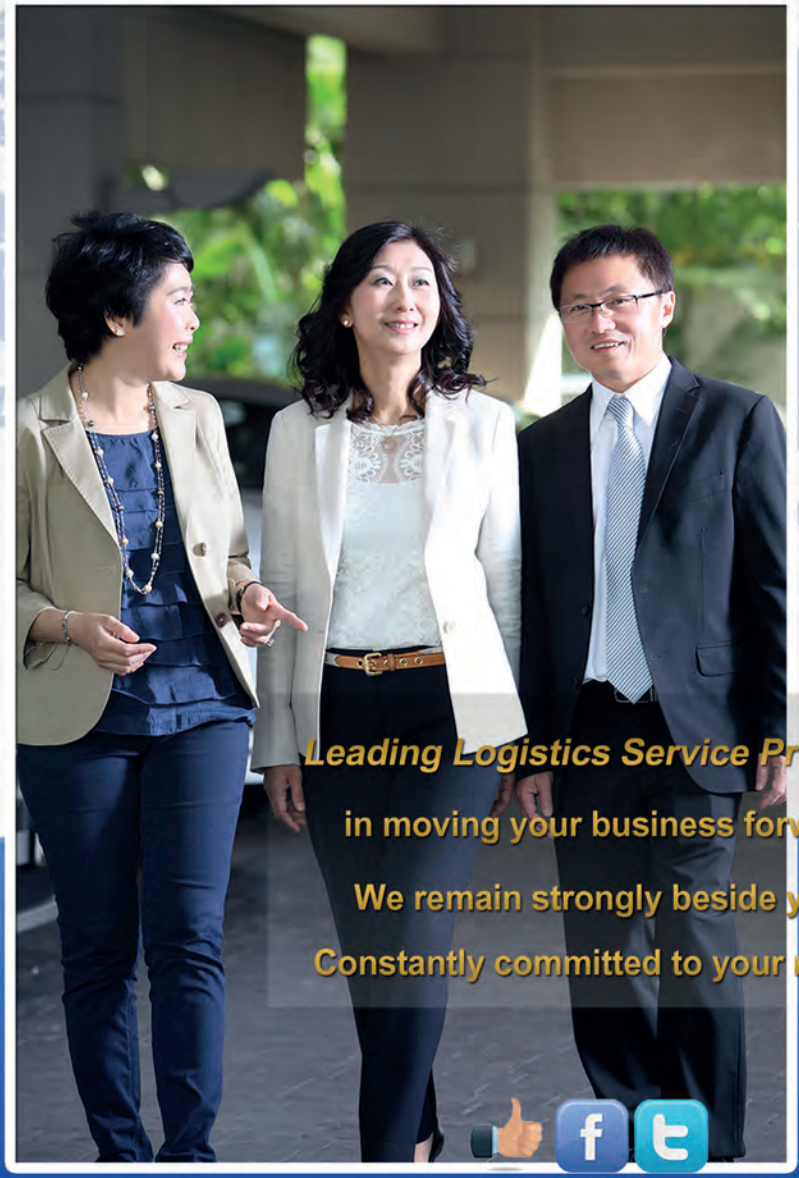
COMMITMENT TO SERVICE EXCELLENCE



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WICE Logistics Public Company Limited
88/8 Nonsee Road, Chong-nonsee,
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Tel: (662) 681 6181
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INTRODUCTION

This is the 7th international conference organised by the Centre for Logistics Research at Thammasat Business School, Thammasat University and the Excellence Centre in Logistics and Supply Chain Management, Chiang Mai University. This is major event for researchers in transport, logistics, supply chain and value chain management especially in the Asia Pacific region. This year's event in Lyon, France will be the first time the conference is being held in Europe and is a continuation of past successful conferences held in ChiangMai (Thailand), 2009; Queenstown (New Zealand), 2010; Male (Maldives), 2011; ChiangMai (Thailand), 2012; Kyoto (Japan), 2013 and Kuala Lumpur (Malaysia), 2014. This year's event is held during November 17th to 20th, 2015 and is hosted by Université Lumière Lyon 2, Lyon, France.

Under the theme of "Asia-Europe Connectivity for Sustainable Competitiveness", the following topics were welcomed at the conference:

Procurement & Supply Management	Supply Chain Design/Configuration
Planning & Forecasting	Supply Chain Risk Management
Relationship & Collaboration	Sustainable Supply Chain
Production Planning & Operations	Production & Inventory
Inventory Fulfilment	Supply Chain Performance
International Logistics	Global Supply Chain
Humanitarian Logistics	Multimodal Transport
Maritime Logistics	Freight Logistics
Logistics Services Providers	E-Logistics
Logistics Development Policies	Logistics Facilitation

The conference best paper will be invited and considered for publication in the International Journal of Physical Distribution and Logistics Management [ABS: 2*, Impact Factor: 2.617] and there will be a special ICLT2014 issue in the International Journal of Logistics Research and Applications [ABS: 2*, Impact Factor: 0.357] if there are sufficient papers.

WELCOME ADDRESS FROM THE CONFERENCE CHAIRS

On behalf of the organizing committee, we would like to welcome all participants to the 7th International Conference on Logistics and Transport (ICLT2015). It has been 7 years since the first conference hosted in Chiang Mai (Thailand). This ICLT conference is expected to continue on an annual basis in order to facilitate the sharing of ideas, research findings, and teaching directions related to logistics and supply chain from an academic perspective.

The theme for this year's event is "Asia-Europe Connectivity for Sustainable Competitiveness". As technology has posited considerable impact to the current logistics and supply chain practices, distances from channel members has been extended. This has allowed companies to gain competitive advantage through cost and value. However, due to the current market situation, searching for sustainable competitiveness is one of the key topic in today's business world.

"Asia-Europe for Sustainable Competitiveness" is an important concept for industries in all scales. It can be seen as a guidance to help in improving companies' resources, capabilities and operational efficiencies through sustainability across the entire supply chain continuum. The challenge to harmonise these subtle changes in between each members of the supply chain remains an elusive challenge.

Nonetheless this concept does lead to greater opportunities in reviewing and revising processes, operations, and production activities that can comply with this given paradigm. Other potential advantages of sustainability in supply chain management is cost reduction, waste reduction, cycle time reduction, risk mitigation, and asset utilisation.

We would like to sincerely thank all presenters, reviewers, our scientific committees, and keynote speakers for their appreciated contribution. We also apologise in advance if there are any difficulties you may encounter while participating the conference. Finally, we hope that you will enjoy this conference and we hope that the deliberations will be fruitful and successful.

Ruth Banomyong

Apichat Sopadang

ICLT General Chairs

CONTENTS

A PRATICAL IMPLEMENTATION OF TIME-DEPENDENT FASTEST PATH ALGORITHM: A CASE STUDY OF BANGKOK ROAD NETWEOK

Kriangsak Vanitchakornpong, Nakorn Indra-Payoong, Peerapol Sittivijan
Faculty of Logistics, Burapa University
eaksung@gmail.com, nakorn.ii@gmail.com, peerapoljt@gmail.com

Introduction

Shortest path algorithms e.g. Dijkstra and A* have been applied to business and industrial applications. Unit of measurement can be various in a shortest path algorithm. With distance, the algorithms try to find the path with shortest distance between a pair of origin and destination while in case of travel time, the algorithm try to find a path with minimum travel time or fastest path instead. In case of fastest path, the resulted fastest path would be reasonable when the variation of travel time on the network is small. However, when the variation of travel time is large the resulted fastest path would be unreasonable and inapplicable. For example, in large cities, travel time between peak and off-peak periods can be obviously different. An alternative is to apply time-dependent travel time e.g. a set of travel time during peak period and another one for off-peak period to the fastest path algorithms. However, the implementation of time-dependent fastest path is problematic when there are many periods to be considered. In this case, the computational complexity and required data to be processed can be enormous. In this paper, the pre-processing step and database architecture of time-dependent fastest path will be introduced. The pre-processing and database architecture were applied to Dijkstra algorithm to reduce computational time for time-dependent fastest path algorithm. The fastest paths for all pairs between origins and destinations in the network in each period were pre-calculated and stored in the database based on travel time in each period. These fastest paths will be retrieved and combined to find the fastest paths between an origin and destination at the specified starting time at origin node. The database is designed so that the pre-calculated fastest paths for all pairs between origins and destinations will be easily retrieved. In Section 2, related literature will be discussed. Section 3 describes the pre-processing and data architecture for time-dependent fastest path algorithm. Section 4 describes application of the pre-processing and data architecture proposed in Section 3 to the time-dependent fastest path with arrival time-window and to the time-dependent fastest path with multiple drops. Section 6 concludes all of the work and discusses potential future work.

Literature Review

Dijkstra (1959) proposed an exact algorithm to find a shortest path between an origin and destination. In Dijkstra's algorithm, the search begins by trying to find a node with shortest distance to the origin node and extends node by node in this fashion until reaching the destination node. Dijkstra's algorithm uses only the distance from the origin node in finding the shortest path. A* algorithm (Hart *et al*., 1968) improves Dijkstra's algorithm by using both the distance from the origin and the distance to the destination for a node to find a shortest path. Fu et al. (1998) proposed an algorithm to calculate expected fastest path where travel time on a link in the network is dynamic and stochastic. The calculation uses average and variation of travel to find an expected fastest path. However, this also adds complexity to the problem and it takes longer computational time. In this case, they proposed k-shortest path instead of shortest path to reduce computational time. Chen et al. (2005) proposed algorithms to find fastest paths under three different searching criteria, namely, expected value, dependent-choice and choice-constrained. Genetic algorithm was applied to find fastest path under these criteria Zhang et al. (2006) proposed allFP query method to find fastest paths with specified departure and arrival time interval. The allFP query method was developed based on A* algorithm. One of its advantages is it can keep track of previous calculated data, therefore, there is no need to run the algorithm every time when one needs to find the fastest paths. They also proposed the way to estimate the lower bound of the fastest path to reduce the computational time. Wu and Nie (2009) studied the algorithm to find fastest path in the network with stochastic travel time. They proposed alpha-discrete scheme which is able to find fastest paths in a large network without necessarily adjusting parameters for a specific network.

Pre-processing and Data Architecture for Time-dependent Fastest Path Algorithm

An example of time-dependent path can be illustrated in Figure 1. In this example, there are two routes i.e. R1 and R2 from the origin a to the destination d. For route R1, it passes through links: ab-bc-ce-ed and, for R2, links: ac-ce-ed. Common links between these two paths are ce and ed. As one can see that, for route R1, the traveler arrives at the beginning point of link ce at 8:20 and it takes 5 minutes to travel through link ce. In comparison, for route R2, the traveler arrives at the beginning of link ce at 8:10 and it takes 8 minutes to pass through link ce. In this case, to find a shortest path between an origin and a destination, one has to take into account the arrival time at the beginning of each link and the travel time of that link at that specific arrival time.

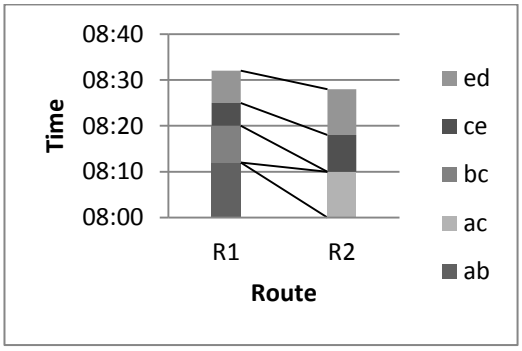


Figure 1: an example of time-dependent path

In order to consider the time-dependent travel time in the fastest path algorithm, the conventional mathematical programming to find shortest paths can be adjusted as follows.

$$min \sum_{i \in N} \sum_{j \in N} x_{ij} t_{ij}^{p} \quad (1)$$

S.T.

$$\sum_{j \in N} x_{ij} - \sum_{j \in N} x_{ij} = 0 \ ; \ \forall \ i \in N \setminus \{s, e\} \quad (2)$$

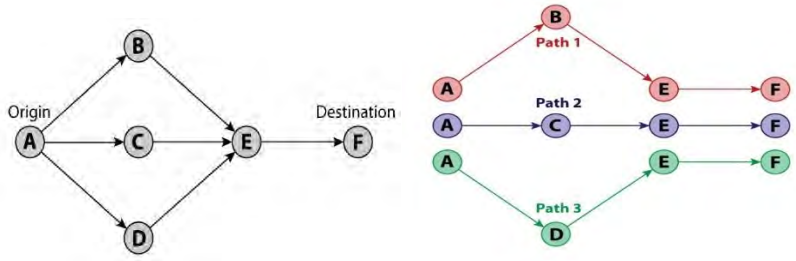
$$\sum_{j \in N} x_{sj} - \sum_{j \in N} x_{js} = 1 \quad (3)$$

$$\sum_{j \in N} x_{ej} - \sum_{j \in N} x_{je} = -1 \quad (4)$$

Where

N = set of all nodes in the network, x_{ij} = 1 if arc ij is a part of the shortest path; 0 otherwise, t_{ij}^{p} = travel time from node i to node j with staring time from node i equal to p, s = an origin node, e = a destination node

The objective function is to minimize the total travel time from an origin node to a destination node. Constraints (1) – (3) is the conventional constraints for network modelling. In this case, we assumed that $t_{ij}^{p_1}$ and $t_{ij}^{p_2}$ has the same value if p_1 and p_2 are in the same time interval, k. For example, if k is equal to 5 and the initial time is set to be 0, then the value of t_{ij}^{2} and t_{ij}^{4} would be the same, as well as, the same value between t_{ij}^{122} and t_{ij}^{124}. In addition, we also assumed that the link travel time satisfies the first-in first-out (FIFO) property, this implies that a vehicle departing later cannot arrive earlier than a vehicle departing earlier. The following example shows how to find a time-dependent fastest path for a small network.



a) b)

Figure 2: a) an example network b) 3 possible paths from A to F

Figure 2 shows a small network to illustrate how to find time-dependent fastest path. In the example, the origin is A and the destination is F. There are three possible paths from A to F e.g. through B, C and D. Figure 3 shows the travel time of each link during different time period. For example, the travel time on the link AC, t_{ij}^{p} when $0 \leq p < 5$ is equal to 4. However t_{ij}^{p} when $15 \leq p < 20$ is equal to 6. If one starts his/her journey from A to F at time 0 then the fastest path will be on the route A-B-E-F with the total travel time of 21 units.

Time horizon	AB	AC	AD	BE	CE	DE	EF
0	4	6	4	12	12	13	5
5	5	5	5	10	11	13	7
10	3	5	3	12	9	11	6
15	6	6	5	9	10	10	5
20	6	3	3	11	10	11	6
25	6	6	6	11	9	11	7

Figure 3: link travel time depending on the arrival time period of that link

However, if one starts the journey at time 5 and 10 then the fastest path will be A-C-E-F with the total travel time of 19 and A-D-E-F with the total travel time of 20, respectively. These fastest paths at different starting time from A can be illustrated in Figure 4

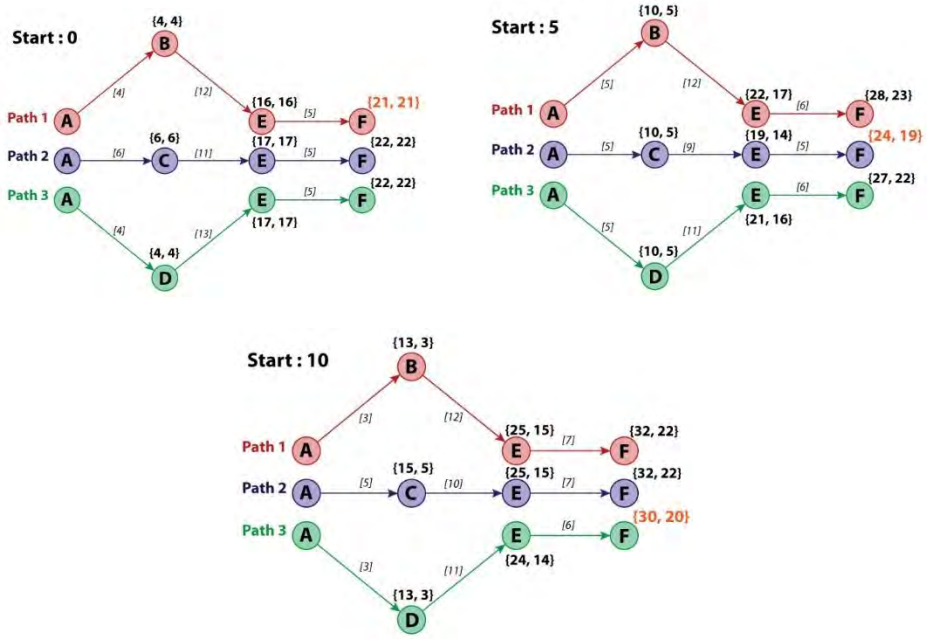


Figure 4: Fastest paths from A to F at different starting time.

As one can see, the computational time to find time-dependent fastest path can be exponentially intractable based on the curse of dimensionality. This could be problematic for real-time applications. Therefore, we proposed a pre-processing step to calculate the fastest paths for all origin-destination (O-D) pairs for all time periods in advance and store the pre-processed data in the database. To improve the computational time of time-dependent fastest path, the multi-threading calculation was applied to calculate time-dependent fastest path for each O-D in parallel. The pre-processed data of time-dependent fastest path can be fast and easily retrieved for the databased when it is required by the applications.

Empirical Study

To examine the efficiency of the time-dependent fastest path with the proposed pre-processing and data architecture, the experiments were conducted on the road network in Bangkok consisting of 3,500 × 3,500 nodes. In this paper, it was assumed that the interval of travel time is five minutes and the travel time, $t_{ij}^{p_1}$ and $t_{ij}^{p_2}$ are equal if p_1 and p_2 are in the same time interval. The time-dependent fastest paths for all origin e.g. 3,500 nodes to all destination 3,500 for all 288 time intervals e.g. 24 hours for every 5 minutes were calculated based in the proposed algorithm and store in the database to be retrieved and utilized. Figure 5 illustrates the travel time on the fastest path of a free-flow path from 6 AM to 7 AM. As expected, the travel time varies from 30 minutes to 45 minutes which is quite small.

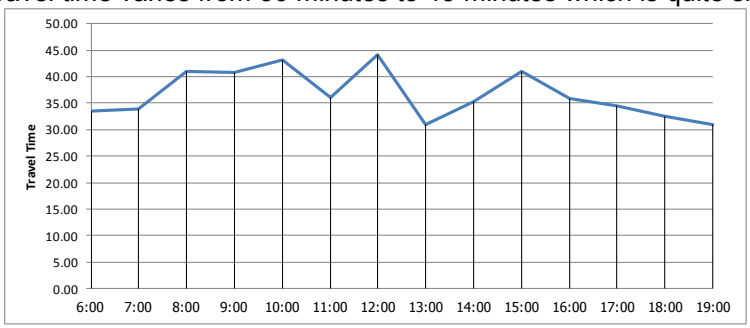


Figure 5: An example of travel time on the fastest path of a free-flow path from 6 AM to 7 PM

To better understand variation of travel time on time-dependent fastest path, the time-dependent fastest path of three O-D pairs, namely, O-D pair I, J and K on the Bangkok road network were examined. The mean and standard deviation values the travel time of the time-dependent fastest paths on these three O-D pairs were collected for every 30 minutes. For example, for O-D pair I, the travel time for the time-dependent fastest paths for every 5 minutes from 3.30 PM to 4 PM were calculated and the mean and standard deviation of travel time for O-D pair I from 3.30 PM to 4 PM were calculated.

In the experiment, the total costs comprising of vehicle operating cost (VOC) and value of time (VOT) between the shortest paths and time-dependent fastest paths for paths I, J and K. The travel time for both the shortest and time-dependent fastest paths were calculated based on the historical data on Wednesday for 50 days at 7 AM and 5 PM. The values of VOC and VOT used in the experiments were 5 Baht/KM and 300 Baht/hour, respectively. Table 1 shows the comparison of the total costs between the shortest and time-dependent fastest paths for all three O-D pairs.

Path	Peak Time	Shortest			Fastest				Savings	
		Dist	Time	*Cost**	Dist	Time	Stdev	*Cost**	Baht	%
I	7:00	5	41.45	232	11.49	35.75	3.69	236	-4	-
	17:00	5	46.84	259	12.63	32.75	3.30	227	32	12
J	7:00	15	98.34	567	24.56	65.25	6.65	449	118	21
	17:00	15	101.45	582	25.36	84.00	14.02	547	35	6
K	7:00	33	151.61	923	55.14	89.75	16.78	724	199	22
	17:00	33	142.87	879	52.70	110.75	26.15	817	62	7

Table 1: Comparison of the total costs between shortest and time-dependent fastest paths

The mean and standard deviation values of travel time for the time-dependent fastest paths for all O-D pairs for all intervals were calculated and compared as shown in Table 2. In Table

2, the travel time for time-dependent fastest paths was calculated at 7 AM and 5 PM as well as ± 5, ± 10 and ± 15 minutes. It can be observed that, for these three O-D pairs, there is not much difference of the mean and standard deviation values of travel time in different time interval. Therefore, it might be possible that the range of interval can be increased to 15 minutes, for example, to reduce the total number of interval in a day and improve the efficiency of the computation.

Time-dependent Fastest Path with Arrival Time Window

In this section, the algorithm to find time-dependent fastest path will be applied to an additional condition i.e. a restricted arrival time window. This condition restricts the arrival time at the destination to be within a pre-specified time interval.

Path	Time	Mean travel time (min)			
		0	±5	±10	±15
I	7:00	40	44 (6.08)*	47 (5.86)	42 (8.79)
	17:00	31	41 (10.02)	43 (9.03)	44 (8.38)
J	7:00	63	61 (1.73)	61 (1.64)	62 (2.00)
	17:00	66	67 (2.31)	69 (3.32)	72 (6.40)
K	7:00	114	117 (8.50)	123 (18.10)	120 (15.55)
	17:00	135	128 (9.64)	125 (12.26)	124 (10.52)

Table 2: Comparison of travel time for time-dependent fastest paths in different time intervals

* Number in parenthesis is the values of standard deviation (min)

$$min \sum_{r \in R} x_r (e_r - s_r) \quad (5)$$

S.T.

$$\sum_{r \in R} x_r = 1 \quad (6)$$

$$l \leq e_r \leq u \quad (7)$$

Where

R = set of all possible routes from an origin node to a destination node, x_r = 1 if route r is selected and 0 otherwise, e_r = starting time for route r, s_r = arrival time for route r

For the small example in Figure 4, the time-dependent fastest paths with the starting time at 0, 5 and 10 can be shown in Figure 6. If the restriction on the arrival time at node F is between 20 and 25, then path 3 will be violated the constraint and the optimal path will be path 2 with the travel time of 19 units.

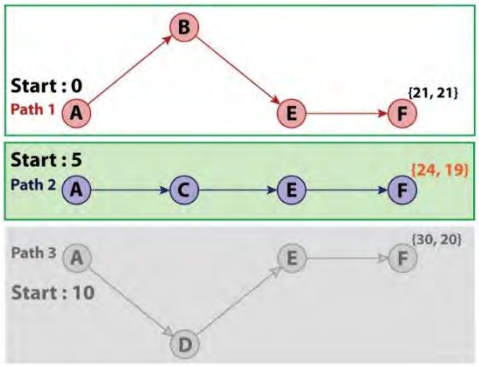


Figure 6: Time-dependent fastest path with different stating time

We also conducted an experiment to compare the travel time selected by the travelers and that calculated by time-dependent fastest path. A random sample of 30 people traveling between 3 O-D pairs, namely, L, M and N were asked about their selected paths on October 3, 2012. All these three O-D pairs were selected because they are all in the central business district and their distances are short. The mean values of travel time for the selected paths and time-dependent fastest path between these three O-D pairs from 10 AM to 7.30 PM were shown in Table 3.

O-D	Time window	Selected paths				Fastest Paths			
		Dist	Time	Depart	Arrival	Dist	Time	Depart	Arrival
L	10:00 - 10:30	23.69	49	9:25	10:14	24.23	42	9:35	10:17
	13:30 - 14:00	24.68	55	12:35	13:30	22	30	13:00	13:39
	18:30 - 19:30	23.69	69	17:45	18:54	23.3	49	18:05	18:54
M	10:00 - 10:30	27.9	45	9:25	10:10	17.61	36	9:50	10:26
	13:30 - 14:00	20.64	40	12:55	13:35	17.92	39	13:15	13:54
	18:30 - 19:30	26.95	63	17:30	18:33	17.61	36	18:15	18:51
N	10:00 - 10:30	9.47	24	9:55	10:19	9.81	23	10:05	10:28
	13:30 - 14:00	8.29	32	13:25	13:57	7.97	19	13:40	13:59
	18:30 - 19:30	9.47	24	18:55	19:19	8.13	21	18:30	18:51

Table 3: The mean values of travel time for O-D pairs L, M and N

Time-dependent Fastest Path with Multiple Drops

In this section of the paper, we describes how to apply the algorithm for time-dependent fastest path with multiple drops. This can be applied directly to the logistical system where a company has many customers to serve at different locations. For practical reasons, we scope our experiments to a limited number of customers to be served because, in real world, a company usually, has only about 8 working hours per day and the maximum number of customers to be served is normally less than 10. The mathematical programming for this type of problem can be formulated as follow.

$$\min \sum_{i \in N} \sum_{j \in N} t_{ij}^{d_i} x_{ij} \tag{8}$$

S.T.

$$\sum_{j \in N} x_{ij} = 1 \tag{9}$$

$$\sum_{j \in N} x_{ji} - \sum_{j \in N} x_{ij} = 0 \tag{10}$$

$$\left(a_j - a_i + s_i + t_{ij}^{d_i}\right) x_{ij} \geq 0 \tag{11}$$

$x_{ij} \in \{0,1\}$; $\forall (i,j) \in N$

Where

N = set of all nodes in the network, x_{ij} = 1 if arc ij is a part of the shortest path; 0 otherwise, $t_{ij}^{d_i}$ = travel time from node i to node j with staring time from node i equal to d_i, a_i = arrival time at node i, s_i = service time at node i

The objective function (8) is to minimize the total travel time used on the network. Constraints (9) and (10) are the conventional constraints for network problem. Constraint (11) says that the link from node i to node j is selected then the arrival time at node j must be greater than or equal to the sum of arrival time at node i, service time at node i and travel time from node i to node j. We assumed in this work that the service time is equal to 45 minutes.

The experiments with four O-D pairs were conducted. For the first O-D pair, the trip starts at node P1_A then goes to P1_B, P1_C and P1_D, respectively. For the second O-D pair, the trip starts at node P2_A then goes to P2_B, P2_C, P2_D, P2_E and P2_F respectively. For the third O-D pair, the trip starts at node P3_A then goes to P3_B, P3_C, P3_D, P3_E and P3_F respectively. The fourth O-D pair starts from node P4_A then goes to P4_B and P4_C respectively. **Error! Reference source not found.**The resulted time-dependent fastest path based on the travel time data on August 6, 2012 can be illustrated in Table 4. In addition, the travel time between the shortest paths and time-dependent fastest paths on 40 Mondays from the historical data were compared as shown in **Error! Reference source not found.**.

Problem	Path	Distance (km)	Time		
			Start	End	Total
P1	P1_A, P1_D, P1_B, P1_C, P1_A	32.08	14:00	17:26	3:26
P2	P2_A, P2_C, P2_D, P2_F, P2_E, P2_B, P2_A	56.21	9:00	14:17	5:17
P3	P3_A, P3_B, P3_F, P3_C, P3_D, P3_E, P3_A	15.53	9:00	13:33	4:33
P4	P4_A, P4_C, P4_B, P4_A	279	14:00	18:41	4:41

Table 4: The time-dependent fastest paths for all four O-D pairs

Problem	Distance (km)			Time (min)				Best route	
	Shortest	Fastest	Diff	Shortest	Fastest	Diff	%*	Distance	Time
P1	30.5	32.7	2.2	218	200	18	22.61	30.5	198
P2	50.9	54.4	3.5	338	308	30	26.46	51.9	299
P3	14.4	15.8	1.4	281	269	12	21.25	14.4	265
P4	93.0	105.9	12.9	368	301	67	24.35	96.8	268

Table 5: Comparison of the mean travel time of shortest and time-dependent fastest paths

Conclusion

In this paper, the algorithm to find time-dependent fastest path was considered. A main problem is the complexity and computational time of the algorithm when there are many time interval to be considered. The pre-processing and data architecture were proposed to handle this problem. The efficiency of the proposed concepts were examined with the real road network in Bangkok with 3,500 × 3,500 nodes with the time interval of 5 minutes for a day. The results shows that the proposed concepts works quite well and can be practically applied to the real world problem. The time-dependent fastest path with arrival time window and with multiple drops were also examined. The total cost saving between the shortest and time-dependent fastest paths were compared to better understand the travelers 'behaviors. Based on the proposed concepts, the future work could be the development of decision support system for travelers using real-time traffic data and hierarchical optimization for trip planning.

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AN ASSESSMENT OF MULTIMODAL TRANSPORT CORRIDORS: EUROPE - IRAQ

Ziad al Hashimi[1], Anthony Beresford[2], Stephen Pettit[2]

[1]United Arab Shipping Company, [2]Cardiff Business School, Cardiff University, Colum Drive, CF10 3EU

Introduction and Literature Review

The United Arab Shipping Company (UASC) was established in July 1976 by six countries (Bahrain, Iraq, Kuwait, Qatar, Saudi Arabia and U.A.E). The main mission of this line is providing shipping services to the Arabian Gulf region and the Middle East by linking this area with international ports and expanding into global trades (Dean, 2004). Currently, UASC is one of the largest shipping lines for containers to the Middle East. UASC intends to strengthen and expand its services and lifting to Iraq to achieve early entry to the Iraqi market, which is expected to have significant potential in terms of transported cargoes, either to the domestic market or for the governmental and project sectors. The key aim of this paper is to explore and evaluate the various multimodal transport corridors currently being used from Europe to Iraq for the import of general merchandise, consumer goods and rebuilding materials. The research is based on UASC containers' lifting and services to Iraq in recent years.

The transport network could be defined as a combination of transport routes, including railways, shipping routes, highways and inland waterways, which link different nodes along the transport chain, such as rail terminals, sea and airports. Each transport node enables the transported cargoes to be switched to another mode according to an agreement between shippers and consignees. The transport network represents the supply part of transportation, thus the quality of the network relies on the cargoes' flow conditions and the connectivity degree between transport modes (Steiner, 2009). Some shippers and consignees tend to assume that cargoes move directly from their origin to destination. However, this is not the case for all transported shipments, since many factors should be taken into consideration while determining the length and structure of the transport chain, such as shipment size, transport distance and geography (Banomyong and Beresford, 2001).

Transport networks thus have different frameworks. The 'direct link' network represents an absolute direct connection between origin and destination using one mode of transport and no involvement of any nodes, and normally this network design may be applied for a short distance with a low volume of cargo. In the 'Hub-and-Spoke' system, one node is dedicated as a centre to distribute or tranship freight traffic to other smaller nodes in the same region. The core advantage of this network is to link a large number of origins with wide hinterlands, backed by regular and reliable services. Furthermore, a 'Connected Hubs' network has a similar layout, but the main disparity is its ability to connect several hubs in one region with the hubs of another (Woxenius, 2007). In liner shipping, hub-and-spoke networking has become predominant since the mid 1990s. The shipping lines found that hub-and-spoke networks were the most appropriate networking pattern towards enhancing the 'load factor' for their deployed vessels, reducing operating costs and guaranteeing service regularity to hinterland ports (Global Insight, 2005). In this type of network mother vessels make scheduled and direct calls to main hubs, leaving feeder vessels to distribute containers to other smaller ports.

In contrast, in 'Corridor' networks, the volume of the transported cargoes is high and the distances are longer, which require several modes to be utilised within the transport chain, and cargoes may be handled several times before reaching the final destination. The transport operators have flexibility to design the appropriate corridor and select the appropriate modes and nodes. Thus, transport corridors could be divided into maritime, inland waterway, land or a combination of routes and modes. However, other factors may affect the corridors' design, such as transport infrastructure, and some transport modes, like rail and shipping, need more pre-planning to manage costs and delivery time. A good example of corridors is the corridor between Japan and Boston-Washington in the USA (Banomyong and Beresford, 2001).

Research Methodology

The methodology underpinning this paper is case study research based on real-time commercial data and information obtained from interviews. According to Yin (2003), adopting a case study methodology is considered sensible when little is formerly known about the researched area, and the aim of the study is to achieve a comprehension of the case being researched. Data collection relied on a combination of primary and secondary data. Primary data were collected from the UASC Middle East office in Dubai, UASC-Iraq branch and other UASC agents in Jordan, Jeddah, Dubai and Lattakia, as well as the UASC European office in London. Information and statistics were collected in respect of shipping services, main transported shipments, cargo handling operations in Europe and the Middle East by UASC agents. Further, trade route descriptions from Europe to Iraq, UASC's client's modal choices, and container lifting statistics were also obtained. Secondary data were collected from the relevant academic literature and from other public sources. Some constraints emerged while conducting the research, such as the confidentiality of some data regarding UASC's future strategies in Iraq, the availability of data with respect to UASC clients' preferences, and the availability of accurate statistics about the Iraqi transport sector due to the Iraqi political situation.

In order to gain a better understanding of the current freight transport to Iraq and factors influencing modal choice, a case study of multimodal corridors from EU to Iraq based on United Shipping Company (UASC) services was conducted to evaluate and analyse these corridors. The UASC line was chosen due to several factors: firstly, the robustness of the shipping services provided by the line to the Middle Eastern ports; secondly, the line is interested in the Iraqi markets and has new strategies to develop its presence and contribution to shipping services to Iraq; and finally, the lead author has a direct professional relationship with the shipping line meaning that data collection was well supported by the management. Accordingly, different regional offices and agents, in London, Dubai, Amman, Baghdad and Mersin were approached. The aim was to collect information and data with respect to pre-carriage services and costs for outbound boxes to Iraq from Europe, the mainly utilised inland modes and main factors affecting modal choice based on agents and shippers' perspectives, and main loading ports and other destination hubs.

For the second stage, the aim was to collect statistics relevant to import container volume to Iraq from Europe and West Mediterranean, freight rates for the shipping leg from Europe to several Middle Eastern ports and other relevant charges, destination ports' conditions, capacities, descriptions of inland trade routes from Iraq's neighbouring countries' ports to Baghdad, and factors affecting routes and modal choices based on consignees perspectives. The responses of the offices varied: some of the feedback provided thorough information about the case, whereas elsewhere it was relatively basic, which led the authors to seek assistance from other resources within the company. The outputs were carefully assessed based on the general multimodal transport literature. Then, a specific model was adopted to analyse each multimodal corridor to Baghdad.

Multimodal Corridors to Baghdad based on UASC line lifting and services

The geographical location of the country, as a result of having limited access to the sea, puts Iraq in a similar position to landlocked countries, and war and military conflicts have placed other burdens and obstacles on the country in terms of its international trade transactions. The ports in the south are deemed obsolete and small, and their activity has been drastically affected by previous wars. The quality of shipping services' and operations' has also therefore declined. Accordingly, the country has started utilising other inland alternatives, which involve international trade corridors through some neighbouring countries, and domestic road and railroad networks have been developed and expanded to counteract the implications of the sea gateway limitations. However, the social consequences and internal conflicts resulting from the recent war have inflicted the country with instability and insecurity, which have negatively reflected on the domestic economy and cargoes flow and transport services crossing borders from some neighbouring countries have also been affected due to high risks on roads and delays at borders. For the time being, inbound cargoes are still moving to Iraqi cities from different routes, despite uncertainties and the inhibiting influence of poor reliability.

UASC services to Iraq have developed primarily to cater for shipments mainly from the Far East and Europe, discharged at Khorfakkan Port(1) and then transhipped to Um Qasr port. The imported volume from Europe and Western Mediterranean had reached its peak during 2001, but thereafter the volume started to diminish, due to the impact of the 2003 war, especially the period between 2003 and 2007 and subsequent instability with increased regional tensions culminating in the civil unrest stemming from the expansion of the Islamic State in northern Iraq and Syria. . Market demand has subsequently increased and all previous governmental restrictions have been abolished, enabling significant increases of cargo flow to the Iraqi markets. Accordingly, the line took several steps to exploit Iraqi market emergence and attempt to improve its presence in such high potential market, which resulted in gradual increases of UASC containers' lifting to Iraq, starting from 2007 until now from the Far East, EU, USA and WMED. In the context of exports to Iraq, UASC, through its offices and agents has worked jointly to develop cargo lifting to Iraq from different European origins, as a part of a marketing campaign to revive business to Iraq. Therefore, the level of cargoes from Europe and Western Mediterranean to Iraq increased gradually from 2004, originating mainly from Germany, UK, Poland, Sweden, Belgium, Denmark, Italy and Spain; and Antwerp, Hamburg and Valencia ports have been used for the overwhelming containers' volume transported by UASC to Iraq.

UASC Corridors from North Europe to Baghdad

Most cargoes shipped by UASC from northern Europe to Iraq include food stuffs, machinery and aid cargoes. A high proportion of UASC cargoes start from Germany, notably Munich and it is these routes that are now discussed. Cost and transit time are the main factors affecting modal choice for shipments from northern Europe to Iraq. Market recession and the demand nature of the Iraqi market put a direct impact on shippers' tendency to find cheaper transport methods. However, the contractual agreements with the Iraqi consignees oblige shippers to take transit time into consideration as well. Therefore, German shippers tend to use one mode to reduce switching between modes (which often carries both a time and cost penalty). Trucking is used for time sensitive cargoes and railroad for other general shipments. Moreover, those shippers tend to exploit Inland Depots near Munich in the shipment process, stuffing UASC boxes before loading by the designated mode, since UASC has a stock of empties at some of these depots, and thereby squeezing transport costs. Customs' clearance formalities can also be arranged in some instances.

Corridor 1: Munich – Antwerp - Jeddah - Aqaba - Baghdad (Table 1)

Containers normally take one day to reach Antwerp port from Munich ICDs, using road transport only, since the railroad tends to be expensive and the network is not extensive. Then, two days are needed to ship boxes through UASC services. The transit time between Antwerp and Jeddah ports is 11 days, and from Jeddah the boxes are transhipped to Aqaba port within 3 days. At Aqaba port, containers take about two days to be cleared and loaded onto trucks, since no other modes are utilised for boxes for Iraq. Thereafter, the inland route starts from Aqaba port – Maan – Zarka – Turaibeel (Iraqi border), and then UASC boxes are switched to Iraqi trucks, according to governmental instructions, to achieve the final leg to Baghdad via Highway 10. The overall transit time for this inland transport is about four days. In total, containers need 22 days to reach Baghdad from Munich, crossing about 10,504 km.

Table 1. Corridor 1: Munich – Antwerp – Jeddah – Aqaba – Baghdad

Route Progress	Transit Time (day)	Cost (USD/TEU)	Mode	Distance (km)
Munich ICD	-	160	-	-
Antwerp Port	1	1210	Trucking	620
Antwerp Port	2	200	Port Charges	-
Jeddah Port	11	1423	All water	7400
Aqaba Port	3	0	Transhipment	1062
Aqaba Port	2	200	Port Charges	-
Iraqi Border	2	1500	Trucking	850

1 Hub port located on the Arabian Sea – UAE.

Baghdad	2	0	Trucking	572
Total	23 Days	USD 4693		10,504 km

With regard to the cost factor, the processing and stuffing of each TEU in Munich ICDs costs almost USD 160 on average, trucking to Antwerp port costs about USD 1,210 per TEU, and the Antwerp port processing cost is USD 200. Regarding UASC ocean freight from Antwerp port to Aqaba, via Jeddah, the costs are USD 1,423 all inclusive, and each TEU costs USD 200 in Aqaba Port. The final inland cross-boarding from Aqaba to Baghdad adds an extra USD 1,500 in total. This route has higher pre-carriage costs compared to other routes. However, the shorter transit time has attracted some businesses to move to this route, especially technology items, which have been shipped according to L/Cs that are issued by Jordanian banks (for account Iraqi Consignees), which recommend using Aqaba port and a shorter transit time to release payment. The shipping leg is predominant at 81 percent of the total corridor's distance. On the other hand, there are still some security problems along the inland route inside Iraq, and therefore some clients tend to use other safer corridors to ensure better cargo delivery. Currently, the cargoes' proportion on this route is still low, with almost 12 percent of total UASC containers transported from Northern Europe to Iraq, indicating that cost and safety factors are still predominant.

Corridor 2: Munich – Hamburg - Khorfakkan - Um Qasr - Baghdad (Table 2)

This route begins from Munich towards Hamburg Port for 2 days, using the railroad mode, and 2 days are required for containers to be loaded onto a UASC vessel. The shipping mode on this route crosses the Red Sea towards the Arabian Sea and discharges containers at the UASC Gulf hub (Khorfakkan Port). The transit time for this leg is the longest at 18 days. Thereafter, containers are transferred to another local base port (Jebel Ali), and then containers are transhipped by feeders to Um Qasr Port (Iraq), taking about 8 days. At Um Qasr Port, UASC containers will be inspected and cleared in 2 days. Finally, containers are trucked from Um Qasr – Basra – Amara – Kut, and then, Baghdad, since the railroad mode is still inefficient to carry containers, taking about one day to reach the delivery point and covering about 610 km on Highway 6.

Regarding the cost factor, USD 160 for container stuffing at ICD, the pre-carriage charges from Munich to Hamburg Port using the railroad mode cost USD 549 and USD 250 at Hamburg port. Then from Hamburg to Um Qasr via Korfakkan, the freight rate increases on this route to USD 2,321 per TEU, covering the all-water mode. At Um Qasr Port, each TEU costs about USD 655, which covers customs clearance, handling, x-ray, and delivery order. Finally, the Um Qasr to Baghdad leg costs USD 630 per TEU.

Table 2. Corridor 2: Munich – Hamburg – Khorfakkan – Um Qasr – Baghdad

Route Progress	Transit Time (day)	Cost (USD/TEU)	Mode	Distance (km)
Munich ICD	-	160	-	-
Hamburg Port	2	549	Railroad	610
Hamburg Port	2	250	Port Charges	-
Korfakkan Port	18	2321	All water	11610
Jebel Ali Port	2	-	Transhipment	322
Um Qasr Port	6	655	Port Charges	953
Baghdad	3	630	Trucking	610
Total	33 Days	USD 4565		14,105 km

This route is mainly used for capital goods and high volume shipments, such as wheat or food stuff, for Iraqi ministry accounts. Some delays can occur, especially in Um Qasr Port, where the berths are still inefficient, superstructures are obsolete and limited, and port management capabilities are poor. Such conditions have led to congestion in the port, which creates vessel queues. Nevertheless, most shipments under contract with government parties are discharged at Um Qasr Port, since there is a governmental instruction to all state companies to contribute in port business revival, and any delay which may happen at Um Qasr Port

would be covered by the governmental end-users. Such factor could be a new factor that affects modal choice, causing shippers who have signed contracts with the Iraqi Government to exploit the route via Um Qasr and to focus on the transit time of the route before discharging at Um Qasr. This leaves the government to bear the costs of any delay which could happen later, especially where such contacts have volume cargoes and include several partial shipments, and any delay, if calculated, would incur high costs. Accordingly, about 70 percent of UASC inbound boxes from Northern Europe are discharged at Um Qasr.

UASC Corridors from West Mediterranean to Baghdad

These corridors have been initiated from Spain. This country has regular shipments to Iraq, transported mainly through L/Cs opened by Jordanian or Emirates banks. Cargoes include tiles, industrial ceramic, hey, paper and waste paper. UASC has robust services from Spain to the Middle East using Valencia Port as a hub for Western Mediterranean services linking Port Said, Jeddah and Khorfakkan directly. In this regard, UASC utilises two scheduled services from the Mediterranean to the Middle East, namely, AMC1 and AMC2, calling at Valencia every Wednesday and Friday. The following corridors' analysis will focus on tiles' shipment movement from Castellon (2) to Baghdad, since Spanish tiles have a massive market in Iraq. Trucking is deemed to be the predominant mode used to transport tiles' containers to Valencia Port, compared to railroads, due to high costs of rail services and the limitations of its network, therefore, about 90 percent of containers are transported by the former mode. In terms of logistics, ICDs' role for Spanish tiles is still negligible and most shippers, through their forwarders, tend to handle shipments at factories directly. For tiles' business, shippers tend to find the cheapest trade route to transfer their products, as a result of high competition, putting other factors in a less preferred position.

Corridor 3: Castellon – Valancia - Khorfakkan – Jebel Ali – Um Qasr – Baghdad (Table 3)

In Castellon, tiles' shipments are normally stuffed in 20' containers, due to the cargoes' weight and volume. Each box is transported by a truck to Valencia Port within one day, a distance of about 65 km. In the port, container handling and loading operations require about two days before vessels depart. The shipping leg for this route runs from Valencia – Khorfakkan – Jebel Ali to Um Qasr, a distance of 9,443 km within 20 days. At Um Qasr Port, containers require 2 days, under normal circumstances, to be discharged, cleared and loaded onto trucks. Finally, the inland mode requires one day to reach Baghdad, crossing about 610 km to the final destination, using Highway 6.

Costs start in Castellon shippers' premises with USD 145 per TEU, and trucking to Valencia Port costs about USD 326. In Valencia Port, the total charges per TEU are USD 196, and then the shipping leg from Valencia to Um Qasr costs about USD 1,441, including all charges. At Um Qasr Port, each container costs about USD 655. In the final leg, the trucking mode costs USD 630 per TEU to Baghdad. The private sector is the main user of this route importing tiles to the Iraqi market. The consignees deem Um Qasr to be a reasonable gateway to Iraq, since the route to Baghdad is safer than other routes from Syria and Jordan, and the entire motorways used for the final trucking leg are well monitored and protected by the police and army. Moreover, personal relationships can play a significant role in facilitating container clearance, waiving some ports' costs and demurrages, exploiting the ports' premises, helping the consignees to minimise transit time and ensure safer delivery, since Spanish tile shipment is costly and Iraqi customers tend to bear extra costs to attain a higher level of safety and attempt to squeeze the transit time through these inappropriate approaches.

2 The biggest ceramic tiles production area in Spain, located in the south.

Table 3. Corridor 3: Castellon – Valancia - Khorfakkan – Jebel Ali – Um Qasr – Baghdad

Route Progress	Transit Time (day)	Cost (USD/TEU)	Mode	Distance (km)
Castellon	-	145	-	-
Valencia Port	1	326	Trucking	65
Valencia Port	2	196	Port Charges	-
Korfakkan Port	12	1441	All water	8168
Jebel Ali Port	2	-	Transhipment	322
Um Qasr Port	6	655	Port Charges	953
Baghdad	3	630	Trucking	610
Total	26 Days	USD 3197		10,118 km

Corridor 4: Castellon – Valencia - Port Said – Latakkia – Baghdad (Table 4)

The route begins from Castellon and containers take about one day to be trucked to Valencia Port, a distance of 65 km. Two days are then required for port operations until loading. The shipping mode starts from Valencia Port to Lattakia, via Port Said, taking about 9 days and 3,660 km. At Lattakia port, each container needs about 3 days to be handled, checked and cleared. The inland route can only use the trucking mode from the port to the border with Iraq, since no railroad services are available for container transport. This route runs from Lattakia – Tartous – Homs - Palmyra and Alwaleed border point, crossing about 650 km within one day. At the border, if there is no delay boxes can be cleared and switched to Iraqi trucks in one day, and it takes another day to travel 446 km on Highway 1 to the final destination in Baghdad. The costs start accumulating as usual during cargo stuffing operations, which include USD 145, USD 326 for trucking to Valencia Port and USD 196 per TEU for the port's charges. The shipping mode up to Lattakia costs USD 795 in total. On the Syrian side, each box costs USD 260 in the port, USD 250 at the border and USD 1,750 in total for trucking from the port to Baghdad. Lattakia Port conditions are relatively poor and the main berths and handling equipment are mainly designated for break bulk cargoes.

Table 4. Corridor 4: Castellon – Valencia - Port Said – Latakkia – Baghdad

Route Progress	Transit Time (day)	Cost (USD/TEU)	Mode	Distance (km)
Castellon	-	145	-	-
Valencia Port	1	326	Trucking	65
Valencia Port	2	196	Port Charges	-
Port Said	7	795	All water	3088
Lattakia Port	2	260	Port Charges	572
Iraqi Border	4	250	Trucking	650
Baghdad	1	1750	Trucking	446
Total	17 Days	USD 3722		4,821 km

Further, the Syrian government has its own influence on the port, through some restrictions to control transhipments, resulting in a limited number of containers crossing the port, and high charges for each container. Accordingly, port competitiveness has been enormously affected and traders normally attempt to find other alternatives; however, the route is still viable for time-sensitive shipments, where shippers have to achieve shorter transit time to comply with their swift delivery commitments. In terms of transport conditions inside Iraq, there are still some security concerns, and consignees tend to arrange for convoys to protect their shipments. Therefore, container movements on this route are relatively small (at almost 9 percent), since UASC clients have been influenced by safety concerns and cost, and may decide to find other safer and cheaper routes, despite being able to save time by using this route. The Confidence Ratio for this corridor is about 2.3. Another factor that affects the modal selection is the stringent governmental system, which directly affects cost, for instance, the railroad can be utilised for domestic cargoes only and any international traffic can use the trucking mode exclusively.

Corridor 5: Castellon – Valencia - Jeddah – Aqaba – Baghdad (Table 5)

On this route containers are transported 65 km by trucks to Valencia Port from Castellon in one day, and two days are required in the port before vessel departure. The all-water leg requires 9 days and crosses 4,422 km to Jeddah Port. In the second shipping phase, UASC transhipments its boxes to Aqaba Port after 3 days, through 3rd Party Feeders, crossing about 1,062 km. At Aqaba Port, each container requires two days for processing, and one day to get to the Iraqi border, where containers could be delayed for two days as a result of swapping trucks. The final road leg needs another day to reach the final delivery point in Baghdad, passing about 1,422 km in total on Highway 10.

Table 5. Corridor 5: (Castellon – Valencia - Jeddah – Aqaba – Baghdad)

Route Progress	Transit Time (day)	Cost (USD/TEU)	Mode	Distance (km)
Castellon	-	145	-	-
Valencia Port	1	326	Trucking	65
Valencia Port	2	196	Port Charges	-
Jeddah Port	9	1066	All water	4422
Aqaba Port	3	0	Transhipment	1062
Aqaba Port	2	200	Port Charges	-
Iraqi Border	2	1500	Trucking	850
Baghdad	2	0	Trucking	572
Total	21 days	USD 3,433		6,971 km

Container stuffing at Castellon costs USD 145 per 20' container and USD 326 for the road leg to Valencia Port. At the port, each TEU costs USD 196 for handling and loading operations. For the shipping leg, all inclusive charges from Valencia to Aqaba port, via Jeddah cost about USD 1,066. In Aqaba port, container handling and clearance charges are USD 200 per box, and finally, USD 1,500 as a total charge from Aqaba to Baghdad, including all charges for trucking and borders crossing. This route is often chosen by Iraqi consignees who have a business presence in Jordan and it is easier for them to arrange payments through Jordanian banks. Furthermore, the Jordanian government adopted some steps to facilitate cargo transit to Iraq via Aqaba to attract more businesses and to revive the bilateral agreement that had been signed with the former Iraqi regime. Therefore, a good proportion of tiles' shipments towards Baghdad is discharged and transported to Iraq to entertain financial and operational privileges that could be attained via this route. However, some security issues which have occurred in the past still affect the route's popularity, despite the highway used in this route being well protected by police and only minor incidents happening during the last 12 months.

Findings and Conclusion

This paper has focused on some of the multimodal corridors initiated from North Europe and West Mediterranean zones to Iraq, based on UASC line services and lifting. Several important points have been raised during the discussion, implying that modal choices could vary between shippers and consignees, based on differences between countries of origin and destination. In Northern Europe, the cost factor still has a prominent influence on modal choice, and thus, on route selection. This can be seen from the two corridors starting from Munich, where shippers trade off between cost and transit time and prefer to use cheaper modes and a trade route with a longer transit time and distance, rather than a route with shorter transit time but with higher costs. On the Iraqi side, and beside the cost factor, safety has a direct impact on modal and route choice by the Iraqi consignees, and the tendency is to divert containers to safer routes despite bearing higher cost and longer transit time. Thus, Iraqi consignees mainly trade off between safety versus transit time, and safety versus cost.

Governmental policy also has some impact on modal choice, encouraging state companies and ministries to monitor and steer the flows to optimise both cost and reliability, but sometimes incurring higher costs and longer transit times. In such cases the shipping mode will be extended covering longer distances, and the shorter shipping leg combined with road mode via neighbouring counties neglected for the sake of complying with these instructions. Therefore, such governmental intervention could be regarded as a new factor that affects

modal and route choice. Personal relationships therefore have a direct influence in this regard. The case of Iraqi corridors highlights that modal choice is also related to route choice. This can be found when Iraqi consignees tend to use routes via Um Qasr port, which have a longer shipping leg, rather than other routes which include a shorter shipping leg and longer inland mode, indicating that modal choice diversification does not necessarily include shifting to another mode, but could be as an extension of the same mode, which leads to the use of a particular corridor.

The Iraqi Port's conditions and the longer transit time have not strongly affected customers' choices, and port users still believe that using the longer and more costly corridor is reasonably justified by the safety factor, which cannot be achieved on other routes. Customer's modal choices after the shipping leg are limited to one mode only, making customers focus on better available corridors. In summary, the multimodal transport concept is essential to transport cargoes from Europe to Iraq and several multimodal corridors are being used. Seaports located in the neighbouring countries have become vital for linking transport legs in some of multimodal corridors to Iraq, since the Iraqi ports are still primitive and have poor access to the main sea routes. Nevertheless, the direct corridors to Iraq via its minor seaport are still more attractive compared to other routes as a result of safety concerns and governmental instructions. The UASC line has utilised several corridors to Iraq and increased deployed tonnage and services enabled to meet demand on transport from Europe to Iraq, and to diversify the choices available to its clients. The importance of UASC's services is well perceived in such corridors, since the shipping leg has the biggest proportion of all these corridors, which has contributed positively in developing businesses to Iraq.

Finally, an interesting finding of this paper, emerging from the case study routes, is that there is a fairly strong inverse relationship between overall transport costs and speed. That is to say, for the movements originating in Munich the slower route (Route 2) is significantly cheaper than the quicker route (Route 1). Although this comparison is dependent on a comparatively limited set of data, this inverse relationship is also visible with the shipments originating in Castellon. The three Castellon – Baghdad routes show a clear inverse relationship between cost and speed. Route 3 is both the slowest and the cheapest, Route 4 is the fastest and most expensive and Route 5 is between the other alternatives in terms of speed – cost performance. The data enable us to reach a tentative conclusion that sourcing unitised freight from Munich implies that there is trade-off of 9 days additional time for a $500 saving in freightage. From Castellon, for a 10 day time penalty freightage appears to be around $150 lower. This opens opportunities for testing the time / cost sensitivity of unitised freight more rigorously in both unstable and stable commercial environments.

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ACTOR ROLES IN MANAGING SERVICE VALUE RISK IN MULTIMODAL SUPPLY CHAINS

Jyri Vilko[1], Teemu Santonen[2]
[1]School of Business, Lappeenranta University of Technology, P.O.Box 20, 53851 Lappeenranta, Finland
[2]Laurea University of Applied Sciences, Vanha maantie 9, 02650 Espoo, Finland

Introduction

The dominant role of services in value produced in the global economy has raised the attention both the managers as well as the academics. The estimates of services in the US which state that the value produced by alone services will increase to close to 90 per cent of the total value production in the USA by 2050. Historically, the value has increased from the less than 40 per cent of the 1950 to the 84 per cent in the 2001, and the development seems to follow still similar trend (Spohrer, 2010). Although the value of services have been a popular topic in the scientific literature for several decades studying the value of them has mainly concentrated on macro level economies or organizational and process level while the network perspective has received only limited attention.

When considering the network perspective and supply chain studies, it becomes obvious that the focus in the previous literature has mainly been on traditional manufacturing rather than services. Indeed, several authors have identified this gap and also discussed about the differing natures between products and services (e.g. Vilko and Ritala, 2014; Sampson and Spring, 2012; Niranja and Weaver, 2011; Sengupta et al., 2006). The calls for more research starting from a decade ago have however received only little attention when comparing to the extensity of the traditional manufacturing supply chains research (e.g. Ellram et al., 2004; Demirkan and Cheng, 2008).

Risks have increased in the international supply chains and supply chain disruptions have become a critical issue for many companies. As logistic operations are getting divided between an increasing number of operators, organizational responsibilities relating to risk management are becoming hazier. The ability to identify risks decreases as the visibility of the supply chain diminishes beyond the organization's own functions. The risks and their visibility and impact depend on the position of the companies in the supply chain and on the level of analysis they are able to carry out. Events that affect one supply chain entity or process may interrupt the operations of other supply chain members. In a service value network this means that the right connections must work in risk event to ensure the undisrupted production of value to the customer.

On the other hand the demands for service value are increasing. In logistics for example the demands for better transportation performance, higher on-time delivery performance, and reduced damage-in-transit, require a high level of flexibility and ability to adapt to changes. Considering that the functions in the service supply chains are also highly dispersed among outside service providers, companies' dependency on the right network connections is crucial. A good example of how vulnerable the value provision in supply chains can be seen from the study of Hencricks et al. (2009) where companies admitting to major supply-chain difficulties lost 10 percent of their shareholder value on average.

Yet, little research about the customer value creation have been done from the risk management perspective. Especially the supply network perspective in managing the vulnerability of customer value has been neglected. Therefore, the purpose of this study is to analyze the value production process of logistics service sales from network perspective. A network analysis is conducted to illustrate the relationships and roles of different actors in logistics service network. The study is based on the existing literature on supply chain risk management and the findings of case study of a newly launched logistics services sales process.

The paper begins by describing the concepts of supply chain risk management. Next, the empirical part of the study is introduced by describing the study methods and the process of the case supply chain. Thereafter, the case network analysis between supply chain actors presented and finally the results are discussed in the conclusions.

Theory

Service value in supply chains

Logistics companies have become increasingly concerned about the value that the offered service brings to the customer. While the importance of recognizing the attributes related to logistics service value have been discussed in the scientific literature for two decades (e.g. Mentzer et al. 1997), the network perspective of the value creation has been received attention only more recently (e.g. Yazdanparast et al. 2010; Lusch et al. 2010). Nowadays, managers and scholars have woken to the issues related to the complexity of networked value production. Basole and Rouse, (2008) defined the service value networks to comprise from consumers, service providers, multi-tier and auxiliary enablers.

Indeed, the network perspective of is identified as one of the most challenging aspects to service systems (Basole and Rouse, 2008). The recent contributions in logistics field, scholar have presented visions of the service value networks (see e.g. Bose et al. 2014), links to the know philosophies and measurements of service value to logistics (see. e.g. Chao and Anantana, 2014).

Service supply chain risk management

The research on traditional manufacturing is well represented in the current supply chain risk management literature whereas the work on services is still quite sparse. The limited amount of work that considers the service nature of supply chains has defined service supply chain management to include the management of information, processes, capacity, service performance and funds from the earliest supplier to the ultimate customer (e.g. Ellram et al., 2004; Baltacioglu et al., 2007). The management models used for traditional manufacturing supply chains do not necessarily work well on services. More importantly for our case, even less work has been done to investigate service supply chain risk management.

Previously, studies have concentrated mainly on product-based manufacturing supply chain (Chen et al. 2013). Although the importance of service supply chains has been identified and discussed by several scholars, the specifics of their management have been addressed by relatively few (e.g. Arlbjørn et al., 2011; Baltacioglu et al., 2007; Ellram et al., 2007). The current studies on service supply chains have, so far, focused mainly on applying the existing supply chain management models to the service context (e.g. Arlbjørn et al., 2011; Baltacioglu et al., 2007; Ellram et al., 2007), while only a few have developed new frameworks for service supply chain management (e.g. Ellram et al., 2004; Baltacioglu et al., 2007). In doing this, some scholars have noticed that the current supply chain management applications do not work well in service management.

The benefits of taking into special nature services have been argued to provide, for example, better coordination of processes, improved performance through process integration and improvement of the customer interface (Giannakis, 2011). Considering the distinctive attributes of services, namely intangibility, heterogeneity, inseparability of production and consumption, and perishability (see e.g. Vilko & Ritala, 2014, Zeithaml et al., 1985; Fitzsimmons & Fitzsimmons, 2000; Nijssen et al., 2006) it is no wonder that scholars have highlighted the importance of differentiating the tasks in service supply chain management (Arlbjørn et al. 2011). According to Cho et al. (2012) this can be done through different types of relationships between the supply chain actors.

Research design

The qualitative and explorative case research approach was considered appropriate to gain theoretical and empirical insight into the topic because it had received only limited research attention in the past (Yin, 2008). The case study form was considered well-founded in serving the information-oriented focus of the research and discovering causalities of the phenomenon (Yin, 2008, Jensen and Rodgers, 2001).

Research Process and Data Collection

The empirical part of the study is based on the empirical data mainly received from the interviews and the questionnaire posted. The experience and insights of the executive and managerial level informants were utilized to build up the case study process and secondly to identify the relevant actor roles in creating customer value in the service network. The knowledge of the informants was considered essential in order to make in-depth sense of the phenomena (Eisenhardt, 1989), as the experiences and first-hand knowledge of the value creation in the case were the base for the study. The informants interviewed were selected on the basis that they would have the best knowledge about their organization and value network.

The interviews were analysed by researchers from two different disciplines, namely economics, and industrial engineering. As a conclusion a process map of the value chain process was build and the most essential actors of the value network identified. The accuracy of the researcher analysis conclusions were verified with the informants. After identifying the roles and the value process a network analysis based on questionnaire to the most essential actors were posted. An email request to participate on electronic survey was send to ten actors (i.e. data from customer viewpoint was not collected even if the relationship to customer was evaluated from company actor to customer point of view). By the end of data collection period, six out of ten actors answered, resulting 60 percent response rate. The research process is illustrated in Figure 1.

Figure 1 Research process

The main goal of this case study was to describe and compare the importance of communication between known actors in a multimodal supply chain during the normal and risk situations. Each network node is referring to an individual person which are having different roles and hierarchical status within the network. In this study we are especially interested on individual actors role regardless their formal hierarchical status. By utilizing social network analysis (SNA) method (Wasserman and Faust 1994), each actor within our case company example was asked to evaluate the perceived importance of communication between other known actors in the network. The proper selection of network questions and scale is a critical success factor to all network studies (Borgatti et al. 2013, p. 45).

To amplify the importance differences with the network of actors, the perceived importance of communication was measured similarly to Six Sigma approach. More precisely the connection importance scale ranged from 0 to 9 where 0 denotes not relevant connection, 1 denotes a weak connection, 3 denotes a somewhat important connection and 9 denoted highly important connection.

To avoid recall errors (Johnson et al. 2003), the closed-ended question format was used and a roster of actors was presented to respondents, asking them to evaluate the other supply chain actors with the respect of their importance on communication issues. The roster of actors included eleven individual actors and seven different roles. Although some of the actors had similar job title such as product captain, their actual job description and formal status with the organization hierarchy was varying as presented in Table 1.

Table 1 Descriptive profile of network actors

Actor	**Code**	**Role in case process**	**Hierarchical status**	**Response**
Product Captain 1	PC 1	Sales director	Member of management team	Yes
Product Captain 2	PC 2	Technical support	Operative	No
Product Captain	PC 3	Freight manager	Member of the extended	Yes

3			management team	
Product Captain 4	PC 4	Technical support	Operative	Yes
Product and Freight Manager	PFM	Regional manager	Regional management of services	No
Product Manager	PM	Customer information manager	Operational	Yes
Sales Manager 1	SM 1	Sales	Operational	Yes
Sales Manager 2	SM 2	Sales	Operational	No
Key Account Manager	KAM	Sales	Operational	No
Manager NBSS	M NBSS	Customer solutions manager	Member of the extended management team	Yes
Customer	C	Service purchaser		No

Analysis and Results

Overview of the case process

The analysis for the study was conducted in two separate phases: First, the network process was discovered, recorded and verified based on the personal interviews. The process revealed the organizations customer interface to occur with three different methods, namely telephone, Internet and email. While this case concentrated on the on the logistics services sales process through the organizations newly launched Internet platform also the email and telephone connections played an important role – especially in the events of risk realization. The case process is illustrated below.

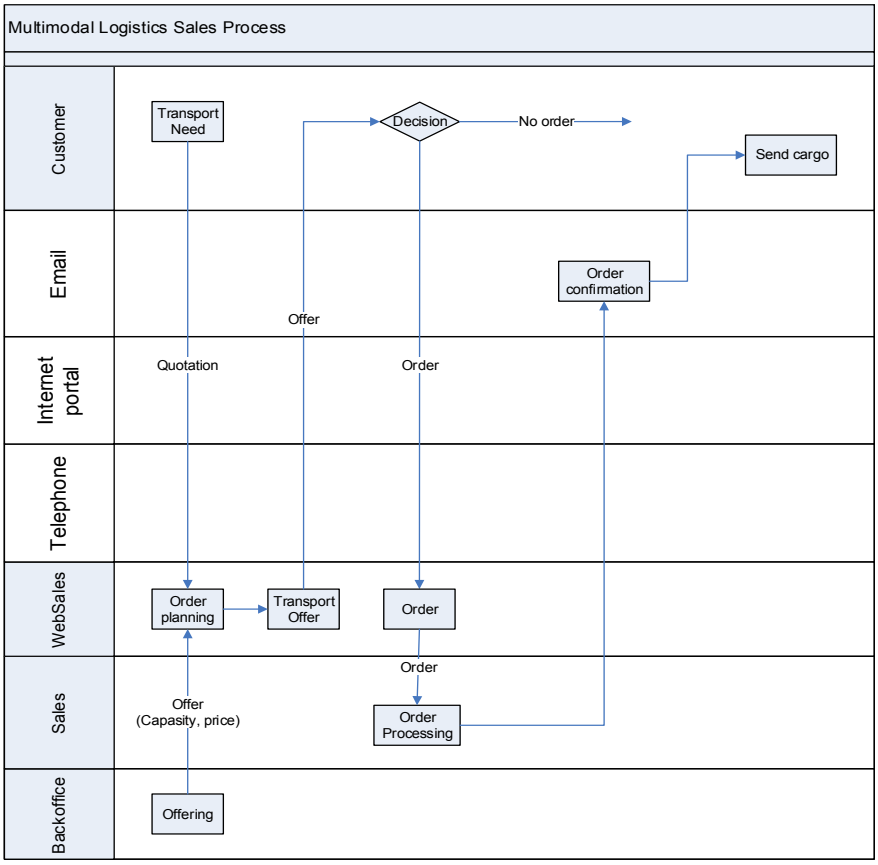

Figure 2 Value chain process

Service value network connections analysis

Based on the survey instrument results, the connections between the actors were analysed in two different occasions. Firstly, a normal value creation scenario was used where the actors evaluated the importance of their connections within the network. The results of the analysis are shown in Table 2. The table role codes are presented in Table 1 previously. The analysis

revealed that the actors had clear differences in how they saw the importance of the network connections. The right hand column of the table illustrate the average result of how the respondents evaluated the importance of their own connections to the network, whereas the last row of the table illustrates the importance evaluated by other actors in the network of the connection to the respondent. For example, considering the role of M NBSS, the connections of his position to the network seem relatively important (6.1 / 18.2% of the six respondents) whereas the other respondents evaluate the connection with the role of M NBSS as clearly less important (3.4 / 5.1 % of the eleven roles)

Table 2 Importance of service value network connections in normal situation

	PC 1	PC 2	PC 3	PC 4	PFM	PM	SM 1	SM 2	KAM	M NBSS	C	AVG	%
PC 1	0	1	9	1	9	3	9	9	9	1	9	6	17.9
PC 3	9	9	0	9	9	3	9	9	3	3	9	7.2	21.5
PC 4	9	3	9	0	9	3	9	0	0	3	3	4.8	14.3
PM	3	3	3	3	1	0	9	9	9	9	3	5.2	15.5
SM 1	9	3	9	3	3	3	0	1	1	1	9	4.2	12.5
M NBSS	9	9	9	9	3	3	9	0	1	0	9	6.1	18.2
AVG	7.8	5.6	7.8	5	6.8	3	9	5.6	4.6	3.4	8.4		
%	11.6	8.4	11.6	7.5	10.1	4.5	13.4	8.4	6.9	5.1	12.5	100	

In the second connection analysis we concentrate on the event of risk realization in the service value network process (see Table 3). Overall the important connections in the network lessen. This can be seen for example in the number of the connections that the respondents considered as highly important. Overall the network structure seems to change to a bit denser form as some of the connections lose their importance. Overall it can be noticed that even though the network connections importance lessens cumulatively, some of the network roles see the importance of the connections growing.

Table 3 Importance of service value network connection in risk events

	PC 1	PC 2	PC 3	PC 4	PFM	PM	SM 1	SM 2	KAM	M NBSS	C	AVG	%
PC 1	0	4	9	4	3	3	3	3	3	4	3	3.9	13.1
PC 3	9	5	0	7	9	2	3	3	3	2	9	5.2	17.5
PC 4	3	3	9	0	9	1	7	0	0	2	3	3.7	12.5
PM	5	5	5	5	1	0	9	9	9	9	3	6	20.2
SM 1	9	3	9	3	2	3	0	1	2	1	9	4.2	14.1
M NBSS	9	9	9	9	9	3	7	0	3	0	9	6.7	22.6
AVG	7	5.8	8.2	5.6	6.6	2.4	5.8	3.2	4	3.6	7.2		
%	11.8	9.6	13.8	9.3	11.1	4.3	9.9	5.4	6.7	6.2	12	100	

To better illustrate the difference between the connections in Table 2 and 3, Table 4 was created. It illustrates well the changes between individual connections. It is important to notice that the table does not distinguish if direction of the change in the importance, but only the change in strength. It can be noticed that for example in the role of PC 1's connections importance lessens for most of the other roles while to PC3 and to PM they remain as equally

important compared to the normal value production. Also the difference of perspective is clearly visible in the differences of role PC 3: Where PC 3 sees the importance of his connections weakening other actors of the network do not report a great difference in their connections to PC 3.

Table 4 Importance of service value network connection in risk events

	PC 1	PC 2	PC 3	PC 4	PFM	PM	SM 1	SM 2	KAM	M NBSS	C	AVG	%
PC 1	0	3	0	3	6	0	6	6	6	3	6	39	43.3
PC 3	0	4	0	2	0	1	6	6	0	1	0	20	22.2
PC 4	6	0	0	0	0	2	2	0	0	1	0	11	12.2
PM	2	2	2	2	0	0	0	0	0	0	0	8	8.9
SM 1	0	0	0	0	1	0	0	0	1	0	0	2	2.2
M NBSS	0	0	0	0	6	0	2	0	2	0	0	10	11.1
AVG	8	9	2	7	13	3	16	12	9	5	6		
%	8.9	10.0	2.2	7.8	14.4	3.3	17.8	13.3	10.0	5.6	6.7	100	

Social Network Analysis

The second part of the connections analysis included the illustrative social network mapping. A visual presentation of the network connections was considered a good way to illustrate the dynamics of the network connections.

Due to the fact that the response rate of the questionnaire data was 60%, we had to carry out some special measures to improve the quality of the results. More precisely, missing data creates a row of missing values in the network adjacency matrix. This is a problem when illustrating the connections between network actors. Many SNA procedures which are derived from graph-theory are treating the missing values as non-ties, which is an incorrect interpretation (Borgatti et al. 2013, p. 73). In SNA methodology there are multiple options to manipulate missing data including deleting those node altogether from analysis, and filling the missing row data from corresponding column when possible. The dichotomizing and symmetrizing of data process was utilized (Borgatti et al. 2013, p. 77).

In this study we are focusing only the most important communication relationships. Therefore, the normal and risk matrixes were first dichotomizing by setting threshold value to 9 (Highly important connection). All the cells that passed the threshold value were set to 1 indicating relationship between actors, while setting the remaining cells to 0 (i.e. no relationship). Next, the both matrixes were symmetrized by utilizing union rule and taking the larger of the two entries. This procedure helps to fill out some of the missing data by assuming that all ties reciprocated and undirected. An illustration how the network connection changes between a risk situation and in a normal situation and in case of a risk event can be seen from the Figure 3. Those actor's nodes who responded to our survey, are indicated by gray colored square, whereas non-responded actor nodes are indicated by red colored triangles. The black and blue lines are the connections in a normal situation, while the blue and red lines are those in a risk situations (connections dynamics are the black and red lines).

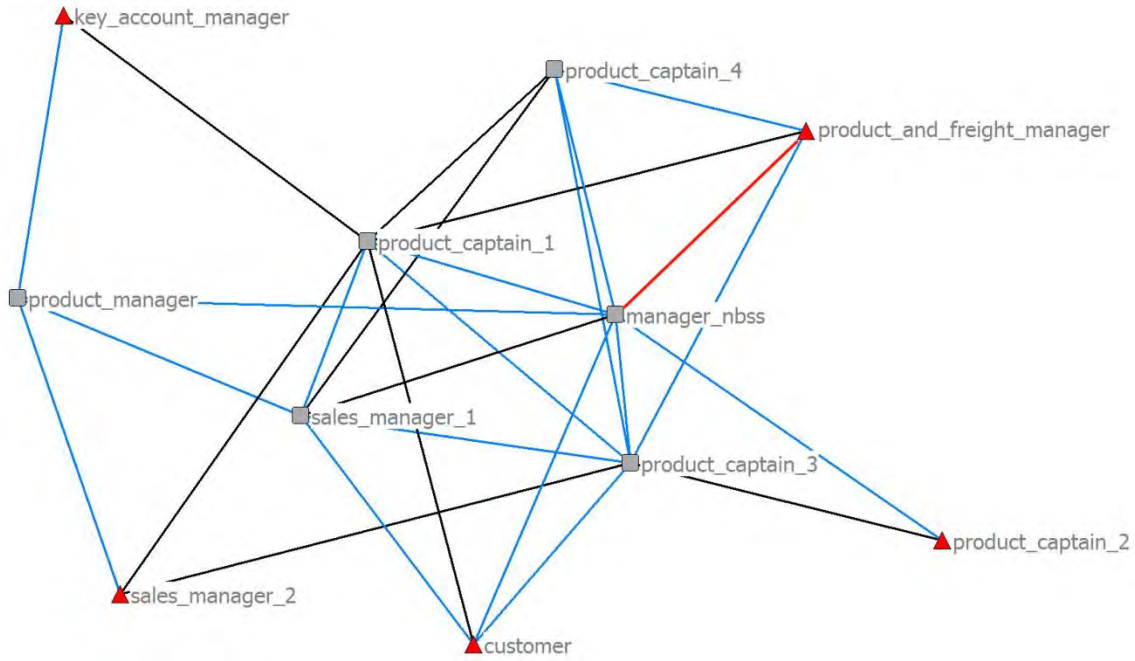

Figure 3 Normal and Risk situation relationships

When normal and risk management networks are compared, it appears that in risk management situations, some of the actors are decreasing their communication relationships whereas some are keeping all their relationships. For example product captain 1 who is a sales director and a member of management team, is reducing his/hers connection from 8 to 3. Instead manager nbss who is a member of extended management team and responsible for customer solutions and systems, is keeping all his/hers relationships (red line in the Figure).

Discussions and conclusions

Service value networks' profitability depends on its actors' collaborative ability to identify and mitigate the risks that they face. The more the complexity of the network increases, the more they require to identify the relevant connections between the roles to ensure an undisrupted flow of value (Mentzer 2001). Although the awareness of supply chain vulnerability and risk management has increased among practitioners during the last decades, many of related concepts are still in their infancy and there is a lack of conceptual frameworks and empirical findings to provide a clear meaning of the phenomenon of supply chain risk management (Jüttner 2005; Manuj & Mentzer 2008). In their studies Harland et al. (2003) came to the conclusion that in the supply chains examined, less than 50% of the risk was visible to the focal company.

In this paper, we analysed the logistics service value network process and the connections of its actors. More precisely, we analysed the logistics sales processes in two scenarios, namely in a normal situation where the service value is being delivered and in an event of risk realization. The main aim of the study was to provide new insights to the logistics services from both the value provision perspective as well as from the value vulnerability perspective in terms of the actor role connectivity. The study has both theoretical and managerial implications which are discussed below.

The theoretical implications

The theoretical implications of this study can be considered threefold. Firstly, the service supply chain management should be understood as a network which both creates and protects the value. While most of the academic studies encompassing service value have so far failed to take into account the inherent vulnerability of the value, this study takes more holistic approach to value production by looking both the production and protection of the value. Because services are by their nature more challenging to manage compared to traditional products the understanding of the vulnerability aspects is essential.

Secondly, our research takes into account network nature of service system and helps to form a comprehensive picture about the links which are essential in different levels in both creating the value and managing the risk against it. Scholars have found social network analysis to be an appropriate way to investigate supply chains (e.g. Borgatti and Li, 2009, Kim et al. 2011), however it is still little used for studying the formation or protection of value in service supply chains. The method seemed to work well for studying the network nature in different levels and thus our study confirms the results of earlier studies and further adds that it works well in studying different scenarios and aspects.

Finally, the results of this study imply that different network members have different opinions about the importance of their connections. As such this confirms the results of previous network analysis research, however, discovering the causalities behind these differences should be further investigated in the future research.

Managerial implications
The results of this study enhance the practitioners' awareness on the nature of connectivity that is needed in the service networks in order to ensure the delivery of value. The results of the study reveal that in a risk situations, the connection priorities change and number of the most important connections is reduced. By taking this into account the service network connections practitioners can improve understanding of what is required to manage the value in the service networks in the most efficient way.

Limitations and future research
This study has obvious limitations due to its case research design. Further research is needed to develop explicit methods for analyzing the causalities behind the phenomenon. The fact that the empirical part of the study relies on the two informants' interviews and that the SNA questionnaire had 60% response rate do oppose some limitations in terms of generalizability and furthermore includes risks in misjudging the representativeness of the case. Future research should be conducted with more complete data in different cases in order to gain more evidence on the phenomenon.

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COMPETITIVE NEUTRALITY AND STATE-OWNED ENTERPRISES: CASE OF E-LOGISTICS IN THAILAND

Dr.Yudh Jayapravitra, Viktória Horváth
Chiang Mai University, Thailand

Introduction

Competitive neutrality is a policy describing that State-Owned Enterprises (SOEs) should not have competitive advantages in business competition over Private Enterprises (PEs). It assumes that SOEs have competitive advantages over PEs because they are market incumbents who continue to enjoy monopolies in their value chains or government subsidies, in compensation for public service obligations (Capobianco and Christiansen, 2011). Competitive neutrality policy involves activities including both ex-ante regulations and ex-post laws to ensure a level playing field for competition between SOEs and PEs (UNCTAD, 2014).
This research aims to falsify the statement that SOEs have competitive advantages over PEs. It seeks the answers to the following research question (RQ): Do SOEs always have competitive advantages over PEs?

Literature review

Competitive neutrality means that SOEs and PEs compete on a level playing field. This is essential to use resources effectively within the economy and thus achieve growth and development. Therefore the principle of competitive neutrality is gaining wide support around the world. The building blocks that governments need to address in order to achieve competitive neutrality, have been identified. They include choosing the best corporate form, achieving a commercial rate of return, accounting for public service obligations, improving debt neutrality, and making public procurement open and transparent (OECD 2012).

Methodology

This research follows the holistic single-case methodology, described in the Case Study Research (Yin, 2009). It studies the case of Thailand Post Distribution (THPD) Co., Ltd., a logistics SOE in Thailand. THPD is a wholly owned subsidiary of Thailand Post (THP), a postal SOE. It offers total logistical solutions including packing, warehousing, delivery and payment services for both private companies and government organizations.
This research collects data about THPD from several sources of evidence, shown in Table 1 and investigates THPD's competitiveness using Porter's Generic Strategies (Porter, 1985) shown in Figure 1

	Data about THPD[3]
1	Documentation related to THPD · Company information[4] · Governing laws and regulations[5]
2	Interview with THPD's top executives · 21-24 July 2015
3	Observation during THPD visit · 21-24 July 2015

Table 1: Data collection

[3] Details are unavailable for public due to non-disclosure agreement.
[4] http://www.thailandpostdistribution.com/
[5] http://www.sepo.go.th/en/2011-09-01-16-43-12/blog.htm

Figure 1: Porter's Generic Strategies (Porter, 1985)

Result

To falsify the statement that SOEs have competitive advantages over PEs, this research analyses data about THP and THPD with a focus on 2 issues including the monopoly power from being market incumbents and the government subsidies in compensation for public service obligations. It finds that even though THP and THPD are both SOEs, they differ in many ways.

While THP has monopoly power from being postal market incumbents and has government subsidies in compensation for public postal service obligations, THPD is not market incumbents, has no monopoly power, and has neither public service obligations nor government subsidies. The differences between THP and THPD are shown in Table 2.

		THP	THPD
1	Monopoly power from being market incumbents?	Yes. THP has monopoly power from being postal market incumbents.	No. THPD is not market incumbents and has no monopoly power.
2	Government subsidies in compensation for public service obligations?	Yes. THP has government subsidies in compensation for public postal service obligations.	No. THPD has neither public service obligations nor government subsidies.

Table 2: Differences between THP and THPD

Because THPD is classified as an SOE by law, it subjects to the same governing laws as other monopoly SOEs. The governing laws have a high level of command and control as they

are designed for monopoly SOEs. It is very difficult for THPD to run its business effectively and efficiently especially in the areas of human resource management, procurement management, financial and asset management.

This research analyses data about THPD using the framework of Porter's Generic Strategies. It finds that, compared to PEs, THPD has not only no competitive advantages (i.e., Cost Leadership, Differentiation, Cost Focus, and Differentiation Focus) but also competitive disadvantages. The competitive analysis of THPD and PEs are shown in Table 3.

Competitive advantages		THPD	PEs
1	Cost Leadership	No	Yes
2	Differentiation	No	Yes
3A	Cost Focus	No	Yes
3B	Differentiation Focus	No	Yes

Table 3: Competitive analysis of THPD and PEs

Furthermore, in the digital era, e-Logistics is expected to enhance the effectiveness and efficiency of logistics enterprises. E-Logistics, shown in Figure 2, is defined to be "the mechanism of automating logistics processes and providing an integrated, end-to-end fulfilment and supply chain management services to the players of logistic processes. Those logistic processes are automatized by e-logistics provide supply chain visibility and can be part of existing e-Commerce or Workflow systems in an enterprise" (Yadav, Zhang, and Chang, 2007).

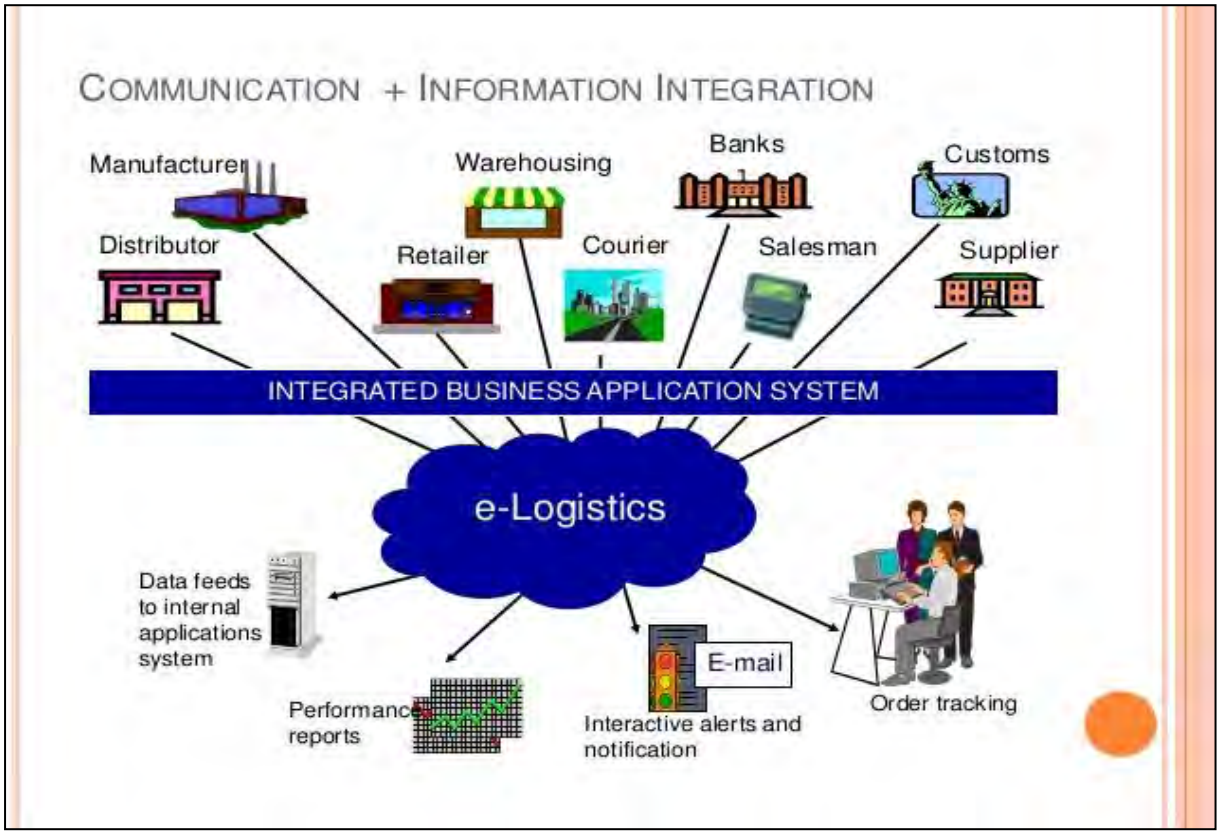

Figure 2: e-Logistics[6]

[6]http://www.slideshare.net/amitupadhye/e-logistics-14978887

While PEs can freely manage to become e-logistics service providers, THPD has difficulties in procuring e-Logistics solutions due to governing laws. Compared to PEs, THPD has greater competitive disadvantages in this specific situation. Therefore, governments should consider the competitive neutrality policy carefully because SOEs do not always have competitive advantages over PEs, especially in the case of subsidiary SOEs such as THPD.

Conclusion

For the first time, this research has investigated the case of THPD and falsified the existing knowledge stating that SOEs have competitive advantages over PEs. It argues that SOEs do not always have competitive advantages over PEs, especially in the case of subsidiary SOEs who are not market incumbents. Moreover, compared to PEs, SOEs may even have competitive disadvantages in some specific situations, such as e-logistics service developments. Existing knowledge and new knowledge about SOE's competitive advantages are compared in Table 4.

Existing knowledge	New knowledge
SOEs have competitive advantages over PEs.	SOEs do not always have competitive advantages over PEs, especially in the case of subsidiary SOEs.

Table 4: SOE's competitive advantages

The new knowledge has strong values and implications for government's market intervention policy in general and the competitive neutrality policy in specific, especially in the digital era.

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COSTCO'S SUCCESS AND IMPACT IN JAPANESE MARKET

Jung-Yim BAEK
Associate Professor, Faculty of Commerce, University of Marketing and Distribution Sciences,
Jung_Yim_Baek@red.umds.ac.jp

Introduction

While the success or failure of foreign entries depends on the appropriateness of the firm's not only post- entry decisions but also the strategic entry choices made at the time of entry (Green et al., 1995), specifically, Gielens and Dekimpe (2001) suggested that the strategic decisions made at the time of entry continue to influence the future performance in foreign markets. There are simultaneously several strategic entry decisions such as scale of entry, mode of entry, order of entry, the adaptation of retail format to local market condition and the familiarity of the store format to the parent company. Given this variability in entry strategic choices, we focus on especially the adaptation of retail format to local market condition.

Foreign retailers are still struggling to develop the competencies needed to compete in the local markets where the retailing industry is maturing and competition is stiffening, to avoid a market share game in increasingly competition-stiffened emerging markets. Actually, few global retailers realize comparable returns in their host maturing markets as in their host emerging markets or in their home market. Some global retailers like Wal-Mart, Carrefour, Tesco lost money in many of their maturing markets like Japan or Germany (Arnold and Fernie, 2000; Fernie and Arnold, 2002; Berggoetz and Laue, 2004; Ghehard and Hann, 2005; Talaulicar, 2009, etc). As most literatures pointed out, global retail companies have differed in their approaches by the rapidity and progress of development in the country's retailing industry, because retail formats has already diversified and competition between similar retail formats has considerably intensified in their maturing markets, compared to their emerging markets constituted by pulling factors for the entry of global retail firms.

However, Costco was the first major entrant, having a success outside their home market with their same strategic decision, regardless of the rapidity and progress of development in the country's retailing industry. We seek to answer in this paper questions such as: Does Costco have their different strategic choices from their emerging market when entering their maturing country? Unless their entry or post-entry strategy is different, how can Costco have a success which is said to be quite harder in their maturing markets than their emerging markets? Specifically, we focus on simultaneously the foreign player's retail mix, resources and the host market's condition and even the impact on host market.

Literature review

The internationalization of retailing is considered an ongoing process (Whitehead, 1992; Dawson, 1994; Vida and Fairhurst, 1998; Alexander and Myers, 2000; Dawson and Mukoyama, 2006), in which retailers have rich opportunities to learn how to expand successfully their operations in foreign markets (Palmer and Quinn, 2005; Palmer, 2006). The selection of foreign market is influenced by the similarity of country characteristics as well as growth opportunities.

Many studies of international retailing are presented around the concepts of "standardization" and "adaptation" (Salmon and Tordjman, 1989; Treadgold, 1990/91; Helfferich *et al*., 1997; Alexander and Myers, 2000). For example, Salmon and Tordjman (1989) generalized two types of internationalization strategies. The first is called "Global

Strategy", with which retailers replicate its core business concept in other countries. The second is called "Multinational Strategy", with which retailers modify their core business concept (or format) to fit local market conditions while keeping the basic elements of its core concept. Treadgold (1990/91, pp.24-25) proposed a concept of "Transnational Strategy" as a type of "Hybrid Strategy (Douglas and Wind, 1987, p.27)." It is similar to the concept of "AdaptStandation" in the field of global marketing (Vrontis, 2003). "Glocal Marketing" is based on those point of views (Svensson, 2002, p.579).

Researchers have different views on the respective merits of standardization and adaptation (Burt and Carralero-Encinas, 2000; Burt and Mavronmmatis, 2006). Some believe that a retailer with unique offerings can expand its business opportunities in new markets in a standardized manner (Salmon and Tordjman, 1989; Treadgold, 1990/91), because standardization is considered to be the easier approach than adaptation. As well, standardization could be achieved without making many efforts or incurring great cost. Others argue that when operating in a standardized manner across national borders, retailers are placed in different social and economic contexts from their home market. That is, by adopting the standardization approach, retailers may not be able to achieve the same level of performance as in their home market due to diverse factors such as consumer preference and retail competition.

Some international retailers adopt a hybrid strategy that combines elements of both standardization and localization so as to maximize the value of offerings. To implement hybrid strategies, global retailers must adopt flexible organizational arrangements that permit the use of country-specific knowledge (Sashi and Karuppur, 2002). Leknes and Carr (2004) have pointed out that there are more subtle distinctions in terms of geographic expansion, entry mode, international integration, and standardization of operations than a simple distinction between global or adaptive retail strategies.

Regardless of the strategies, the performance of a global retailer can be viewed as a continuum of the internationalization process. Performance is often described with either of the two keywords: success and failure, and the choice of strategies lead a global retailer to ascertain the success or failure of its operations in foreign countries.

With regards to failure, much has been written about global retailers' withdrawal from a foreign market, which has been evaluated not always in negative, but often also in positive, terms. Even if a global retailer's withdrawal from a foreign market is described as a failure in adapting to local market conditions, it can still be seen as a lesson that leads to revised strategies for entering a new market. Indeed, when a company's withdrawal from one of its foreign markets is seen as a failure, the lessons learned can benefit the company for setting up future operations in other foreign countries (Palmer and Quinn, 2007). In this sense, failure can also bring about a positive contribution to the internationalization process. At least, the experience of a retailer's withdrawal can be an important step leading to development of new internationalization strategies (Alexander and Quinn, 2002; Palmer, 2004; Jackson et al., 2004; Toba, 2006, etc.)

Methodology

While many Japanese domestic retailers were watching Carrefour closely, none of them paid enough attention to the entry of Costco as a serious contender. Costco, the largest company in the wholesale membership club sector in the world, entered Japan at almost the same time as Carrefour, but has been making steady inroad, with a markedly different business model from not only that of other foreign retailers but also those of the domestic food and general merchandise retailers. This raises an important research question: how has Costco been able to win the Japanese consumers with a business model unfamiliar to them, whose shopping

behaviours were said to be difficult, if not possible, to be changed. Through a case study of Costco Japan, this paper aims to promote our understanding of how foreign retailers influence local consumers in a mature market with differentiated business models. In particular, we focus on Costco's operational methods in a mature foreign market and its appeal to well-educated and well-informed consumers.

Our study suggests that there are different types of localization strategies for a global retail company when operating in a foreign market. Information and data used in this study are obtained from both secondary and primary sources. Secondary sources include the Costco annual reports and reputable Japanese-language newspapers and business journals.

Food retailing in Japan

Food retailing in Japan is much more developed and more resistant to foreign competition. Carrefour, Costco, Wal-Mart and Tesco all attempted to introduce changes to the Japanese food market. Carrefour brought its hypermarket format to Japan in 2000, but from the Japanese consumers' viewpoint, it was not much different from the Japanese general merchandise stores. In fact, the domestic food retailers were so advanced that they made it difficult for the Western retailers to penetrate the Japanese food market. It is no exaggeration to say that domestic retailers have been dominating the Japanese food market. Not being able to achieve expected results, Carrefour had to exit Japan in 2005.

The Japanese domestic retailers have more sophisticated handling technology and know-how of "three perishable foods" such as fishes, fruits & vegetables, and meat, compared with the Western retailers, because they have to satisfy the needs of Japanese consumers who are sensitive to the "freshness". Wal-Mart realized through Carrefour's being in trouble that the procurement capabilities and reinforcement of handling know-how in three perishable foods would be keys to the success in the Japanese food market. At that time, Seiyu which is one of the largest retail chain stores, developed "Muji" as their private label in 1980 was finding some advantageous business partners, since the financial situation at its entire group has worsened. Wal-Mart judged that Seiyu which has been operating the Japanese traditional retail format, general merchandise stores for a long time understand better the Japanese retail environment and customer and has more highly handling know-how of perishable foods. In 2002, Wal-Mart acquired a 6.1% stake in Seiyu, and after, in 2005, they acquired a majority interest, making Seiyu a Wal-Mart subsidiary. Wal-Mart proceeded with additional steps to acquire all of the remaining shares, and in 2009, Seiyu became a wholly-owned subsidiary of Wal-Mart. Japan is the seventh entering country in Wal-Mart which operates in 26 countries around the world outside home country (http://corporate.walmart.com/our-story/our-business/international/walmart-japan,29 October, 2014).

Although even domestic retail companies operating general merchandise stores at the mature stage are forced to have a hard fight for market positioning competition, Wal-Mart Japan is striving to enhance store operations and product procurement capabilities fully leveraging the global networks in order to acquire the competitive advantage.

In recent years, domestic retailers have a tendency to reduce their business size, whereas Wal-Mart expands their business scales. Tesco as one of the world's largest retailers in 12 countries, in 2014, entered Japanese market in 2003 through the acquisition of 75 discount supermarkets in Japan from Tsuru Kame Land. They continued to acquire small-sized of discount stores in 2004 from Frec's and in 2005 from Super Tanekin. After that, Tesco Japan was operating a small-sized retail format of Tesco Express at the difference from some other Asian countries but could not acquire their market positioning between supermarkets and convenience stores until the last. Although Tesco wanted to provide the Japanese consumers who go shopping frequently with more highly valuable shopping experiences, finally they announced their decision to sell their business in Japan in 2011.

However, Tesco Japan could not find any players to buy their business for around one year since the announcement of withdrawal, because most Japanese players could not feel the attractiveness about the small-sized stores of Tesco Express. Later that year, Aeon, domestic retailer in Japan became a new buyer of Tesco Express.

The Costco Business Model in Japan

The first Costco store in Japan opened in 1999 as a key tenant of a large shopping centre in Fukuoka (Hisayama). More openings followed in subsequent years. As of June 27, 2014, Costco operates 20 stores across Japan. From the beginning, Costco Japan attracted the attention of a large number of Japanese consumers, with more than 260, 000 member sign-ups in its first year (including free memberships). This initial success occurred despite the fact that its business concept and operating system were ridiculed in the media and condemned by academia.

Indeed, Costco was facing a big challenge at the time of its entry in the Japanese market. Its operation was based on a business concept that had already disappeared in Japan. Basically, the business concept was characterized with transactions in the form of "Cash and Carry", limited to paid members. This was the same concept that the domestic Daiei Group used to operate its Kou's stores. The Daiei wholesale club called "Kou's"as the first membership club had opened their first store in Habor Land, Kobe, in 1992. After the big earthquake in Osaka-Kobe in 1995, that store moved to Port Island as an artificial island of Kobe, but closed in 2002, when the financial situation at its entire group has worsened (*Nihon Keizai Newspaer*, 24 April, 2009).

The core elements of the concept were to offer their members low prices similar to retailers' buying ones on a limited selection of brands (about 5,000 SKUs) but in a wide range of merchandise categories, and to eventually achieve high sale volumes such as one case of apples (about 10 kg). Daiei hoped to achieve high operation efficiencies in their Kou's stores through high volume sales and low-cost handling of merchandise in a no-frills and self-service warehouse environment, allowing the Kou's stores to make a profit despite lower gross margins. Kou's had a markedly different business model from that of GMS (general merchandise stores) of their main retail format in the number of items and employees, display and selling way and so on. For example, Kou's had only 5,000 items compared to GMS with 45,000 items and made the number of employees around a one-third of GMS (*Nikkei Marketing Journal*, 20 October, 1992). Also, Kou's simplified a work procedure by using the forklift in the product display way so that even a part-time job and a part timer having low skill could easily perform that work. Kou's strived to enhance their store operations and product procurement capabilities in order to provide customers with products 40 % more cheaply on the average than a manufacturer's recommended price. This was supported by goods purchases without returns in difference from other

As stated above, the Kou's format was quite specific one for the Japanese consumers for several reasons. First, the Japanese consumers were not used to purchasing daily goods and food stuff in large packages. Second, the other important characteristic of Kou's business concept was to provide a continuing source of membership fee revenue, and to reinforce member loyalty. Kou's had two primary types of members such as Business and Individual, and members could utilize their membership at any Kou's six store locations like Costco. Both members pay an annual membership fee of \3,000 (approximately US$ 29.6) each, but have to pay more \500 (approximately US$4.9) as card cost for the first time, which includes one additional card used by family members.

Kou's tried to overcome the way not being familiar with the Japanese by suggesting the new consumption- style to buy the large packages with much lower prices at a time in four

people, because it could be accompanied to three people in one member (*Nikkei Industry Newspaper*, 02 November, 1992). At the beginning of their doing business, it seemed as having succeeded because it became a topic in the media including the achievement of more sales and memberships than expectation. For example, the number of members was 38,000 people, and 5 months later, the membership increased 3 times (*Nikkei Marketing Journal*, 13 March, 1993). Also, they were striving to enhance their product procurement capabilities in order to provide customers with goods 40% more cheaply on the average than a manufacturer's recommended price. Actually, they introduced the way of goods purchases without returns from most manufacturers directly for only their wholesale club distinguished from other formats which Daiei group was operating (*Nikkei Marketing Journal*, 13 March, 1993). Even if the number of memberships continued to increase in 1997, they opened their price information and published the ticket of entry for non-members through their homepage (*Nikkei Marketing Journal*, 22 January, 1998). Daiei group kept off opening new stores due to their managerial deterioration, but they decided to actively open new stores of membership wholesale club because only some Kou's stores showed a 40% increase in the sales of as compared with that of last year (*Nikkei Newspaper*, 27 July, 1998). And also they tried to carry on the renewal of existing stores and on the adoption of selling their goods not only by cartons or in cases but also by each item, and of looking around the entire store by shortening the racks (*Nikkei Marketing Journal*, 28 July, 1998).

The membership fee must be the most fundamental and important factor in membership wholesale club, the total number of members was more 300 thousand in the second half of 1998. Kou's kept with the policy of member satisfaction and was earning \900 million (approximately US$8.9 million) every year by taking membership fee and that policy made Kou's low cost operation passible (*Nikkei Newspaper*, 16 November, 1998). At that time, the depression by deflation made the membership wholesale club of the lowest price policy root in the Japanese market, but at the same time, badly hit Daiei group as a whole. They decided to separate the department of membership wholesale club and to found Daiei Wholesale Corporation for a full-dress expansion in 1999 (*Nikkei Marketing Journal*, 19 November, 1998).

Due to their changing membership policy, shoppers did not need to pay a membership fee any more from September, 2001 and it was changed to discount 5% off on all bills for existent members. Kou's which had been in the red since 1996 because of depression and reducing of members could not avoid changing their membership policy. However, Kou's changing membership policy was considered the abandonment of warehouse business and produced bad results for them. Even though membership fee and member service must be the most fundamental and important factor in membership wholesale club, Kou's did not keep with the policy of member satisfaction.

They tried to embark on the reconstruction of the entire group through the discount store sector such as Kou's, but in last, Kou's shut down their six stores in August, 2002. The Daiei, Inc. used to be the largest retailer in Japan their total sales declined by nearly a quarter in the five years leading up to 2003, and was under the process of debt restructuring and support given by financial institutions in 2005. While Costco Japan follows the same concept, its business model is considerably different. According to the President of Costco Japan, Kou's is not really a wholesale club; the only element that is common to both retailers is the membership requirement, designed to both reinforce customer loyalty and provide a continuing source of revenue from membership dues. The differences between Costco and Kou's are summarized in Table1.

Element	Costco	Kou's
Store format	Warehouse-style, cash & carry, membership wholesale club: offering two types of membership such as business and individual being possible to use at any locations in the world	Likely similar to Costco
Product offering	Limited brands with wide assortments of merchandize; high proportion of merchandise are imports	5,000 SKU's compared to Costco with 3,500 to 4,000 SKU's
Pricing	Discount: everyday-low-price	40% more cheaply on the average than a manufacturer's recommended price
Selling method	Large/bulk package	High volume sales, low-cost handling of merchandise selling their goods not only by cartons or in cases but also by each item
Store configuration	Using high racks and industry-standard palettes for product display and stock	Product display by using the forklift, looking around the entire store by shortening the racks, using more boxes and carts sitting on the floor, instead of tall racks and the industry-standard palettes like Costco
In-store amenities	Food court, pharmacy, optician, print of a photograph, tire change (only for members)	Food court (non-member is available), optician, vending machine for CD
Store location	Suburban	Likely similar to Costco
Marketing	In-store promotion; free tasting/testing; no printed fliers	Likely similar to Costco
Customer service	Easy refund (including refund of the unused portion of the membership), no extra charge for membership card	Locker, telephone call to the person in charge in the sales floor

Table 1: Elements of the Costco Business Model, in comparison with Kou's

Costco is the first membership warehouse club in the world that provides its members the best possible prices on brand-name products. Its operating system is to keep costs low and pass the savings on to its members. Membership card is accepted at any Costco store in the world. It offers two primary types of members: Business, and Gold Star (individual). Businesses (including individuals with a business license, retail license, or other evidence of business existence) may become Business members. Business members pay an annual fee of \3,765 (approximately US$37) for the primary card plus one household card. Additional

cards are available for an annual fee of \2,625 (approximately US$26) each, up to six employees. Many business members also shop at Costco for their personal and family needs. Gold Star membership is available to individuals who do not qualify for a Business membership, for an annual fee of \4,200 (approximately US$40), which includes one additional card used by family members.

Costco offers its members low prices on a limited selection of national-brand and private-label products in a wide range of categories. At Costco, the range of merchandise is limited be 3,500 and 4,000 SKUs, as opposed to 45,000 or more SKUs at GMS leading to the Japanese retail industry. Costco seeks to limit specific items in each product line because merchandise is stored on racks above the sales floor or displayed on palettes containing large quantities of each item. Costco is much more efficient in merchandise handling and inventory control. It buys the majority of its merchandise directly from manufacturers and routes the merchandise to a cross-docking consolidation "depot" or directly to its warehouse stores. With industry-standard pallets, deliver of goods from manufacturers to warehouses and stocking of merchandise in stores become much more efficient and economical. Rapid inventory turnover, when combined with the operating efficiencies achieved by volume sales, efficient distribution, and reduced handling of merchandise in no-frills, self-service warehouse stores, enables Costco to be profitable, despite with significantly lower gross margins than traditional supermarkets and supercentres.

The Costco stores enhance their attractiveness by carrying imported goods of international brands, including such well-known apparels as Tommy Hilfiger, Polo, and Lacoste. Imported goods account for one third of all merchandises that go through Costco's distribution centre in Japan (*Toyokeizai Weekly Magazine*, Feb. 10, 2001). Its premium private label products, Kirkland Signature, are also sold in its Japanese stores at prices lower than comparable domestic products, and are well liked by Japanese consumers. It is reported that many seniors are very pleased when their children bring to them imported goods purchased at Costco as presents.

Even the ordinary food court at the Costco store is a popular attraction. Japanese consumers have a tendency to enjoy leisure time with family. On a shopping trip to Costco, children and adults often spend a good amount of time in the food court. To many Japanese consumers, shopping at Costco is an exciting event.

Costco is good at listening to customers' suggestions and adjusting its selling methods accordingly. Many Japanese customers bring their friends and relatives to Costco, who do not have a membership card, and share the bulk purchases with them. For one example, Costco changed its 2.4 kg- package of "Sakura Chicken" from two 1.2 kg component packs to four 0.6 kg packs, to make sharing easier. After passing a cash register, shoppers share their bulk purchases with each other in the food court or parking lot (*Trendy*, April, 2011, p.38).

In order to sell new products to the conservative Japanese consumers, Costco needs to do active and aggressive in-store promotions to "educate" the shoppers. Japanese consumers are typically shy to try a product in a retail store, because they feel that they would be obligated to purchase the product after a free trial. Costco hired a local marketing firm, known as Club Demonstration Services, to do in-store promotions, offering "two free bites" to each customer. This made consumers feel comfortable to try out the new products. Consequently, long lines began to form in front of the sampling tables. The best-selling item called "Bulgogi Beef Yakiniku (Korean grilled beef)" has resulted from active in-store promotion.

It puzzles many observers that the Japanese consumers do not reject Costco's selling method, which has been used by almost all foreign discount retailers that have operated in

Japan. The foreign retailers either ended up with modifying their selling method to be similar to the Japanese methods, or withdrew from Japan. When Dairy Farm, a large discount retailer from Hong Kong, brought the same selling method to the Japanese market, many researchers warmed that it would not align with the Japanese shopping behaviour. Indeed, it was not long before Dairy Farm withdrew from Japan.

The Impacts of Costco on Japanese Producers, Retailers, Developers, and Consumers

Costco continues to open stores in Japan since its entry 15 years ago. In 2013 alone, it opened five stores. So far, it has not closed any stores, as did Carrefour and Wal-Mart. Besides, it continues to enjoy a high membership renewal rate, currently at 87%. These should be taken as evidence of its success in Japan. Its impacts extend to manufacturers, suppliers, retailers, developers, and consumers alike.

Despite that one third of its merchandize offers are imports, Costco sources large quantities of goods from domestic producers and suppliers. That means that some Japanese manufacturers are using Costco as a platform for their market expansion. For one example, the company named Japan Green Tea Co. Ltd., which imports “Crazy Salt” as a popular product for Costco Japan, always sells its new products for the first time in the Costco stores. It is reported that about 60% of Japan Green Co. Ltd’s new products are sold the rate of sales through (*Trendy*, June, 2013, p.109).

Costco often acts as a complement, instead of rivals, to the established Japanese retailers, and develops a cooperative relationship with local developers. “Power Mall Maebashiminami” is a huge shopping centre developed by the Beisia group in Maebashi-minami, Gunma, opened in December, 2010. Both Costco and a large Beisia supermarket co-tenant the shopping center (*Trendy*, June, 2013, pp.110-111) . Mitsui Real Estate Development, which developed the surroundings of JR Shinmisato Station, also chose Costco to cotenant with Ito Yokado’s general merchandise store the Lalaport Shimisato shopping center (*Nikkei Business*, Aug/Sep. 16, 2010, p.27).

Costco even works with shopping agents to reach far-away consumers. The shopping agents provide shopping services to consumers whose community does not have a Costco Club yet. For example, the shopping agent service, Town Tsukimino, buys some goods from Costco (but in damaged cartons) and retails them to consumers in single items. “costcost21” is an online agent that buys goods from Costco and re-sells them with a 30 percent markup (*Trendy*, April. 2009, p.29; June, 2013, p.113, http://costcost21.jp, the date of access, June 30, 2014). “Resell Town”, another shopping agent service, provides free delivery service. Some Japanese consumers purchase small amount of goods from the shopping agents for testing a product before going to Costco to buy in large packages. Even if the prices at the agent services are usually higher than at a Costco store, it is not that expensive if one considers the other components of the total shopping cost, such as transportation cost and travel time.

With the variety of new products introduced by Costco, particularly the imported products, many Japanese consumers developed new recipes. The spread of these recipes online and the desire to try these recipes induce more consumers to purchase ingredients from Costco.

Result and conclusion

According to Nikkei Business, the smart and careful Japanese consumers are undergoing self-change (*Nikkei Business*, April 6, 2009, p.86). The smart and careful consumers in a mature retail market have invented recipes for using the specific products and services

offered by Costco more efficiently. Also, they have even called for some purchasers to act assist with the joint procurement on the internet, because they could not afford to accept the policy of the bulk purchase of the same merchandise in Costco. As a result, Costco does not have to change the core business concept except for minor adjustment, but it could succeed by stimulating consumers to change their own purchasing behaviour.

In addition, the change of social environment has enabled the success of Costco in Japan. The Japanese consumers cannot any longer spend as much time to go out shopping as it used to be. The rise of women in the workforce has required them to choose a store where all necessary items are available instead of having to shop multiple times for different items. It is also due to this trend that Everyday Low Price had a chance to spread in Japan recently. High-Low Price was preferred in Japan previously, and so shoppers used to go around to several stores in order to get the cheapest item. At this time, Costco appeared to the Japanese consumers who had many difficulties in their retail environment and was equal to the challenge of satisfying consumer needs and adapted themselves to the change in social consciousness.

We could also examine that foreign retailers should be focused on their own differentiated advantage in order to success in mature market such as Japan, because they have to compete with local retailers in maturity-stage general merchandise store market, and to satisfy with more informed consumers. Product differentiation from local retailers gave Costco a competitive edge. When local retailers as well as foreign retailers attached importance to “core competence”, a smart and careful consumer would be stimulated to enjoy higher satisfaction.

But the theoretical significance of the interaction with more informed consumers has led some to wonder if the data requires further analysis for showing the factors contributing to success of a foreign retail company in a mature market. Further, it would be possible to compare internationally with other Asian countries where Costco has seen success also such as in Korea and Taiwan.

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CREATING A LOGISTICAL-MEGA-GATEWAY: THE EMIRATE OF DUBAI POTENTIALS

Dr. Syd Gilani[1]
Director of Strategy & Excellence, Dubai Maritime City Authority, Government of Dubai, Dubai, United Arab Emirates

Shahrin Osman[2]
Regional Manager of Maritime Advisory, DNV GL Maritime (Middle East & India Sub-continent)
Dubai, United Arab Emirates

1. Introduction - Logistic Hubs and Gateways

Notteboom and Rodrigue (2008) describe gateways and hubs as "similar elements of the spatial structure of flows". Gateways and hubs manage flows of information, cargo and people on an international, world-wide level. Numerous manufacturers and logistics companies that seek new facilities are starting to notice the importance and presence of logistics freight corridors and hubs (Luttrell, 2015). The increasing importance of supply chain and logistics is the main reason behind this trend.

1.1 Hubs

The Euro-Platforms group (2015) defines a logistics hub as "a centre or specific area designated to deal with activities related to transportation, organisation, separation, coordination and distribution of goods for national and international transit, on a commercial basis by various operators". The buildings and facilities may be owned, leased or rented by the operators. Examples of facilities provided by a logistics hub are trucking and shipping services, offices, distribution centres and warehouses (The Gleaner Report, 2015). Rodrigue, Comtois and Slack (2013) refer to the logistics hub as a main place used for many purposes, ranging from shipping and distributing products to a specific geographic location for receiving, collecting, and organising products within the hub. This idea of a logistics hub originated from "Hub and Spoke" which is an air transport phrase used to describe one place for collection and distribution of both air passengers and freight. Also, manufacturing and warehouse distribution projects often choose to operate out of logistics hubs because according to Luttrell (2015), they are quite often "Metropolitan Statistical Areas (MSAs) that are strategically connected by various popular freight corridors". Luttrell (2015) also emphasises that logistics hubs are strategically located in proximity to important consumer markets or to freight corridors that are near to these consumer markets. Some may be situated in between markets, or they may be ports or cities that transformed from home to land-based rail and interstate interchanges. According to Luttrell (2015), inland hubs connected to port hubs also act as inland ports. When sea ports develop and increase in size and volume, the area becomes congested (Luttrell, 2015). To avoid overcrowding, incoming cargo from abroad is transferred immediately from ship to barge, rail or truck and then sent to a processing and distribution facility in the hinterland. LaSalle (2014) confirms that these hinterland logistics hubs enable sea cargo to get through the port terminal in a shorter period of time and at a lower cost. These hinterland ports are also equally efficient and cost effective if used as processing points for exporting cargo overseas.

1.2 Gateways

Gateways, on the other hand, are locations that enable ease of access to an entire huge group of flowing passengers and cargo (InterVistas as cited by the Southern Ontario Gateway Council Strategic Plan, 2006). Teo (2001) defines a gateway as "a pivotal point for the entrance and the exit in a region, a country, or a continent and often requires intermodal transfers." A gateway consists of a point of transit, a destination, and an origin, controlling what enters and exits its catchment area (Rodrigue, 2007). A hub is the transport system's central location with many inbound and outbound connections of the same mode. Rodrigue (2007) explains that a gateway often shifts and changes from one mode to another mode, like from land to maritime. Gateways are situated in important locations with benefits such as

proximity to a port, the joining of rivers, inter-state highways and have resulted in a lot of transport infrastructure, like terminals, being built (Senguttuvan, 2006). Rodrigue (2007) explains that a hub tends to be more transmodal, moving within a mode, whereas a gateway performs an intermodal function, moving in between modes. Gateways are linked with manufacturing and production facilities in the hinterland via transport corridors. Maritime gateways, as described by Notteboom and Rodrigue (2008), are “large terminals with high capacity inland connections (rail and road)". Satellite terminals or inland ports are increasing all over the world, especially in Europe, as a response to overcrowding and not having enough room next to maritime terminals to carry out logistics facilities (Notteboom and Rodrigue, 2008).

2. Logistics Gateways Attributes: Components

2.1 Port/Gateway System

To be considered efficient and to contribute effectively to overall gateway performance, a gateway port must have certain characteristics such as: strategic location, efficiency, adequate infrastructure, connectivity and a wide range of port services (Tongzon and Oum, 2007).

2.1.1 Strategic Location and Efficiency

For a port to be classified as being strategically located, it should fulfil three criteria: it should be located on main maritime routes with close proximity to production and consumption centres, it should have a natural deep water harbour or breakwater, and it should have a favourable climate. Hong Kong and Singapore, the two top-ranked ports world-wide, are prime examples of this. Tongzon and Oum (2007) assert that while having a strategic location is vital for being considered ‘gate-worthy’, many top ports have also concentrated on other competitive factors such as efficiency in differentiating themselves from the competition. For ports, this primarily means the speed and reliability of port services. Another determinant is adequate infrastructure. In addition, Rodrigue and Notteboom (2010) emphasise the importance of another factor that affects governance within the port system: land availability and ownership.

2.1.2 Multi-modal connectivity

Time is crucial in logistical gateways. This requires the gateway port to have overall connectivity to other ports as well as different modes of transportation because containers sitting idle are costly and counter competitive in terms of transit time (Martin, 2004). Fast travel time between feeder and mother vessels and increasing the frequency of ship visits which allows freight forwarders greater choice in transportation of their cargo and therefore allows them to benefit from competitive costs, greater flexibility and lower transit time (Frazelle, 2004).

2.1.3 Infrastructure and Terminals

Even though gateways are vital for the land and maritime interface, functional regionalism is shaped by physical infrastructures known as terminals. While gateway systems are mostly similar, differentiation occurs in their respective hinterlands. To illustrate this, Rodrigue and Notteboom (2010) highlight the example of Europe which would require much more inland terminals to handle the same amount of volume as in America. Finally, the last key characteristic of a gateway port is the multitude of port services it offers to attract additional vessels to call the port. Tongzon and Oum (2007) suggest that a gateway port should provide integrated services such as bunkering, pilotage, warehousing, cold storage and other value-adding services to be considered a logistically efficient distribution system.

2.2 Customs and Supply Chain Management

Another hallmark of a logistical-mega-gateway is large custom free zone areas that facilitate value chain activities to be performed without incurring constraints on import duty

specifications. Value chains reflect the specific economic processes of the market. In logistical gateways, Rodrigue and Notteboom (2010) draw attention to a frequently-arising question which is: how and where do value-added functions take place along the supply chain? Customisation is an aspect which has added value to the chain through labelling, repackaging, localised manuals, etc. The more varied the cultures within a country or region, the greater becomes the need for further customisation which affects distribution efficiency (Rodrigue and Notteboom, 2010). Classical distribution structures have also been replaced with more fluid and flexible logistical structures that are actively linked with inland ports such as cross-docking and merge-in-transit.

2.3 Labour Mobility

Labour flexibility and mobility play a major role in logistical activities. Both of these factors vary according to region, and this variance is caused by items related to labour law such as recruiting and dismissing employees, flexibility of work timings and the requirements of workers' associations. Labour costs remain a sizable component of freight distribution costs, with the majority being attributed to container terminal operating costs as well as trucking. Due to these factors, Rodrigue and Notteboom (2010) conclude that there has been an increase in requirements of the educational system in these regions because companies place greater emphasis on improving logistics training and education. Equal emphasis is placed on evaluating workers' performance and productivity, measuring labour performance and efficiency, and improving logistics-related training and education.

2.4 Hinterland

Hinterlands are an important aspect of the port and maritime shipping industries, with its density and extent shaping inland freight distribution and inland port operations. The main hinterland defines a region where the terminal dominates the share of the flows. It has been suggested by Notteboom and Rodrigue (2007) that the rule has been that inbound hinterland traffic is consumption-based while outbound hinterland traffic consists of outcomes of production either as finished products, semi-finished products, or raw materials. To secure and maintain the position of a logistical-mega-gateway, there are additional factors that must be taken into consideration such as costs, quality, marketing, and transport time (Gordon, Lee and Lucas Jr., 2005). Another key characteristic of a gateway is pre-emptive investments in infrastructure based on forecasted future capacity requirements. Common services, such as finance, insurance and administrative services would also need to be provided in a business friendly atmosphere in order to attract manufacturing-related activities that require efficient and cost effective movement of goods (Gordon, Lee and Lucas Jr., 2005). Another recent trend associated with mega-gateways has been the development of e-commerce and e-services tools provided or coordinated by the government which is a critical enabling tool for the logistics industry worldwide, allowing gateways to serve as information networks while facilitating trade in the region (Lee and Yang, 2003).

3. Logistics Gateways Attributes: Proponents

3.1 Shipping Services

A gateway is the link between the regional or local market and the international market. One way this is accomplished is through the use of shipping services, such as containerships and the like, which provide direct access to and from a multitude of international markets. Excellent connectivity, a wide choice of carriers, quick access to global markets by having direct service and a high shipping frequency are all factors that encourage efficiency and offer a multitude of options by encouraging competition within shipping services (Pettit and Beresford, 2009).

3.2 Logistics Infrastructure

After cargo has been received at the point of entry, regardless of the mode of transport, logistics plays the deciding role in how efficiently and effectively it will reach the end customer. This is done through various services. The higher the number of services, the more efficient the transportation of the goods, provided that the cost of procuring or rendering these

services will be competitive for the importers and exporters (Lambert, Stock and Ellram, 1998). The availability of multi-modal services with local, regional and global distribution centres complements the overall logistics infrastructure while providing comprehensive logistics and transportation options catering to the mega-gateway location. This results in overall cost-effective solutions to facilitate the large movement of cargoes coming in and moving out of the gateway.

3.3 Size and Type of Industry Operating in the Hinterland

For a mega-gateway to form, there has to be ample demand for the movement of cargoes in both directions, both imports and exports. This significant volume of demand is usually generated by the manufacturing related industry, with their need for raw materials which they may have to import as input for the manufacturing activities and thereafter generating semi-finished or finished products mainly for export, with potentially few products supplied in the local market (Helms, 2015). There are a variety of sectors within the manufacturing industry that contribute to this demand namely the automotive, electronic, garments, furniture, industrial goods and petrochemical industries. How much each sector contributes to the total demand will vary across different regions and countries. Both import and export activities are key requirements of logistical-mega-gateway activities.

4. Methodology

In this study, the explorative research approach is used where differences between a Hub and a Gateway are highlighted. In addition, the common-base attributes, components and proponents of Logistical Gateways are identified and applied to analyse the Emirate of Dubai's potential as a Maritime Logistical-Gateway. This research approach is chosen because of the versatility and wide-ranged approach it offers to the preliminary investigation. The exploratory research approach used in this study draws upon the already widely available secondary data sources, both from electronic and non-electronic means.

5. Analysis & Findings

5.1 Dubai as a Transhipment and International Logistics Hub

Dubai is internationally recognised for its extremely high standards of logistics facilities. Due to its strategic location and historically being a transit route between Asia, Africa and Europe, Dubai has grown to be where the East meets the West. India and China, as well as other thriving markets of the BRICS nations, have further strengthened Dubai's position as a strategic place for logistics and distribution worldwide. Thanks to its affordable logistics charges and number-one-rated outstanding infrastructure, Dubai has enjoyed massive foreign investment. It is these qualities that make Dubai ideal for companies in the logistics sector whether the need be to set up a company in Dubai or to open a branch of their company in this region (Business Benchmark Middle East, 2014). As such, Dubai is both regionally and globally seen as a major multimodal transportation and logistics hub.

Dubai's assets as a logistics hub include a liberal and advanced government, top-notch infrastructure, and strategic location. The World Bank Logistics Performance Index (2012) ranked Dubai's overall logistics as 17th worldwide in 2012. A recent survey undertaken by the Menon Business Economics Group (2015) ranked Dubai as the 5th place globally with respect to ports and logistics. In 2011, Dubai Port was ranked third place worldwide in terms of capacity and world-class services provided. Additionally, Dubai comes in third place in size for re-export hubs. In fact, from 2010 to 2011, Dubai's exports and re-exports grew by 21 percent to AED 431 billion or US$ 117 billion (HULT Consulting Club, 2015). Frost and Sullivan (2014) forecasted that by 2014 the UAE logistics market will have contributed AED 34.5 billion (US$ 9.4 billion). Due to increased manufacturing locally and increased volumes of import and export, it is predicted that Dubai's logistics market will increase to AED 99 billion (US$ 27 billion) by 2015 (Manda, 2014). Income derived from logistic services for the agricultural sector, import-export trading, domestic manufacturing, and services accounted for US$ 23.4 billion in 2013 (Manda, 2014). Out of the UAE gross domestic product (GDP) in 2013, six percent was contributed by the logistics sector (Manda, 2014).

5.2 Dubai: Potentials as a Competitive International Maritime Logistical-Mega-Gateway

Having evaluated the components and proponents of a logistical-mega-gateway, the next logical step is to analyse Dubai and where it stands currently in this regard. Dubai's Jebel Ali Port is unique because it is not located close to any of the main maritime routes but it has established itself as the logistical hub of the region, positioning itself as the major hub port between Rotterdam in Europe and Singapore in Asia. It also offers a multitude of port services, another key factor to being considered as a gateway port. However, to attract more shipping services, Jebel Ali port needs to continue investing in other value-added port activities such as LNG bunkering while ensuring seamless integration of multi-modal activities with the development of Etihad Rail, the UAE railway project currently under development.

Another critical factor in the development of a logistical-mega-gateway is land availability and ownership. For economic development to take place, an incentive would be to lower land to lesser than that of its intrinsic value (Southern Ontario Gateway Council Strategic Plan, 2006). One way to achieve this is by the establishment of special economic zones or industrial zones with efficient logistics interfaces within the port. In general, Dubai has excelled in developing business free zones that are present in the Emirates such as JAFZA, DAFZA, DWC, DMCC, DIFC, and JLT which offer cost effective business solutions and enabling measures such as the reduction or waiving of import duties and customs or corporate taxes.

As Jebel Ali Port is a logistical and transhipment hub, it has a variety of large shipping lines calling at it on a daily basis. Thus, another feature of a gateway is the port's ability to connect to multiple shipping services in order to provide importers and exporters with a multitude of shipping options. Furthermore, port efficiency is considered as the most important factor in categorising a port as gateway worthy. This can be seen in the infrastructure of Jebel Ali Port, one of most up-to-date ports in the area and completely prepared to cater to the requirements of current and upcoming demands by investing in new capacities ahead of time. A more recent trend with logistical-mega-gateways that Dubai has already implemented at a basic level consists of e-commerce and e-service activities. "Matajircom", a purpose-built smart retail hub, was recently launched by Dubai's Economic Zones World (EZW) along with Dubai Customs with the aim of rising above markets from local levels to country-wide and global levels (Department of Economic Development, 2015).

On the other hand, a major criterion of international gateways which Dubai fails to realise to its full potential is the size and type of industries operating in its hinterland. Efforts to reduce this gap can be seen in neighbouring emirate Abu Dhabi with KIZAD, an industrial zone close to the newly built Khalifa Port, which has aspirations to become a hub for manufacturing, logistics and trade industries. In addition, a lack of major manufacturing industries within the UAE severely hinders the growth in the volume of cargo movement designated as exports, thereby negatively impacting the potential of Dubai becoming a logistical-mega-gateway. Furthermore, Dubai needs to ensure that its customs procedures are coherent for the movement of cargoes to and from other emirates such as Fujairah or Abu Dhabi. This will enable seamless and smooth cargo movement within the UAE for land transportation.

5.3 Expansion, Development and Growth Trajectory

As cited by the Department of Economic Development (2015), the BMI foresees that between 2011 and 2015, Jebel Ali port's throughput will increase to 9.3 percent approximately with 18 million twenty-foot equivalent units (TEUs) forecast as box throughput. In addition, a dedicated inspection facility has been jointly launched by Dubai Municipality, Dubai Customs and DP World to provide rapid clearance of freight and cargo (Bin Sulayem, 2015). Aimed at reaching 50 million TEUs when completed in 2030, the total investment for the 14-stage inspection facility is AED 5.5 billion (USD 1.5billion). More recently, the Ports, Customs and Free Zone Corporation and the Department of Economic Development launched the Dubai's Virtual Freight and Logistics Corridor (VFLC), which aims at sustaining the business leadership and competitiveness of Dubai through provision of a unique automated customs procedure designed to facilitate goods transport between two Dubai Customs centres by road,

connecting the point of entry to the point of destination in Dubai under the Cargo Transport Requests submitted by clients.

Connectivity to other modes of transport is a hallmark of a logistical-mega-gateway, and Dubai plans on delivering this, as evidenced by the development of Dubai World Central (DWC) where super-airport-hub Al Maktoum International is based. DWC also connects with DP World's leading port which is Jebel Ali. In addition, encompassing Jebel Ali's port, cargo and logistics developments, the Jebel Ali Free Zone (JAFZA) has also had continuous investments. Al Maktoum International's plan for the Dubai Logistics Corridor will create the largest multimodal logistics platform in the world by connecting JAFZA and DWC thereby encompassing sea, land and air. Dubai's logistics advantages such as Jebel Ali Port, ranked eighth busiest worldwide and largest between Rotterdam and Singapore; its connection to DWC through the Logistics Corridor; and its strong unimodal land infrastructure, both via road and the upcoming nationwide and inter-GCC rail system, offer endless opportunities for trade into and out of the Middle East. With proper strategies in place for the creation of more Inland Ports (IPs), Freight Villages (FVs), extensive 'Massification' and 'Atomization' activities, coupled with an Industry Strategic Plan for strong Manufacturing Hinterlands (MHs) that are spatially planned and capable of offering the "last mile effect", Dubai will be able to create strategic Logistics Poles (LPs) and Clusters that are linked with its Port Centric (PC) Jebel Ali through a Logistics Corridor to position itself as the central Spoke Hub status for the MENASA region which encompasses the Middle East, North Africa and South Asia region. Along with the fully geared move to be the most efficient, effective and cost competitive logistics and supply chain management centre, backed by the latest and competitively advanced logistics and SCM technologies and systems, Dubai is doing all the right things to position itself to becoming a competitive international maritime logistical-mega-gateway.

6. Conclusion & Recommendations

Dubai has all that it takes to become a competitive international maritime logistical-mega-gateway. In order to do so, it is recommended that Dubai undertakes the following initiatives:

1. Further develop the functional relations between Inland Terminals and their Hinterland to strengthen Dubai's logistics capability of 'Massification' and 'Atomization'.
2. To enable Dubai to create large Logistics Poles, strong zoning and polarisation of logistics sites and the hinterland is required, coupled with de-zoning in primary logistics zones and the functional bundling of logistics zones.
3. Collective, connected and coordinated large Logistics Poles would further help to form strategic Logistics Clusters in Dubai.
4. In addition to continued expansion in industrial and manufacturing zones in its hinterland and the region, and the development of new port facilities, the national and regional rail network (Etihad Rail) is being developed. These developments have implications for what services can be provided competitively by Dubai and the UAE. As such, the key is to identify the optimal range of logistics infrastructure and facilities that will attract service providers and ensure that Dubai and the UAE can continue to compete for investment and support the development of maritime logistics.
5. Facilitate the establishment of vocational level training as well as encourage further investment in the institutes of higher learning catering to the port and logistics sector within the UAE. This should be complemented with an increase in research activities related to the port and logistics sector and with a stronger collaboration between educational institutions and the industry.
6. By 2020 the UAE economic activity may increase to more than double its current levels (Department of Economic Development, 2015). This level of activity may support the critical mass even further in developing and sustaining logistics infrastructure and services in the long run.
7. The UAE has to work strategically to improve its status within the World Logistics Performance Ranking. From a World LPI ranking of 17 in 2012, it has been overtaken by many international newcomers, rendering its latest LPI ranking to be at the 27th position globally (The World Bank, 2014).

8. Dubai and the UAE need to take the challenge of developing Logistical Poles and Clusters, and create a Maritime Logistical-Mega-Gateway to take on and be ahead of international competition.
9. Furthermore, on a national level, the UAE needs to: 1. Develop a UAE Comprehensive Integrated Multimodal Transportation and Logistics Strategy; 2. Develop the UAE into strategic Logistics Clusters and Mega-Gateways; 3. Harmonise and make seamless the regulations, processes and procedures between Airports, Ports, FZs, FVs, Hinterlands, Logistical Terminal/Depots and interconnectivity components; 4. Support the development of physical and virtual logistics corridors including the logistics 'Last Mile' business model; 5. Form the National Logistics Council to work on enhancing the inter-Emirate and inter-GCC logistics model and processes; 6. Increase the supply of skilled personnel trained and educated from local institutions combined with an increase in research activities to ensure the long-term and sustainable growth of the port and the logistics sector.
10. Dubai has the added advantage of attracting leading names in logistics, distribution and manufacturing to enable the industry to reach a critical mass of key players. Dubai can position itself as a location providing skilled resources and cost-efficient logistics infrastructure. It will be able to attract more manufacturing industries catering to the regional and international market. This will lead to a significant increase in the movement of goods going through Jebel Ali port, hence establishing Dubai as an undisputed mega-gateway.

The MENASA region consists of the world's most rapidly developing emerging markets, accounting for 25% of the world's people who come from a much more consumer-led environment. Dubai's significant location within this region offers a means of entry into an economy which has grown three-fold in the last ten years with AED 13.2 trillion(USD 3.6 trillion) as the total GDP. In this scenario of logistics, development and expansion, Dubai plays a very significant role. Given the above ten recommendations and the assurance of continuous development and investment, Dubai stands as the regional leader in logistics facilities. With its exceptional opportunities, its unparalleled geography, and its strategic location, Dubai's vision to develop into a competitive international maritime logistical-mega-gateway is not only inspirational but achievable.

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CUSTOMS BONDED TRUCK SERVICE PROVIDER SELECTION IN AIR TRANSPORTATION CASE STUDY: LAO PDR

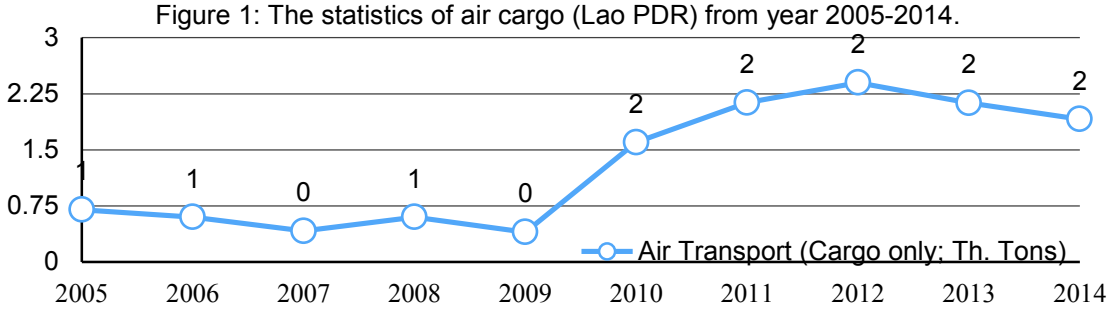
Tipavinee Suwanwong, Apichat Sopadang*

Excellence center in Logistics and Supply Chain Management, Chiang Mai University

Introduction

Theoretically, geography can impact economic development of the country in many ways, especially, the country with landlocked area. Land-locked area refers to the geographical situation of a country without direct access to the sea (Glassner, 1970). According to the world bank data, there are 44 landlocked countries in the world (as 2014). Lao PDR is the only land-locked country in the Southeast Asian region. Being a land-locked country with poor infrastructure has put the limitation to the economic development of Lao People's Democratic Republic (Lao PDR) (Oraboune S, 2008). Figure 1 also show the number of air cargo statistics from year 2005-2014. The data show that from year 2010, even some year dropped because of economic crisis, the number of air cargo increased year by year. The situation of the transportation infrastructure in the landlocked developing countries is updating very slowly, therefore the logistics company needs alternative solutions to ensure the movement of the freight in and out of the country (Kovacs and Spens, 2006). Multi-modal transportation will take part in the logistics system in this kind of situation. The situation that customer's demand is now getting higher and the growth of the speed-to-market product delivery is taking into account. Efficiency related to logistics services that are measured by the logistics service provider's potential in providing timeliness, cost effective, accurate in terms of low levels of losses and risk of damage to the specific location demanded by the shipper and consignees (Nordas and Piermatini, 2004).

Figure 1: The statistics of air cargo (Lao PDR) from year 2005-2014.



Air transportation (Cargo only): As cargo commodities are worth to deliver in timely basis while all airlines have very limited cargo space. There is only narrow-body aircrafts could operate. Thereby, an alternative to expand air cargo carriage by road feeder service will enhance such limited cargo space. In case of Lao PDR, Table 1, according to Lao Japan Airport Operator, show the number of airline operated by narrow body aircrafts and major cargo commodities. According to ICAO (2004), *Narrow bode aircraft* is an aircraft having only one aisle in the cabin with passenger seating divided into two axial groups and capable of carrying bulk cargo only. As mentioned above, this will lead to the other alternative for the transportation which is Air-to-truck transportation.

Number of Airline (all narrow body aircrafts)	Air Asia-AK/A320 , Thai Airways-TG/B737-400, T'way Airlines-TW/B737-800, China Eastern Airlines-MU/B737-700, Bangkok Airways-PG/A319, Vietnam Airlines-VN/A321
Major cargo commodities in general	Electronics, Machineries, Spare parts, Vaccineries

Table 1: Airline operated by narrow body aircrafts and major cargo commodities.

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Literature review

There are many studies about the landlocked countries and their economics. According to Banomyong (2010), the study highlighted the key issues that are affecting the integration of four countries (Cambodia, Lao PDR, Myanmar and Vietnam) from a logistics point of view and used Lao PDR as a case study of limited logistics connectivity. Be a land-locked country, there are number of limitations such as infrastructure — poor transportation. In case of transportation, Air transportation is the one option. In Lao PDR, logistics service providers are involved in the activities. Many studies have analysed the extent of the logistics service provider involvement in various logistics activities (La Londe and Cooper, 1989). Mode and carriers selection are the one of decision-making process in transportation that includes identifying relevant transportation performance variable, selecting mode of transport and carrier, negotiating rates and service levels, and evaluating carrier performance (Monczka et al., 2005).

The decision for the determination and selection of strategic partners creates a multiple criteria problem that changes from time to time (Ding and Liang, 2005). The goal of the multiple criteria decision-making (MCDM) method is to support decision makers in merging objective measurements with the valuable assessment that are based not only on individual opinions but on collective group ideas (Belton and Stewart, 2002), in order to choose the best alternative, that is, the one with the highest degree of satisfaction (Jacanbarg et al, 2012). Methods such as the weighted point method (Timmerman, 1986) or the matrix approach (Gregory, 1986) are applied to evaluate the qualification of the service providers. There are many different studies associated with service provider selection or supplier selection in any mode of transportation either sea or air or even location selection that have been commonly carried out by using MCDM techniques. AHP, was first developed by Saaty (1980), integrates specialists' opinions and evaluation scores into a simple hierarchy system. Yahoo and Kingsman (1999), applied AHP for rating the vendor for entrepreneur development programme. Tsaur at al., (2002) applied the fuzzy MCDM in order to evaluate the airline service quality.

Fuzzy Analytic Hierarchy Process (FAHP) applied fuzzy logic to basic AHP. Kahraman et al. (2003) used fuzzy AHP to select the best supplier from for the white good manufacturer. Zakir et al. (2009) also use the method the to select the third party logistic service providers. Golam, (2012) used fuzzy AHP and TOPSIS method to select the third party logistics service provider. Ding and Liang, (2005) also used fuzzy MCDM to select partners for strategic alliance for liner shipping. For the location selection such as selecting a site for a logistical centre on factor and methods (Chen and Liu, 2006), logistic centre selection with fuzzy-AHP and Electre Method (Ghoseiri and Lessan, 2008) and multi-modal hub location (Ashayeri and Kampstra, 2002). In 2013, Ayhan also used Fuzzy AHP for supplier selection. These methods can provide a better outcome in using complex, multi-dimensional data to solve decision making problems for selecting service provider. In this study, there are many criteria that are unclear, therefore, Fuzzy-AHP under Multiple Criteria Decision-Making (MCDM) theory will provide the comprehensiveness and reasonableness strengthen of the decision making process.

Research Methodology

This section will apply Fuzzy-AHP to evaluate the criteria and find the optimal solution. Assess to the data in the country is very difficult (Banomyong, 2000). In order to collect the data in this manuscript, this was assisted through the support from Lao Japan Airport Operator and Cargo space management and load planning department at Thai Airways International Public Company limited. Because of the time limited, the questions were distributed by emailing the person who are in charge of the activities. The question format is divided into two parts;

*Part one f*or *Lao Japan Airport Operator:* The question was utilized to get more entire picture of the current situation of air transportation in Lao PDR, especially, the general data that are not available in public.

Part two for Cargo space management and load planning department at Thai Airways International Public Company limited : The question was focused on the truck service provider criteria, how the current selection criteria being used, and the criteria weighted. The question was generated to five divisions which are Network Planning and Support division, Europe and Australia Division, Transpacific and North Asia division, Regional and Domestic division, and Alliance and Interlines division.

Criteria evaluation

The multiple criteria evaluation problem focuses on a set of feasible alternatives and considers more than one criterion to determine a priority ranking for alternative implementation (Tsaur et al.,2002). Three general criteria - time, cost, and risk - are emphasised by nearly all the studies as the most important criteria for selecting an agent (McGinnis er al., 1981; Mentzer et al., 1989; Cakravastia and Takahasiy, 2004). Table 2 show the evaluation criteria of truck service provider in air cargo transportation.

Main Criteria	Attribute	Measurement	Alternative 1	Alternative 2
Financial term	freight rate from BKK-VTE 6 wheels	value	6 wheels: 72,000	6 wheels: 60,703
Service performance	Fleet *	Number of trucks	10	6
	Schedule (Frequency)	Number of freight	Tue, Fri	M,Tue, Wed, Thrs
	Track and Trace system	scale 1-10 (10 is the best)	GPS	GPS
Trade restriction	Custom formalities	Value	8000	7000
Quality assurance	Damage and loss	No. of claim (2 year history)	4	2
	Insurance coverage	value	Limited of liability THB 10,000,000	Limited of liability THB 10,000,000

Table 2: the evaluation criteria of truck service provider

Fuzzy Analytic hierarchy Process (FAHP)

The AHP is accepted to be a powerful and flexible method for ranking decision alternatives and selecting the best ones when decision maker has multiple criteria. In FAHP, the pairwise comparisons of both criteria and alternatives are performed through the linguistics variables, which are represented by triangular numbers (Ayhan, 2013). The scope of this study, Buckley's method (1985) and Ayhan (2013) is applied to determine the weights for the attribute and alternatives.

Stage 1: As specialist's response, the selection of the attributes will be compared. Table 3 show the triangular fuzzy conversion scale and Table 4 show the pair-wise comparison matrix of the specialist evaluation in attribute level. Track and Trace system (A4) and Insurance coverage (A7) are eliminated because both alternatives have the same level.

Saaty scale (1980)	Linguistic Scale	Fuzzy Triangular Scale
1	Equally important	(1,1,1)
3	Weakly important	(2,3,4)
5	Fairly important	(4,5,6)
7	Strongly important	(6,7,8)
9	Absolutely important	(9,9,9)
2,4,6,8 : The intermittent values between two adjacent scales		

Table 3: The triangular fuzzy conversion scale

The pair wise matrix equation: where; d_{ij}^{k} indicate that k is the decision maker's preference of i criterion over j criterion.

$$\tilde{A}^{K}=\begin{bmatrix} \tilde{d}_{11}^{k} & \tilde{d}_{12}^{k} & \cdots & \tilde{d}_{1n}^{k} \\ \tilde{d}_{21}^{k} & \cdots & \cdots & \tilde{d}_{2n}^{k} \\ \cdots & \cdots & \cdots & \cdots \\ \tilde{d}_{n^1}^{k} & \tilde{d}_{n^2}^{k} & \cdots & \tilde{d}_{nn}^{k} \end{bmatrix} \quad (1)$$

If there are more than one decision maker, preference of each decision maker are average.

$$\tilde{d}_{ij}=\frac{\sum_{k=1}^{k}\tilde{d}_{ij}}{K} \quad (2)$$

	Freight rate	Fleet	Schedule	Tariff	Damage
Freight rate	(1,1,1)	(4,5,6)	(6,7,8)	(1,1,1)	(4,5,6)
Fleet	(1/6,1/5,1/4)	(1,1,1)	(6,7,8)	(2,3,4)	(4,5,6)
Schedule	(1/8,1/7,1/6)	(1/8,1/7,1/6)	(1,1,1)	(1/6,1/5,1/4)	(1,1,1)
Custom formalities	(1,1,1)	(1/4,1/3,1/2)	(4,5,6)	(1,1,1)	(6,7,8)
Damage	(1/6,1/5,1/4)	(1/6,1/5,1/4)	(1,1,1)	(1/8,1/7,1/6)	(1,1,1)

Table 4: The pair-wise comparison matrix of the specialist evaluation in attribute level.

Stage 2: At the second stage, the geometric mean of the fuzzy comparison values of each attribute (3) and the fuzzy weight of attribute (4) is calculated. Also the the averaged and normalized relative weights of attribute

Equation	Example of "Freight rate"
(3) $\tilde{r}_i=\left(\prod_{j=1}^{n}\tilde{d}_{ij}\right)^{1/n}$	$=[1\times4\times6\times1\times4]^{1/5}$; $[1\times5\times7\times1\times5]^{1/5}$; $[1\times8\times8\times1\times6]^{1/5}$ =[2.491,2.809,3.1036]
(4) $\widetilde{w}_i=\tilde{r}_i\otimes(\tilde{r}_1\oplus\tilde{r}_2\oplus\ldots\oplus\tilde{r}_n)^{-1}$ $=\left(lw_{i,}\, mw_{i,}\, uw_i\right)$	=[(2.491×0.126);(2.809×0.143);(3.103×0.164)] =[0.313,0.401,0.508]
(5) $M_i=\frac{lw_i+mw_i+uw_i}{3}$	=(0.313+0.401+0.508)/3 =0.407
(6) $N_i=\frac{M_i}{\sum_{i=1}^{n}M_i}$	=0.407/1.213 =0.335

Therefore, the Geometric means of fuzzy comparison value, Relative fuzzy weights of each attribute, and the averaged and normalised relative weights of attribute are given in Table 5;

Attribute	$\tilde{r}_i$			$\widetilde{w}_i$			M_i	N_i
Freight rate	2.491	2.809	3.103	0.313	0.401	0.050	0.407	0.335
Fleet	1.515	1.838	2.168	0.190	0.262	0.355	0.269	0.221
Schedule	0.304	0.332	0.370	0.038	0.047	0.060	0.048	0.039
Custom formalities	1.430	1.634	1.888	0.180	0.233	0.309	0.240	0.197
Damage	0.322	0.355	0.401	0.040	0.050	0.657	0.249	0.205
Reverse	0.164	0.143	0.126					
Increasing order	0.126	0.143	0.164					

Table 5: the Geometric means of fuzzy comparison value, Relative fuzzy weights of each attribute, and the averaged and normalised relative weights of attribute

Stage 3: At this stage, the alternatives should be pair wise again compared with each attribute particularly. Meaning, the analysis will repeat five more time for each attribute. The processes are the same, it will start back again from the beginning. Therefore, the normalized non-fuzzy relative weights of each alternative for each attribute are given in Table 6;

Alternative	Freight rate	Fleet	Schedule	Custom formalities	Damage
A1	0.126	0.831	0.168	0.126	0.545
A2	0.875	0.168	0.831	0.875	0.456

Table 6: The normalised non-fuzzy relative weights of each alternative for each attribute

Using Table 5 and 6 together, each attribute will present the individual score as shown in Table 7;

Criteria	Attribute	Weights	Scored of Alternatives	
			Alternative 1	Alternative 2
Financial term	freight rate from BKK-VTE : 6 wheels	0.335	0.126	0.875
Service performance	Fleet	0.221	0.831	0.168
	Schedule (Frequency)	0.039	0.168	0.831
Trade restriction	Custom formalities	0.197	0.126	0.875

Quality assurance	Damage and loss	0.205	0.545	0.456
Total			0.361	**0.627**

Table 7: Aggregated results for each alternative

According to the results, Alternative 2 is with the best score, therefore, it is recommended as the suitable truck service provider among two of them.

Conclusion

According to various criteria, service provider is the significant task for the firms. Because of the huge budget and customer satisfaction are involved, the firms need to find the best way to evaluate those fuzzy criteria. Therefore, the techniques are developed for this goal. AHP technique is used to delegate the fuzzy logic. The studied have demonstrated a methodology for evaluating the truck service provider for airline, in order to transfer the product to the land-locked country — Lao PDR by using Fuzzy AHP model. The above analysis shows that the model employ to solve the truck service provider problem in the airline company. There are 7 criteria, namely, freight rate, Fleet, Schedule (Frequency), Track and Trace system, Custom formalities, Damage and loss, and Insurance coverage. As mentioned, no need to evaluate the criteria; Track and Trace system and Insurance coverage because there both have the same level. As the result of the case study, the alternative 2 surpass the other one.

Using this formulation, the airline can easily test a number of what-if scenarios. For future research, it would be worth wide to implement the FAHP model with an airline decision makers. The airline with have a reliable tool to select truck service provider in order to expand its network to offline station.

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EFFICIENCY IMPROVEMENT OF DRIED LONGAN PRODUCTION LINE USING ECRS PRINCIPLES

Wassanai Wattanutchariya*, Atitaya Ounjai
Advanced Manufacturing Technology Research Center,
Department of Industrial Engineering, Faculty of Engineering,
Chiang Mai University, Chiang Mai, Thailand
*Tel: 6653-944125 Fax: 6653-944185 *E-mail: wassanai@eng.cmu.ac.th*

Introduction

Longan is one of the most important agricultural products that has high economic significance in Thailand. Longan has been widely consumed by both domestic and international people in form of fresh fruit or dried product. From the statistical data in 2012, the volume of exported longan products was as high as 596,418,680 kilograms, generating over 19.8 trillion THB in value (Office of Agricultural Economy, 2012). The high production areas located in the northern provinces of Thailand, including Chiang Mai, Lamphun, Chiang Rai, Phayao, Phare, Nan, Lampang, Tak, Mae Hong Son, and Sukhothai, which are 90% of total longan production area of the country. Other regions that are able to produce longan in Thailand include Chanta Buri, Loei, Nong Kai, Nakorn Phanom, and Muk Da Harn. In order to prolong the shelf life of longan, it was preserve into dried product using hot air drying technique. At present, approximately 67% of total longan products are being prepared into dried longan either skinned or un-skinned form.

This research was conduct at one of a company which produces dried longan in Chiang Mai, Thailand. Majority activity of this company was to produce the skinned air-dried longan and export to international market. The main production lines of this company were separated into two types: make-to-stock and make-to-order. The study was focus on improving make-to-order production line, which has higher priority to the company, since it effect to the satisfaction of the customer in the international market. Consequently, productivity improvement techniques such as ECRS and Motion and time study are employed to identify and suggest improving strategy to increase production line efficiency (Kasemset et al., 2014 and Makprang et al., 2014), while still preserve a quality of the dried longan.

Literature Reviews

To identify and improve the current production line; (1) motion and time study and (2) ECRS techniques are together applied in this study. The details of both concepts are briefly explained as follows.

Motion and Time Study

Motion study is a study and analysis of the motion of working parts in the production, including machine, tool, equipment, and work station, or workplace.

Principles of Motion

Motion principles can be separated into three groups, based on relations of factors, including human structure, workplace designing, and equipment designing.

(1) Human structure: is a principle which utilizes working parts of human body and use them at their most effective condition, mostly hands. Most of the time, people use their hands to do works. The human structure principle emphasizes on the equality of body parts use, for instance, the equally use of both hands. Both hands must to start and stop working at the same time, while the motion of both arms must be balanced. Furthermore, other parts of body must help support each other to reduce tiredness during working position.

(2) Workplace designing: is a principle which emphasizes on designing a workplace that allows people to do their job conveniently and effectively. It is recommended that a person must work in only one position in one spot. The tool and equipment must also be kept in their usual places, which allow users to be familiar and easily access to them when needed. Moreover, there should be adequate brightness in working place, and the color tone of workplace should be highly contrasted with the work piece, in order to reduce tiredness of eyes.

(3) Equipment designing: is considered to be an alternative way to reduce human body parts movement. The equipment should be utilized where possible, in order to reduce tiredness from work. The tools using in any work must be designed to minimize users' effort, or in the most convenient handling position; for instance, Jig and Fixture are used to help in work piece handling.

Process Chart

Process chart is a tool, which allow a user to record the production processes briefly, in order to make a later analysis easier. Marks are utilized in the process chart to clearly identify working processes, and easier to read. The recorded processes started from obtaining raw material and follow up through production line.

Signs used in process chart include "O" for Operation, "⇒" for Transportation, "□" for Inspection, "D" for Delay, and "∇" for Storage.

Flow Diagram

Flow diagram illustrates map of workplace and the locations of every related machine, with the directions of marks. The scale of map may be applied. There are two types of mark being used in the diagram.

(1) Man Type: illustrates the moving directions of workers in the job.

(2) Material Type: illustrates the path that materials used in the production are being transported.

Time study is a technique that can be applied in the production cycle, allowing the producer to gain control over production management and production yield, which are related to performance evaluation. The unit of performance indication is calculated by seconds or minutes that a person get the job done using given method (Teerawatsakul, 2009).

ECRS principles

This technique helps generate an approach to improve productivity of the production line each character has its meaning as follows (Klomjit, 2013):

E = Eliminate: is the elimination of unnecessary processes during the production. The seven areas of detected loss in present processes, which has been eliminated, are including over-production, waiting time, unnecessary change, unnecessary job, over-stocking, unnecessary transportation, and damages to products.

C = Combine: is the combination of processes that allows the producer to save more time and energy used in the production. Some processes can be combined together; for instance, the production line used to have 5 steps to produce, which some of these steps could be done together at the same time, the processes then are being combined. As a result, the overall steps are reduced, allows the whole production process to complete faster and more efficient. This also eliminates the transit between processes that requires different tools to get the job done.

R = Rearrange: is the rearrangement of the required processes. The rearranged processes allow the production to complete faster by removing unnecessary transit to another process, or to eliminate waiting time. For example, if step 2 and step 3 in the production are swapped, it would reduce distances between production processes.

S = Simplify: is to improve the process or invent new tools that allow the production to operate more efficiently. The simplification of working processes may employ Jig or Fixture to help improving convenience and accuracy of the job, which not only reducing damages to the product, but also eliminate distances and unnecessary work.

Research Methodology

This research methodology consists of study data collection, problem identification, system design for improvement, performance measurement and conclusion (show in Figure 1)

Data Collection

This research is a study of dried longan production process, which occurs seasonally in a dried longan company in Chiang Mai. The process is emphasized on make-to-order production line, which has more complication that make-to-stock line. In the beginning, the study was focus on data collection based on factory maps, production processes, and

process activity maps of each work station, in order to clarify the current situation of the production line.

Problem Identification
The information received from the data collection process is used to create a process activity mapping to identify critical points in the production processes. There are several signs being employed to represent these critical points, including: "D" represents delays and/or waiting time, "⇒" to represent transportation of the product from one point to another. Moreover, each process is being defined using: VA (value added), NVA (non-value added), and NNVA (necessary but non-value added).

System Designing for Improvement
According to the flow chart previously created from ECRS and VSM techniques, a new flow chart is being designed to eliminate non-value added works in the process, in order to minimize waiting time, transportation, and other unnecessary works.

Performance Measurement Comparison
The results between before and after improvement will be compared based on total time, transportation distance, and total number of tasks

Results and Discussion

Data collection
According to a study, a dried longan make-to-order production process started from transporting frozen longan out from the freezer and dry the product and finish in the packaging process (as shown in Fig. 1). The first activity is called Re-dry process in which the pre-dry process kept in the frozen is transferred into oven to oven dry the longan into proper condition. Within this activity, it includes total of 13 steps of work as shown in table 1. The second part or activity 2, it started from transporting dried longan out from the oven, passing through finishing process and then going into packaging process, which include a total of 7 steps as shown in table 2. Both parts of these two activities have total of 5,151.87 minutes per production cycle, and a total of 37 km. in transportation.

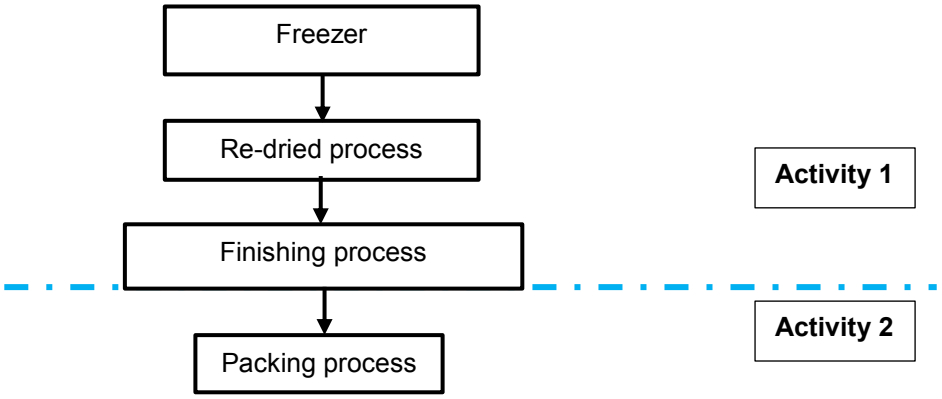

Figure 1: Process flow of make-to-order dried longan

Table 1: Current Process Activity Mapping [Activity 1]

Activity Mapping / Details of processes		○	⇨	□	D	∇	VA	NNVA	NVA	Transportation length (Meters)	Time (min)
1	Transport out from freezer	○						√			143.25
2	Transport in to grille		⇨					√		6,930	82
3	Put longan in grille	○						√			159.7

Activity Mapping Details of processes		○	⇨	□	D	∇	VA	NNVA	NVA	Transportation length (Meters)	Time (min)
4	Put longan in oven		⇨					√		2,304	138.8
5	Drying longan	○					√				768
6	Post-drying check			□				√			42
7	Cool- down waiting				D			√			791.1
8	Transport longan to grille-flipping point		⇨					√		3,312	73
9	Transport longan out from grille	○						√			143.64
10	Put longan in big bags	○							√		157
11	Transport big bag to silo		⇨						√	10,368	102.75
12	Wait to put longan in silo				D				√		790.2
13	Put longan in silo	○							√		540
<----------Total---------->		**6**	**4**	**1**	**2**	**0**	**1**	**8**	**4**	**22,914**	**3,931.44**
%		**46.2**	**30.8**	**7.7**	**15.4**	**0.0**					

Table 2: Current Process Activity Mapping [Activity 2]

Activity Mapping Process details		○	⇨	□	D	∇	VA	NNVA	NVA	Transportation length (Meters)	Time (min)
1	Wash, dry, polish, grading	○					√				10.71
2	Fill longan in boxes	○						√			67.2
3	Check and weight			□				√			720
4	Transfer to store area		⇨						√	14,080	17.6
5	Cool down waiting				D				√		287
6	Packing	○						√			117.92
7	Put in storage					∇		√			
<----------Total-------->		**3**	**1**	**1**	**1**	**1**	**1**	**4**	**2**	**14,080**	**1,220.43**
%		**42.9**	**14.3**	**14.3**	**14.3**	**14.3**					

Problem Identification

According to table 1, the total of 13 steps of work in activity 1 can be divided into 6 steps of operation process, 4 steps of transportation process, and 1 inspection process. In addition, there are 2 delays, 1 value added process, 8 necessary but non-value added processes, and 4 non-value added processes. The total transportation length is 22.9 km. and a total of 3,931.44 minutes were consumed in the processes.

In the meantime, when consider the process activity mapping of activity 2, as shown in table 2, it consists of 7 working steps, including 3 operation steps, 1 transportation step, 1 inspection step and 1 storing step. There is 1 delay being detected. Moreover, there is 1 value-added process, 4 necessary but non-value added processes, and 2 non-value added processes. The total length of transportation taken was 14 km and total of 1,220.43 minutes were consumed.

System Improvement

1) E-Eliminate: according to table 1, the tenth to thirteenth processes were non-value added processes, hence they could be discarded. When these steps, including put longan in big bags, transport big bags to silo, wait to put in silo, and put in silo were eliminated, the length of transportation is reduced by 10,368 meters and time consumed is reduced by 1,589.95 minutes.

2) S-Simplify: according to table 1, the eighth step was simplified by changing transport method. Instead of using big bags, the conveyor belt is employed to directly transport the dried longan from the oven to the silo. Consequently, the transportation length was reduced by 1,317.60 meters.

3) C-Combine: according to table 2, the forth to sixth steps were processes of transfer dried longan to waiting point to cool them down, which create waiting time. In response, these three steps were combined, with additional cooling fan equipped in grading process. As a result, total of 14,080 meters in transportation and 304.60 minutes of time consumed were reduced.

4) R-Rearrange: In this production line, rearrange cannot be applied due to the specification of dried longan processing step.

After using ECRS technique, the improved flow process activity mapping can be represented as Table 3 and Table 4

Table 3: Process Activity Mapping after improvement [Activity 1]

Activity Mapping		○	⇨	□	D	∇	VA	NNVA	NVA	Transportation length (Meters)	Time (min)
Details of processes											
1	Transport out from freezer	○						√			143.25
2	Transport in to grille		⇨					√		6,930	82
3	Put longan in grille	○						√			159.7
4	Put longan in oven		⇨					√		2,304	138.8
5	Drying longan	○					√				768
6	Post-drying check			□				√			42
7	Cool- down waiting				D			√			791.1
8	Transport longan to grille-flipping point		⇨					√		1,994.40	73
9	Transport longan out from grille	○						√			143.64

Activity Mapping Details of processes	○	⇨	□	D	∇	VA	NNVA	NVA	Transportation length (Meters)	Time (min)
<----------Total----------->	**6**	**3**	**1**	**1**	**0**	**1**	**8**	**0**	**11,228.40**	**2,341.49**
%	**46.2**	**33.3**	**11.1**	**11.1**	**0.0**					

Table 4: Process Activity Mapping after improvement [Activity 2]

Activity Mapping **Process details**		○	⇨	□	D	∇	VA	NNVA	NVA	Transportation length (Meters)	Time (min)
1	Wash, dry, polish, grading	○					√				10.71
2	Put longan in boxes	○						√			67.2
3	Check and weight			□				√			720
4	Packing	○						√			117.92
5	Storing					∇		√			
<---------Total--------->		**3**	**0**	**1**	**0**	**1**	**1**	**4**	**0**	**0**	**915.83**
%		**60.0**	**0.0**	**20.0**	**0.0**	**20.0**					

Performance Measurement Comparison

The comparison of existing and the proposed system is illustrated in Table 5

Table 5: Comparison of before and after improvement

	Before	After	Difference	% Reduction
Total distance (meters)	36,994.00	11,228.40	25,765.60	69.7%
Total time (min)	5,151.87	3,257.32	1,894.55	36.8%
Total Number of tasks	20	14	6	30.0%

Conclusion

This study emphasized on make-to-order dried longan production line in one of dried longan manufacturer in Chiang Mai, Thailand. The process starts from transfer frozen longan out from freezer and pass through drying process and finishing step before going to the packaging process, there are total of 20 processes included. The total production time was 5,151.87 minutes per production round, and total of 36,994 meters of total transportation length.

According to the process activity mapping, all of the processes were divided in to two activity group. The first section includes the processes from transfer frozen longan out of freezer to silo filling. This section contains total of 13 work steps; 4 of which were non value added and not necessary processes. Hence, ECRS technique was applied in order to improve efficiency in production. The technique was applied by removing the tenth to thirteenth steps, which could eliminate 4 working stations. Moreover, in the eighth step, the process has been simplified by equipping conveyor belt to replace big bags transferring, in order to minimize transportation time and delays. In the second section, the processes include transferring dried longan from silo to packaging process. There were total of 7 work

steps, 3 of which created unnecessary waiting time, including the forth to sixth steps, which is the processes of transferring dried longan to waiting point until cool down, then transfer them back and put in boxes. As a result, these three steps were combined in accordance with an equipped cooling fan in grading machine. This combination allows the transportation and delays in the production to be eliminated.

From employing ECRS and VSM techniques, the total of 20 working steps were reduced to 14 steps (30% reduction). The total transportation length was reduced from 36,994 meters to 11,228.40 meters (69.7% reduction). Therefore, these reduced steps allow the organization to save energy consumption in transportation by approximately 13,000 THB per annum (calculated from fuel consumption per distance unit), and reduce labor cost by 367,290 per annum (calculated from numbers of employees to labor costs in one production). Furthermore, the time consumed in the production were reduced from 5,151.87 minutes to 3,257.32 minutes (36.8% reduction), leading to the reduction of production lead time from 3 days to 2 days. This allows the factory to acquire an additional one day per annum, which can be calculated equally to an opportunity to generate additional 1.37 million THB each year.

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ENHANCING SUSTAINABLE COMPETITIVENESS TO THAI SME BY USING LOGISTICS AND SUPPLY CHAIN MANAGEMENT

Taweesak Theppitak

Faculty of Logistics, Burapha University

Introduction

Thai SME firms are a major driven to Thailand's economic growth in many decades. The questioning issue is how to sustainably create competitive advantage to Thai SME firms. Thai government continuously boosted Thailand's economic growth through many projects. One of dominant policy is how to improve logistics capacity building and efficiency of Thai SMEs. The government expected that the success of logistics projects would boost sustainable economic growth.

After launching the logistics project in Thai SME firms, there are problems and barriers associated with the implementation, especially, in the area of integrating marketing, production, and logistics. With other areas, the government put full efforts to use marketing and production strategies for developing and promoting SME products in world market. However, the role of logistics has been still ignored or at least seen as cost-generated activities. Therefore, the aim of the study is to examine the current status of logistics' implementation for Thailand's SME firms. It also examines factors affecting the implementation, including using logistics strategies for building competitive advantage. Finally, the effectiveness and efficiency of SME firms' logistics implementation will be examined.

Literature Review

The literature from four leading logistics journals between 2010 and 2014 (International Journal of Logistics Management, International Journal of Physical Distribution & Logistics Management, Journal of Business Logistics, Logistics, and Transports and Transportation Review) were reviewed to address issues related to implementation of logistics strategies in SMEs. The relationship between logistics implementation and its organizational effectiveness, especially focusing on the SMEs was also examined.

Logistics refers to the art of managing the flow of physical and information from a source to user (1). It encompasses all of the information and material flows throughout an organization and interorganisation (2). Logistics includes everything from movement of a product or from a service that needs to be rendered, through to management of incoming raw materials, production, storing of finished goods, its delivery to the customer and after sales service (3). The role of logistics function is a key determinant of business performance to ensure that there is smooth flow of material and information throughout a company's supply chains (4). Logistics has also become more prominent as a critical success factor in competitive advantage (5, 6) through reducing costs and improving service level or responsiveness to customers.

Problems arising in small firms include delayed and inaccurate information, incomplete services, slow and inefficient operation, and a high product damage rate (5). While the western small firms are developing and implementing quick response systems, efficient consumer response, cross docking and other areas of logistics management (3,4,5). These concepts are not yet well recognized by Thailand's SME firms. Normally, Thai SME

firms start their operations with simple business processes. The SMEs effectively lack strategic logistics formulation and implementation. The consequences are an inability to provide interlinked services, high operating costs and lack of flexibility in responding to changing demand.

Authors (4,5,and 6) identified the critical success factors in effective logistics management including not only good planning, close relationship with partners, effective warehouse and distribution management, and effective order processing, but awareness in logistics concept and mindset would be pervasive to all levels of an organization.

The literature review led to conclusion that logistics is power tool to drive and improve efficiency of operations and respond to customer satisfaction. Currently, SMEs are increasingly recognizing the role and importance of logistics management as a strategic tool for enhancing competitive advantage. It revealed that effective logistics adoption would be carefully considered associated with factors affecting physical and information flows. Further, it revealed that studies on SME firms in Thai context were few and very limited, especially in logistics management. Exploratory research found that SME firms have not given importance or priority to logistics management. Logistics activities (e.g. purchasing, transport and warehousing) are overlooked as potential areas for building competitive advantage.

Research Methodology

To achieve the research objective, this study developed its research data through two sources. First, secondary sources were conducting through *literature review* and *data analysis*. Secondly, primary data were collected by using *survey method*, *in-depth interviews* and *observation methods* for examining a relationship between variables and answering research questions. The literature reviewed was related to logistics management, logistics implementation and its effectiveness. Secondly, relevant data was collected by questionnaire surveys and in-depth interviews. This part of the research focused on exploring the current status of logistics implementation and its effectiveness in Thai SME firms. In-depth-interviews were used specifically to obtain deeper insight into the relevant opinions from 20 Thai SME owners.

The questionnaire was used for eliciting attitudes and perceptions of SME firms in Chonburi province, Thailand. First, pre-testing was carried out to forty five respondents, which found Cronbach's Alpha equaled 0.945. There were some minor changes in some items of questionnaires. Three weeks later, the second pre-testing was conducted on the same group of respondents, with Cronbach's Alpha equaling 0.9564. The result showed that the research instrument had a highly acceptable degree of reliability.

The key measures were based on assessing their perceptions related to roles and the importance of logistics, including implementation of logistics functions. Further, they also examined factors affecting implementation and effectiveness and efficiency after implementing logistics strategies in their operations. The questionnaires were randomly distributed to sampling targets by applying a five-point Likert-type scale. The 148 questionnaires were distributed in three major channels: *postal mail, face-to-face and electronic mail (e-mail)*. The total response rate generated was very good with 126 *respondents or 85.1 percent*. The span of time took four months. The data was processed with SPSS 14.0.0. Verifying dimensionality and reliability of each construct that included factor analysis, and item-to-total correlation and regression analysis were conducted.

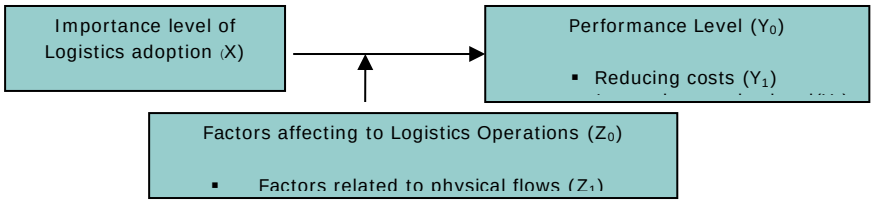

Figure 1 theoretical framework of the study

The literature review provides solid conceptual framework on relationship between importance level of logistics adoption and performance level (Y_0) by reducing costs (Y_1) and improving service level(Y_0). Performance-Importance Analysis (P-I analysis) is used model for testing hypothesis. Based on theoretical framework, variable **X** covers SME firms' implementation of logistics functions (i.e. purchasing, transport and warehouse). Variable $\mathbf{Y_0}$ covers effectiveness from logistics implementation and building competitive advantage to firms. After having conducted factor analysis, the variable was grouped in 2 parts: $\mathbf{Y_1}$ **and** $\mathbf{Y_2}$ which were building competitive advantage through cost reduction and improving service level to customers respectively. Variable $\mathbf{Z_0}$ included factors affecting logistics implementation and using logistics to build competitive advantage. The variable $\mathbf{(Z_0)}$ was divided in 2 parts: $\mathbf{Z_1}$ and $\mathbf{Z_2}$ were factors related to physical flows and information flows respectively

The model was based on two hypotheses of SME firms' behavior to logistics implementation and using logistics strategies for building competitive advantage:

1. There is a relationship between importance level of logistics adoption and performance level (Y_0).
2. There is a relationship between factors affecting logistics operations and effective logistics implementation. Identifying the factors would facilitate SME firms to develop carefully more integrated logistics strategies.

Research Finding

The results show that samplings are normal distribution, and it is significantly used as representative of the population. The results show that variable $\mathbf{Y_0}$, which means adoption of logistics to build competitive advantage can be divided in two groups: $\mathbf{Y_1}$ **and** $\mathbf{Y_2}$ which are creating competitive advantage through cost reduction (e.g. operating costs, logistics costs), and improving service level to customers (e.g. responsiveness, flexibility) respectively. Variable $\mathbf{Z_0}$ includes factors affecting logistics implementation for building competitive advantage. The variable is also divided in two groups: $\mathbf{Z_1}$ and $\mathbf{Z_2}$, which are factors related to physical flows (e.g. effective purchasing, warehouse, transport), and information flows (order processing, information technology for logistics and warehouse management system) respectively.

The study examines factors affecting SME firms' operations and business. The results show that most firms identify the following factors: lack of raw materials (80%), lack of skilled labors (72%), product quality (70%), intense competition (65%), economic conditions (63%), fuel prices (63%), customer demand (60%), funds for investment (50%), and support from government sectors (45%).

It also identifies factors influencing logistics implementation, as the result reveals as follows: warehouse management system (90%), after sale services (86%), fuel prices (83%), information technology (IT) for logistics (82%), order processing (80%), material management (76%), transport system (73%), logistics knowledge and management (74%), physical distribution management (62%).

Variable		Sig.	P-Value
Independent	**Dependent**		
X	Y_1	0.001	-0.678
	Y_2	0.000	0.620
Z_1	X	0.000	0.804
Z_2	X	0.000	0.840

Table 1 summary relationship between variables

After testing the hypotheses, the results show a significant relationship between tested variables in some degrees. It shows that there is a negative and moderate relationship between the adoption of logistics management **(X**) and building competitive advantage through reducing costs **(Y_1)**. Furthermore logistics adoption is positive and moderate relationship with improving service level **(Y_2)**. Further, it also found that there is strong relationship between these factors and effective logistics implementation. Importantly, the factors have influence in a higher degree on logistics operations and management, especially factors related to information flow. Physical flow **(Z_1)** has a relationship to a lesser degree with improving service levels to their customers.

Discussion and Research Implications

The results indicate significantly strong relationships between variables. The first hypothesis reflects that firms recognize the importance and need of logistics implementation for building and enhancing their competitive advantage. Although adoption of their logistics tends to reduce operating costs more than improve service levels, it also reflects that firms have an expectation of outcomes from logistics implementation to a high degree. Further, it found that resources have not been fully utilized. Many Losses of raw materials, for example, occurred in production and movement processes. Transporting finished goods to markets took several weeks, instead of a few days. The symptoms reflect that firms sufficiently lack essential skills and knowledge how to effectively implement the logistics strategies to utilize efficiently their resources to minimize costs and improve service levels to customers.

It also found that some factors using IT for logistics for example have a strong contribution and influence on logistics functions and operations. The question is why firms provide the factors related to information flow a priority. Mainly, the reason is that firms use the internet as importance channel for transaction and receiving orders from customers. However, the internet has been narrowly limited of using only the four and five star products'. Further, some factors related to physical flows influence logistics implementation. Poor warehouse and distribution management, for example, would influence to logistics implementation, in a negative way including their competitive advantage.

While the study covered a wide range of SME products, it only surveyed in a specific province. It uses an inductive method or inferential statistics. It studied a small group, but the results should tend to represent the whole population. Therefore, in a broad view, SME firms would recognize logistics' role and importance as a value-added tool for their operations, including considering as key driving for enhancing their competitive advantage. They would increasingly put more focus on adoption of logistics techniques and strategies with their

operations, especially in weak logistics functions (e.g. inventory, distribution and transport management).

Further, firms would seek an optimized way for managing logistics functions to reduce costs, in particular non-value added costs. Also, to improve the service level, they would understand importance of customer service, including how to effectively and efficiently manage physical and information flow with higher service quality to enhance customer satisfaction. Controlling is one of the major activities which have been ignored. They would adopt a performance measurement system to monitor and control logistics functions effectively and efficiently. The research implications reflect that building and adopting effective logistics and supply chain strategy offers opportunities to create sustainable competitive advantage. The role of support and assistance from government sectors is still needed, including seeking a way to build sustainable networks among SME stakeholders.

Conclusion and Recommendations

The paper examined issues related to logistics in the case of Thailand's SME products. The literature was reviewed in area of small and medium enterprises (SME), SME products, logistics and supply chain. The review provided a foundation for clearly developing a conceptual framework and research objectives. The rigorous methodology was conducted to generate a reliable and valid measurement instrument. Questionnaires and in-depth interviews were a major tool for collecting data. The sampling was randomly chosen to ensure that it represented characteristics and attributes of the population. The obtained data was analyzed using SPSS.

In conclusion, SME firms have been limited in understanding the role and importance of logistics affecting their operations. However, it found that firms have mostly low education, including low skills and knowledge related to logistics implementation. The importance of factors influencing logistics operations has been ignored. Further they lacked a creative system, process, and culture to support systematic adoption of logistics activities. In addition, they lacked efficient and effective integration of activities related to physical and information flows. Therefore, they urgently need to develop and improve understanding and knowledge of logistics to firms. It includes encouraging them for adopting new logistics techniques and management. Supports and assistances of government sectors still need with the aim are to building sustainable networks, including providing essential facilities and infrastructures.

Further Research

The study examines issues of Thailand's SME industry related to logistics implementation and its effectiveness, and it provides broad views of SME products (foods, cloths and gifts), but needs for focusing on logistics implementation on specific products are necessary so that the results can be effectively applied to specific SME firms.
Further, studies mostly use questionnaire survey to the respondents; it was found that it is difficult to make clearly understandable to firms, who have mostly low education, through all items of questionnaire. Future research would find an appropriate methodology to elicit their attitudes and opinions based on research objectives.

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Energy Efficiency Analysis of Wind Turbine Supply Chains

Toni Maetze, Henning Strubelt
Institute of Logistics and Material Handling Systems, Faculty of Engineering, Otto-von-Guericke University, Magdeburg, Germany

1. Introduction

In the past years the general awareness of environmental challenges, like global warming, climate change, and greenhouse gas emissions has increased. Therefore, it has become necessary to evaluate and improve the use of renewable energy sources. (Demir and Taşkın, 2003)

To ensure the shift to renewable energy sources, the European Commission developed an energy directive determining that 20% of the total energy consumption should be fulfilled by renewable sources by 2020 (European Commission, 2015). The increasing focus on sustainable development, lead to rapid growth in the wind energy sector. For the first time a total capacity of more than 50GW of new wind turbines were installed in 2014. The global total installed wind energy capacity at the end of that year was 369.6GW. (Global Wind Energy Council, 2015)

In general, wind energy is considered environmentally friendly, but there have been concerns about its possible negative environmental impacts. The main issues are noise, visual impact and impact on wildlife. However, wind energy is increasingly viewed as an alternative to non-renewable energy sources. Therefore, the general population accepts some of these negatives more easily. (Magoha, 2014) Renewable energy sources are mostly presented as “green” and “clean“, but environmental impacts during their whole life cycle from “cradle to grave” are usually not considered. Although there are no direct emissions during the energy production process of a wind turbine, its production requires the consumption of energy and natural resources, including the release of pollutants. Thus, it is not only important to reach the goals set by the European Commission, but also to do this with as few emissions as possible. As any energy consumption causes emissions, it is necessary to keep the energy demand within the supply chain as low as possible, from raw materials extraction until disposal of the materials. This paper identifies the biggest drivers of energy consumption during the life cycle of wind turbines and offers possibilities for a more energy efficient design of the associated supply chain.

2. Life Cycle of Wind Turbines

One way to identify drivers of energy consumption can be the life cycle assessment (LCA) or modified hybrid methods thereof. For these, the life cycle and the structure of wind turbines must first be understood.

There are many different kinds of wind turbines, differing in their structure (with or without gearbox), power rating (from 150 kW to 8 MW), design (horizontal or vertical rotor), number of blades (two or three), hub height (50m to 149m) and field of application (onshore, offshore). (Enercon, 2015; Vestas, 2015) However different wind energy plants are, the main components are the same:

- tower
- nacelle
- rotor (hub, nose cone, blades)
- foundation
- cables (connecting the individual wind turbines of a wind farm)
- transformer station. (Vestas, 2006)

This paper does not analyze any specific type of wind turbine, but combines the results of several LCAs of different types to identify the main energy drivers and subsequently design a more efficient supply chain.

The life cycle of a wind turbine consists of six main phases, shown in Figure 1. It illustrates the steps of the life cycle, including raw material production, manufacturing, installation, operation & maintenance and decommissioning. Transportation processes are necessary between the phases 1 and 2 and 2 and 3, but also during phases 4 and 5, cp. Figure 1. In the following paragraphs, these phases are described in detail.

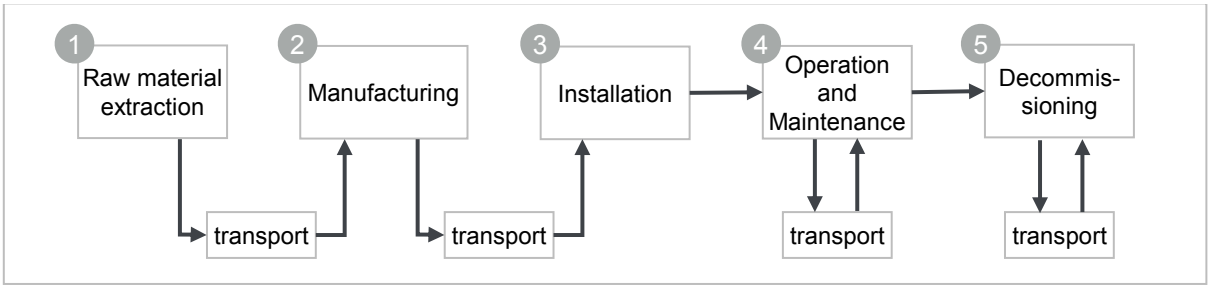

Figure 7: Life cycle of a wind turbine

2.1 Raw Materials

The materials used for wind turbines are often extracted in different countries. (Schleisner, 2000) Table 1 shows the most relevant materials used for the components of wind turbines. (Demir and Taşkın, 2003) The extraction of the different materials requires a lot of energy, with the extraction of iron ore needed to manufacture necessary steel components especially energy consuming. Another highly energy consuming process is the extraction of crude oil for the production of epoxy materials such as wind turbine blades. (Vestas, 2004) Some of the materials are secondary, i.e. recycled materials. In Germany, for example, 40% of copper is produced from secondary copper. If recycled steel is not used, energy consumption during steel production doubles. (Guezuraga et al., 2012)

Component	**Foundation**	**Tower**	**Nacelle**	**Rotor**	**Other Component**
Material	Concrete Steel Iron	Steel Aluminum Plastic Copper Paint	Steel Copper Aluminum Iron Epoxy/Resin Fiberglass	Steel Fiberglass Epoxy/Resin	Aluminum Copper

Table 5: Materials of wind turbine components (cf. Demir and Taşkın, 2003)

2.2 Manufacturing

The components are either manufactured at a supplier or at the manufacturer. The most energy intensive component manufactured is the tower of the wind turbine, due to its large dimensions. (Guezuraga et al., 2012)

2.3 Installation

Wind towers are generally installed by cranes and other typical construction machines and tools. To install a wind power plant, an infrastructure of foundations, electric cables, cable trenches, paths and road connections, and transformer room must be built on location. (Ardente et al., 2008)

One of the first steps at the construction site is building a road giving access to the location of the wind turbine for equipment during construction and future operations. It must accommodate cranes and trucks delivering the large parts of the wind turbine. The wind turibine foundation is constructed out of reinforced concrete. After it is finished the wind turbine segments are delivered and built. (We Energies, 2009) For offshore wind turbines, the installation conditions are more complicated, due to construction requirements, special installation equipment, like crane ships, and weather conditions.

2.4 Operation and Maintenance

The lifetime of wind turbines is calculated as around 20 years. (Vargas et al., 2015) As wind turbines are computer-assisted, daily operation requires negligible permanent personnel. However, maintenance and control cycles are necessary. Inspections are done 3 to 4 times a year. (Ardente et al., 2008) Service is carried out in the form of oil changes and renewing lubricant. Geared turbines need more maintenance, because of the bigger number of rotating parts. (Guezuraga et al., 2012) In general, it is expected that one blade and 15% of the

nacelle's components, including half the gearbox, will be replaced over the lifetime of wind turbines. (Vargas et al., 2015)

2.5 Decommissioning

After a lifetime of 20 years, wind turbines must be disassembled before their parts can be recycled or disposed of. The process of disassembly is similar to installation. *Vestas* assumes that 90% of the metals are recycled and 10% landfilled. Composite materials like glass fiber components and plastics are mostly incinerated. (Vestas, 2006) As mentioned before, it is important to recycle most of the materials to reduce the energy consumption required during raw material mining for wind turbines.

2.6 Transport

Transport processes connect the phases of the wind turbine life cycle. They are responsible for carrying the materials used for the wind turbines between the manufacturing steps and the place of installation. More than 10 trucks are necessary for the transport of one wind turbine, due to the large dimensions of its components. (Gasch and Jochen, 2012)

3. Life Cycle Assessment

One way to analyze the life cycle of a wind turbine is the life cycle assessment, a "cradle to grave" analysis to investigate the environmental impact of a system. ISO 14040 defines the LCA as analysis and evaluation of the inputs, outputs and the potential environmental impacts of a system during its lifetime. (ISO 14040, 2006) The LCA approach is to compare the environmental impacts of different products and the energy used in their production. This is of great importance especially for renewable energies. As mentioned before, renewable energy plants are not zero-emission energy sources, as they require energy over their lifetime. Some argue that the energy used to produce renewable energy infrastructures is not paid back during its lifetime. (Schleisner, 2000) Using LCA helps prove the contrary. It can be applied to identify process steps with the biggest environmental impacts, and thus to support the development of an environmentally oriented supply chain management. (Bonou et al., 2015)

A number of LCA studies focusing on the manufacturing and installation of wind turbines already exists. However, the process of disposal is often neglected. A study that analyzed 72 LCAs found that they all studied the manufacturing phase, 70% studied the installation, 56% studied operation and maintenance, but only 19% included the decommissioning phase. (Liberman, 2003)

To evaluate the energy and environmental performance of wind turbines the energy payback time gives a comparative index for renewable plants. The payback time states the time to recover an initial investment. (Ardente et al., 2008) However, the energy payback time compares primary energy with electricity produced by a wind turbine, which is not representative. In contrast, the primary energy payback time (PEPBT) compares the primary energy input (E_{In}) and the primary energy produced during the life cycle. (Tremeac and Meaner, 2009) This could be implemented by converting the electricity produced ($E_{Out;Elec}$) by the wind turbine into primary energy by using an energetic supply factor (ESF) (for Germany e.g. about 3.0 kWh Primary Energy Equivalent per kWh electricity). (Wagner et al., 2011)

$$PEPBT = \frac{E_{In}}{E_{Out;Elec} * ESF} \quad (1)$$

This paper focuses on the energy input and output and the primary energy payback time. Environmental impacts of wind turbines are not discussed in detail.

Six LCAs from other previous studies, chosen for their consideration of energy calculations, are analyzed and summarized in Table 2. Only the data for the energetic supply factor is assumed based on the German ESF factor to calculate the primary energy payback time, since it is not considered equally in the LCAs analyzed. Furthermore, the table shows the different types of wind turbines and the corresponding turbine heights, location (onshore/offshore) and the estimated lifetime. In addition, the energy data for the previously defined life cycle phases are listed in the table. Not all researches define these phases in the same way, with raw material extraction, manufacturing and installation often seen as one phase.

Wind turbine			LCA						Energy			
Type	Height [m]	Life [years]	Raw Material extraction [GJ]	Manufacturing of Components [GJ]	On site installation [GJ]	Operation and Maintenance [GJ]	Decommis-sioning [GJ]	Transport [GJ]	Energy Input [GJ]	Energy Output [GJ/ year]	Energetic supply factor	Primary Energy Payback time [years]
660kW onshore	55	20	not considered	2.316	1.234	264	70	247	4.127	4.157	3,02	0,33
		20		56,12 %	29,90 %	6,40 %	1,70 %	5,98 %				
1,8 MW gearless onshore	65	20	6.411		included in transport	418	235	532	7.596	11.772	3	0,22
		20	84,40 %			5,50 %	3,10 %	7,00 %				
2 MW gearbox onshore	105	20	11.880		included in transport	774	436	985	14.076	21.528	3	0,22
		20	84,40 %			5,50 %	3,10 %	7,00 %				
2 MW gearbox onshore		25	17.594	1.359,3		167,8	218,3	243,4	19.583	25.200	3	0,26
		25	89,84 %	6,94 %		0,86 %	1,11 %	1,24 %				
4,5 MW gearbox onshore	124	20	52759			5.242	-3.480	15.631	70.152	42.120	2,87	0,58
		20	75,21 %			7,47 %	-4,96 %	22,28 %				
5 MW gearbox offshore	90	20	150.250			39.167	2.333	included in the phases	191.667	70.200	3,007	0,91
		20	78,39 %			20,43 %	1,22 %					

Table 6: LCA comparison (cf. Ardente et al., 2008; Guezuraga et al., 2012; Ghenai,2012; Tremeac, Meunier, 2009; Wagner et al., 2011)

3.1 Raw Material

The first step during a life cycle of a wind turbine is the extraction of raw materials. Most of these materials come from non-renewable sources. The majority of scientific studies on wind energy LCA do not investigate the energy needed for the raw material extraction further. Usually only the amount of material is shown. The demand of energy to extract for example iron ore is not discussed. Those papers which do imply the energy for the material extraction refer to data from software like GEMIS (Guezuraga et al., 2012) or LCA databases like GaBi EDIP. (Vestas, 2006) Only one LCA (2MW, gearbox, onshore) examines the energy consumption of the raw material stage and calculates nearly 90% of overall energy consumption for this stage.

The most energy intensive process in raw material extraction is the production of stainless steel followed by concrete and cast iron owing to their large material input. The biggest energy consuming process per kilogram is the production of plastics. (Guezuraga et al., 2012)

3.2 Manufacturing

This phase is supposed to be the most energy consuming one according to all but one of the analyzed LCAs. Most LCAs studies consider manufacturing and raw material extraction as one phase, consequently leading to the connection of energy consumption for raw material extraction and turbine manufacturing. *Ardente et al.* state the tower manufacturing with 50% as the most energy consuming process of the component manufacturing, (Ardente et al., 2008) followed by the second largest contributor – nacelle production – that has to be divided into gearless and geared nacelles. The gearless nacelle construction (28%) requires significant more energy than a geared nacelle (12%) caused by the heavy direct drive gearless generator. (Guezuraga et al., 2012)

3.3. Installation

The installation is the least described phase. The energy data is included either in the manufacturing phase or in the transport energy data (see Table 2). The main contributor in this phase is the energy expenses for the machines, like cranes and excavators.

3.4 Operation and maintenance

For onshore wind turbines the energy consumption during the operation and maintenance phase is about one to eight percent. The energy consumption for offshore wind turbines is much higher (20%) due to the long distances that have to be traversed by boat or helicopter. Only one fifth of the energy for offshore operation & maintenance is used for changing spare parts, oil and lubrication. (Wagner et al., 2011) As mentioned before, the energy expenses for geared turbines are higher than for gearless turbines, because the gearbox needs more maintenance.

3.5 Decommissioning

The phase with the lowest energy requirements is the decommissioning phase. This is because the energy regained during the recycling or the incineration processes is subtracted from the energy needed for the disassembling and the recycling process itself.

3.6 Transport

The amount of energy used for the transport phase is usually less than 10% of the total energy consumption of a wind turbine's life cycle. The main drivers are the distances between raw material and component supplier to the manufacturing plant and the distance between manufacturing plant and installation site. For off-shore locations, the energy expenses are even higher due to the larger distances and transport modes.

3.7 Energy Input

Focusing on the energy input, the data indicates a broad variation of consumed energy during the life cycle. This variation may be caused by many factors. One of these factors is the power category. There is a significant connection between output size of a turbine and the energy required for its construction, mainly due to the rising material input for bigger turbines. In addition, the height of the turbine tower necessitates a larger material input and therefore a greater energy input. Another factor is the type of wind turbine: a gearless wind turbine needs less material and only half of the energy in comparison to a geared turbine. The last impact factor on the input energy is the location of the wind turbine.

3.8 Energy Output

The energy output is highly dependent on the rated energy output of the wind turbine: The bigger the turbine, the higher the possible energy output. More factors are the geographic location, tower height and system efficiency. (Crawford, 2009)
According to *Enercon* the energy production is mainly influenced by the location of the turbine. An offshore wind turbine could deliver up to 50% more energy than an onshore turbine. (Enercon, 2012)

3.9 Primary energy payback time

The calculated primary energy payback time ranges from 0.22 to 0.91 years. This means no matter which power category a wind turbine, the plant is energetically amortized in less than one year. Nevertheless, the data shows that an offshore wind turbine needs more time for the energy payback than an onshore turbine. As this paper only analyses one offshore LCA, this may not be representative.

3.10 Energy Value Stream Mapping

In this paper, the methodology of energy value stream mapping is used to identify the main energy drivers of the life cycle of a wind turbine. Therefore, the method of value stream mapping, a lean enterprise technique to document, analyze and improve the flow of information or materials, is extended with energy data. (Erlach, 2013)
The energy value stream mapping is conducted based on Table 2. The data show that the first three energy phases are combined to one phase. The energy consumption ranges from 75% to 97%, illustrating that the first three phases are the main energy consumer during the life cycle of a wind turbine, cf. Figure 2. All processes during these phases are value adding. The operation and maintenance phase is partly value adding and partly non value adding, but necessary. The same applies to the decommissioning phase, because the recycling processes regain energy and value, but the disassembling does not directly add value. The transport connecting these phases is a not value adding, but it is clearly necessary.

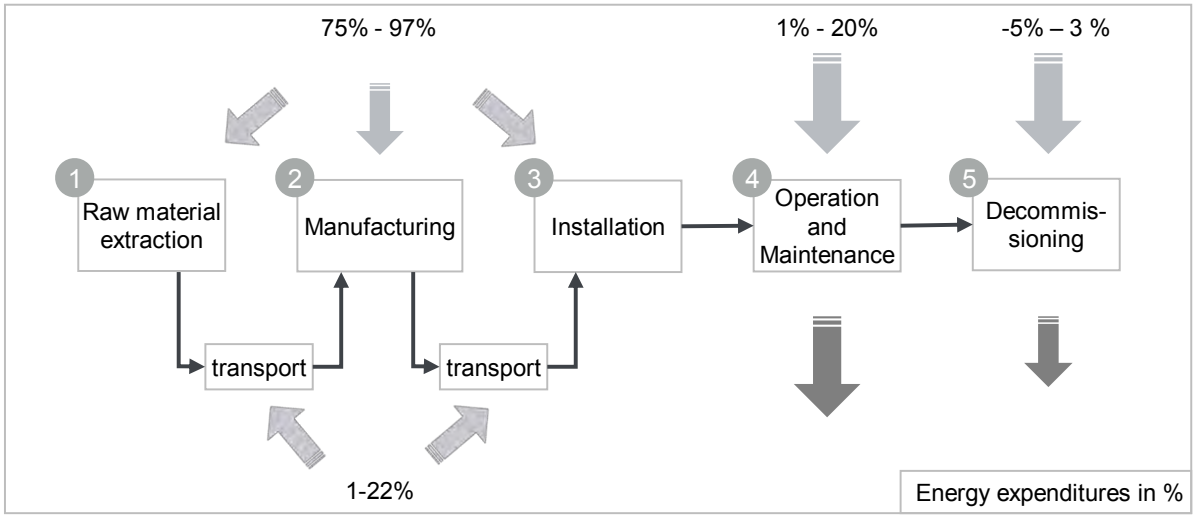

Figure 8: Energy Value Stream Mapping

4. Energy Efficient Supply Chain

The potential of an optimized supply chain of wind energy turbines is outlined by an example in the following paragraph. Figure 3 displays an extract of a wind turbine supply chain from cradle to grave. It shows the different components of a wind turbine while the discussion focuses exemplarily on transport processes of the tower for an onshore wind turbine. For a holistic approach, all components and supply chain processes as well as the different manufacturing processes need to be analyzed.

Based on this exemplary supply chain different location scenarios are developed which result in different energy consumptions. The energy data are based on distance and transport modes, calculated with the tool ECOTRANSIT. (EcoTransIT, 2015) Different transport modes are considered and their energy consumption is computed for each route. The modes considered are sea ship, train, truck and barge. Sea ship and barge transport in addition include transportation by truck for distances from and to the ports.

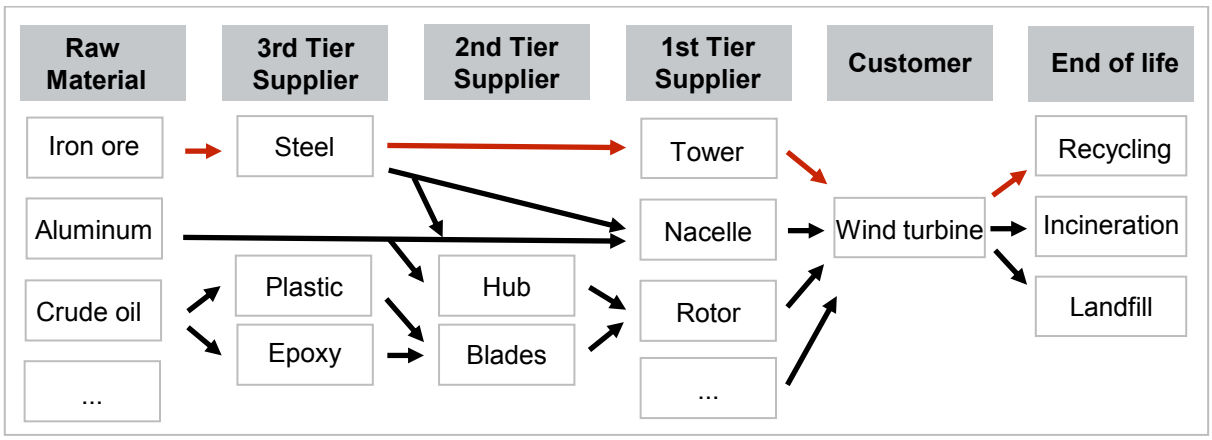

Figure 3: Wind turbine supply chain

The location of the tower manufacturer is predefined to be close to the German North Sea, while the locations for iron ore extraction, steel mill and recycling are interchangeable. According to the world mineral production, three main producers of iron ore are China, Australia, and Brazil. In addition, the biggest producers in Europe are Russia and the Ukraine. (Brown, T.J. et al., 2015) These five producers are included in the energy efficiency analysis. For the steel mill process three different sites in North Germany (Bremen, Eisenhüttenstadt and Salzgitter) are considered, while for the site of the wind turbine a radius of 130 km around

the tower manufacturing is assumed. This area covers all relevant locations on and near the German North Sea coast. In the next step, the supply chain is modified in terms of locations and transport modes to identify the most energy efficient combination. For the main component of the tower, steel, a mass of 200 t is assumed for the calculations.

4.1 Transport optimization

Starting at the raw material extraction, the energy required for the transportation of those materials strongly varies with the mining location. Reducing the distance between mining location and wind turbine manufacturing site leads to a sharp decrease of energy consumption. Changing the transportation mode also offers potential to decrease energy consumption. Transport by train and boat are highly efficient in terms of energy used per transported weight. Analysis shows that transporting iron ore from the Ukraine to any of the steel mills considered consumes the least amount of energy. However, to reduce the overall consumed energy from the mine to the tower manufacturer, the distance between the steel mill and the manufacturer must also be analyzed. Table 3 shows all energetic optimal relations from each iron mill considered to the tower manufacturer. The most energy efficient way to transport iron ore to the tower manufacturer at the North Sea is from the Ukraine via Bremen with a consumption of 167GJ. In this scenario, the first distance is traversed by sea ship via the Mediterranean Sea to Bremen and from there by train to the manufacturer. In comparison, the transport from the world's largest iron ore producer China consumes about 100 GJ more.

Iron ore mine to steel mill		**Steel mill to tower manufacturer**		**Energy [GJ] iron ore mine to tower manufacturer**
Location of mine	**transport mode**	**Location of steel mill**	**transport mode**	
Ukraine, Krywvj Rih	sea ship	Bremen	train	167
Ukraine, Krywvj Rih	train	Eisenhüttenstadt	train	183
Ukraine, Krywvj Rih	train	Salzgitter	train	182
Russia, Kursk	train	Bremen	train	204
China, Benxi	sea ship	Bremen	train	265
Brazil, Carajás	sea ship	Bremen	train	335
Australia, Tom Price	sea ship	Bremen	train	509

Table 7: Excerpt - transport energy from iron ore mine to tower manufacturer

For reasons of simplicity (and due to the large dimensions of the pre-mounted tower parts, which are difficult to transport by train) only truck transport is viable from tower manufacturing to installation site. For this stage, an energy consumption of 27 GJ is calculated. The same applies for the transportation of the disassembled tower to a steel recycling yard; also assuming a 130 km radius leading to an energy consumption of 27 GJ. In the **best scenario only 221 GJ in total are necessary for the entire transport of the 200 t steel** tower components. To illustrate the potential of improving the supply chain under energy efficiency aspects, it should be noted that this amount is **less than the 247 GJ** listed in Table 2 **for the transport** of a 660 kW wind turbine, requiring only **66 tons of steel**.

4.2 General optimization

Besides the argued potentials considering transport processes a variety of other optimization potentials can be identified over the life cycle of wind turbines. As mentioned before, the manufacturing phase itself is very energy intensive. Optimizing the processes that transform the components into wind turbines certainly has potential to save additional energy. Currently,

steel is difficult to replace as the ideal material for wind turbines, but **material saving options**, like lattice or concrete towers should be considered. To solve the acceptance problems of lattice towers, General Electric developed the space frame tower – a lattice tower covered by a cladding. This tower type eases material needs and transport efforts. (General Electric, 2014) The introduction of **modular towers** with **smaller components** also shifts the location of value creation. The more components mounted and installed on-site, the lower the transport requirements and energy consumption, due to **smaller transportation metrics**. Finally the **manufacturing processes** itself should be further analyzed, especially because of their great impact on the total energy requirements.
At the end of the life of a wind turbine, the foundation normally remains in the ground covered by soil. A possibility to save energy is to **re-use** the foundation or to recycle the reinforced concrete. Moreover, it is essential to focus on the recycling process to improve the efficiency of material use and to save energy. Especially glass-reinforced plastic components like turbine blades should be considered for recycling. Currently the blades are shredded and thermally recycled. (Isenburg, 2015) New **recycling processes** need to be developed to allow re-use of these materials.

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ENERGY RECOVERY AS A SUSTAINABLE MEANS TO MANAGE POSTCONSUMER FOOTWEAR WASTE

Nakorn Tippayawong*[1], Korrakot Yaibuathet Tippayawong[2]

[1]Department of Mechanical Engineering, Faculty of Engineering, Chiang Mai University, Chiang Mai 50200 Thailand
[2]Department of Industrial Engineering, Faculty of Engineering, Chiang Mai University, Chiang Mai 50200 Thailand
**Correspondence, Tel.: +66-5394-4146, Fax: +66-5394-4145, E-mail: n.tippayawong@yahoo.com*

Introduction

All over the world, an increased generation of waste during production and at the end of use is a serious problem due to unsustainable consumption and economic growth. Waste management has become a major concern and one of the most important environmental and political issues in modern society. Importance of controlling and minimizing waste at source is recognized, but total waste elimination in the products' life cycle is impossible. Management of end-of-life waste is a major part of the integrated waste management concern.

In this work, the focus was on the footwear industry. The shoe industry has grown steadily over the past several decades, reaching almost 25 billion pairs of shoes a year (APICCAPS, 2015). While demand is rising, mass production lowers the price. Shoes often have a relatively short product life, resulted in a large waste stream. Even through significant efforts have been made to improve energy and material efficiency of the production process, not much has been placed in recovering and recycling of this post consumer footwear. Most of postconsumer shoes end up as waste, and are likely to be disposed of in landfills (Lee and Rahimifard, 2012).

In Thailand, managing end-of-life waste has still been a sole responsibility of governmental agencies and local authorities. Apart from recycling and recovery of material, one of the options advocated by waste management planners and government regulations is via energy recovery. Modern waste-to-energy (WTE) facilities with adequate and careful environmental monitoring have been shown to be a safe and cost effective technology. WTE conversion has a worldwide adoption and is becoming popular in Asia. It is also realized that WTE facilities may contribute to a positive cash flow in areas where tipping fees are high and landfill space is limited (Bebar et al., 2002).

Understanding and managing postconsumer footwear waste sustainably is of major concern. The present study gives a brief overview of end-of-life waste from the footwear industry and an integrated waste management with emphasis on energy recovery option. Challenges of waste management and energy recovery from used shoes are also outlined.

Waste from Footwear Supply Chain

Waste from shoe supply chain is generated throughout the chain (Fig. 1), starting at raw materials extraction, processing, component making, product assembly, sales and distribution, and at end-of-life. Waste generated are in various forms, solid, liquid and gas. Examples are raw material by-product, refuse, excess materials, disposed packaging materials, disposed end-of-use product, wastewater, chemicals, oils, and air pollutants.

Worldwide footwear consumption was increased from about 1 pairs of shoes per person per year in 1950 to 2.6 pairs per person per year in 2005. In 2010, worldwide

production was about 20 billion pairs and expected to reach nearly 25 billion pairs in 2015. Dominant manufacturers are concentrated in Asia, accounting for almost 90% of the total global production output (APICCAPS, 2015). Footwear industry and leather products contributed to about 2% of Thailand gross domestic product. In 2010, Thailand was ranked 7th in terms of production volume at almost 250 million pairs. Domestic consumption was more than 160 million pairs a year (Laiwechpittaya and Udomkit, 2013). It was reported, on a global basis, that about 95% of shoes consumed annually are ended up in landfills (Lee and Rahimifard, 2012). It is expected that increased raw material costs, stakeholders' responsibility issue and more stringent environmental regulations will significantly affect the footwear industry.

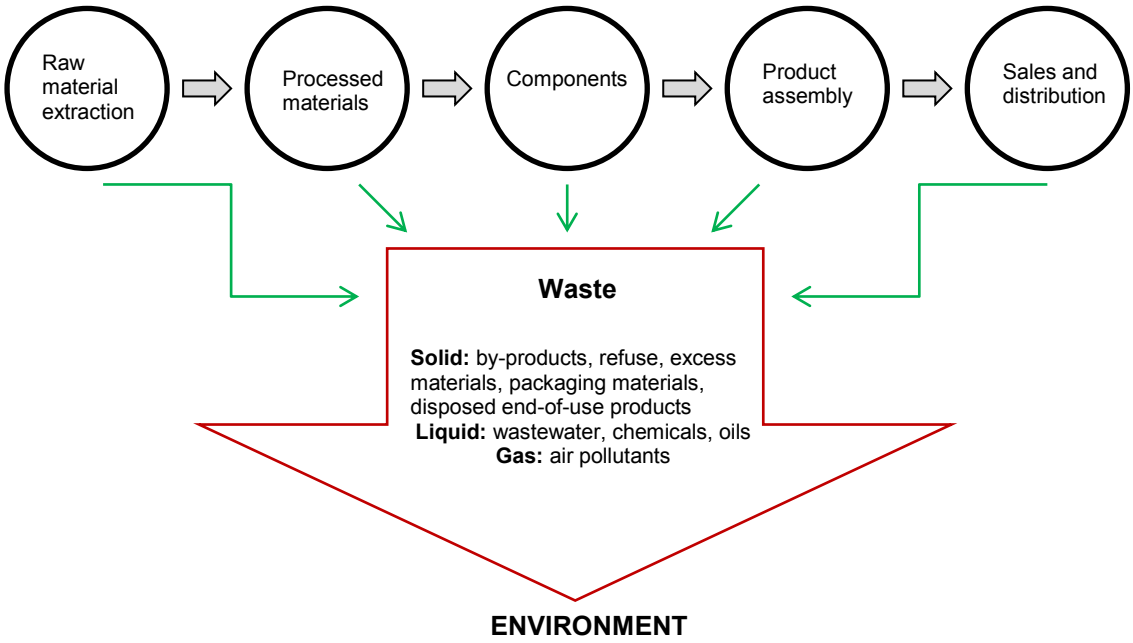

Figure 1. Waste generation from footwear supply chain

Typical Shoe Materials

In modern days, shoes are viewed as items of fashionable products that are not only used to protect and comfort, but also to enhance personal image. There are largely different types and styles of footwear, manufacturing from a wide variety of materials. Around 40 different natural and synthetic materials may be used to make shoes (Weib, 1999). Leather, rubber, plastics and textile are among the most common materials used. Table 1 shows the material composition of a typical footwear product. The diverse range of shoe types and complex mixture of materials pose serious challenges for recycling in an economically sustainable manner.

Component	(% w/w)
Leather	25
Rubber	23
Plastics	
Polyurethane	17

Ethylene vinyl acetate	14
Poly vinyl chloride	8
Textile and fabrics	6
Other (adhesives, metals, woods, etc.)	7

Table 1. Materials composition of a typical shoe (Weib, 1999)

Integrated Waste Management

The increase in waste generation has placed a tremendous pressure on the government and local authorities to manage it effectively. Thailand's present solid waste management strategy focuses on bulk collection and mass disposal. According to US Environmental Protection Agency (EPA), an integrated waste management is a comprehensive waste prevention, recycling and disposal program.

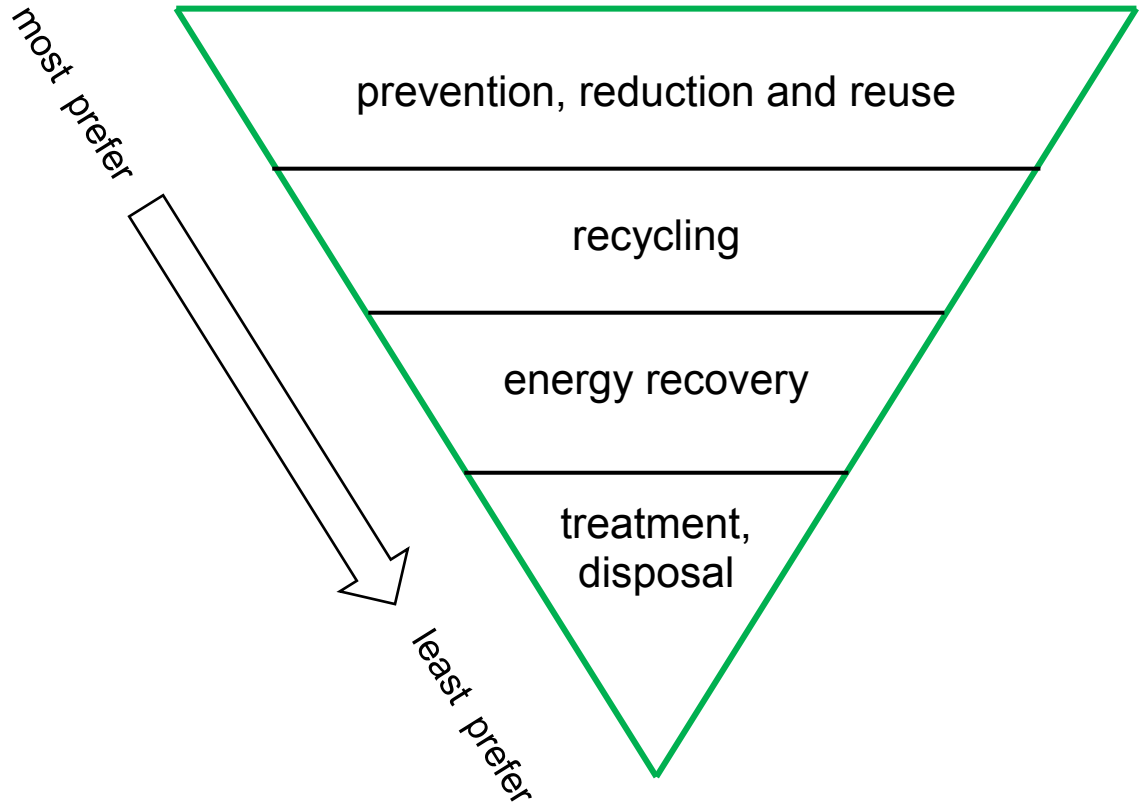

Figure 2. Integrated solid waste management hierarchy, based on EPA

4.1 Waste prevention

Waste prevention or source reduction seeks to avoid waste generation. Its strategies include using less packaging, designing products to last longer, and reusing products and materials.

4.2 Recycling

Recycling is a process involving collection, reprocessing, and recovering of valuable waste materials to make new materials or products.

4.3 Disposal

Usually, disposal includes treatment, incineration and landfilling. These activities are used to manage waste that cannot be recycled. Controlled burning of waste helps reduce its volume.

An effective waste management system considers prevention, recycling, and management of waste in such a way that most effectively protect human health and the environment. They range from the most to least preferable methods, Fig. 2. For footwear products, a waste management framework has been developed (Staikos and Rahimifard, 2007a). The proposed framework divides management options into proactive and reactive approaches. The major activities include waste prevention, minimization, reuse, recycling, energy recovery and, to a smaller extent, disposal in properly designed, constructed and managed landfills. Decision support tool and decision making model were developed in helping the footwear industry deal with its waste (Staikos and Rahimifard, 2007b; 2007c). Several cases were reported for material recycling, as well as studying value chain of used shoes (Lima et al., 2010; Lee and Rahimifard, 2012; Somboon and Tippayawong, 2015) A few studies were carried out for thermal conversion (Bahillo et al., 2004; Godinho et al., 2011).

5. Energy Recovery

Total waste elimination is impossible in the product life cycle. There will always be some fraction of waste that cannot be reused and recycled. They may be used to generate energy in terms of fuels, heat, or electricity. The chemical composition of shoe component is listed in Table 2. Using empirical formula shown in Eq. 1 (Demirbas, 1997) and average material composition, the average heating value of a typical shoe is estimated to be more than 20 MJ/kg, in similar range to coal.

$$HHV \text{ (MJ/kg)} = 33.5\,C + 142.3\,H - 15.4\,O - 24.5\,N \quad (1)$$

	C (%)	H (%)	O (%)	N (%)	S (%)	Cl (%)	water (%)	ash (%)
Leather	43.1	5.4	11.6	1.3	1.17	4.97	10.0	22.5
Plastic	56.4	7.8	8.1	0.9	0.29	3.00	15.0	8.6
Textile	37.2	5.0	27.1	3.1	0.28	0.27	25.0	2.0
Wood	41.2	5.0	34.5	0.02	0.07	0.09	16.0	2.8

Table 2. Composition of common materials used for footwear

where *HHV* is the higher heating value of fuel. *C*, *H*, *O* and *N* are carbon, hydrogen, oxygen and nitrogen contents (% by weight of fuel), respectively.

It was clear that energetic content of a shoe was quite high. They may be used as fuels via WTE conversion which includes several established and emerging technologies such as refuse derived fuel (RDF) production, and thermochemical conversion technologies including combustion, gasification and pyrolysis.

5.1 Physical upgrade

The postconsumer shoe waste as solid fuel is composed of combustible components (plastics, rubber and leather, textiles and woody matter). The proportion varies, depending on designs and recycling programs. The RDF production may be accomplished through successive treatment stages of screening, shredding, size reduction, classification, separation, drying, densification, and storage. The processed solid fuel has a number of advantages over untreated waste which are the higher calorific value, the homogeneity of physico-chemical composition, the ease of storage, handling and transportation. RDF technology and equipments are well established for handling municipal solid waste. However, no system has yet been designed for shoe waste. Modifications of existing hardware as well as new development may be required specifically for it.

5.2 Thermochemical conversion

Direct combustion or incineration is the most common WTE approach. More advanced thermochemical conversions such as gasification and pyrolysis have been established. Each technology gives a different range of products, sets different requirements for the input, and operates in different modes (Table 3).

	Combustion	Gasification	Pyrolysis
Temperature (°C)	800–1450	500–1800	250–900
Pressure (bar)	1	1–45	1
Atmosphere	Air	Air, O_2, H_2O	Inert
Stoichiometric ratio	≥ 1	<1	0
Products:			
Gas phase	CO_2, H_2O, O_2, N_2	H_2, CO, CO_2, CH_4, H_2O, N_2	H_2, CO, H_2O, N_2, hydrocarbons
Solid phase	ash, slag	slag, ash	char
Liquid phase			bio-oil, water

Table 3. Characteristics of main thermal technologies considered (Bosmans et al., 2013).

Combustion

Combustion is basically a rapid, high temperature oxidation of the combustible components contained in the waste. It is used to treat a wide range of wastes. The main mechanisms are drying and degassing, devolatilization, and oxidation. During combustion, flue gases (CO_2, H_2O, O_2, N_2) are generated that contain the majority of the available fuel energy as heat. Tiny amounts of CO, NO_X, SO_2, volatile organic and heavy metal compounds may be formed. Nevertheless, burning of waste can be an environmentally friendly method if combined with energy recovery, emissions control and an appropriate disposal method for the remains. The following types of combustor are most frequently encountered in practice: grate incinerators, rotary kilns and fluidized beds, with heat exchangers to generate high pressure steam. The steam is piped directly to drive turbo-generators. Air pollution control devices such as dry, semi-dry and wet scrubbers to remove acid gas, heavy metals, dioxin and furans,

bag filters and electrostatic precipitator to remove large and small particulate matter as well as dust are usually employed.

Gasification

Gasification is thermal decomposition and reformulation of organic materials at elevated temperature (500–1800 °C) to produce a fuel gas. The fuel gas contains CO, H_2, CH_4, CO_2, H_2O, N_2, trace amounts of higher hydrocarbons and various contaminants such as tar and char particles. This gas can be used as a fuel for efficient production of heat and/or electricity, or as a feedstock for synthesis of chemicals. A gasification reactor or gasifier can use air, oxygen, steam, carbon dioxide or a mixture of these as gasification agents. The three main gasifier types are fixed bed, fluidized bed, and entrained flow gasifiers. Example of a gasification process is schematically shown in Fig. 3.

Pyrolysis

Pyrolysis is thermal degradation of organic materials in the absence of an oxidizing agent, or with only a limited supply at relatively low temperatures (400–900 °C) to produce pyrolysis gas, liquid and solid char. Proportions of the three products depend on the pyrolysis method and process parameters. Conventional pyrolysis reactors include fixed bed, fluidized bed, entrained flow, moving bed, rotary kiln, and ablative reactor. Example of a pyrolysis process is schematically shown in Fig. 4.

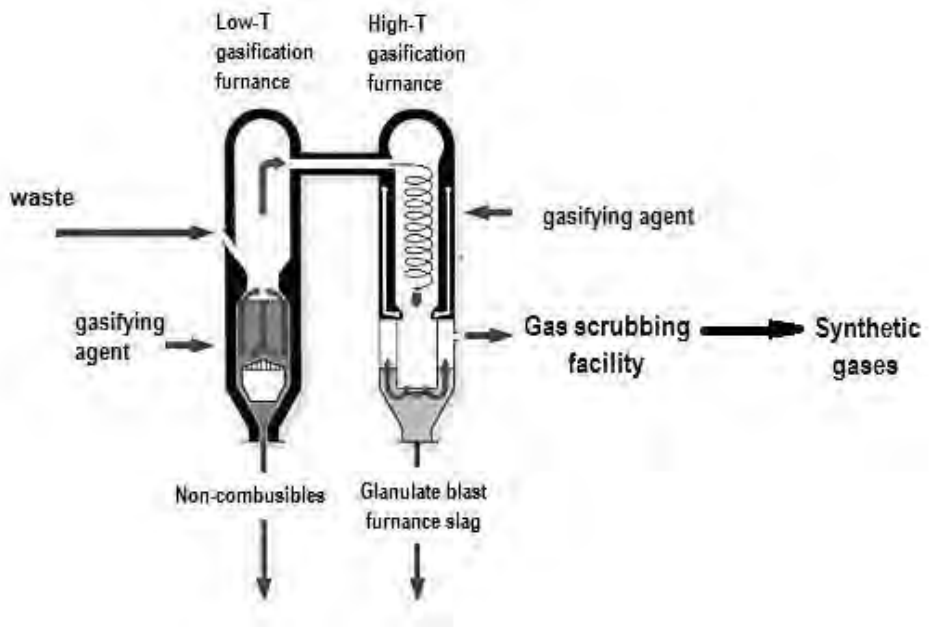

Figure 3. Gasification process for converting waste to fuel gas

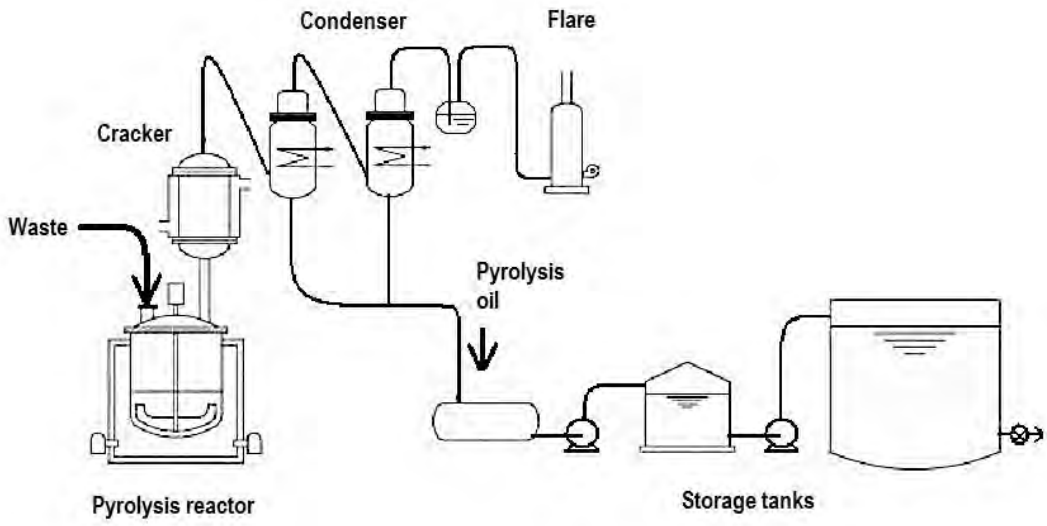

Figure 4. Pyrolysis process for converting waste to bio-oil

6. Challenges in Management of Postconsumer Footwear Waste

Increased raw material costs, public concern, manufacturers' responsibility issue and tighter environmental legislations are expected to challenge the way the footwear industry, the relevant governmental agencies, as well as the customers currently deal with the postconsumer waste.

Rethink - The shift in thinking for customers, manufacturers and governmental agencies is required to manage the waste sustainably. This involves changes in values and behaviors, which will switch to adopt better systems of manufacturing, distributing, using, servicing, and regulating the industry.

Reuse and Recycle – Structural changes to the footwear industry may be required throughout the supply chain from production to end-of-life to accommodate successful recycling program. Sustainable reverse logistics in the sector as well as value recovery chain may be established. New generation of recycling processes should be developed.

Recovery of energy – Landfilling must be the last method adopted. Those wastes that are not ultimately recycled must be treated possibly by energy recovery option. However, waste treatment infrastructure is almost non-existent. National strategies or incentives for development of new technologies are not clear and still lacking. Demonstration of the technology may be needed.

7. Concluding Remark

Tremendous amount of used shoes waste is generated every year. Sustainable management of footwear waste is needed. In this study, a brief overview of postconsumer footwear waste was presented. Energy recovery options to deal with ultimate non-recyclable waste were highlighted. Apart from waste prevention and recycling, the end-of-life WTE recovery can be not only environmentally friendly, but may also be economically justified.

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EXPLORING VIETNAMESE LOGISTICS SERVICE QUALITY IN THE RUN-UP TO AEC 2015

David B. Grant[1], Trinh Thi Thu Huong[2], Chandra Lalwani[1]
[1]Hull University Business School, Hull, UK, [2]Foreign Trade University, Hanoi Vietnam
Emails: D.Grant@hull.ac.uk, ttthuhuong@ftu.edu.vn, C.S.Lalwani@hull.ac.uk

Introduction

The logistics and supply chain management domain faces a number of ongoing trends and resultant challenges including costs, the globalisation of supply and markets, time compression, product complexity and shrinking product life cycles, quality of performance and service, a shortage of logistics and supply chain management talent, their impact on the natural environment, and risk and disruption and supply chain security (Grant, 2014). This is particularly true in and important for developing economies such as Vietnam.

The Vietnamese economy, measured by GDP, has grown from about US$ 33.6 billion in 2000[7] to over US$ 184.2 billion in 2014[8]. However, despite this significant progress Vietnam only broke into the top 50 in the 2014 World Bank Logistics Performance Index or LPI (Arvis *et al.*, 2014). Issues affecting Vietnamese logistics include high costs (logistics costs represent 25% of Vietnam's GDP), lack of good infrastructure, poor customs clearance procedures, poor connections with goods areas despite significant spending from the government, lack of a proper legal framework and regulations that match current realities, and logistics service providers (LSPs) who lack skills, networks and capital (Blancas *et al.,* 2014; Viet Nam News, 2014).

However, these high-level or macro perspectives do not deeply consider perspectives from key logistics-specific 'actors' such as LSPs, manufacturers and retailers, or external stakeholders such as end-customers or consumers, non-profit associations and Vietnamese public authorities. Hence, we argue that an in-depth investigation of such micro perspectives is warranted to consider not only whether these barriers are the only ones inhibiting Vietnamese logistics development but also what drivers or key success factors might enhance Vietnamese logistics.

This paper reports on an in-progress research study of this phenomenon and is important to provide deeper insights as Vietnam prepares to join other SE Asian countries in implementing the ASEAN Economic Community (AEC) initiative at the end of 2015. The study's objective is to enhance understanding about exogenous and endogenous issues in Vietnamese logistics from the individual stakeholder or firm's point of view in particular, and about logistics issues generally in developing nations. The study has been designed to do this by addressing current gaps regarding state-of-the-art Vietnamese logistics, as well as firm capabilities and readiness to become part of a wider regional logistics network stemming from AEC 2015.

The proposed outputs from this study should also identify the most important factors that are barriers to, or drivers of, logistics development for firms in Vietnam, as well as overarching latent constructs. Further, the study should provide guidance for domestic firms concerned with logistics, i.e. LSPs, manufacturers and retailers, and well as other stakeholders including customers, Vietnamese public authorities and foreign firms operating in Vietnam.

Theoretical Background

Logistics and supply chain management (SCM) permeate almost all aspects of our daily lives and without them we would not have many of the goods, products and services that we take for granted in our normal existence. Logistics activities also have a major economic impact on countries and their societies and hence the cost of logistics and SCM are important criteria for both firms and governments (Grant, 2012).

Logistics costs accounted for 8.2% of gross domestic product (GDP) in the United States in 2013, or about $1.39 trillion (Wilson, 2014). In Europe, they accounted for 7.2% of GDP

[7] Source: http://data.worldbank.org/indicator/NY.GDP.MKTP.CD/countries/VN?page=2&display=default
[8] Source: http://data.worldbank.org/country/vietnam

across the EU 27 countries or about €850 billion in 2008 (A.T. Kearney and the European Logistics Association, 2009). Asian logistics costs, excluding China, Japan and India, accounted for about 17% of GDP (Wilson, 2014), while in Vietnam they represented US $55 billion of GDP in 2010 at 25% (Blancas *et al.,* 2014; Viet Nam News, 2014).

Banomyong *et al.* (2014) explored some issues related to firms' logistics cost and performance in Vietnam and found that respondents may have a lack of understanding related to logistics concepts. Service level capability was the most important issue with lower levels of performance when compared with neighbouring countries. Banomyong *et al.* (2014) based their survey on a similar one conducted in Thailand by Banomyong and Supatn (2011). The latter survey was informed by and made use of measure developed by Grant (2004) and Grant *et al.* (2006) regarding logistics performance, service and satisfaction. Reliability was a key variable in the latter work and Banomyong *et al.* (2014) found an inverse relationship between logistics service quality levels and logistics costs, i.e. logistics costs were high but service performance was low.

The general concept of logistics service quality (LSQ) relates to the 'seven rights': the right quantity of the right product at the right place at the right time in the right condition at the right price and with the right information (Mangan *et al.,* 2011). Two distinctive classifications from the literature have emerged regarding the LSQ concept. The first distinguishes among three typologies: outcome; process; and structure/potential/functional. This conceptualization is close to the traditional construct of company performance. The second develops the LSQ concept's focus either oriented towards customers and their evaluations or perceptions, i.e. a 'subjective quality' towards the service provider.

The overarching framework for customer satisfaction is the expectancy-disconfirmation paradigm where customers develop expectations prior to a product or service experience, and then either confirm or disconfirm those expectations afterwards (Grant, 2004). Negative disconfirmation usually refers to dissatisfaction while a positive disconfirmation refers to on over-provision of product or service performance. Both have important implications for producers or other suppliers providing the product or service when designing their service strategies.

But, although researchers have examined the influence of general service quality on consumer satisfaction and loyalty (e.g. Parasuraman *et al.,* 1985) there has been less research conducted on LSQ. What research has been conducted over the past forty years has found that LSQ, customer satisfaction and subsequent loyalty are influenced by a wide variety of factors or variables occurring at the different moments within the service experience (e.g. La Londe and Zinszer, 1976; Sharma *et al.,* 1995; Mentzer *et al.,* 2001; Grant, 2004). The issue then is to determine which factors are most important to customers and service providers in the context under consideration – Vietnam in this study's case.

Perceptions of important factors are correlated with perceptions the logistics capability of a country. For example, ineffective customs procedures and slow-acting border crossings will underlie firms' and individual perceptions about a country's customs performance. Hence, using the expectancy-disconfirmation paradigm as part of an LSQ investigation can confirm the strength of these perceptions and provide guidance for logistics-related firms and other stakeholders to meet expectations and thus shape perceptions (Parasuraman *et al.,* 1985; Grant, 2004).

One way of measuring the logistics capability of any country is the World Bank's Logistics Performance Index (LPI), which is a weighted average of individual country scores on six dimensions: the efficiency of clearance processes, quality of trade and transport related infrastructure, the ease of arranging competitively priced shipments, the competence and quality of logistics services, the ability to track and trace consignments and the timeliness of shipments in reaching destination within a scheduled or expected delivery time (Arvis et al., 2014). The maximum score is 5.0 and the country at the top of the 2014 Index was Germany with a score of 4.12. Vietnam was ranked 48th with a score of 3.15, an improvement from 53rd place in 2012.

The final step in such an investigation is for individual firms to assess their capabilities relative to what LSQ factors are important to them and their perceptions of how well those factors are provided in their external environment will enable firms to benchmark themselves firstly in order to determine if improvements are required (Kotzab *et al.,* 2011; Grant, 2012).

The foregoing issues have informed our study in the target country of Vietnam. Its lagging logistics performance relative to its rapid development and economic growth of this country suggests it is important to deeply investigate these issues and also very timely given the development of AEC 2015 and its members' intentions to modernise and update aspects of their respective economies and standards of living.

Methodology

This study is undertaking a fresh and new approach to the phenomena of interest, LSQ, and is exploratory given a lack of substantive literature on this topic in Vietnam. Accordingly, and to ensure construct, internal and external validity, a two-stage research process with a multi-method approach will be undertaken using Churchill's (1979) two-stage framework for the development and validation of items and constructs in marketing. Dunn *et al.,* (1994) subsequently adopted this framework for logistics and thus it has been proven robust in both disciplines.

In the first stage the domain of the important variables of interest must be specified and confirmed (Churchill, 1979; Dunn *et al.,* 1994). In the second stage, the relevant variables generated in the first stage are tested and purified via major empirical and quantitative research. For this paper we report on the first stage study and will discuss the second stage under conclusions as part of our ongoing work.

We set out the domain of first stage important variables by generating a set of variables from the literature and then conducting exploratory qualitative research to confirm them. The fourteen factors investigated contained eight factors or variables derived from the series of studies used as antecedents in Banomyong *et al.* (2014) and the six factors used in determining the LPI (Arvis *et al.,* .2014), and are listed in Table 1 with the findings

The qualitative study for this stage comprised an exploratory survey distributed to Vietnamese logistics 'actors' and external stakeholders to identify the variables of importance to them. This stage was undertaken in June-August 2015. The survey contained usual demographic questions and had three sections for logistics 'actors' but only two sections for external stakeholders. The first two sections used a five point Likert scale asked respondents to rate the importance of LSQ factors from very unimportant to very important and of their perceptions on how these factors are being addressed in Vietnam from very poorly to very well, e.g. the ease of arranging shipments.

The third section for the logistics 'actors' only asked respondents to rate how capable their firm is relative to twelve of the total set of fourteen factors that are endogenous, i.e. within their control. For example, how well can they monitor and control logistics costs. Data analysis consisted of descriptive statistics involving data frequencies, means and standard deviations have been performed on the data.

Findings

There were 24 logistics 'actors' and 6 external stakeholders responding for a total response set of 30 respondents. The latter group comprised two Vietnamese government employees and three academic, who each had around 25 years of experience, and one business support officer who has four years experience.

The 24 actor respondents represented 13 privately-owned firms, 3 Vietnamese state-owned firms, 4 foreign-owned firms, and 4 other types, i.e. joint-stock firms. Eleven firms had 50-249 employees and another nine had more than 250 employees. The remaining four had 10-49 employees. Only fifteen respondents reported their firm's annual turnover – the average was US $56 million, however there was a large disparity among them. The highest amount of turnover was $940 million while the lowest was just $335,000.

Nine logistics 'actor' respondents were import-export companies, seven were production or manufacturing companies, while six were logistics service companies and six classified themselves as other. Respondents could select more than on category but only two did so. The average number of years experience for the responding managers was 18, but ranged from 3 years to 54.

Table 1 shows the mean scores on the 5 point Likert scales used for the three sections. As there were only six external stakeholder respondents their scores were added to the logistics actors. The means of the two groups were not significantly different except for the importance of the exogenous variables of proper legal framework and appropriate regulation in the first section. The means for the six external stakeholders was 4.17 for each while the combined respective means were 3.47 and 3.70.

Factor Statements	**How important to your firm are these factors? (1=very unimportant, 5=very important)***	**How are these factors addressed in Vietnam? (1=very poorly, 5=very well)***	**Score differences between importance and provision**	**How capable is your firm relative to these factors? (1=very incapable, 5=very capable)****	**Score differences between importance and capability**
Costs	**4.53**	3.13	**1.41**	3.67	0.86
Company infrastructure	3.40	3.10	0.30	3.33	0.07
Efficiency of customs and border clearance	**4.03**	3.20	**0.83**	3.46	0.57
Quality of Vietnamese trade infrastructure	3.47	2.93	0.54	N/A	N/A/
Quality of Vietnamese transport infrastructure	3.44	2.83	0.61	N/A	N/A/
Ability to track and trace shipments	3.53	3.10	0.43	3.63	-0.10
Ease of arranging shipments	**4.00**	3.13	**0.87**	3.67	0.33
Quality of logistics services	**4.00**	3.17	**0.83**	3.71	0.17
Proper legal framework	3.47	3.00	0.47	3.42	0.05
Appropriate regulation	3.70	2.90	**0.80**	3.75	-0.05
Employee skills	**4.10**	3.53	0.57	3.75	0.35
Access to capital	3.73	3.13	0.60	3.63	0.10
Timeliness	**4.33**	3.13	**1.20**	3.75	0.58
Reliability	**4.43**	3.47	**0.96**	3.88	0.54

Mean scores over 4.00 were recorded for seven factors of importance and there were seven significant score differences between them and how well the fourteen factors are addressed; five of which related to important factors. Those results are shown in bold in Table 1.

Table 1: Survey Findings
(*n=30 – logistics actors and stakeholders; **n= – 24 logistics actors)

Conclusions

The seven LSQ variables of costs, efficiency of customs and border clearance, ease of arranging shipments, quality of logistics services, employee skills, timeliness and reliability were found to be the most important to this respondent group and will inform our future work to drill down into detail to validate these variables. Respondents' perceptions of how well these variables are addressed in Vietnam were significantly different for six of them; only employee skills were not significantly different, perhaps indicating that respondents perceive this variable is being addressed fairly well in Vietnam. While appropriate regulation was not part of the seven most important variables, perceptions of how well this variable was addressed was also significantly different, perhaps indicating that respondents perceive more need to be done with regulation to improve logistics activities and perhaps provide a more level playing field.

These exploratory findings have allowed us to better understand perceptions of respondent firms regarding which variables are important and not being well addressed. Four of these seven variables: efficiency of customs and border clearance, ease of arranging shipments, quality of logistics services and timeliness are from the LPI, and thus provide individual firm support underlying Vietnam's performance in the LPI. Initial findings presented in this paper represent the first of their kind on LSQ in Vietnam and is important within the context of AEC 2015. The number of responses is a limitation to this exploratory work however the findings provide a start to continue this line of enquiry more deeply before developing the larger and more penetrating study.

Following completion of this first stage this study will continue with a quantitative survey targeting a wider sample of Vietnamese logistics 'actors' and other external stakeholders to confirm and validate the variables, and make general observations for the population. Such a larger study will analyse data again using descriptive methods but also include exploratory factor analysis (EFA**)** to determine latent constructs and verify the internal consistency of individual variables. Confirmatory factor analysis (CFA) and structural equation modelling (SEM) will also be used to determine the validity, reliability, and relationships among the variables and latent constructs and to provide a parsimonious set of constructs and variables for logistics 'actors' and external stakeholders to consider for future strategy and policy initiatives respectively.

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IMPROVEMENT OF POSTCONSUMER FOOTWEAR SUPPLY CHAIN BY LEAN CONCEPT

Jureerut Somboon, Korrakot Yaibuathet Tippayawong*
Excellence Center in Logistics and Supply Chain Management, Faculty of Engineering
Chiang Mai University, Chiang Mai, 50200 Thailand
**korrakot@eng.cmu.ac.th*

1. Introduction

In any declining economy, consumers tend to spend more carefully. Second hand markets can be considered as the market of choice to save their money. Used goods are popular if they are generally in good quality and low price. In Thailand, there are many second hand markets, for example at Chatuchak, Wang Lang, Klong Thom, Srinakarin etc. One of the biggest second hand markets in Thailand is Rong Kluea Market located near Thai-Cambodia border approximately 360 km from Bangkok. This market is popular for Thai people, tourists and sellers.

There are several materials and processes involved which are driving the production process for sandals and specialized shoes. The footwear industry is growing and the demands of these products are increasing. The product cycle is relatively short. With the rapid changes in fashion, consumer trends could lead to a higher level of post-consumer waste. Worn and discarded (end-of-life) shoes are disposed of, despite their remaining market values.

In Thailand, there are imported used shoes from overseas through Laemchabang port located in Southern Bangkok which are then forwarded to Rong Kluea Market for reselling. The process flow of the selling chain is of great interest. The middlemen who import used shoes sell them to merchants in Dech Thai market (Sub-market of Rong Kluea market). The merchants are classified into 3 groups by grade and price of products they selected. Used shoes are put into the following processes: separating, selecting, washing, repairing and coloring. Subsequently, the shoes are resold with retail and wholesale price. Generally, all products in this chain are used shoes and consumers are interested in buying them, because they contain brand name shoes which have lower prices than new shoes.

This study focuses on reviewing the postconsumer footwear supply chain to analyze the value creation along the chain. The processes are analyzed and defined using Value Stream Mapping (VSM) to reduce unnecessary activities. Finally, improvements based on lean concept are suggested to reduce total time to finish the process.

2. Literature Review

There have been relatively few studies on the postconsumer footwear supply chain, hence the reason for this study. The scope of this paper is related to the review of the used shoes supply chain and to understand the value added in the chain by means of value chain analysis. Moreover, lean concept is applied to improve processes in the postconsumer footwear supply chain.

Previous studies carried out in this area are reviewed in 4 main categories, end-of-life strategy, value chain management, waste management in footwear industry, principal and generalization of lean concepts.

This section aims to describe some of the key concepts in understanding why the business organizations are interested in recovery products. How companies add value to their products. In addition, waste management in the footwear industry is analyzed. Finally, this research will illustrate and show some examples about an application of lean concept.

2.1 End-of-life Strategies

Previous studies reported that businesses attempt to create appropriate procedure to reduce waste at products' end-of-life cycle. Pigosso, et al. (2010) introduced eco-design concept which focused on remanufacturing. They concentrated on products' end-of-life as a part of product life cycle. The End-of-life strategy includes processes such as; reuse, repair, refurbishment/reconditioning, remanufacture and recycling. This concept tries to close the loop, minimizing environmental impact and cost of life cycle manufacturing processes.

Nowadays, numerous business organizations intend to follow up the end-of-life strategies, because they believe it can reduce the cost of their business and wastes produced in the process. Moreover, it can help to decrease environmental impact. Therefore, they try to add value to the recovery products and complete processes in short time. End-of-life strategies use in many businesses extensively especially in electronic equipment, automobile industries, mobile phone industries, returnable packaging etc. For example, Subramoniam et al., (2010) presented an aftermarket remanufacturing strategic planning decision-making framework where the surveys were conducted in 3 target groups of automotive aftermarket. End-of-life strategies of mobile phones are studied in many areas such as India, Hong Kong and United Kingdom (Rathore, et al., 2011; Chan and Chan, 2008; Canning, 2006; Geyer and Blass, 2010). During the research carried out on mobile phones reuse and recycling, the authors surveyed supply chain components, market structure and economy scale of these products. In addition, they focus on product life cycle of a typical mobile phone. Lastly, they show how mobile phones currently move through the value chain and the important of recovery markets.

It can be seen that majority of previous studies focused on automotive or electronic industries which adopted concept of End-of-life strategies to their business. There is hardly any study, investigating in second hand textile or footwear products.

2.2 Value Chain Strategy

Generally, value chain is a strategy that they used for analyzing their chain from the beginning. Value Chain focuses on processes, and how inputs are changed into the outputs purchased by consumers (Porter, 1985). Elements in Porter's value chain are divided into primary and support activities. Primary activities are inbound logistics, operations, outbound logistics and marketing/sales. Support activities are served as major driven function for primary activities. There are procurement, human resource management, technological development and infrastructure. Walters and Lancaster (2000) reported that several businesses have value chain process in details more than Porter's model, such as The bluegum group, automotive industry, The Caterpillar, etc. Each of them has different value chain model. Customers today have more selection of products and services than ever before, but they are not entirely satisfied. The concept of co-creation is, therefore, presented to combine the firm, market and consumer together. Prahalad and Ramaswamy (2004) compared concept between no co-creation and co-creation. Co-creation increases interaction between the firm, the market and the consumer. For example, they are joint problem definition and problem solving. For this reason, this concept creates experience variety and then aggregate into one idea. Problems may be resolved directly according to the customers need. As a result, co-creation is an interesting practice in value creation. Value chain of fashion industry is likewise interesting because it has rapid change with demand driven. Fashion supply chain concerns on lead times, time to market, customer response. Today, fashion market is extremely competitive and need to modernize product all the times. If they shift into an agile supply chain and the demand can be accurately forecasted, their cost will reduce (Christopher, et al., 2004). This research analyzes the value chain of postconsumer footwear based on 5 primary and 4 supporting activities to outline how the used shoes create value.

2.3 Waste Management in the Footwear Industry

The footwear industry is a significant part of the fashion industry. In recent years, demands and competition in this industry has rapidly increased. Life cycle of footwear can be relatively short, leading to a higher level of waste towards their end-of-life. Despite this, very few studies have investigated the impact of waste produced from the footwear industry on the environment. Staikos and Rahimifard (2007) aimed to create an optimal method for waste management in footwear industry. They presented a decision-making model using analytic hierarchy process (AHP), which is a multi-criteria decision-making (MCDM) method. Normally, shoes waste management model consists of four options in end-of-life which are reuse, recycling, energy recovery and disposal. In addition, they try to use an associate software tool to support the decision-making model. The research provided optimal model for waste management process to represent responsibility for environmental and help the company to reduce cost in waste disposal process. However, this research focuses mainly on reuse, repair, recycle and refurbish of used shoes.

2.4 Lean Concept Application

Lean method is a concept which focuses on eliminating wastes in processes in order to increase efficiency and productivity. There are several tools and techniques in lean such as Value stream Mapping (VSM), Total Productive Maintenance (TPM), Kanban, Visual Management, and etc. (Kumer et al., 2006). Businesses adapt tools and techniques of lean in different ways.

VSM is considered as one of the most important tool of lean techniques in reviewing overall processes. The current state mapping of processes is initially generated then the processes are defined and classified into three categories; non-value adding (NVA), necessary but non-value adding (NNVA) and value-adding (VA). Subsequently, appropriate procedures are implemented to eliminate wastes in the system. The future state mapping is finally constructed to display process modification. The expected result includes minimizing time and cost in value chain (Hines and Rich, 1997). The VSM concept is considered as a significant tool in the improvement stage of this research.

Lean thinking is not only suitable for production industries but also found to be used in other types of industries. The hospitals are interested in lean to solve their problems. On the other hand, lean can apply to eliminate waste in communication process such as waiting time, critical path related queues and erroneous data or information (Gîfu and Teodorescu, 2014).

This research applies main concept of lean using VSM to analyze the current and future state of post-consumer footwear business.

3. Research Methodology

A review on the postconsumer footwear supply chain was conducted from secondary databases and documented for understanding this chain briefly. Survey of the chain and interview of stakeholders in the chain were then performed. Value chain analysis starts from analyzing primary activities and support activities. Finally, value added of the used shoes has focused by looking at value changed in each step in the chain.

VSM is later used to define and analyze processes. Processes are classified into three categories; value added activities (VA), necessary but non-value added activities (NNVA) and non-value added activities (NVA). Wastes in these processes were identified. Suggestion and concepts were proposed to help improving the process, after implementation and reporting.

4. Results

4.1 Overview of The Post Consumer Footwear Supply Chain

Rong Kluea market is located in Sakaeo, near Aranyaprathet border. There are 6 sub-markets including Old Rong Kluea market, Golden Gate market, Dech Thai market, Thesaban II (New- Rong Kluea market), Benjawan market and Indochina market. Each market can be divided into specialty markets. For example, Golden gate market sells new and second hands items; Benjawan market sells second hands clothes and accessories, and Dech Thai market is specific to used shoes.

The used shoes supply chain starts from middleman in Dech Thai market who import used shoes from other countries such as Korea, Hong Kong, China through Laemchabang port in approximately 45 containers per month. The middleman sells used shoes to 4 groups of merchants at Dech Thai market. After reconditioning processes, used shoes are resold to tourists and provincial merchants in order to distribute to other second hand markets in Thailand. The overview of the used shoes supply chain is exhibited in Figure1.

Used shoes supply chain can be identified into 3 stages; inbound logistics, internal logistics and outbound logistics. This can be an initial idea to analyze value chain of the used shoes supply chain in the next stage.

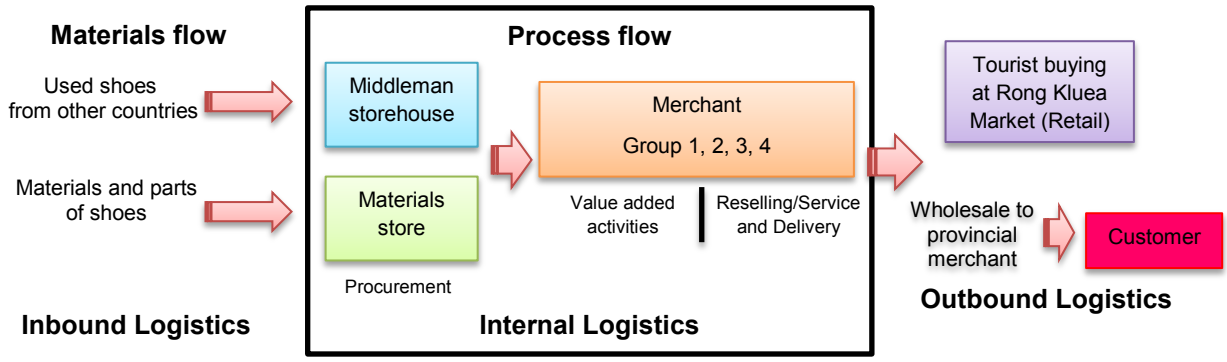

Figure1. Postconsumer footwear Supply Chain

4.2 Value Chain Analysis

Value chain analysis aimed at finding value added activities in supply chain for understanding current business process. Nowadays, stakeholders try to create several activities for supporting their business. Table1 illustrate the post-consumer footwear value chain analysis. The result here specifies what activities stakeholders currently perform in order to add value to the chain.

4.3 Value Creation in Postconsumer Footwear Supply Chain

Used shoes are imported from other countries at a price by container. Total cost of achieving 1 container of shoes including used shoes price, imported tax, shipping cost, warehouse rental, and labor cost is approximate 27,000 USD. Each container contains 48,000 pair of shoes, which cost about 0.56 USD/ pair. The middleman sells them to 4 groups of buyers in Dech Thai market at different

Table1. Value Chain Analysis of Post-Consumer Footwear

Support Activity	**Procurement:** - Middleman contacts with suppliers on aboard by email - Each group of merchant supplies materials and parts of shoes from material store	Margin
	Human Resource Management: - Employ flexible labors and hire them fairly - Teach technique and skill to laborers	

Firm infrastructure: - Business model of middleman and merchants				
Inbound Logistics	**Operations**	**Outbound Logistics**	**Marketing and Sales**	**Services**
- Used shoes from other countries - Materials and parts of shoes from store	- Selecting by each merchant - Value added activities such as; Soles repairing, Washing, Repairing and Ornamenting heeled shoes & Painting	- Reselling by retail and wholesale	- Select used shoes in good quality for customers when they can't come to select by themself - Delivery for province customers	- Compensate to customers in case deliver incomplete quantity
Primary Activity				

prices. Subsequently, each buyer put their shoes in different reconditioning process (wash, repaint sole repair etc.) depending on shoe conditions. The reconditioned shoes are then resold to different second hand shoe market. Trading of the used shoes in this case study is approximately 20% to retail market (tourist group) and 80% to wholesale market (provincial merchants) depending on quantity requested by customers. Each stakeholder benefits differently. Details of value creation in of the used shoes supply chain and selling margin of each stakeholder is exhibited in Table 2.

Table2. Margin of Each Stakeholder in Post-Consumer Footwear Supply Chain

Stakeholders		Cost (in USD)[*1]			Selling price (Avg.)	Margin (%)	
		Used shoe cost	Reconditioning cost (Ave)	Total cost			
Middleman/ Importer		0.56	0.00	0.56	3.48	520.17	
Merchants Group 1		11.43	0.16	11.59	14.57	25.71	
Merchants Group 2	2.1	5.71	0.19	5.90	8.69	47.14	39.98
	2.2	5.14	0.21	5.36	7.71	44.00	
	2.3	4.29	0.24	4.53	5.83	28.79	
Merchants Group 3	3.1	1.94	0.27	2.21	3.71	68.18	66.82
	3.2	1.29	0.32	1.60	2.97	85.38	
	3.3	1.14	0.37	1.51	2.46	62.57	
	3.4	0.71	0.42	1.13	1.71	51.13	
Merchants Group 4		0.09	0.52	0.61	1.14	87.79	

[*1] 1USD = 35 THB (As of 28 Aug, 2015)

4.4 Processes Analysis by Value Stream Mapping

Value stream mapping is used to understand the current processes in the used shoes supply chain. The chain starts from a middleman in Dech Thai market who imports used shoes from oversea suppliers through Laemchabang port, approximately 45 containers per month. After paying the import duty, the used shoes are forward to warehouses in Dech Thai market. The middleman sells the used shoes to merchants in Dech Thai market who can freely select used shoes with grade and price as they need. These merchants are separated into 4 groups; Merchants in group 1 and 2 are among the first selectors. They can select whole goods in container; normally, they always select brand name grade as good quality. Group 3 selects goods which merchants group 1 and 2 did not select. Finally, group 4 buy used shoes in bulk. The used shoes are selected for reconditioning before reselling.

The VSM was applied in this process to identify current stage of activities in post-consumer footwear supply chain. Those activities can be classified into three categories; value added activities (VA), necessary but non-value added activities (NNVA) and non-value added activities (NVA). Table 3 shows the grouping of activities which were investigated by Value Stream Management (VSM) concept.

Table 3. The current state analysis of activities in postconsumer footwear supply chain by VSM

No.	Activities	Activity Time Estimate (T_e)- (hours)	VSM
1	Middleman order used shoes from oversea supplier	1.66	VA
2	Shipping	372	NNVA
3	Pay import duty at Laemchabang Port	1.35	NNVA
4	Transport to middleman storehouse at Dech Thai market	4.70	VA
5	Move product from container and stacking in 1 ton bulk	3.5	NNVA
6	Merchant gr.1&2 selected	5.04	VA
7	Separating	4.01	NNVA
8	Storage (waiting for merchant gr.3 selected)	15.0	NVA
9	Stacking in 16 piles	2.89	NVA
10	Select by Merchant gr.3	4.42	VA
11	Buy the remaining shoes in bulk by Merchant gr.4	2.0	VA
12	Selected used shoes are moved to merchant's shop at Dech Thai Market	0.25	NNVA
13	Separate shoes needed for sole repairing	1.25	NVA
14	Sole Repairing	4.07	VA
15	Washing	7.43	VA
16	Drying	26.58	VA
17	Repair and recondition shoes' heels	12.0	VA
18	Color repainting	8.55	VA
19	Prepare used shoes for wholesaler	3.75	NNVA
20	Transport to wholesalers in provinces	24.83	NNVA
21	Repackage at each merchant (wholesaler) shop	6.27	VA
Total		**511.55**	

There are 21 activities in total, 11 of VA (52.38%), 7 of NNVA (33.33%) and 3 of NVA (14.29%). Activities no.1-11 were undertaken at the middleman storehouse and no.13-19 were carried out at merchant's shop in Dech Thai Market. Time in each activity was determined from observations and interviewing with stakeholders in the chain. Processes time is uncertainly. Therefore, activity time estimate; Te (equation 1) is suitable.

$$Te = \frac{a+4m+b}{6} \qquad (1)$$

where; a = optimistic time estimate, m = most likely time estimate, b = pessimistic time estimate

The overall processing time from placing used shoes order from overseas to reselling to the end customer was approximately 512 hours. The most time consuming activity was shipping, occupy more than 70% of total time.

4.5 Processes Improvement

This process improvement focused on middleman storehouse and merchant's shop at Dech Thai market. Most activities at these parts are operations and value added activities. Therefore, reducing number of processes and shortening process time involved in supply

chain were recommended. ECRS and lean concepts were applied in this stage to identify improvement solutions.

4.5.1 Processes Improvement at middleman storehouse

At middleman storehouse, total operating time before improving was 37.11 hours. The most time consuming activity was storage (15 hrs.), which was classified NVA. This location we applied “Rearrange”, “Combine” and “Elimination” concepts as in the following detail.

For rearrangement and combine, separating process (no.7) will be operated immediately after used shoes are shifted from container. At this station, shoes will be separated and arranged in 16 piles (3,000 pairs each), then merchants group 1 and 2 are consequently allowed to select shoes. By doing this, merchants group 3 are permitted to enter the selecting process soon after group 1 and 2 finish each pile selection. This could eliminate storage time (no.8). After rearrange, combine and eliminate processes, total time at middleman storehouse reduced from 37.11 to 17.51 hrs.

4.5.2 Process Improvement at merchants’ shop in Dech Thai market

Elimination of NVA activities, combine and rearrange processes are techniques used in merchant station. Separating shoes needed for sole repairing (no.13) is removed from the processes. The shoe reconditioning process include sole repairing (no.14), shoe and heel repair (no.17) and color repainting (no.18) are combined at one working station. The washing and drying processes are rearranged after finishing all fixing processes. After process modification, operating time at merchant’s shop reduced from 88.46 to 86.31 hrs.

The activities highlighted in Table 3 are modified as previously explained. The summary of postconsumer footwear supply chain improvements in each location are again concluded in Table 4.

Table4. Summary of used shoes supply chain improvement

Stage	Estimate operating time at current state (Hrs.)	Estimate operating time at future state (Hrs.)	Reducing time (Hrs.)	Percentage of reducing time (Hrs.)
Middleman storehouse	37.11	17.51	19.6	52.82%
Merchants’s shop at Dech Thai Market	88.46	86.31	2.15	2.43%
Total operating time in supply chain	511.55	489.8	21.75	4.25%

5. Summary and Discussions

Used shoes are imported in approximately 45 containers per month (16 tons per container). Processes before reselling are sorting and reconditioning. Nowadays, there are no definite patterns within the supply chain. Some activities take a long time to process. Moreover, there are many wastes from the imported goods that could cause significant damage. For sellers, each pair of shoes has different prices which depending on merchantability and brands of products. Each stakeholder has similar processes but they do not get benefit equally. The highest margin appeared among middleman producing 520.17% and the lowest margin was 25.71% in merchant group 1. Last section, processes in the supply chain was defined into 3 categories; non-value adding (NVA), necessary but non-value adding (NNVA) and value adding (VA). Process improvements by ECRS and Lean concept were implemented to eliminate non-value adding processes and shortening processes time. As a result, it can decrease 21.75 hours of total operating time resulting in better time to market and cost

saving. However, the most time consuming activity (shipping) is excluded from improvement consideration since it related to external uncontrollable factor.

6. Acknowledgements

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IMPACT OF PORT PRICING POLICIES FOR INCREASING THE EFFICIENCY OF PORT UTILIZATION

Pairoj Raothanachonkun[1] and Nakorn Indra-payoong[2]
[1,2]Faculty of Logistics, Burapha University, Chonburi, Thailand
{pairoj.iang[1], nakorn.ii[2]} @gmail.com

Introduction

A port is an important part of supply chain that provides transshipment services especially for cargoes movements. There are many activities and stakeholders concerned to the port services such as freight forwarders, shipping lines, terminal operators, and customs. Laem Chabang port (LCP) is a major port in Thailand that is owned and regulated by the Port Authority of Thailand (PAT). In LCP, there are seven container terminals, a multipurpose terminal, a RO/RO terminal, a passenger RO/RO terminal, a cargo terminal and a shipyard terminal as illustrated as Figure 1. These terminals are operated by the private sectors under the contracts between them and the PAT (The Port Authority of Thailand, 2013). In the first stage of LCP development, the PAT aimed to encourage many private companies to invest and manage the terminals in LCP. Therefore, the PAT attempted to propose incentive port charging with the minimum costs which mainly focused on covering the initial investment.

Figure 1: Layout of terminal operators in LCP
(Namyong Terminal Public Company Limited, 2013)

LCP is currently the main port for import and export cargoes that is continuously increasing to around 5 million TEUs. However, truck is the main transportation mode that transport the containers as demonstrated in Figure 2.

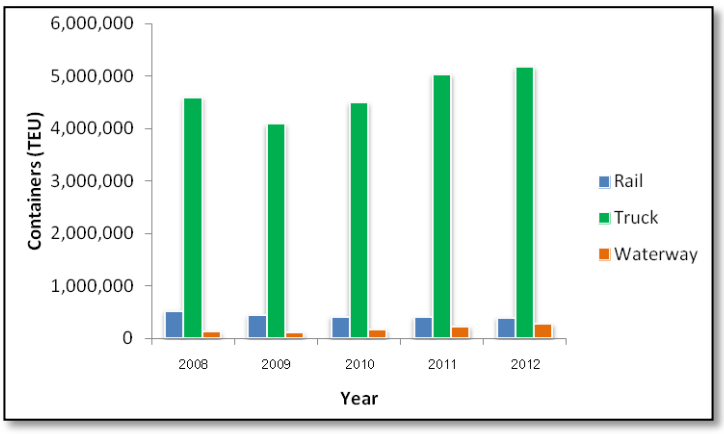

Figure 2: Statistics of Import-Export Cargo Containers through Laem Chabang Port, Fiscal Year (Modified from Laem Chabang Port, 2013)

Because of the unbalance of sharing in transportation mode choices as demonstrated in Figure 2, a huge volume of haulage trucks caused a serious traffic jam, i.e. a long queue length was occurred around 3 kilometers at the front of entrance gates as shown in Figure 3.

Figure 3: Traffic jam at the entrance gates

Moreover, in view point of fairness in market competition, the PAT has to prepare suitable port pricing strategies for new concessions contracts. Without social costs consideration and appropriate port charging policies, LCP will have traffic jam in the port again as it often occurs. Therefore, this research aims to analyze the proper alternatives of win-win port pricing policies. Win-Win policy can provide an important role to increases the efficiency of port infrastructure utilization. This research analyses various port pricing strategies for increasing the efficiency of port infrastructure utilization. This research also highlights how port pricing policies affect to the social impact especially traffic congestion.

Literature Review

There are many studies on port pricing as reviewed by Acciaro (2013). He reviewed over 60 papers and classified the researches in five areas consisting of strategic pricing, pricing and infrastructure cost recovery, pricing and market conditions, pricing and external costs and empirical research. The paper highlighted the current gap and demonstrated the interesting attentions. Therefore, there were very few researches that developed analytical models of strategic pricing, especially the interaction between various types of charging practices to reduce the negative external impacts.

To apply a theory about port pricing, Maffii, Parolin and Ponti (2010) demonstrated how to implement the economic theory to the practice. Generally, the theory sets the social marginal cost as the first-best condition. However, in case of failure to set the first-best condition, the second-best condition can be implemented. To implement the second-best condition, some serious problems should be awareness.

Moreover, Bandara, Nguyen and Chen (2013) reveled the seaport infrastructure pricing from data of 159 seaports and evidenced that cost-based approach was the major role in port pricing. However, Tovar and Wall (2014) indicated that the impact of variation of demand on port infrastructure costs should be considered in the port pricing policy.

Haralambides and Gujar (2011) explained the economic recession that affected to the international shipping and port sectors. India's dry port was considered to improve the supply chain efficiency. Thus, they argued the competition-enhancing by using public-private partnerships (PPPs) as same as demonstrated by Hamzah, et al (2014). They also highlighted the necessary legal, regulatory and policy too. Hence, Song and Geenhuizen (2014) analyzed the effect of port infrastructure investment and regional economic growth in China. The results from analysis discovered the positive impact to economic development. In

addition, they demonstrated the positive effect of the connectivity of transport network improvement especially intermodality among various traffic modes. Therefore, performance of port should be evaluated. Talley, Ng and Marsillac (2014) used the concept of port service chain and a service network to measure the quality of port services.

According to existing studies on port pricing, they highlighted the financial approach, impact of variation demand, social marginal cost, and lots of studies in cost-based approach. However, there is a few studies that analyzed the proper alternatives of win-win port pricing policies by using incentive KPIs to encourage the private sector to increases the efficiency of port services.

Methodology

This research proposes various port pricing strategies to find the proper approach. Thus, a research methodology is described as:

- The first step is to collect related data such as historical statistics of import-export containers, investment costs of LCP, operations costs and others. In this step, we can receive history demand and trend for the future. Additionally, we can estimate the initial investment in LCP form the PAT.
- The second step is to convert the investment cost from the PAT to be annually costs throughout the life cycle of the project or concession contract which is around 30 years.

$$A = P\left[\frac{i(1+i)^n}{(1+i)^n - 1}\right]$$

where A is an equivalent annual cost (Baht)
P is an initial investment cost (Baht)
i is an interest rate (%)
N is a project period (years)

- The third step is to propose various alternatives as the followings:
    - Current condition: cost-based approach with minimum port charging to make an incentive for the private sector during the first stage of LCP development
    - Alternative 1: cost-based approach based on new fixed fee and regularly increasing in additional port charging along with higher containers (demand).
    - Alternative 2: cost-based approach based on new fixed fee and moderately increasing in additional port charging along with higher containers (demand).
    - Alternative 3: cost-based approach based on new fixed fee and suddenly increasing in additional port charging which focuses on the assumed port capacity (600,000 TEUs). This concept is to utilize the congestion pricing which aims to relieve the traffic congestion based on extraordinary marginal costs.
    - Alternative 4: cost-based approach based on new fixed fee and incentive variable fee by using some KPIs to make an incentive for the private company. That means, we encourage many terminals to improve their services which reduce the marginal social cost. Thus, the PAT can make incentive for them by decreasing the port charging.
- The forth step is to demonstrate analysis results. We aim to maximize social profit by providing more services until our marginal costs is equal to the price. However, in the viewpoint of private sectors, they attempt to get demand until their marginal costs is equal to their marginal revenue that is the profit maximizing point.

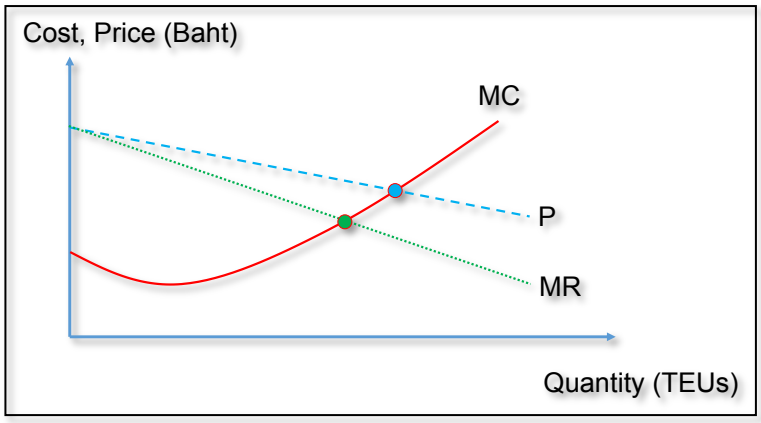

Figure 4: Profit Maximizing Point

- The last step is to summarize and discuss the proper alternative.

Results and discussions

To implement the new contracts, this research used the data based on the historical statistics of containers flows through focused terminal operators as shown in Table1.

Unit: TEUs/year

Fiscal Year	X1	X2	X3	X4	Average
2009	799,766	500,604	505,173	605,499	602,761
2010	817,121	469,263	604,765	644,473	633,906
2011	738,881	444,457	641,332	725,980	637,663
2012	752,058	542,508	599,251	815,489	677,327
2013	722,645	535,616	489,485	880,725	657,118
Average	766,094	498,490	568,001	734,433	641,755
Length of birth (m.)	300	300	300	300	300
Average containers/m.	2,554	1,662	1,893	2,448	2,139

Table 1: Quantity of containers through LCP

From table 1, we can notice that most of terminal operators services containers more than 600,000 TEUs which are the capacity of each terminal. Some terminal operators have customers less than the capacity such as 498,490 TEUs per year. This amount of containers reflects the relationships between operators and customer and their business strategies. However, the high volume of customers affects to theirs service time at the terminals as described in Table 2.

Container No.	Terminal	Main Gate		Sub Gate		Lead time (hrs)
xxxU14438xx	xx	23-04-2015	23:17	24-04-2015	1:36	2
xxxU68272xx	xx	23-04-2015	22:45	24-04-2015	0:46	2
xxxU85769xx	xx	23-04-2015	23:25	24-04-2015	2:45	3

xxxU09297xx	xx	23-04-2015	23:35	24-04-2015	5:21	6
xxxU71481xx	xx	23-04-2015	04:16	24-04-2015	06:32	2
xxxU91652xx	xx	23-04-2015	07:30	24-04-2015	10:06	2.5
xxxU78962xx	xx	23-04-2015	04:30	24-04-2015	06:38	2
xxxU71618xx	xx	23-04-2015	03:33	24-04-2015	05:55	2.5
xxxU30544xx	xx	23-04-2015	07:00	24-04-2015	09:30	2.5
xxxU30544xx	xx	23-04-2015	07:20	24-04-2015	09:50	2.5

Table 2: Example of service times at some terminals

From Table 2, we can see the high variation of lead times between main gate and terminals that ranges from 2 to 6 hours. Moreover, the PAT did not have any key performance index about service time at the terminals. When some terminals have demand more than their capacity, these amount of truck volume will generate the queue length in the roadway. Additionally, the current condition of the concession contract attempted to make incentive for the investors to get more demand during the development of the LCP. Therefore, the demand that higher than 600,000 TEUs will be benefit for the investors that makes them to get lower average cost as shown in Figure 5.

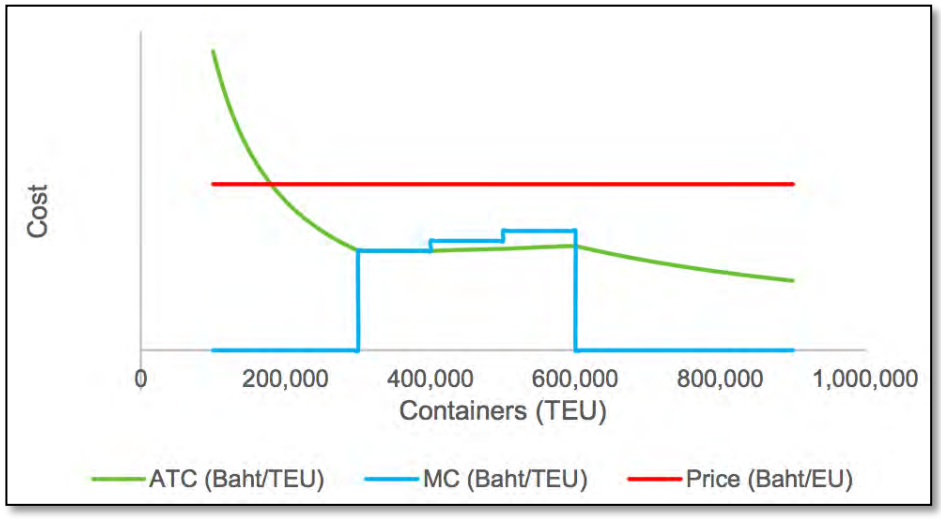

Figure 5: Current condition

From Figure 5, it cause the unbalance of market competition especially for the new comers. Moreover, the port utilization also will congested in some specific terminal that affects to other terminals. Hence, we propose the first alternative to increase the port charging every 100,000 TEUs as illustrated in Figure 6. However, it seems that these additional charges may not high enough to control the capacity of operations. Nevertheless, the operations of terminal also are not incentive to make them to improve their service time according to higher demand too.

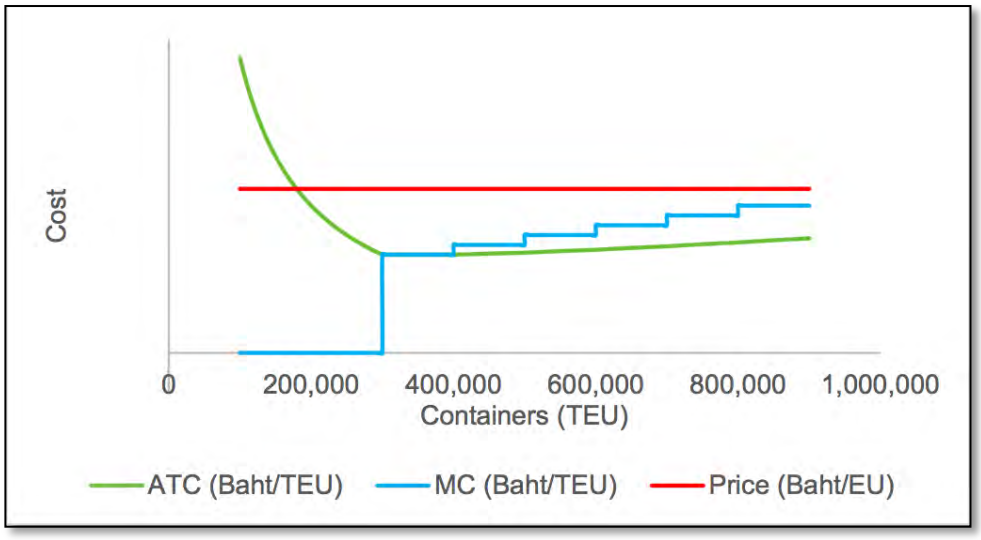

Figure 6: The first alternative

To distribute the demand at each terminals to be around 600,000 TEUs, we propose to increase more additional charges when the demand is over 600,000 TEUs as demonstrate in Figure 7. The investors will stop their services at around 700,000 which is the point of MC=MR to get the highest profit.

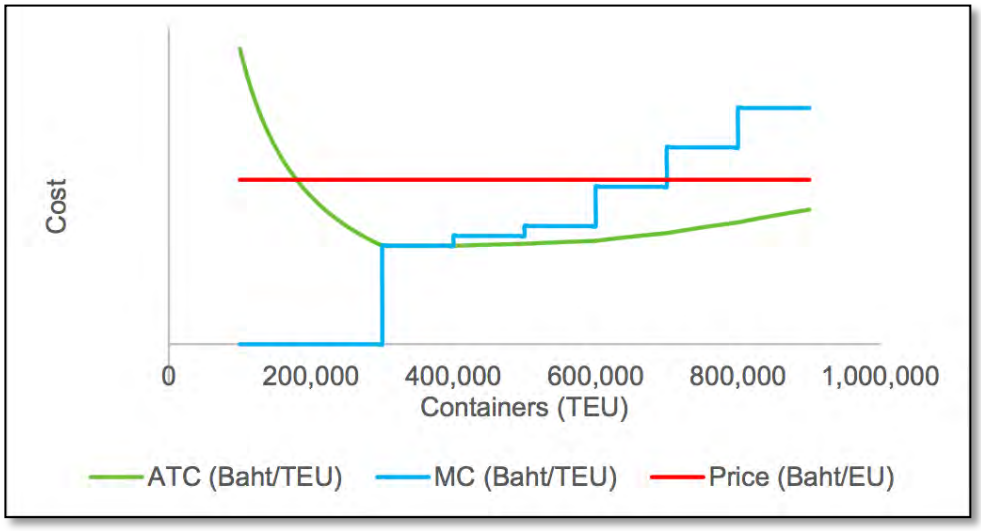

Figure 7: The second alternative

The third alternative is to strictly control the demand at 600,000 TEUs as Figure 8. We can notice that there are very high additional charges when the container demand overs 600,000 TEUs. However, this may discourage the investors to invest and may obstruct the growth of the LCP.

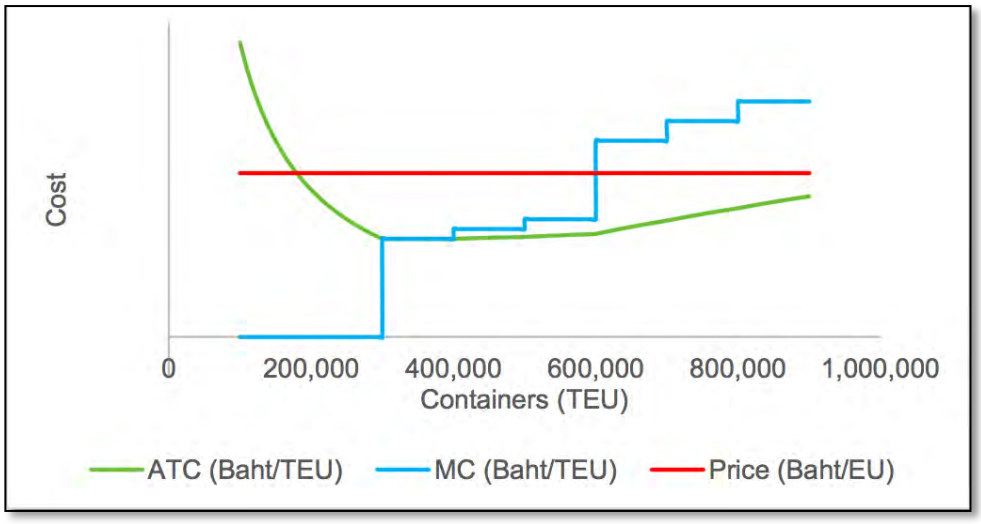

Figure 8: The third alternative

Nevertheless, these three alternatives seem to create high negative impact to all stakeholders. The first alternative can cause negative impact to the regulator. On the other hand, the second and the third alternative cause unattractive to the private sectors and inefficiency of market competition.

Therefore,the last alternative, we propose to charge them less costs if the terminal operators can improve their efficiency based on the implemented KPIs, i.e. improving their service time to less than xx minute per TEU, decreasing the quantity of truck share by increasing both rail and waterway shares. Thus, the PAT may regulate the port pricing as illustrated in Figure 9. This can make more incentive to the private sector which make more attractive too. We can notice that, private sectors can provide more additional service around 200,000 TEUs which is nearly the highest average demand as demonstrated in Table 1. Moreover, we can increase the port services and port infrastructure utilization whereas many stakeholders can get benefit.

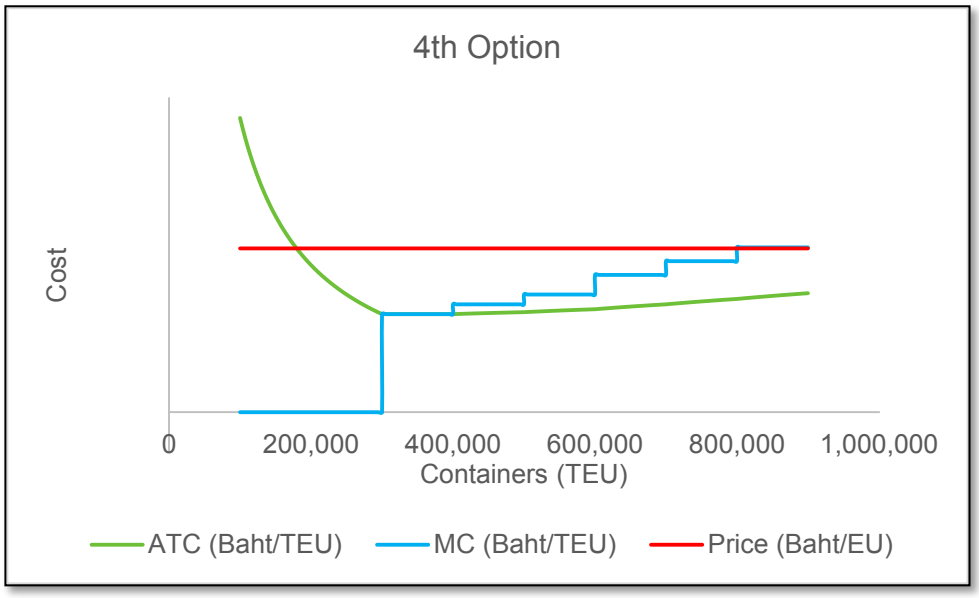

Figure 9: The forth alternative

Conclusion

This research proposes various pricing strategies to discover the traffic impact in port. Thus, the suitable alternatives should be implemented. The existing cost-based charging firstly attempts to make an incentive for many private companies to operate the terminals. From this policy, many terminals gain several benefits while the PAT lost some proper benefits. Then, after ending the old concession contract, the PAT should have appropriate alternatives by considering various factors.

From the cost-based approach, the result of the first alternative demonstrated that the private sector received lots of profits. However, other stakeholders still get the same impacts such as traffic jam, imbalance of modal choices because of no KPIs for the terminals. Then, the second and the third alternatives can potentially make negative impacts to the existing market especially the private sectors because of too high additional port charging. Moreover, this policy is also not incentive for the private sectors. However, this concept aims to control the excess capacity (demand that is over 600,000 TEUs per year) to relieve the traffic congestion. Thus, both policies can reduce the attractiveness for improving their operations too. Finally, results from the forth approach that attempts to utilize the incentive pricing policy by considering efficiency of port utilization. The proposed method can charge the terminals less than both the second and the third alternatives in case that the private sector can reduce the social impacts. Therefore, the appropriate benefit for whole stakeholders can make incentive for port development and win-win solution for them.

However, this research still does not consider the in-depth impact of the traffic jam situation from the proposed pricing policies. Thus, we will utilize the simulation to make empirical study for the future research.

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MEASURING THE EFFECTIVENESS OF NATIONAL SINGLE WINDOW IN MALAYSIA AS TRADE FACILITAION TOOL

Nor Bakhriah Sarbani, Harlina Suzana Jaafar
Malaysia Institute of Transport (MITRANS)
Universiti Teknologi MARA
Shah Alam, Selangor
scholarbakhriah@gmail.com, harlinasj@yahoo.com

Introduction

International trade is generally an exchange of goods from one country to one another to fulfil the supply and demand between nations which evolved broader supply chain activities. It normally involves three categories of cross border movement, namely cargo, people and modes of transport either land transport, air transport, or sea vessel (Choon, 2011). Beyond the physical movement of goods, there are detail information that entwined with the cargo that reflects the status of the cargo (ADB, 2009a). Cargo information management plays an important role to measure the supply chain process efficiency, public administrators efficiency and legislative impact on market efficiency (Fudong & Jiang, 2005). Therefore, management of information at international border is very important because it determines information traffic during clearance of goods at the border (Djankov, Freund, & Pham, 2006).

Literature Review

Trade Facilitation

In 1998, trade facilitation was introduced by the United Nation as a potential solution to the world trade with the objectives of simplifying the trade process and minimizing transaction costs in international trade while maintaining effective levels of government control. Trade facilitation is defined as *"systematic rationalization of customs procedures and documents. In a broader sense, it covers all the measures that affect the movement of goods between buyers and sellers, along the entire international supply chain"* (ADB, 2009a). As indicated in the trade facilitation action agenda, the establishment of a single window will force authorities to collaborate and streamline their processes, to collaborate and consult with the business community and also lead to coordinated border management, cutting lead time not only in the administrative procedures but also in the actual border-crossing (Pontén, 2011).

Single Window

The single window concept was created as part of an initiative for a solution to impediments to trade from trade procedures and documentation perspectives. Trade procedures are divided into commercial, transport, regulatory and financial categories. According to a study conducted by UNESCAP in 2001 and 2002in a few trade friendly countries in Asia, for an export procedure, trade will interface with 15 parties, 24 documents and approximately 700 data elements for a total transit time of more than 22 days (ADB, 2009b). The phenomena in trade are becoming an unnecessary burden towards the buyer and seller due to the existence of the additional cost of trade procedures through the requirement of exchange of information and documents between parties. Therefore, Single Window recommendation was developed as part of the trade facilitation agenda to eliminate or minimizing the procedures by enhancing efficient information exchange.

Single Window is defined by UNECE in their Recommendation No. 33 as *"A facility that allows parties involved in trade and transport to lodge standardized information and documents with a single entry point to fulfil all import, export, and transit-related regulatory requirements. If information is electronic, then individual data elements should only be submitted once"* (UNCEFACT, 2005). In another word, Single Window is an adoption of 'standardization' element of the trade facilitation concept that was derived by UNCTAD in 2002 which emphasize on international standard through agreed format, procedures and information practice for all member countries (ADB, 2009a). Single Window could assist government to have a better risk management handling and improve security management gain from traders' compliance while traders in return will gain a transparent rules and productive public (ADB, 2009b).

The development of Single Window in the logistics industry is associated with paperless trading; an adoption of information system management whereby a comprehensive framework of information flows has been developed in order to trigger the movement of goods (Graiger, 2010). Single Window are closely related with ICT (Information Communication Technology) as a key enabler of the speed of information transfer but still allow the provision of hardcopy documents transaction in the operation (UN/CEFACT, 2005).

Malaysian Single Window

The emergence of National Single Window in Malaysia was initiated from the adaption of trade facilitation measures developed by UNCEFACT purposely to facilitate the trade through effective management of information (UN/CEFACT, 2005). Thus, a committee was set up in the mid 1990s and led by the Ministry of International Trade and Industry (MITI) that brought to the appointment of Dagang Net Technologies Sdn Bhd to serve as national IT service providers to develop a reliable framework for the operation of Single Window in Malaysia. Since then, Dagang Net Sdn Bhd has become the sole assessment service providers to design, develop, manage and operate NSW system in Malaysia until 2014, after another contract renewal in 2009 (Choon, 2011). Single Window in Malaysia is design to operate in electronics means to assist the clearance process between trade community and custom office at the border. This trade community consists of port operators, shipping agencies, forwarding agents and traders. In the existing structure, National Single Window consists of five core services namely Electronic Declarations (e-Declare), Electronic Manifest (e-Manifest), Electronic Duty Payment (e-Payment) and Electronic Preferential Certificate of Origin (e-PCO) to cover basic cross boarding activities (UNNExT, 2010). Figure 1 shows simple diagram on information transaction process in national single window from the users to the respective authority. The submission process will be assisted by system moderator currently host by DagangNet Technologies Sdn Bhd that will act based specific request on main five core services.

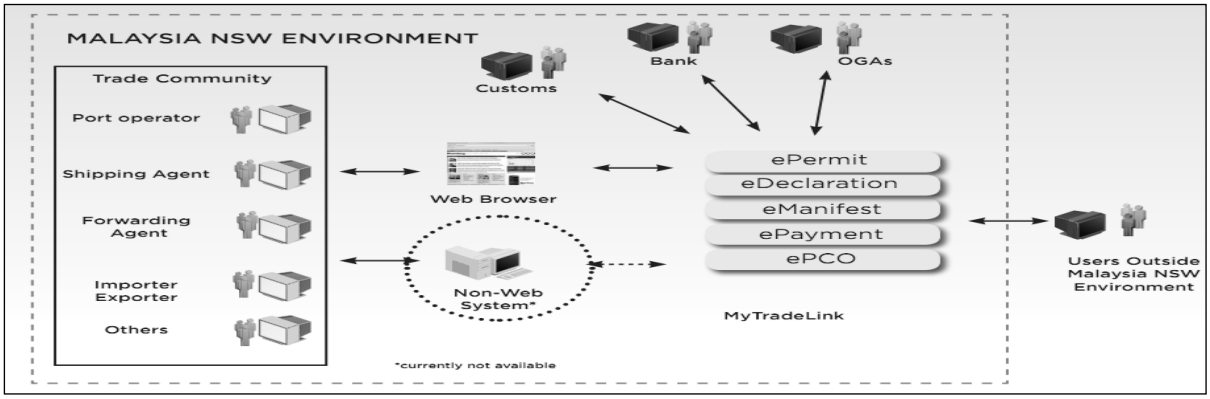

Figure 1: Malaysia single window environment system operational map. Source: UNNExT. (2010). Case of Malaysia's National Single Window. *Towards Single Window Trading Environment,* (Brief No. 04), 1-8. Retrieved from http://www.unescap.org/unnext

Research Methodology

Case Study Method

The core strategy of this research is the individual experience of the subjects interviewed, represented through narrative analysis and interpretation to determine any pattern or trend especially for further research efforts. The target audience is specific and focused on the group of users from private and public sectors unique to the national single window service in Malaysia particularly freight forwarders in the operation line.

Within the qualitative paradigm research, sampling size is not judgmental referring to the nature of this research, which adopts the phenomenologist point of research. The sample selection may be small to be more focus and maintained the closeness to the situation and transform them to a pattern (Hussey & Hussey, 1997). This research adopts single window private users as the unit analysis. It represents various types of organizations with a different portfolio in the industry including freight forwarders, shipping agent and traders. The percentage of respondent is selected according to purposive sampling as it allows researcher to examine a selected group of subjects (Singh, et al., 2006). 21 participants were selected

active national single window users in Klang Valley area. The users view were taken from of regulators and freight forwarding agencies. Majority of the partipants are participated direcly in the cross border clearance at Port Klang and Kuala Lumpur International Airport as applicants and authorities accordingly.

The main data was collected based on in-depth, open-ended interviews using a prepared interview guidelines. Average interview length is one hour for each participant.

According to Glesne & Peshkin (1992), data analysis in qualitative research is managing, filtering as well as selecting data using detail judgment and interpretation. It is spelled out using an entails process consist of sensing themes, constant comparison, recursiveness, inductive and/or deductive thinking and interpretation to generate meaning (Ruona, 2005). In this research, interview session voice data was properly recorded and data were translated and filed according participants' unique code for easy references and pseudonyms were used to maintain its confidentiality. Hence, the data were transcribed and analyzed to extract out the themes that were highlighted by homogenous groups, who share the same interest like freight forwarders and traders as its main users.

Findings

After each interview, common themes were identified across interview transcripts. Seven (7) measures were found from the interviews data and were provided in Table 1.

No	Elements	Factors
1	• System ownership • Security • Internet Communication Technology (ICT) • Institutional Collaboration • Financial Facility • Data Harmonization • Investment Incentive	Policy establishment
2	• Authority Collaboration • Data sharing • Trust	Institutional Cooperation
3	• Publicity • Resistance to change • User knowledge • Information channel	Stakeholder Awareness
4	• System ownership • Data security • Value added services • Administrative custom evaluation	Electronic System Reliability
5	• Training availability • Training schedule • Training module • Electronic system literacy	Training
6	• Mobilized equipment • System investment • Telecommunication infrastructure • Financial facility	ICT Supporting facility
7	• Process re-engineering • Timeliness • Trust accountability • Data sharing	Simplified Procedure

Table 1: List of measures for an gathered from user's point of view.

Policy Establishment

Most of the participants are unanimously agreed that government policy plays a vital role to encourage single window implementation. This particularly leads to the need of coherence

principle through government policy to highlight segregation of the single window implementation and integrated border management effectively towards accomplishing single window mission statement. Under this measure there are seven (7) supporting elements. Policy according to the participants should clearly underline the system ownership for national single window. It is preferably belongs to the government and is also operated by government to avoid the possibility of having a personal business interest that may lead to other negative consequences. It also highlighted that data security policy should also be emphasised to both public and private users because both parties were very sensitive in terms of data status. The public authority concerned about few threats. Among others, are potential data manipulation from smugglers that will harm the national security especially for highly sensitive items such as medical drugs. For private users, main concerned was the potential data leakage to their competitors. The policy should also embed the element of internet communication technology, especially on the mandatory single medium of transaction by waiving the hard copy submission. Therefore, it will highlight the importance of ICT in national single window which able to promote greater efficiency. The national single window will also need a policy to align the institutional collaborations. This was due to the involvement of multiple government agencies that rule by different jurisdiction and portfolio. Therefore, the national single window needs to highlight the institutional collaboration in term of commitment to cross border activities. The findings also showed that the financial facility was also important in order to monitor those agencies or business who needs support to initiate an in-house system to promote operational efficiency. Consequently,data harmonization is required by various agencies during customs clearance to bypass the potential bureaucracy along the clearance chain. In addition, the data demonstrated that, the investment incentive should be given to those, who has made an effort by putting in their investment for national single window value added network in encouraging more supporters to the national single window. Those policy elements have led to the effective measures of national single window.

Institutional Support

Institutional collaboration was identified in this research as the second factors contributing to national single window implementation. Within this research the 'institutional' aspect is referring to the public agencies who are responsible as an appointed authorities for the purpose of tax collection as well as for trade protection in terms of security and control in cross border clearance. In this aspect, the users feedback and opinions were presented to the current institutional platform for national single window practice. The opinion was driven by the institutional support towards the single window as part of facilitation tools during border crossing processes. There are three (3) elements derived from the interviews representing this measure including authority collaboration, data sharing and trust. The highest debate among participants was authority collaboration. It is found that others border authorities (other than Royal Malaysian Customs) towards single window and it was considered as one of the biggest hurdles discussed by the users. The data showed a conflicting roles among border authorities that end up with a formulation of redundancy in border clearance processes due to a layer of procedures involving agencies that jeopardizing simplification border crossing process. Another point that was also being highlighted is regarding the institutional support is the data sharing among the agencies. The current single window requires the applicant to make a repetitive process involving certain data to different agencies in order for acquiring certain approval. There were also lacking of trust between agencies that lead to the emplacement of individual policy by agency as additional control measures that conflicting to a single window.

Stakeholder Awareness

Participants are also being asked about the awareness with the single window system in their daily operation. According to participants response the result was lead to certain agreement that support the awareness factor as one of the important measurement in ensuring single window effective implementation. Under this measure publicity plays a vital role in the single window community. The majority of the business users agreed that low publicity efforts led to a low commitment level of business sector towards single window. There is only a certain group of companies who work closely with the government or having adequate info about the single window development. Whereas the majority of the participants responded that they personally hold very limited knowledge about single window and not aware of the latest development. The stakeholder awareness also influences by the users' behaviour who resist

to change with new technology. As a result, it led to passive acceptance towards the single window system, therefore they have very limited knowledge on the latest single window development. On the other hand users knowledge also plays an important role towards national single window awareness. Participants from both freight forwarders and regulatory bodies agreed that level of knowledge depends on the key single window person in charge in each agency or company. Knowledge about single window affecting the person in charge interest to keep themselves aware about single window development. Other elements agreed by the participants were the information channel. The current information channel for the latest single window development are very limited. It is highly depended on the announcement in the service provider's website or through close meeting at the leading ministry. Therefore the information about the latest single window development are hardly arriving to the layman end.

Electronic System reliability

The majority of the interviewed participants emphasised that electronic system reliability has become one of important impediment towards electronic service that gave impact to their businesses. According to a participant, system integrity plays an important role in the electronic declaration because once service fails it affects companies' performance. The effective single window is directly measured by the system reliability from the element of system ownership. The current system is based on public private partnership shares. The government owns the data, but the system run by a private company. This scenario creates a tense atmosphere among the business because the integrity of the system were doubtful as far as they are concerned the private company have their own interest. It then leads to another element in the electronic system reliability measure which is data security. Based on the participants' response the data are administered by the host company and it is solely based on trust without proper agreement between users and the host company especially regarding the data status. Thus, its raised data security concern among the responded participants. Moreover, according to participants, the current single window doesnot show any value added activities.It isjust a transformation of manual data submission to an electroic medium. The procedures and th processes are maintain the same with the additional of electronic submission as a 'pre-clearance' process. The actual border clearance process still undergoing customs hardcopy evaluation process which create hassle through a redundant procedures by embedding electronic submission on top of hard copy validation to the customs desk officer.

Training

Based on the interview result, training was also identified as an effective measure for national single window. There are four pertinent elements that were heavily discussed under this measure, namely training availability, training schedule, training module and electronic system phobia. The result reveal that there were limited single window training session for users available to the community. The training according to the participants are highly important especially to the community new comers from both public agency users or industry as an introduction to single window users. Current practice new comers will be trained by the senior staff who had attended single window official training due to lack of training support for single window. The third element, training schedule is also highlighted as one of the important aspect in the training for single window effectiveness. Consistent schedule allow potential users plan for adequate training session before they practice single window. Another pertinent element that highlighted training as measurement for effectiveness of single window is the training module. The current training modules are limited to the users of the five core services. Each training module are offered according to registered uers for the core services that limit opportunities to new users joining the programe. The last element that highlight training as an effective measure to single window is the electronic system literacy. Interview result revealed that majority of the users are not information technology (IT) savy, therefore it is very important to ensure that the users are familiar with the system to avoid users resistant.

ICT Supporting Facility

It is indeed important to have a proper device or equipment to support the internet communication technology (ICT). This includes the mobilized equipment to keep the users connected to internet connections. The users, especially the operation staff who involved with ground operation werenot always available in the office. Therefore, supporting device

were very useful to enhance the national single window service operation. Thus, the commitment to invest installing the system by the public and private stakeholders are vital in ensuring successful implementation. The single window implementation needs an advance internet solution with a sufficient equipment for its consistent performance. Consequently, , it canl assist sending and retrieving data or information from the main provider. The users fully support the importance of an effective system in implementing a successful national single window. The respondents also highlighted that the telecommunication infrastructure plays a pertinent supporting role to ensure the stability of the system network. These telecommunication infrastructures includes the internet networking service and the electrical supplies at the every critical location will facilitate the single window delivery. The last element to measure an effective single window service is the financial facility given by the government. Supporting these efforts were important to encourage users, especially from small and medium size business operators to participate actively by having their established internet host system at their end instead of using third party provider service which is more costly in the long term.

Simplified Procedure

The existing scenario for the national single window in Malaysia showed that although the electronic system was set up to support the border crossing activities. For Royal Malaysian Custom, the single window implementation was acceptionally relevant because it facilitate their operation. But for the other government agecy, the single window was seen as additional duty that need to be managed wisely. Under the simplified procures there are four (4) main elements that highly discussed by the participants including process re-engineering, timeliness, trust accountability and data sharing. The re-engineering process was seen as critical element duly to the reason that the current procedures in cross border clearance process conflicting single window objective. Obviously, the current its involves multiple submission and approval from various authorities for border clearance formalities. Thus, redundant processes lead to urgency of re-engineering process for simplified procedure. Likewise, timeliness also contribute to simplified procedures in measuring effective single window. The currect back to back practice for verification and approval from various agencies for border clearance affecting single window performance through the messy procedures. Its lead to the third element related to trust accountability. Layers of approval potrays low level of trust accountability between border agencies because it shows that among agencies are not acknowledging each others credibility in getting product shipment release. Thus, its end up with individual agency judgement to confirm the appropriate undertaken control measures for certain item before cargo release. The final point for ensuring this measure contribution is the data sharing element. Data sharing among border agencies are highly demanded in single window to creates simplified procedures for trade border crossing environment. In this sense, according to participants the data sharing are possible practice through electronic single window that be able to minimize layers of agencies for approval purposes in border crossing activities. Therefore, the electronic single window will really fully utilized and creates effective single window service.

Conclusion

In conclusion, since the national single window is one of the main components that facilitate the cross border activity, it is crucial to address the factors affecting its effectiveness especially from the users' perspective. This is because users use the system daily and therefore they are the best category of respondents to assess the effectiveness of the system. Thus, it is also derived from this research that the measurement of the effectiveness of national single window did not influence by one single factor. In fact the effectiveness is influenced by a combination of factors that are affecting each other. The measurement factors are indeed interpreting between one another, creating a unique symbiosis in the single window community. In single window implementation, it is not a matter of a stringent policy implemented or adapting the best system in the world, but it totally depends on great cooperation among the stakeholders involved in the system. Greater benefits could be exploited through the commitment of every stakeholder that would complement each others' strength and weaknesses.

Though the policy establishment is the root of all factors, however other factors are similarly important. The stakeholders, especially the main border regulatory body really need dramatic action in the international border clearance environment which possibly facilitate the border activities at the same time protect the national and international interest. On the other hand,

the regulatory agencies, the financial institution and the business stakeholders should aware of each others interest to enhance harmonization within the community. The electronic medium is compulsory to the fact that the entire single window need a certain transaction tool so that standardization could be established at the centre of operation that would improve the effectiveness of its implementation.

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MULTI-PERIOD HUMANITARIAN LOGISTICS MODEL CONSIDERING TEMPORARY DEPOT LOCATION IN FLOOD DISASTER

***Wapee Manopiniwes*[*1*2] *and Takashi Irohara*[*1]**
[*1]*Faculty of Science and Technology, Sophia University*
Chiyoda-ku, 102-8554 Tokyo, Japan wapee.m@cmu.ac.th
[*2]*College of Arts Media and Information Technology, Chiang Mai University*
Muang, 50200 Chiang Mai, Thailand

Introduction

The challenges of humanitarian logistics have number of key aspects that clearly differentiate them from those of the commercial world (Tatham and Christopher, 2014). During emergencies various aid organizations often face significant problems of transporting large amounts of many different commodities including food, clothing, medicine, medical supplies, machinery, and personnel from different points of origin to different destinations in the disaster areas. The transportation of supplies and relief personnel must be done quickly and efficiently to maximize the survival rate of the affected population and minimize the cost of such operations.

Our former study (Manopiniwes and Irohara, 2015) developed a stochastic linear programming for the integrated decision on strategic planning in pre-disaster and post disaster operational stages where a flood is applied as case study. Of all natural disasters, floods possess the greatest variance in cause and degree. Floods are the most common, most expensive, and most frequent of all natural disasters (Kaaland, 2014). As shown in Figure 1, two major phases of emergency management comprise of the stages of preparedness and response in pre and post disaster operations respectively. Preparedness stage is a planning system before disaster occur in order to make a decision on the location of related facilities and relief supplies. The schemes that usually taken into the consideration for this stage are the stock prepositioning, the selection of distribution centers (DC) and evacuation centers as well as the evacuation planning. The response stage is the later process of relief distribution executed right after the disaster happens. The main thrust of the emergency response operations is related to rapid deployment of resources and aid within the first 72 hours or the first three days (Banomyong and Sopadang, 2012). Vehicle routing plan must be efficiently determined to support the rapid movement to deliver relief supplies from selected DC to the demand destinations both in evacuation centers and remaining people in affected area. We have also proposed the transportation plan for this response stage in the second earlier study (Manopiniwes and Irohara, 2015) considering identical single type of vehicle as the land transportation between only DCs and demand points. However, unlike other natural disasters, a massive flood often requires the decision on temporary depot locations over time besides the distribution centers. For the remaining demand in flooded area, boats are needed for delivery because truck is no longer applicable as the land transportation due to the obstacle by water.

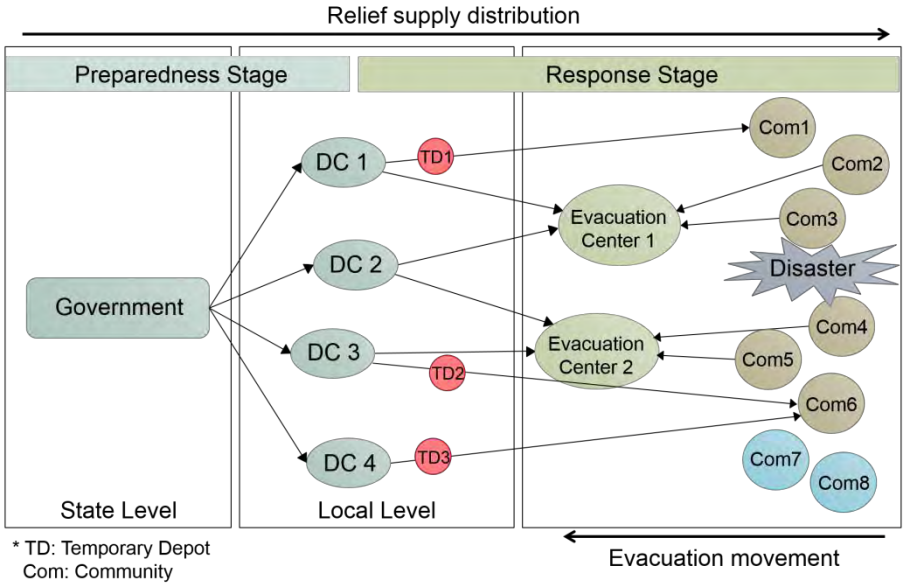


Figure 1: Supply chain management for flood disaster with temporary depots

For this reason, the temporary depots must be taken into the consideration in the relief supply chain where the flood boundary will be considered as the candidate location for. These depots are not mainly for the storage function but for transferring the relief supplies from one carrier type to another carrier type as shown in Figure 2. The most challenge is pertaining to dynamic characteristic as flood size can be changeable overtime period during the disaster. Thus, the location of temporary depots should be determined following to this alteration in order to more closely mimic the realistic behaviour of a disaster.

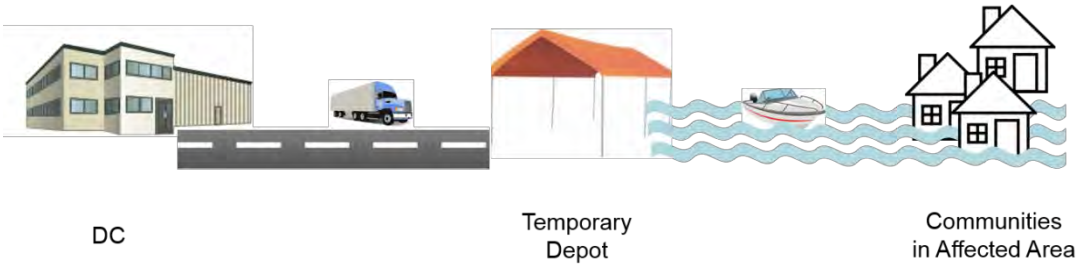


Figure 2: Flow of relief supplies in flood disaster

Literature review

The literature on strategic planning for logistics problems in humanitarian relief is rather rare but increasingly investigated in the Operations Research (OR) society. The studies generally consider in different components of the problem such as the location of emergency services, dispatching of multiple commodities, uncertainty in the supply and demand or traveling costs, etc. This section includes a review of relief supply chain optimization by Manopiniwes and Irohara (2014).

One of the first studies proposed by Knott (1987) considered the last mile delivery of food items from a distribution center to a number of camps assuming a single mode of transportation making direct deliveries to camp. A linear programming model is developed to determine the number of trips to each camp to satisfy demand while minimizing the transportation cost or maximizing the amount of food delivered. Barbarosoglu et al. (2004) focus on tactical and operational scheduling of helicopter activities in a disaster relief operation. They decompose the problem hierarchically into two sub problems where tactical decisions are made at the top level, and the operational routing and loading decisions are made in the second level. MIP models are formulated for tactical and operational problems, which are solved by an iterative coordination heuristic. Balcik and colleagues (2008) proposed a vehicle-based last mile distribution system, in which a local distribution center stores and distributes emergency relief supplies to a number of demand locations. They

conducted a mixed integer programming model that determines delivery schedules for vehicles and equitably allocates resources, based on supply, vehicle capacity, and delivery time restrictions, with the objectives of minimizing transportation costs and maximizing benefits to aid recipients. Recently, Irohara et al. (2013) proposed a tri-level programming model for this integrated category. The top level addressed facility location and inventory decisions; the second level represents damage caused by the disaster, while the third level determines response and recovery decisions. Another recent paper by Ransikarbum and Mason (2014) presents a multiple-objective programming model for the response and recovery phase in post-disaster operations. The network optimization model is developed for making strategic decisions in supply distribution and network restoration in humanitarian logistics operations.

From the literature, the study of humanitarian logistics has attracted a lot of attention in recent years, however, a number of research considering with multi-period problem is limited. Özdamar et al. (2004) develops linear and integer multi-period multi-commodity network flows to coordinate logistics support for relief operations. Model outputs consist of dispatch orders for vehicles waiting at different locations in the area. Hongleri and Nan (2013) proposes the Bayesian sequential decision-making model of multi-period emergency supply distribution based on continuous observation and updated features of disaster information for solving the multi-relief point selection problem in the emergency relief. However, as far as we know, a multi-period problem has not yet been dealt with the selection of temporary depots for supplies transfer between different carrier types has never been found to treat in this area, especially in the aftermath of a flood disaster. A unique and special of flood character is about the dynamic capabilities. Floods may not hit as so urgently as earthquake or other natural disasters but present the unstable size and impact over time instead. In particular, in the case of flooding, where the most common transport channels are trucks in unaffected areas and boats in affected areas. Therefore, it is vital to treat this behaviour of flood problem as a multi-period approach as proposed in this article.

Problem formulation

We developed a multi-period mixed-integer programming model that focuses on the response stage of a disaster management system. To formulate this problem, it is preferable to utilize solutions from earlier stages of preparedness and initial response in our previous study (Manopiniwes and Irohara, 2015). Therefore, in this study, we expand the use of multi-period approach to describe the location-routing problem considering multimodal transportation in order to more closely mimic the realistic behaviour of a disaster.

Notations:

N	set of all nodes in the network $i,j \in N$
M	set of transportation modes $m, m' \in M$
T	Time horizon of response operations
DC	set of permanent distributi on centers
TD	set of temporary depots
DP	set of demand points

Parameters:

s_{it}	amount of relief supplies in node i at time t
d_{it}	amount of demand in node i at time t
a_t	maximum number of temporary depots at time t
$Scap_{it}$	storage capacity for the facility in node i at time t
$Lcap_{it}^m$	loading capacity for the facility in node i for mode m at time t
$Ucap_{it}^m$	unloading capacity for the facility in node i for mode m at time t
$VPcap_{it}^m$	maximum number of mode m vehicles that can be parked (carried over) at the facility in node i from time t to time $t+1$

$VRcap_{it}^{m}$ maximum number of mode m vehicles that can be received at the facility in node i at time t

$VScap_{it}^{m}$ maximum number of mode m vehicles that can be sent out at the facility in node i at time t

cap^{m} loading capacity of vehicles of mode m

t_{ij}^{m} travel time from node i to node j for vehicl es of mode m

$k^{mm'}$ time required to transfer commoditie s from mode m to mode m'

Decision variables:

Z_{it} : $\begin{cases} = 1, \text{if a temporary depot is located on node } i \text{ at time } t, \\ = 0 \text{ otherwise;} \end{cases}$

X_{ijt}^{m} amount of relief supplies shipped from node i to node j by mode m at time t

XO_{it} amount of relief supplies in node i which is carried over from time t to $t+1$

$XT_{it}^{mm'}$ amount of relief supplies in node i which is transferr ed from mode m to mode m' at time t

Y_{ijt}^{m} amount of vehicles of mode m travel from node i to node j at time t

YO_{it}^{m} amount of vehicles of mode m in node i which is carried over from time t to $t+1$

U_{it} amount of unsatisfie d demand in node i at time t

Based on the above definitions, we developed the following MIP formulation:

$$\text{Minimize} \sum_{i}\sum_{t} U_{it} \qquad (1)$$

The objective function in equation (1) minimizes the total amount of unsatisfied demand over all periods and demand points.

$$\sum_{j} X_{ji(t-t_{jim})}^{m} + XO_{i(t-1)} = \sum_{j} X_{ijt}^{m} + XO_{it} \qquad \forall i \in DC, \forall m \in M, \forall t \in T \qquad (2)$$

Constraint (2) refers to supply nodes, the sum of the flows entering each node should be equal to the sum of the flows that leave the same node; in comparison to the commodities that might be already in the system coming from another node or has been at the same node from a previous time period.

$$\sum_{j} X_{ji(t-t_{jim})}^{m} + \sum_{m'} XT_{i(t-t_{jim})}^{m'm} + XO_{i(t-1)} = \sum_{j} X_{ijt}^{m} + \sum_{m'} XT_{it}^{mm'} + XO_{it} \qquad \forall i \in TD, \forall m \in M, \forall t \in T \qquad (3)$$

Constraint (3) requires that for transfer nodes, commodities being carried over in node i from time period t to t+1 do not include those commodities that are being transferred to another mode in node i at time period t. The amount of transferred commodities is captured in the variable $XT_{it}^{mm'}$.

$$\sum_{m}\sum_{j} X_{ji(t-t_{jim})}^{m} + U_{it} = d_{it} + U_{i(t-1)} \qquad \forall i \in DP, \forall t \in T \qquad (4)$$

Equation (4) shows that the total flow entering each demand node plus the unsatisfied demand is equal to the exogenous demand at that node plus any unsatisfied demand from the previous time period.

$$\sum_j Y^m_{ji(t-t_{jim})} + YO^m_{i(t-1)} = \sum_j Y^m_{ijt} + YO^m_{it} \qquad \forall i \in N, \forall m \in M, \forall t \in T$$

(5)

Equation (5) represents the conservation of flow for the vehicles. At any node i and time period t, total number of available vehicles of mode m is equal to the number of vehicles of mode m that left node j for node i at time t-t_{ijm}, plus the number of vehicles that were carried over from the previous time period.

$$cap^m Y^m_{ijt} = X^m_{ijt} \qquad \forall i, j \in N, \forall m \in M, \forall t \in T$$

(6)

Constraint (6) makes sure that commodities are not sent out of a node unless a number of vehicles with enough capacity are available at that node to carry those commodities.

$$\sum_j X^m_{ijt} \le Lcap^m_{it} Z_{it} \qquad \forall i \in TD, \forall m \in M, \forall t \in T$$

(7)

$$\sum_j X^m_{ji(t-t_{jim})} \le Ucap^m_{it} Z_{it} \qquad \forall i \in TD, \forall m \in M, \forall t \in T$$

(8)

$$\sum_m \sum_j X^m_{ji(t-t_{jim})} + XO_{i(t-1)} \le Scap_{it} Z_{it} \qquad \forall i \in TD, \forall t \in T$$

(9)

Constraints (7)-(9) are the maximum capacity for loading, unloading, and storage of commodities at temporary depots.

$$\sum_j Y^m_{ijt} \le VScap^m_{it} Z_{it} \qquad \forall i \in TD, \forall m \in M, \forall t \in T$$

(10)

$$\sum_j Y^m_{ji(t-t_{jim})} \le VRcap^m_{it} Z_{it} \qquad \forall i \in TD, \forall m \in M, \forall t \in T$$

(11)

$$\sum_j Y^m_{ji(t-t_{jim})} + YO_{i(t-1)} \le VPcap^m_{it} Z_{it} \qquad \forall i \in TD, \forall m \in M, \forall t \in T$$

(12)

Constraints (10), (11), and (12) require the maximum number of vehicles that are sent, received, and parked at each depot to be less than the relevant capacities.

$$\sum_i Z_{it} \le a_t \qquad \forall i \in TD, \forall t \in T$$

(13)

Constraint (13) oblige the maximum number of each temporary depot to be limited by the maximum allowable numbers of facilities during the chosen time periods.

Test case description: Flood hazard map

This section presents a case study, in which we demonstrate our approach to the preparation and response to a flood disaster in Chiang Mai province in northern Thailand, where large floods usually occur late in the May–October rainy season that is dominated by masses of moist air moving northeast from the Indian Ocean and associated with tropical depressions moving westward from the South China Sea (Wood and Ziegler, 2008). Chiang Mai has a long history of flooding, since 1956 due to its bowl-like shape.

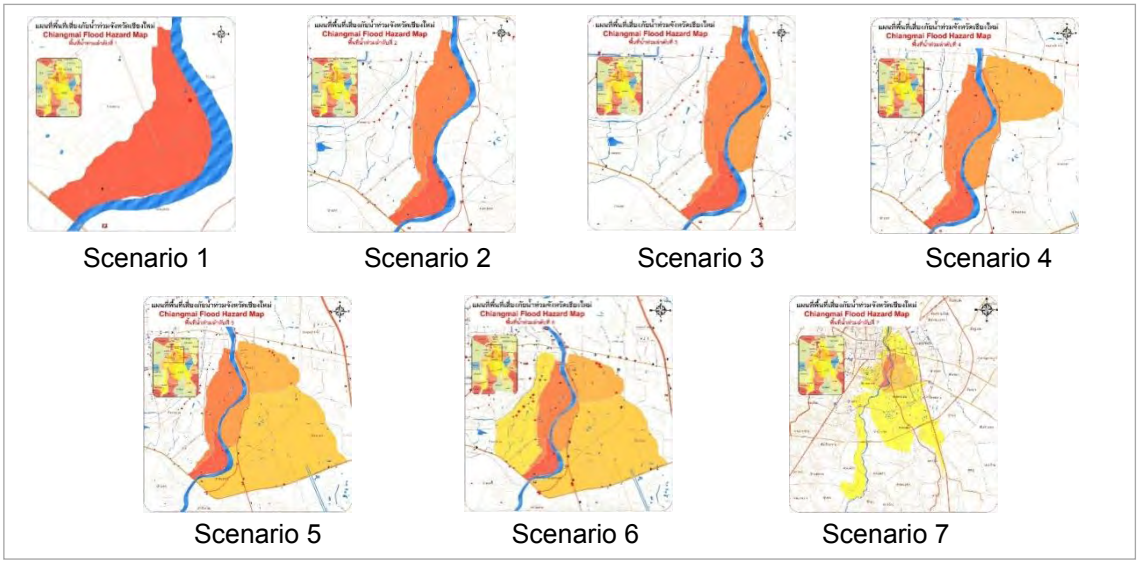


Figure 3. Seven scenarios of impact shown on the Chiang Mai flood hazard map. (CENDRU, 2015)

Chiang Mai implemented a flood warning system for the Ping River in downtown of city. This system makes real-time predictions of the flood level by using a gauging station named station P.67 that is located at Ban Mae-tae in Sansai district, 32 kilometres north of Station P.1, which is in downtown Chiang Mai. When there is heavy rainfall, it usually takes about seven hours for the water to travel from Station P.67 to Station P.1. through the Ping River. Thus, it is possible to estimate the impact on the downtown area by measuring the level of the Ping River at Station P.67 in advance. In this study, we generate various possible scenarios in which there would be a need for relief supplies; these are based on the Chiang Mai flood hazard map produced by the Natural Disasters Research Unit of the Civil Engineering Department of Chiang Mai University (CENDRU, 2015). The flood hazard map shows the flooding risk of each area, based on the historical data from Stations P.1 and P.67; the risk is divided into seven scenarios along the Ping River, as shown in Figure 3.

Computational results

The computational results and analysis of the proposed model behaviour are presented. The optimal solutions were obtained using Gurobi optimizer version 5.6.2 mathematical programming solution software. All experiments were run on a personal computer with an Intel (R) Core (TM) i7-3770 CPU (3.40 GHz) and 16.0 GB of RAM. All test problems were computed in less than ten minutes.

In this section, we present illustrative examples in order to demonstrate how the proposed models can be used to optimize the temporary depot locations for each time period. As it is certainly agreed that the first three days or 72 hours is most critically important for the response stage of emergency management system. Therefore, the example results in this study refer to the solution according to this information as the first 72 hours delivery plan right after the city has been attacked by floods. Considering time scale is important that can affect the performance of time-scale networks dramatically. The problem size may increase hugely with shorter time steps due to the number of time scales in the planning horizon while longer time steps keep the problem at a reasonable size. In this study, hours is appropriate than minutes according to those activities needed in floods response stage. Both delivery flow and transfer nodes requires at least couple hours but less than six hours to complete. Thus, each six hours is appropriate for treating in this problem.

The illustrative results are displayed following the assumption of dynamic demand. This time, we assume that flood causes demand in a certain amount of scenario 2 at the beginning with 12,971 demand in total and the floods and become as enormous as scenario 5 in the next day with 48,041 demand in total. Figure 4a and 4b display the results of the location selection of temporary depots between the beginning of flood at t=1 and the next 24 hours at t=5 which

flood becomes massive for the unlimited capacity case. At the beginning, the certain amount of 13 demand points according to floods in scenario 2 are served by two temporary depots which optimally located in the boundary of flood area in order to receive the relief supplies from the DCs by trucks as land transportation and give a delivery to demand points in affected area by boats. In the next day at t=5, total demand points greatly increase due to the floods in scenario 5. The former 13 demand points in grey colour are completely satisfied within t=5. One of two depots in the earlier stage is moved to a new location to serve those added demand when the other one remains at the same place to serve the new closest demand points. Two more depots are selected to provide the delivery to the rest of demand.

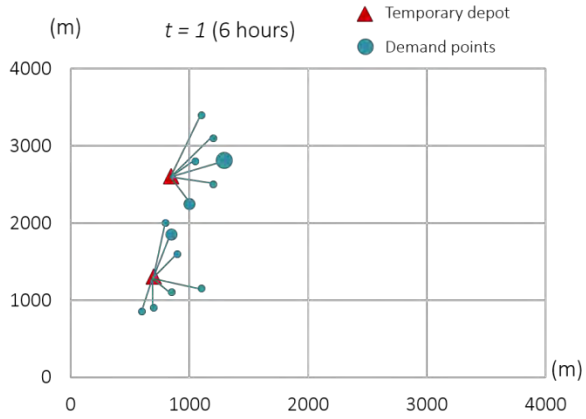


Figure 4a: Optimal solutions for location selection of temporary depots at time period 1st

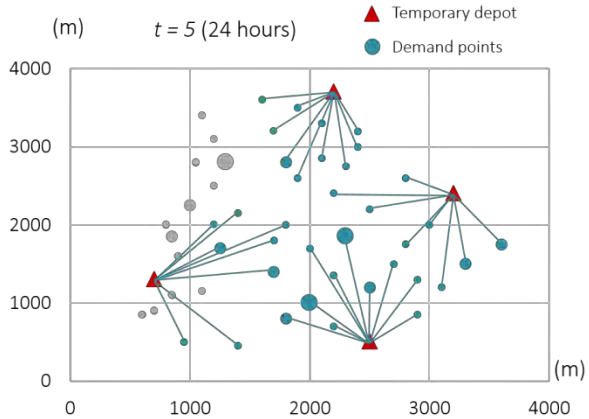
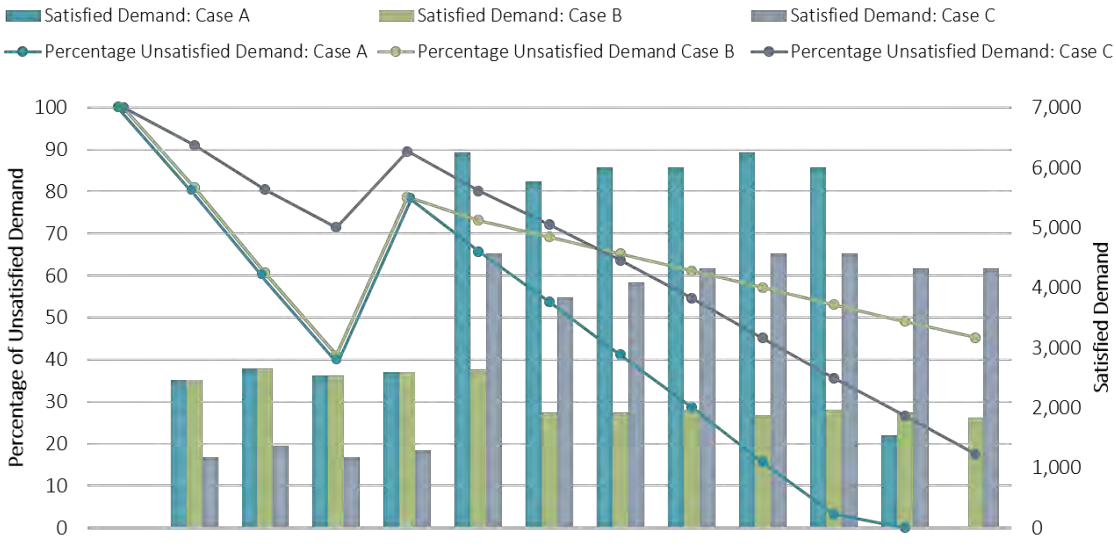


Figure 4b: Optimal solutions for location selection of temporary depots at time period 5th

The experiments in Figure 5 depict the results of objective function in each time period for three cases. Case A indicates the optimal solutions as same as in Figure 4 while single-period approach have been added to case B and C. Two and four temporary depots are located in period 1 and 5 respectively in case A. In order to show how the solutions perform when using unchanged locations of depots for all time period, we conduct case B and C for this purpose. In case B, only two depots are used from the



Time Period	1	2	3	4	5	6	7	8	9	10	11	12	13
Hours	0	6	12	18	24	30	36	42	48	54	60	66	72
Scenario	2	2	2	2	5	5	5	5	5	5	5	5	5
Total Demand	12,971	12,971	12,971	12,971	48,041	48,041	48,041	48,041	48,041	48,041	48,041	48,041	48,041
Number of opened TD													
Case A	2	2	2	2	4	4	4	4	4	4	4	4	4
Case B	2	2	2	2	2	2	2	2	2	2	2	2	2
Case C	4	4	4	4	4	4	4	4	4	4	4	4	4

Figure 5: Experimental results for each time period between limited and unlimited capacity cases

beginning with unchanged locations as in Figure 4a. Finally, case C refers to the results of using four temporary depots all time periods with the location as in Figure 4b.

Generally, the percentage of unsatisfied demand reduces over time period due to the relief delivery from the temporary depots. In case A, about 40% of demand in scenario 2 remains unsatisfied after 18 hours. However, the percentage of unsatisfied demand is sharply increase to 78.7% due to the assumption of scenario 5 at the next day, then continue decreasing until the last demand is served within 66 hours. Case B shows the same performance with case A in the first day, however, remaining only two depots is unable to satisfy all demand increasing in the second day within 72 hours. This is because both depots locate in the same locations with long distances to the rising demand points. The use of four temporary depots from the beginning to all time period is represented in case C. Poor performance occurs for the first day because only one from four depots is applicable due to the water boundary in scenario 2.

Likewise, every 6 hour in case A, an average of about 2,500 demand are served by two temporary depots in the first day and more demand about 6,000 in average are served due to the increasing number of temporary depots as four in total from the second day. Case C shows the similarity with case A that the total satisfied demand from the second day is greater than the total satisfied demand in the first day because more depots are applicable from the second day due to scenario 5. However, only 1,200 demand in average for each period are satisfied in the first 24 hours and the average satisfied demand increases to 4,300 after 24 hours. It is worse than the situation in case A because the selected depots have to satisfy the remaining demands from the first day in scenario 2. At the end of the third day, there are 8,455 demand still not satisfied. Case B shows the worst one after 24 hours. When floods are more spreading from the second day, the average amount of satisfied demand is lower than the average in the first day because both depots remain in the same locations with long distances to the rising demand points. Only 2,000 demands in average for each period are served from the second day and there are the remaining of 21,763 demand are still unsatisfied at the end of the third day.

Conclusions

This study extended the contribution by presenting a decision model at the operational level that describes the details of supply chain logistics in major emergency management agencies, in response to immediate aftermath of a flood disaster. A unique and special of flood character is about the dynamic capabilities. Floods may not hit as so urgently as earthquake or other natural disasters but present the unstable size and impact over time instead. In particular, in the case of flooding, where the most common transport channels are trucks in unaffected areas and boats in affected areas. Therefore, it is vital to treat this behaviour of flood problem as a multi-period approach as proposed in this article.

The results of this research show the optimal locations of temporary depots for each time period regarding to the dynamic characteristics of flood. Single-period solution approach is also conducted in the experimental results to compare the performance of our proposed multi-period model. In this study, we found that the multi-period approach produces better solutions than the single-period ones. The proposed model controls the flow of all the relief commodities from the sources through the chain and until they are delivered to the hands of recipients. This model provided the opportunity for a centralized operation plan that can eliminate delays and assign the limited resources in a way that is optimal for the entire system.

Although, there are a number of possible extensions of this model, future research will explore larger and more complex problems. The use of a heuristic method is expected to provide significant opportunities for improvement when problem sizes and complexity become greater. This can be expected to facilitate finding proper and satisfactory solutions to problem processes. Moreover, improvements to vehicle routing and scheduling can be expected to enhance the flow of the relief distribution network.

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PLANT LAYOUT IMPROVEMENT OF SUPPLEMENTARY FOOD FACTORY USING SYSTEMATIC LAYOUT PLANNING TECHNIQUE IN THAILAND

Chonnanath Kritworakarn*, Jitsiri Siripitukdech, Chavisa Sangkrajang
**Department of Industrial Engineering, Faculty of Engineering,*
Chiang Mai University 50200, Thailand

1. Introduction

Nowadays people around the world focus on beauty and health which stimulates demand for beauty and health-related products. Thailand is a country which is located in Southeast Asia. There are many different types of herbs in forests. Therefore, many traditional medicine or supplements are made of herbs in Thailand. Many Thai entrepreneurs are interested in this business sector. They need to increase their potentials in production and effectiveness. At the same time, the production process needs to be equipped with more or better equipment.

Management would like to improve their plant layout based on many reasons such as wasted times or delays in manufacturing, bad environment, increasing their productivity. According to these problems, researcher would like to analyze the problems and to find the way to improve the plant layout. A good layout is one which allows material flow rapidly.

However, Manufacturers of dietary supplements in Thailand have a legal obligation to comply with good manufacturing practices (Good Manufacturing Practice, GMP) for food products, such cleaning body area, locker room areas, etc. These activities may or may not exist in a company. Some facilities are also fixed. They are already existed in present layout. It takes costs to move to new locations. Therefore, a new plant layout must be considered these conditions in order to get a new plant layout.

2. Literature Review

The Systematic layout planning (SLP) is a tool used to arrange a workplace in a plant by locating two areas with high frequency and logical relationship close to each other. This technique is also organized way to layout planning. It involves of procedures, based on conventions for identifying, rating and visualizing the elements involved in plant (Patill and Kuber, 2014).

Plant layout embraces physical arrangement of industrial facilities i.e, operating equipment, personnel, materials and other services. Systematic layout Planning (SLP) is a plant layout technique that have been used by many academic and practitioners (Zhou, et al., (2010); Sutari and Rao U,2014). The SLP method is showed step-by-step of plant design from input data and activities to evaluation of plant layout (Shewale, et al., 2012).

The detailed procedures for SLP is shown in the figure 1.

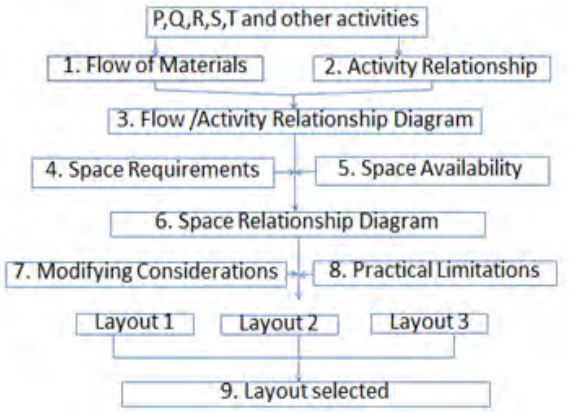


Figure 1 Systematic Layout Planning Processes

A supplementary food company is located in Chiang Mai province which is in northern region of Thailand. The company has its production line already. Area of present production process is 250 square meters. Production capacity of the plant is 1,350,000 bottles per year. Management would like to increase the capacity up to 3,000,000 bottles per year. At present a company is having a new process layout and getting some more new machines.

The company is produced four products. However, all products have the same production processes. These products contain with different ingredient and mixture ratios. The factory has a production period (batch) is producing products based on customer needs. A product which has the highest demand is selected to study.

3. Result

3.1 activity relationships

The production process of liquid supplementary food is started from washing glass bottle, disinfecting filling, sterilizing, labeling and packaging. Many machines and equipment are used in the production process. There are washing machine, disinfection incubator, filling machine, sterilizer oven and labeling machine. The operation process chart, flow of material and activity relationship chart have been used in analysis. A flow diagram of the manufacturing activities of the factory and activity relationship chart are shown in figure 2 and figure 3, respectively.

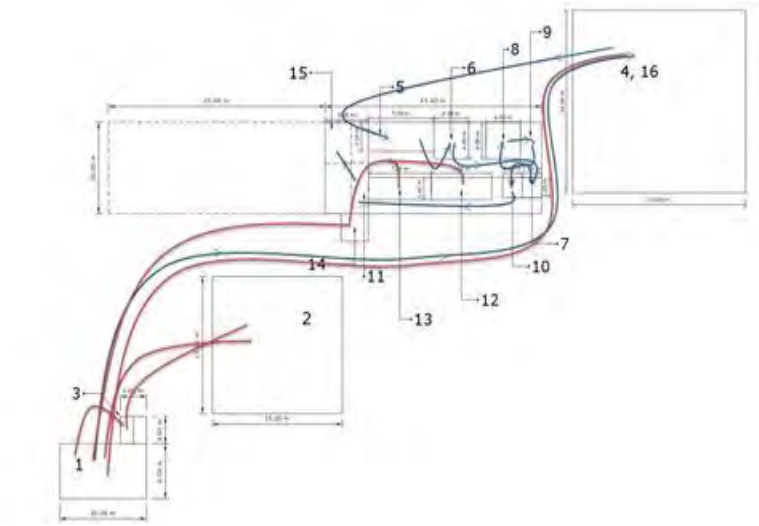


Figure 2 flow diagram of the present manufacturing activities

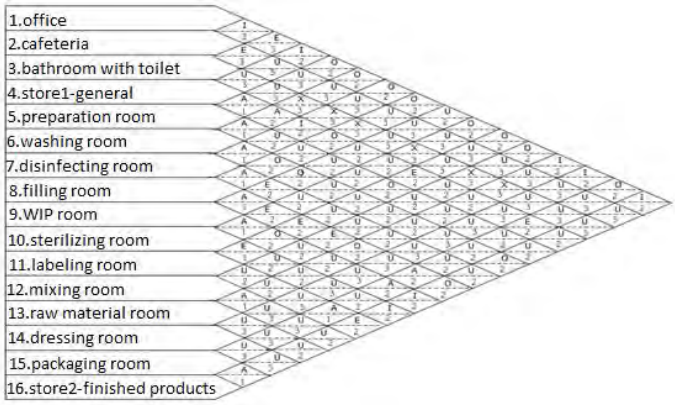


Figure 3 Activity relationship diagram of the present manufacturing activities

In order to calculate the overall score acquaintance (Total Closeness Rating: TCR), the score of all relationship levels were defined as follows: Class A = 10,000, E = 1,000, I = 100, O = 10, U = 0, X = -10,000 (Francis, et al., 1992). TCR is the sum of the value of the relationships with other departments. The highest score will be the first activity of the layout. The scoring is shown in table 1.

Activity	Process																Relationship						TCRs
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	A	E	I	O	U	X	
1	-	I	E	I	O	O	O	O	U	O	O	O	I	I	O	I	-	1	5	8	1	-	1580
2	I	-	E	U	U	U	U	U	U	U	U	U	U	U	U	U	-	1	1	-	13	-	1100
3	E	E	-	U	U	X	X	X	U	X	U	X	X	U	U	U	-	2	-	-	7	6	-58000
4	I	U	U	-	A	A	I	O	U	U	E	U	U	U	E	U	2	2	2	1	8	-	22210
5	O	U	U	A	-	A	U	U	U	U	O	U	U	U	U	U	2	-	-	2	11	-	20020
6	O	U	X	A	A	-	A	O	O	U	U	U	U	U	U	O	3	-	-	4	7	1	20040
7	O	U	X	I	U	A	-	A	E	U	U	U	U	U	U	U	2	1	1	1	9	1	11110
8	O	U	X	O	U	O	A	-	A	E	E	E	O	U	A	O	3	3	-	5	3	1	23050
9	U	U	U	U	U	O	E	A	-	A	O	U	U	U	A	I	3	1	1	2	8	-	31120
10	O	U	X	U	U	U	U	E	A	-	E	U	U	U	U	I	1	2	1	1	9	1	12110
11	O	U	U	E	U	U	U	E	O	E	-	U	U	U	A	E	1	4	-	2	8	-	14020
12	O	U	X	U	U	U	U	E	U	U	U	-	A	U	U	U	1	1	-	1	11	1	1010
13	I	U	X	U	U	U	U	O	U	U	U	A	-	U	U	U	1	-	1	1	11	1	110
14	I	U	U	U	A	U	U	U	U	U	U	U	U	-	U	U	-	-	1	-	14	-	10
15	O	U	U	E	U	U	U	A	A	U	A	U	U	U	-	A	4	1	-	1	9	-	41010
16	I	U	U	U	U	U	U	O	I	I	E	U	U	U	A	-	1	1	3	1	9	-	11310

Table 1 shows a summary of the overall ratings closely

The activity numbers 1, 2, 3, 4, and 16 activities are fixed locations. They are office, cafeteria, bathrooms and storage. Activity number 14 is an activity that must follow good practices (Good Manufacturing Practice, GMP). All production workers need to do this activity before enter to the plant. Therefore this activity must be done outside the plant. Thus there are only 10 activities left (activity 5, 6, 7, 8, 9, 10, 11, 12, 13, and 15).

3.2 Space

The numbers of machine or equipment are also analyzed in order to meet the management's requirement. According to the type of plant layout, which is a product layout, numbers of machine is calculated. The following equation is used.

$$M_{ij} = \frac{P_{ij} \cdot T_{ij}}{t_{ij}}$$

where

Mij = j kinds of machinery products i

Pij = production rate of the machine type i j

Tij = Time of manufacturing equipment type i by j

t ij = All production of products using Mascus i j

The results of the calculations are detailed in Table 2.

Types of machine	Before improvement		After improvement	
	amount (machine)	Area (sq.m.)	amount (machine)	Area (sq.m.)
1. Bottle washer	1	6	1	6
2. Disinfection incubator	1	5.5	2	11
3. Containing machine	1	8	2	16
4. Sterilized incubator	1	5.28	1	5.28
5. Labeling machine	1	3.6	3	10.8

Table 2 Number of machines and their areas before and after improvement

3.3 Adjustments

Position of each activity is developed by using the TCR (table 1). The following step is carried out to select placement sequence of departments:

1. Select the highest TCR value deployed first.

2. Look at the relationship by considering the relationship between A and then followed by E, I, O, U, respectively. If there are two A of the relationship, it is considered that the A which has more value than another. It will be first deployed.

3. The position is held by an anti-clockwise to add to the channel with the lowest number first

A development of placement sequence of departments is shown in Figure 4.

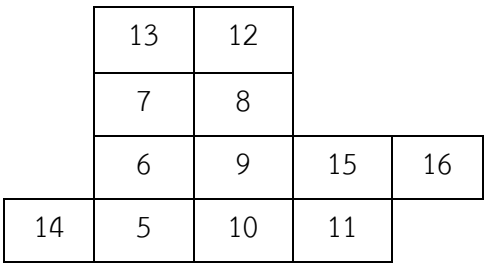
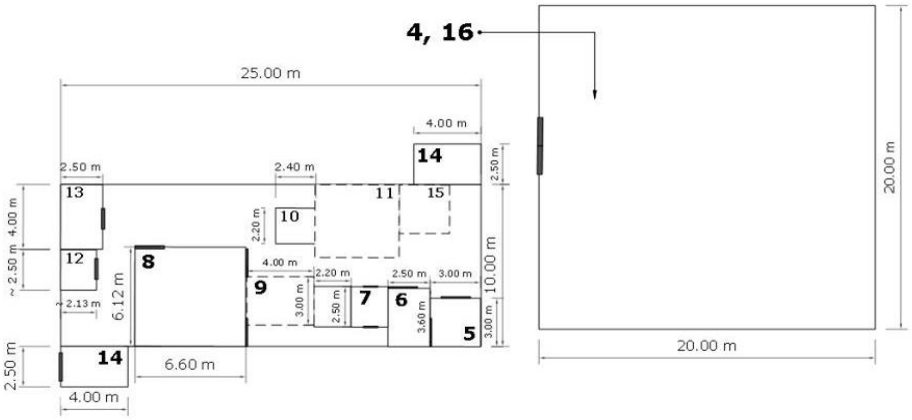
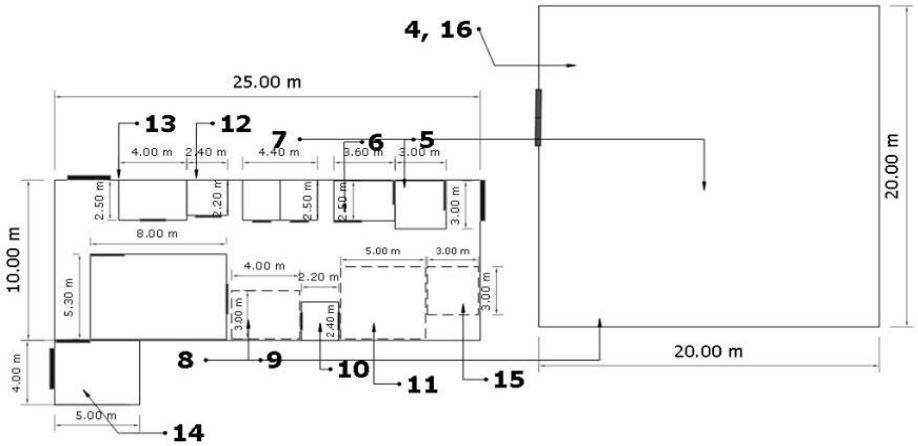


Figure 4 the placement of departments using TCRs.

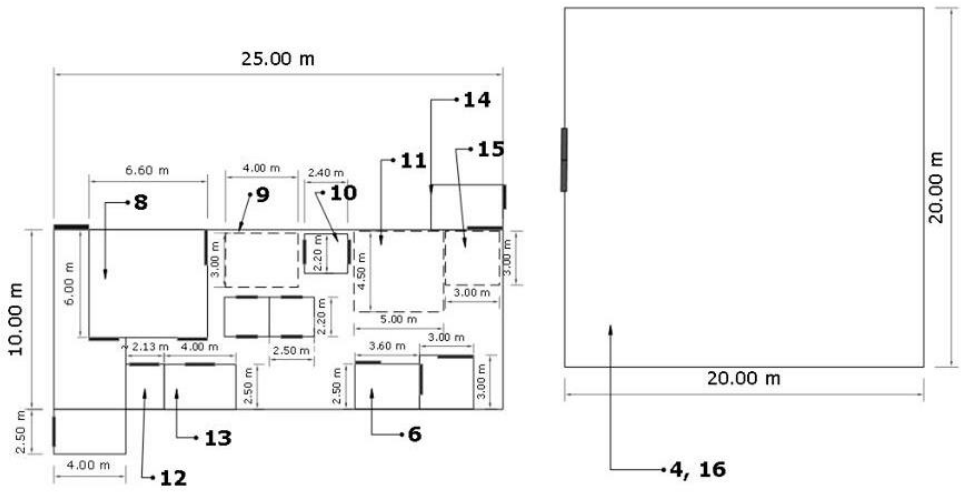
We discussed with management, supervisors, and workers about the placement of departments. Based on adjustment concept and practical limitations, a numbers of layout were developed. There are three different proposed plant layouts as shown in Figure 5.



a. Proposed plant layout no. 1



b. Proposed plant layout no. 2



c. Proposed plant layout no. 3

Figure 5 Three proposed plant layout

3.4 Assessment

Two Assessment methods are used to evaluate the proposed plant layout. There are 1) to evaluate distance-based scoring method and 2) to assess the satisfaction method.

The distance-based-scoring method is a method that needs two different data. The first data is distance data. The distance of each department is measured from the center of department (centroid) to the next department by using the computer program Sketchup. The second data is frequency of each activity. The frequencies of each activity are observed and recorded for 5 days.

The following equation is used to evaluate the activity : for m.

$$S = \sum_{i=1}^{m-1} \sum_{j=i+1}^{m} f_{ij} D_{ij}$$

where

Dij is the distance between activities or departments i and j.

fij is often - out of each department per unit distance moves between departments or between departments i and j, j, i.

The second assessment is to assess the satisfaction of those who involved. A questionnaire is developed. There are seven topics which have different weight. Each topic has four levels of satisfaction levels. Satisfaction levels were defined as follow: 4 = most, 3 = moderately satisfied, 2 = satisfy, and 1 = least. Manager, supervisors and workers were asked. The results of both assessment methods are shown in Table 3 below.

Type of Layout	distance-based scoring method	satisfaction method
Present layout	961.72	-
Layout no. 1	874.62	560
Layout no. 2	808.78	485
Layout no. 3	808.55	515

Table 3 Results of assessment methods using distance-based scoring method and satisfaction method

As results in table 3, we have found that different assessment provides different solution. Management and workers discussed and made a decision. Finally, they have chosen a proposed plant layout no. 1. Their reasons mainly are they did not want to move their dressing rooms and they familiar with its original location.

4. Discussion

Dressing room is a specific activity to comply with good manufacturing practices (GMP). This activity must be done before get in the plant. In this study, we have tried to set its TCR value up to 50,000 (the actual value equals 10). Thus, a dressing room should be the first activity in the plant layout. However, the dressing room should be located outside the plant. Since the present plant layout already has this activity. Therefore, the location of a dressing is in the same.

Frequency data may not enough. Some studies used costs per unit of distance data instead of frequency data. But in this study, the plant is quite small and it is labor intensive investment. Cost per unit of distance data may not appropriate.

Assessment of plant layouts provides different results. It is an interesting issue, which occurs in practice. Although analyst has quantitative data such as distance and frequency data, which are reliable data. However, when the data was analyzed, the result may not acceptable. Because the data has limitations.

The decision making using the satisfaction of the people involved could be quite inappropriate. Generally, people prefer what they familiar with rather than what they have to change. It is possible that they will satisfy with the familiar one rather than the others.

5. Conclusion

A new plant layout of supplementary food plant is developed using systematic layout planning (SLP). Ten activities are relocated within 250 square meters. Some more chines are needed such as filling machine, labeling machine and disinfection oven. The capacity of the new plant can produce 3,000, 000 bottles per year. The total distance of the new plant layout is decreased 9.05% when compare with the distance of the present layout.

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Portfolio Selection in Agricultural Product Processing Industry

Pisit Bungbua[1], Pairoj Raothanachonkun[2], and Nakorn Indra-payoong[3]
[1,2,3]Faculty of Logistics, Burapha University, Chonburi, Thailand
{pisit.bu[1], pairoj.iang[2], nakorn.ii[3]} @gmail.com

Introduction

Agricultural product processing is the process to add value to products. Sakaeo is the eastern border province of Thailand, located in the southern economic corridor. It links urban, economic areas, transportation and logistics with the upper eastern provinces and Cambodia as well as Vietnam. Because of the national policy to promote a special economic zone in Thailand, Sakaeo has an opportunity to develop its areas to support trade, agricultural and industrial investment. (Thailand's Department of Public Works and Town & Country Planning, 2015). From GPP of Sakaeo during 1995-2013, the agricultural production has the most value, compared with other productions (National Statistical Office of Thailand, 2015). Major industrial crops of Sakaeo are: rice, cassava, sugarcane, and maize, and agricultural processing activity is the key to generate income for local people, leading to sustainability of the city.

In order to obtain expected total return, the city needs to find the investment proportion in various assets that has the lowest investment risk, alternatively with a given level of risk with the maximum return. For the city administration in Sakaeo as a developing province, the policy is to target a satisfied level of return. The objective of this research is to analyze the portfolio selection in agricultural product processing industry of Thailand's major industrial crops in Sakaeo, consisted of rice, cassava, sugarcane, and maize. This study tests the policy of selecting portfolio in two scenarios: 1) the minimum proportion for processing each type of agricultural products is not required, and 2) there is a minimum proportion.

Portfolio Selection

Sungkaew (2000) states that in efficient investment all investors are risk-aversed. Consequently, investors try to make diversification by investing in different assets in order to get efficient portfolio which has higher total return than other portfolio in the same risk level or has the lowest investment risk with the same return.

Investment return in portfolio is equal to the sum of investment return expected in each asset, multiplied by the proportion of investment in that asset, as shown in the following equation.

$$E\left(R_p\right)=\sum_{i=1}^{N} w_i E\left(R_i\right)$$

where $E\left(R_p\right)$ is the investment return rate expected in portfolio p, $E\left(R_i\right)$ is the investment return rate expected in asset i, w_i is the investment proportion in asset i, and N is the number of assets in portfolio.

Investment risk is the return an investor actually got (Actual return), dislocating or deviating from the return an investor expected to get (Expected return). The relations between investment return rate and investment risk are related in the same direction, which if investment return rate is higher, the investment risk will be higher too. The Investment risk of portfolio can be shown as the following equation.

$$Var\left(R_p\right)=\sum_{i=1}^{N}\sum_{j=1}^{N} w_i w_j Cov\left(R_i,R_j\right) \quad , i \neq j$$

where $Var(R_p)$ is the variance of investment return rate of portfolio p, $Cov(R_i, R_j)$ is the covariance of investment return rate in asset i and j, and w_i, w_j is the investment proportion in asset i and j respectively.

Optimal portfolio selection

Investors consider the return and the risk of the investment. They are more satisfied when they get more returns or have less risk. However, since investment getting high returns usually has high investment risk as well, so investors looking for higher returns have to accept more risk too.

Efficient portfolio means a portfolio giving the highest return at a risk level or a portfolio with the lowest risk level at the same return level, when considering from all feasible/opportunity sets. The efficient portfolio will be in a line called Efficient frontier (Budsaratrakul, 2005) as shown in Figure 1.

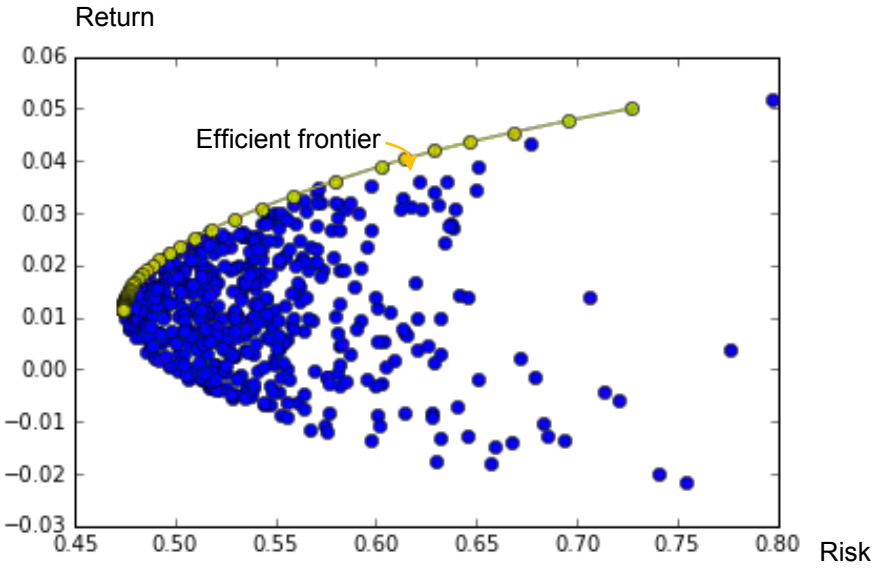

Figure 1: Efficient frontier (Starke *et al*., 2015)

Quadratic Programming

Given: an *n*-dimensional real vector $\mathbf{c}$, an *n* × *n*-dimensional real symmetric matrix $\mathbf{Q}$, an *m* × *n*-dimensional real matrix $\mathbf{A}$, and an *m*-dimensional real vector $\mathbf{b}$, the objective function of quadratic programming is to find an *n*-dimensional real vector $\mathbf{x}$. The quadratic programming with *n* variables and *m* constraints can be written as follows.

Minimize $\frac{1}{2}\mathbf{x}^{\mathrm{T}}\mathbf{Q}\mathbf{x}+\mathbf{c}^{\mathrm{T}}\mathbf{x}$

Subject to $\mathbf{A}\mathbf{x} \le \mathbf{b}$

$\mathbf{x} \ge 0$

where $\mathbf{x}^{\mathrm{T}}$ and $\mathbf{c}^{\mathrm{T}}$ denotes the vector transpose of $\mathbf{x}$ and $\mathbf{c}$ respectively. The constraints $\mathbf{A}\mathbf{x} \le \mathbf{b}$ means that every entry of the vector $\mathbf{A}\mathbf{x}$ is less than or equal to the corresponding entry of the vector $\mathbf{b}$. Besides, vector $\mathbf{x}$ has to be more than or equal to 0. (Wikipedia, 2015)

There have been study related researches which used quadratic programming to solve problems about setting portfolio such as Ekmaturapoj (2010) there was study a portfolio

construction from investment in the Stock Exchange of Thailand by analyzing portfolio optimization from the Markowitz efficient portfolio theory. The study found that an efficient portfolio gave investment return rate 0.12% per day, and there was 0.75% of investment risk. Major portfolio were in the industries which were essential to survive such as energy and utilities industry, food and drink industry, medical industry, insurance industry etc. Meanwhile, Limwattana (2014) there was study the Markowitz efficiency of equity funds: a case study of the Thai equity market was studied to test the efficiency of modern portfolio theory of Markowitz to investment in Thailand's capital market by creating portfolio that were adjusted their management in three ways. These were 1) the variance of the portfolio was minimal, 2) the return was not less than the starting portfolio, and the variance was minimal, and 3) the risk was not more than the starting portfolio, and there was maximum return. The study found that the first way gave risk and average return less than the starting portfolio, the second way made average return and risk higher than the starting portfolio, and the last way made average returns higher than the starting portfolio but still less than the second. At the same time, Hernandez (2014) there was research to fine investment risk in the energy sector, including oil, natural gas, coal and uranium in Australia during the global financial crisis in 2008-2009 by measuring investment risk to decide to invest in the right stocks. The findings indicated that during the financial crisis, investment in oil stocks had higher risk than coal, uranium, and natural gas. Furthermore, there was research related to plan crop production. For example, Sayaphan (2001) it was the analysis of planning crop production in Phitsanulok province under the circumstance that was regardless of risk and the circumstance considering the risk of price fluctuations, by using linear programming model and minimization of total absolute deviation model respectively. Regardless of risk, the analysis showed that an appropriate production plan was in- season rice, off-season rice, peanut, and sugarcane should be planted and would give local agriculturists profits 35,849,290 baht. For the case with the risk of price fluctuations considered, an appropriate production plan at the high level of risk was planting sugarcane. In contrast, at low level of risk, a plan was suitable with maize and peanut. In addition, Hunkittikul (2007) there was study the planning of crop production in Pongyang sub district, Mae Rim district, Chiang Mai province by dividing cultivated areas into 11 zones distinguished by characteristics of crop varieties and irrigation systems acquired. Data was analyzed by using linear programming model. The results showed that zone 1 should plant peas, zone 2 should plant swan plant, strawberry, sayote, and onion, zone 3 was fit with banana, zone 4 should plant sweet pepper, zone 5 was appropriate with chrysanthemum, zone 6 was potato and carrot, zone 7 was potato, zone 8 was persimmon, zone 9 was suitable for roses, lychee, and banana, zone 10 should cultivate sweet pepper, and zone 11 was fit with planting gerbera. That would give local farmers maximum profit average 151,744.93 baht per year per household.

In most literature, it showed that quadratic programming is mostly used to solve the problems of selecting portfolio in the stock market. Nonetheless, the researchers have not found that there is quadratic programming applied to the solution of selecting portfolio for agricultural products processing. Meanwhile, there is research related to crop production planning which are raw materials of agricultural product processing. It is analysis to plan crop production appropriately with characteristics of the areas such as dividing cultivated areas and irrigation systems acquired. That plan might consider or did not consider risk of price fluctuations. Nevertheless, the researchers found no researches that related to planning of portfolio selection in agricultural product processing. This research, thus, desired to study portfolio selection in agricultural products processing industry in order to find the right portfolio based on the portfolio policy that was set. This can be used as a guide to plan and encourage agriculturists to grow crops that meet the demand for products processing, bringing benefits to the economic development of the city.

Methodology

This research applied quadratic programming model to analyze portfolio selection in agricultural product processing industry of Thailand's major crops in Sakaeo province, consisted of rice, cassava, sugarcane, and maize. In this study, we test the policy of portfolio selection in two scenarios: 1) the minimum proportion for processing each type of agricultural products is not required, and 2) there is a minimum proportion. The objective function of the problem is to find the lowest risk of portfolio, subject to a specific value of expected return and

a minimum proportion for processing each type of agricultural products. The generalized reduced gradient algorithm in MS Excel solver is used to find the optimal selection of portfolio.

Agricultural product processing industry

Agricultural products processing industry is crucial to the economic development for farming province. Since the processing of agricultural products is taking the output from crops to process, it helps to add value to products, keep them for a long time, make new products, and increase the variety of distribution of agricultural products to the market. The major crops of Sakaeo province are rice, cassava, sugarcane, and maize. In order to analyze portfolio selection in this research, the outputs from processing was defined to make clear: paddy rice was defined to be processed into polished rice, and cassava, sugarcane, and maize are tapioca starch, sugar, and maize kernels respectively as shown in figure 2.

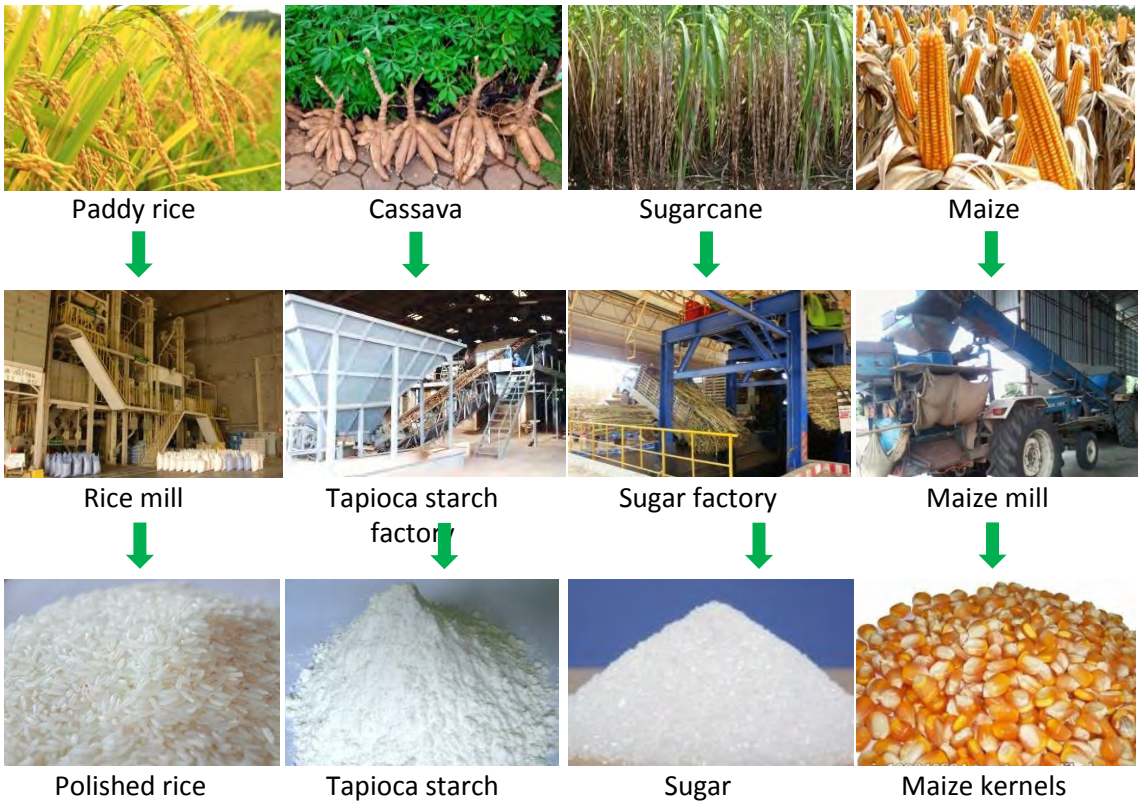

Figure 2: Processing of agricultural products from 4 major crops

Due to the researchers have not found that the agency collecting information about the return on agricultural products processing, the researchers used data from Centre for Agricultural Information Thailand (2010), Thailand's Office of Agricultural Economics (2014), Bureau of Trade and Economic indices Ministry of Commerce Thailand (2015), Thai Feed Mill Association (2015), Thai Tapioca Starch Association (2015), Office of the Cane and Sugar Board (Thailand) (2015), Office of the Cane and Sugar Fund (Thailand) (2015), CPF Feed Marketing Bureau in Thailand (2015), The Stock Exchange of Thailand (2015) to calculate the costs and returns in processing four agricultural products by comparing the percentage of return from products from the average price of each crop during 2007-2014 (Thailand's Office of Agricultural Economics, 2015). The percentage of return from each type of agricultural products is shown in Table 1.

Year	Percentage of return on agricultural products processing			
	Rice	Cassava	Sugarcane	Maize
2014	6.61	8.25	13.35	5.79
2013	7.47	7.95	13.68	5.83
2012	8.66	7.83	14.54	7.59

2011	8.24	9.57	14.48	6.18
2010	7.09	8.51	13.43	6.52
2009	8.07	4.99	11.62	4.39
2008	8.97	6.55	9.49	5.76
2007	5.62	5.22	9.88	5.55
Expected Return	7.59	7.36	12.56	5.95
Standard Deviation	1.05	1.52	1.86	0.85

Table 1: Return on agricultural products processing from 4 major crops

According to Table 1, it has shown that Sugarcane provides the expected return and standard deviation (risk) more than the return from other agricultural products. On contrary, maize processing has a minimum expected return and risk.

Mathematical model

The objective of the research is to minimize the risk of portfolio subject to a predetermined value of expected return, the criteria to find the optimal portfolio for agricultural products processing from the major crops of Sakaeo can be written in mathematical form as:

Minimize $$\sum_{i=1}^{N}\sum_{j=1}^{N} w_i w_j Cov\left(R_i, R_j\right) \quad , i \neq j \qquad (1)$$

Subject to $$\sum_{i=1}^{N} w_i E\left(R_i\right) = R^* \qquad (2)$$

$$\sum_{i=1}^{N} w_i = 1 \qquad (3)$$

$$0 \leq w_i \leq 1, \quad i = 1,...,N \qquad (4)$$

where N is the number of types of processed agricultural products, w_i, w_j is the proportion of agricultural products processing type i and type j respectively, $Cov\left(R_i, R_j\right)$ is the covariance of investment return of agricultural products processing type i and type j, $E\left(R_i\right)$ is the expected return of agricultural products processing type i ,and R^* is the predetermined value of expected return of portfolio.

Eq. (1) the objective function is to find the lowest risk of portfolio subject to a predetermined value of expected return of portfolio. The model constraints are: Eq. (2) is that the sum of processing proportion multiplied by the expected return on each type of agricultural products must be equal to a predetermined value of expected return, Eq. (3) is the sum of proportion in processing all type of agricultural products must be equal to 1, and Eq. (4) is the proportion in processing each type of agricultural product is more than or equal to 0, but less than 1.

Results

We test the policy of selecting portfolio in two scenarios: 1) the minimum proportion for processing each type of agricultural products is not required, and 2) there is a minimum proportion. The result of optimal portfolio selection is shown in Figure 3.

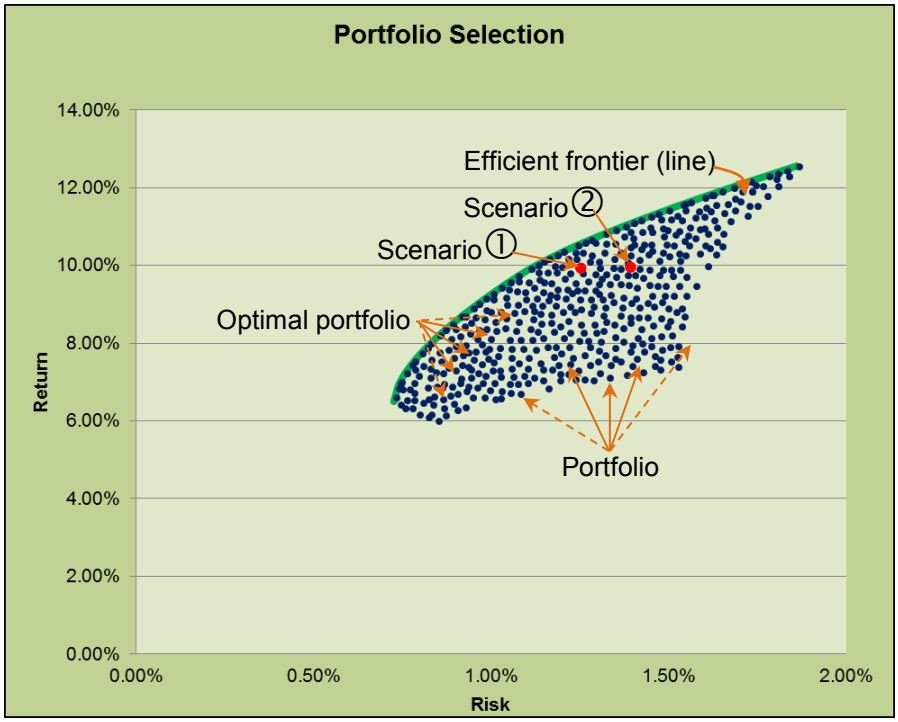

Figure 3: The result of optimal portfolio selection

From Figure 3, the optimal portfolios are on the efficient frontier line. Determining 10.00% of expected return without minimum proportion, the portfolio has a lowest risk (see ① in Figure 3). The portfolio has the total return is 10.00% (as determined), and the risk is 1.13%. Crop to process is consisted of 51.51% of rice, 48.49% of sugarcane, and there are no need from cassava and maize. By setting the minimum proportion at 15.00% for processing each type of products, the portfolio has a lowest risk (see ② in Figure 3), the portfolio has the total return is 10.00% (as determined), and the risk is 1.32%, which is slightly higher than the previous scenario. Crop to process is the proportion of 54.07% of sugarcane, 15.93% of rice, and 15.00% from cassava and maize respectively.

Conclusion

The portfolio selection model for agricultural products processing is developed in this paper, under two testing scenarios: 1) the minimum proportion for processing each type of agricultural products is not required, and 2) there is a minimum proportion at 15.00% for processing each type of products. It is found that both scenarios get the total return 10.00%, which is on the defined target. In scenario 1) 51.51% and 48.49% of outputs from rice and sugarcane are selected, while there are no need to process product from cassava and maize, resulting the risk of portfolio is 1.13%. In scenario 2) 54.07%, 15.93%, 15.00%, and 15.00% of sugarcane, rice, cassava, and maize are selected, and the risk of portfolio is 1.32%, which is more than the previous scenario 0.19%. The risk of portfolio in scenario 2 is slightly higher than scenario 1 because the return rate of processing some types of agricultural products has a relation in the same direction. Consequently, when finding optimal portfolio, it increase the risk of portfolio. The testing results of both scenarios, the risk of portfolio that is a little different. Thus, city administrators may decide to use the policy in scenario 2 which holds determination of minimum proportion at 15.00% for processing each type of products. That the risks of portfolio increase slightly, while processing 4 crops made more various agricultural products distributed to the market and farmers in Sakaeo have alternatives to plant more crops than scenario 1. In summary, the city administrators can practically use this developed model to select portfolio and to support policy making in planting and processing agricultural products.

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PUBLIC PRIVATE PARTNERSHIPS IN LOGISTICS AND TRANSPORT DEVELOPMENT: THE SINGAPORE EXPERIENCE

Yan Weng Tan
School of Business, SIM University
Singapore

Ruth Banomyong
Department of International Business, Logistics and Transport
Thammasat University, Thailand

Introduction

Asia faces a huge demand for infrastructure investment driven by rapid economic growth and urbanisation which is expected to continue over the next two decades. According to the World Bank (2014), the annual percentage growth rate of Gross Domestic Product (GDP) of East Asia (which accounts for about two-fifths of global economic growth) was 6.8% in 2014. Asia has witnessed the rise of megacities (urban areas with population exceeding 10 million). According to Demographia (2015), 9 of the world's 10 megacities are in Asia.

The joint study by Asian Development Bank and Asian Development Bank Institute (ADB/ADBI, 2009) estimated that Asia needed US$8 trillion in infrastructure investment from 2010 to 2020, of which 68% will be for new infrastructure and 32% will be for maintaining and replacing existing ones. ADB President Takehiko Nakao reported in the G20 Australia Summit (2014) that "*Public and multilateral resources are limited … Private-sector financing, including through public private partnerships (PPPs), needs to be increasingly tapped in order to direct private money and skills into much-needed infrastructure projects*."

While government budgets have been the traditional source of infrastructure financing, they may be unable to bridge the gap in investment needs moving forward. PPP models are increasingly seen by governments and development agencies as a possible mechanism for financing infrastructure projects in Asia. This paper presents the experience of Singapore related to PPP in the development of logistics and transport infrastructure. The paper reviews the projects implemented in Singapore that are recognised as PPP by Singapore's Ministry of Finance. We examine the background of these PPP projects and strategies used so as to uncover some of the challenges and issues involved in making these projects work.

Literature Review

Public private partnership (PPP) is a collaborative relationship structure between the public and private sectors to deliver services. The partners agree to share risks, resources and decisions in the development and implementation of projects. Grimsey and Lewis (2004) define PPPs as "*arrangements whereby private parties participate in, or provide support for, the provision of infrastructure, and a PPP project results in a contract for a private entity to deliver public infrastructure-based services*."

In the 1990s, the UK government introduced policies to provide greater transparency and value for money in public accounting (Lovells, Lee and Lee, 2009). This led to the introduction of the UK Private Finance Initiative (PFI). This was set against the backdrop of meeting infrastructure demand with limited public funds coupled with the UK government's pursuit of public sector reform and the need to increase the role of the private sector.

According to Pierson and McBride (1996) cited in Keremane (2011), PPP arrangements may incorporate some or all of the following features:

- the public sector entity transfers land, property or facilities controlled by it to the private sector entity (with or without payment in return) usually for the term of the arrangement
- the private sector entity builds, extends or renovates a facility
- the public sector entity specifies the operating services of the facility

- the private sector entity provides the services for the term of the arrangement with conditions on operating standards and pricing
- the private sector entity agrees to transfer the facility to the public sector (with or without payment) at the end of the arrangement.

Governments play a major role in the formulation of PPP projects, and depending on the risk level and degree of private sector involvement there can be very different PPP models. There is no standard template for a PPP model. Figure 1 describes the spectrum of PPP models to understand the varied approaches to PPPs. In such a framework, the degree of risk transferred to the private sector usually increases with greater private sector involvement. With greater private sector involvement, the government's role shifts from being a supplier to a buyer of services.

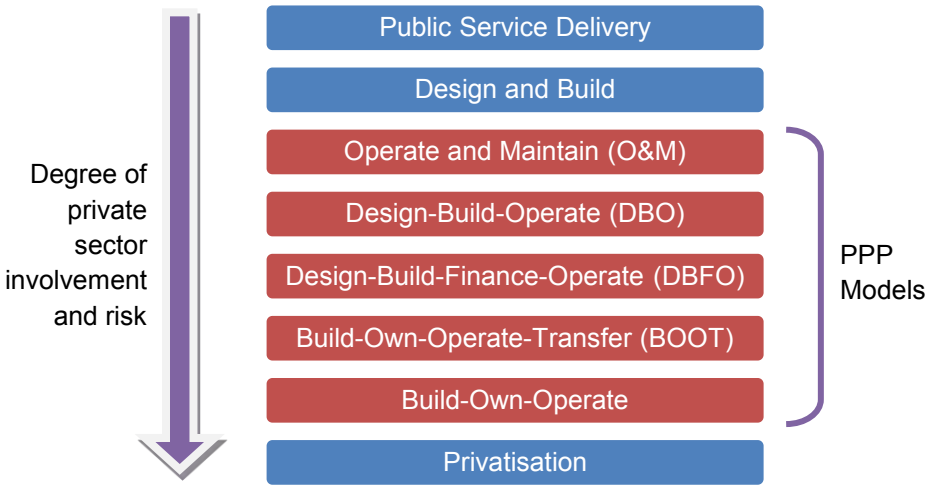

Figure 1: The spectrum of PPP models (Source: Anwar and Ng, 2014)

Both public and private parties have to assume considerable risks during the life cycle of a PPP project. Usually, the risks are borne by the party that is able to manage it most efficiently. Table 1 summarises the possible types of risks in PPP projects and the parties most affected by or are likely to assume these risks.

Party Affected by or Assuming Risk	**Type of Risk**
Public sector	*Political risk:* potential changes in public policy *Bankruptcy risk:* Private company declares bankruptcy while working on a contract
	Closure risk: Inability of bidding party to reach financial closure
	Land risk: expropriation and eminent domain issues, difficulties acquiring land
Private sector	*Design, construction and maintenance risk:* day-to-day operational and management risks, delays in acquiring necessary permits, problems with subcontractors, completion risks, cost and schedule overruns
	Demand/revenue risk: includes unexpected high or low demand compared to initial market assessments
	Political risk: changes in government, changes in public policy, corruption and favouritism, lack of sanctity of contract, arbitration difficulties
	Currency risk: unexpected severe depreciation or appreciation of currency that affects the service provider's ability to pay investors

Table 1: Risk allocation in PPPs (Source: Das and James, 2013)

Singapore's Logistics & Supply Chain Management Industry

The logistics and supply chain management industry is a key pillar of Singapore's economy. The sector contributed to about 7% of the nation's GDP (Singstat, 2015) and employed some 189,000 jobs. Singapore is among the most competitive and efficient nations globally. The island state is well known for its world-class infrastructure, excellent connectivity by sea and air to major markets, high use of information technology (IT), pro-business environment and stable government. It has become a prime location for major logistics firms; 21 of the top 25 global logistics players base their operations here, e.g. Agility, DHL, FedEx, Kuehne+Nagel, Sankyu, Schenker, Toll, UPS and Yusen Logistics. Table 2 provides an overview of Singapore's transport indicators.

Transport Infrastructure	Indicator	2014 Figures
Port of Singapore	Vessel arrivals Shipping tonnage ('000 GT)	134,883 2,371,107
	Total cargo ('000 tonnes) • General • Bulk	581,268 384,418 196,850
	Total container throughput ('000 TEUs)	33,869.3
Changi Airport	Aircraft arrivals Aircraft departures	170,680 170,706
	Air cargo handled ('000 tonnes) • Discharged • Loaded	1,843.8 1,004.6 839.2
Land Transport	Total road length (lane-km) • Expressway • Arterial road • Collector road • Local road	9,233 1,093 3,146 1,599 3,394
	Total rail length (km) • MRT • LRT	183.0 154.2 28.8

Table 2: Transport indicators of Singapore (Source: Singstat, 2015 and LTA, 2014a)

Singapore is connected by 200 shipping lines to more than 600 ports in over 120 countries, with daily sailings to every major port of call in the world. The Port of Singapore is the world's busiest transhipment hub, accounting for about one-seventh of the world's total container transhipment throughput (over 33 million TEUs in 2014). Changi Airport is one of Asia's largest cargo airports and is served by over 6,500 weekly flights connecting to 240 cities in 60 countries, handling about 2 million tonnes of cargo. Both sea and air ports are accessible through a well-planned domestic road network to ensure that Singapore-based companies are well-positioned to serve customers and manage their operating entities. The mass rapid transit (MRT) and light rail transit (LRT) systems serve domestic passengers and do not carry freight.

Singapore's Experience with PPPs

Singapore has engaged in public sector reform since the 1990s (Lam, 2004) and has been open to adopting best practices in many fields, both locally and overseas. PPPs are implemented based on best practices from the UK and Australia. Singapore's Ministry of Finance (MoF) launched its PPP initiative with a PPP Handbook in 2004 that was revised in 2012 to reflect more up-to-date issues (MoF, 2012). Having PPP guidelines on par with international standards has helped to attract overseas investors, especially companies who are familiar with the type of risk allocation and contract structures. In turn, these companies bring in financial institutions to participate in projects. MoF (2015) provides a list of PPP projects that have been awarded in Singapore.

Examples of Design-Build-Own-Operate PPPs

Tuas Desalination Plant (Public: Public Utilities Board / Private: SingSpring)
Singapore's first PPP involved a desalination plant project under the Public Utilities Board (PUB). The contract was awarded to SingSpring in 2003 and the plant opened in September 2005. The supply contract was for 136,000 cubic metres (30 million gallons) of water per day for a 20-year period from 2005 and 2025. The choice of the desalination technology was left to the private sector while the PUB was able to purchase desalinated water at a competitive price. The estimated cost of the project was S$250 million.

Ulu Pandan NEWater Plant (Public: Public Utilities Board / Private: Keppel Integrated Engineering Limited)
This PPP involved the supply of NEWater (which is high-grade reclaimed water purified with advanced membrane and ultraviolet technologies) to the PUB. The contract was awarded to Keppel Integrated Engineering in January 2005 and the plant opened in March 2007. The award was for the supply of 148,000 cubic meters (32 million gallon) of NEWater per day for a 20-year period from 2007 to 2027 to industries and commercial buildings. This PPP approach has helped lower the overall cost of supplying water for the PUB.

Incineration Plant (Public: National Environment Agency / Private: Keppel Seghers Engineering Singapore Pte Ltd)
The PPP contract was awarded to Keppel Seghers in November 2005 and the plant opened in January 2009. The contract was to incinerate 800 tonnes of refuse per day for a 25-year period from 2009 to 2034. This was part of the move to open up the incineration industry to the private sector in line with National Environment Agency's aim of becoming more pro-business and service-oriented by leveraging on the strengths of both public and private sectors.

Examples of Design-Build-Finance-Operate PPPs

Institute of Technical Education College West (Public: Institute of Technical Education / Private: Gammon Capital)
This was the first social infrastructure PPP project completed in Singapore. The project was awarded to Gammon Capital in November 2007 and the College opened in July 2010. The contract was for Gammon to design, build, maintain and operate the education facility for a period of 27 years for an estimated cost of S$400 million.

Singapore Sports Hub (Public: Singapore Sports Council / Private: Singapore Sports Hub Consortium)
This project, the largest sports infrastructure PPP in the world, was awarded to Singapore Sports Hub Consortium led by Dragages Singapore Pte Ltd in August 2010 and opened in June 2014 after many challenges. The Sport Hub comprises a new 55,000-seater National Stadium with retractable roof, an aquatic centre, a multi-purpose indoor arena, a water sports centre, and supporting commercial facilities. This was a landmark PPP deal with a 35ha site to cater to both sports and non-sports enthusiasts for a period of 25 years at an estimated cost of S$1.8 billion. In evaluating bid submissions, higher weightage was placed on the bidder's ability to develop major sports, entertainment and leisure programmes.

Logistics- and Transport-related PPPs in Singapore
Key logistics infrastructure projects in Singapore (e.g. port, airport and logistics parks) are considered public sector projects and not classified as PPPs. Singapore does not have inland clearance depots (ICDs). The two examples of PPPs are from the information technology (IT) and public transport fields.

TradeXchange (Public: Singapore Customs / Private: CrimsonLogic Pte Ltd)
This was the first IT PPP where the government wanted to create a one-stop integrated logistics information system portal. The contract was awarded to CrimsonLogic Pte Ltd in December 2005 to develop the software, maintenance and operation of the system for a 10-year period from 2007 to 2017. The project originated in the mid-1980s when the government reviewed the processes involved in regulatory approvals for trade to improve Singapore's

trade competitiveness and adopted IT to streamline trade processes by reducing costs and improving efficiency as well as turnaround time. TradeNet was launched in 1989 as a one-stop service to achieve several transactions with multiple government agencies. Figure 2 describes the impact of TradeNet on trade processes in Singapore.

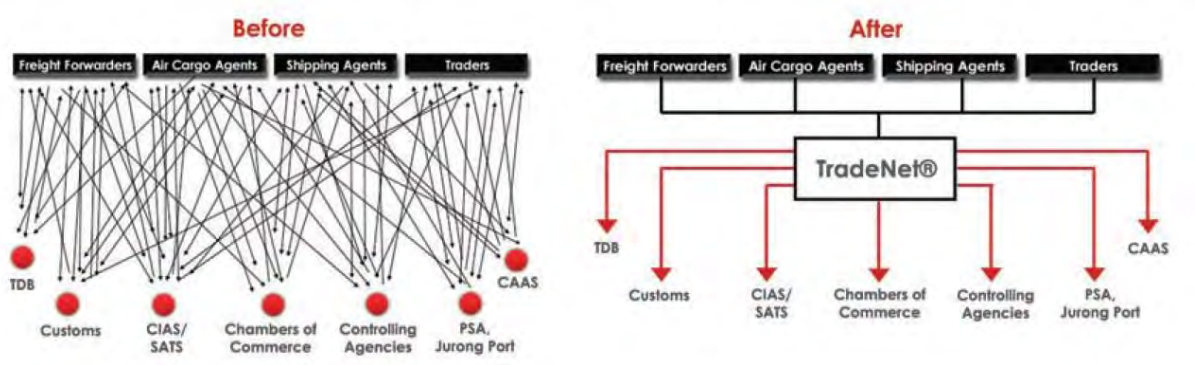

Figure 2: Before and after TradeNet (Source: CrimsonLogic, 2014)

TradeXchange, and the new TradeNet which is a core application, represents a major upgrade. It provides a neutral and secure IT platform that enables the seamless exchange of information between businesses as well as businesses to related government agencies to facilitate the flow of goods within, through and out of Singapore for trade and logistics businesses (Figure 3). The platform provides greater operational efficiencies and clearer visibility to businesses across the supply chain.

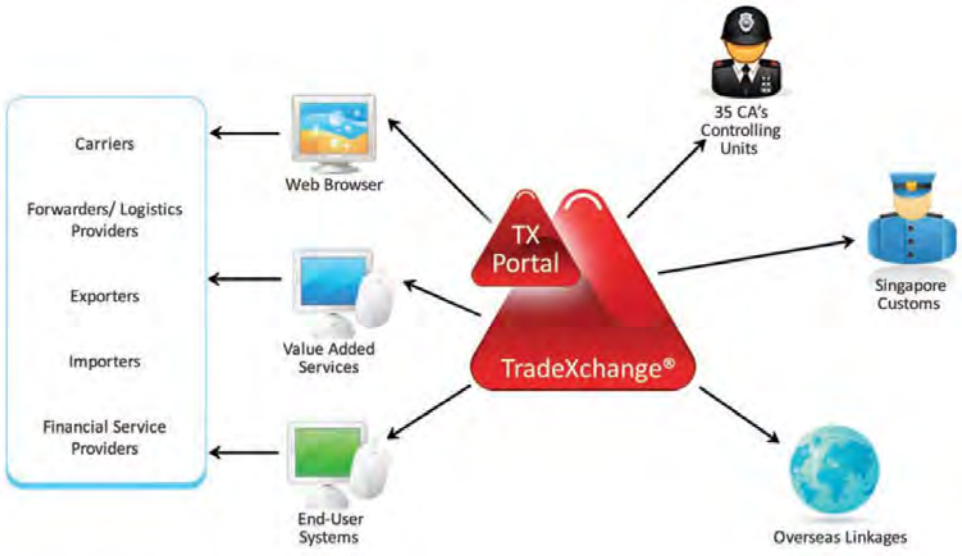

Figure 3: Conceptual diagram of TradeXchange platform (Source: CrimsonLogic, 2014)

The government through its agency, Singapore Customs:

- owns and regulates the TradeXchange
- pays the operator a fixed fee to as a steady income stream and a variable fee to incentivise the operator to drive adoption of the system over the contract period
- The government has the right to terminate the contract, e.g. due to breach of contract by the operator or if the operator becomes insolvent.

The private operator, CrimsonLogic:

- develops and operates the system for 10 years
- pays for the capital, operating and maintenance costs
- collects the fees from the users and remits the government's share
- The operator has no right to terminate as TradeXchange is an essential service.

In relation to data ownership and data privacy, the government owns the information and data collected by agencies as a result of statutory and regulatory requirements. The companies that create the data own the commercial data and consent to share data has to be obtained from data owner.

Bulim Bus Package (Public: Land Transport Authority / Private: Tower Transit)
The public bus industry in Singapore is moving towards a government contracting model through a competitive tendering process (LTA, 2014b). The aim is to make bus services more responsive to changes in ridership, introduce more competition into the industry by lowering barriers of entry, and improve service levels. Currently, the bus industry is a privatised model with two incumbents, namely SBS Transit and SMRT. The government realised that it was difficult to increase capacity and improve service standards as operators have to cover their capital and operating expenses and earn from fare revenue. Under this new contracting model, bus services in Singapore are bundled into 12 packages with 300 to 500 buses for each package.

The Land Transport Authority (LTA) awarded the inaugural bus contract to London-based Tower Transit in May 2015 (Straits Times, 2015). The contract is to operate the new Bulim bus depot in Jurong and 26 bus services from Jurong East, Bukit Batok and Clementi bus interchanges from the second quarter of 2016 for a 5-year period from 2016 to 2021. This contract can be extended by another 2 years based on good performance. The estimated fee for this contract is S$556 million.

The government through its agency, LTA:

- owns all bus-related infrastructure such as depots, buses and fleet management system
- regulates the bus operations by determining the services to be provided and service standards while ensuring the affordability of fares for commuters
- pays the operator the fees to operate the services; retains the fare revenue

The private operator, Tower Transit:

- operates the Bulim bus depot and 26 bus services that meets the stipulated service standards for 5 years
- is responsible for recruitment and training of staff including bus captains and technicians.

Table 3 summarises the responsibilities of the public and private sectors for infrastructure and operations based on Singapore's PPP projects discussed in this paper.

		Infrastructure	
		Public	*Private*
Operations	*Public*	Classic public sector provision	
	Private	O&M TradeXchange Bulim Bus Package	DBOO Tuas Desalination Plant Ulu Pandan NEWater Plant Incineration Plant DBFO ITE College West Singapore Sports Hub

Table 3: Strategies for Singapore's PPP projects

Conclusions and Recommendations
PPPs mark a fundamental shift in focus of the role of the government from being a service provider to a purchaser of services. They can operate within a spectrum of models and there is no standard template to follow. A well-designed PPP allows efficient risk-sharing to take place; risk can be allocated to the party with the greatest incentive and ability to manage it.

The PPP environment in Singapore benefits from a stable regulatory framework, clear and transparent processes, and robust contracts that deal with risk allocation. With the

government as the central actor, PPPs have enabled the private sector to play a greater role in the delivery of traditional public services such as utilities (e.g. desalination, NEWater and incineration plants) and essential services (e.g. TradeXchange and public transport). This enables the government to focus on policy formulation and provide safeguards for the public interest.

PPPs have the potential to provide value for money and quality of services needed, and give strong incentive to ensure projects are completed on time and designed to minimise operational costs. They facilitate the development of specialist expertise, provide opportunities for attracting foreign investment and stimulate the exchange of ideas between local and international companies. For PPPs to be successful, there needs to be long-term political support and government commitment to PPPs for business confidence, standardisation of the contractual framework to improve transparency and efficiency in PPP process balanced with enough flexibility to promote innovation and continuous improvement.

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STRATEGIES FOR THE REDUCTION OF GREENHOUSE GASES EMISSIONS FROM CONTAINER TRANSPORT FOR THE HANSHIN PORT, JAPAN

Jimyoung Lee
University of Marketing and Distribution Sciences, Japan
Interdisciplinary Environmental Studies (IES) Network, University of New South Wales, Australia

Introduction

The contemporary economic arguments are that gateway ports, such as the Hanshin Port of Kobe and Osaka and their surrounds, play a key role in supporting both social and economic development. The *Kinki* region forms an important backbone to the Japanese economy generating 17% of national GDP with a population of 21 million within a radius of 150 km of the ports (City of Osaka, 2015). Good trade performance is an essential ingredient for sustaining economic growth, productivity, living standard and life style. To bolster the international competitiveness of Japanese ports the national government on 6 August 2010 designated the Hanshin ports as "strategic international container port". Many port authorities around the world, however, face difficulties in ensuring a balance between the competing interests of the logistical business of ports, the local communities and the environment.

The containerisation of freight movements since the late 1960s (The first container wharf in Kobe port opened in 1967) has been one of the most significant transport system changes to generate environmental backlashes (Rimmer and Black, 1982). The metropolitan regions of Kobe and Osaka provide a case study of greenhouse gases (GHG) emissions from ships and container trucks as one specific environmental issue. The aim of the paper is to identify the Hanshin port's strategies for the reduction of GHG emissions and to compare these strategies with those adopted by the Port of Long Beach California (POLB) – regarded as one of the world's leaders as a "green port". Benchmarking is one methodology adopted in practice to improve port performance and efficiency (European Conference of Ministers of Transport, 2000, p. 189).

The structure of this paper is as follows. First, we give a brief description of the Hanshin port focusing on logistics. Then we explain the strategy of modal shift to encourage the reduction of GHG emissions. Thirdly, we describe another strategy: the development of an inland port – the Hanshin Inland Container Depot in *Yasu* City, *Shiga* Prefecture. Fourthly, the facility measures to reduce GHG emissions in the Hanshin port are described. Finally, best practice adopted by the Port of Long Beach California (POLB) are summarised and contrasted with the strategies in the Hanshin Port.

Description of the Hanshin Port

History of the Hanshin port

The Hanshin port was nominated by the Kobe port and the Osaka port in 2004 to be selected as one of the "super hub ports" amongst more than 1000 ports and harbours in Japan. Revising the Customs Law and the Port Regulation Law in December 2007, all ports in Osaka bay were consolidated under the name of Hanshin port. However, all ports are still managed by four separate port authorities; Kobe City, Osaka City, Hyogo Prefecture and Osaka Prefecture (Figure 1).

Since other Asian hub ports had expanded their value, the Japanese government response was to additionally centralise both the volume of container freight and port investment. Finally, in 2010 the government designated two "strategic international container port": the Keihin port in eastern Japan; and the Hanshin port in western Japan. The

Figure 1: Hanshin Port Areas
*Port authorities are in parentheses
*Edited from "Port of Osaka Entrance and Departure Manual" Port & Harbor Bureau City of Osaka, 2010

Keihin port represents the ports of Tokyo, Kawasaki and Yokohama. The Hanshin port, as a strategic international container port, refers to the Kobe port and the Osaka port.

Trends in freight and ships in Kobe port and Osaka port

The trends in freight have dramatically changed in Kobe port. Since the time the Kobe port experienced a boost in freight volume in 1960s, a steady increase - mainly from domestic freight - flowed for about 25 year. It was in 1995 that the freight volume decreased by half due to the Great Hanshin Earthquake. Although there was a temporary increase of freight because of the redevelopment of damaged infrastructure, there has not been any significant increase in freight tonnage since 1999. The Osaka port, on the other hand, has had a continuous increase in freight, primarily due to international freight movements (Figure 2).

The number of ships entering Kobe port has significantly decreased since 1971 while the total size of the ships has gone up to 300 million just before the earthquake. The average size of ships has grown to 5000 gross ton. After the earthquake, the number and total size of ships dropped as sharply as freight volumes. This situation, except the effect of the earthquake, can be similarly described for Osaka port (Figure 3). International shipping accounts for about 20% in the number of ships and about 70% in size both in Kobe and Osaka port.

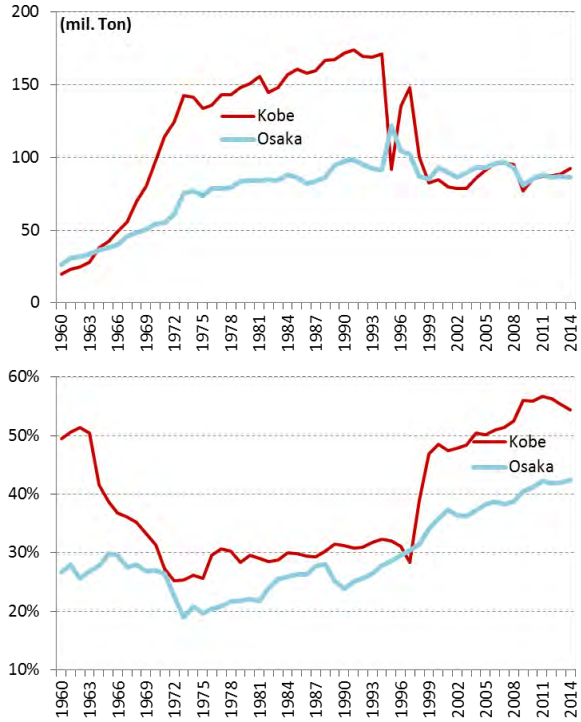


Figure 2: Total freight (left) and international freight rate (right) in the two ports
Data: Annual report of Kobe port, Annual report of Osaka port

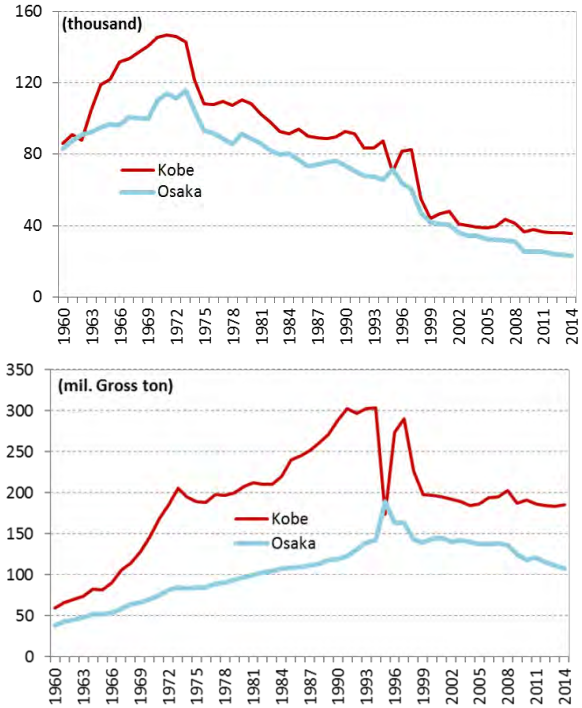
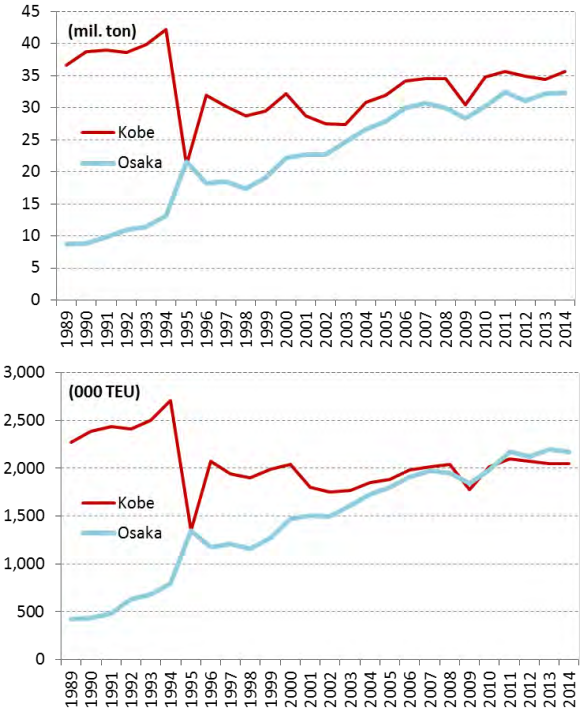


Figure 3: The number (left) and total size (right) of ships entered in the two ports
Data: Annual report of Kobe port, Annual report of Osaka port



*Osaka excludes int'l empty containers until 1991

Figure 4: International container freight (left) and the number of container (right) in the two ports
Data: Annual report of Kobe port, Annual report of Osaka port

Trends in Container shipping

A container ship made a first docked at Kobe port in 1967 and at Osaka port in 1969. Container freight volumes in the Kobe port had gone up to 42 million tons in 1994, significantly above Osaka port with 13 million tons. This difference has been shrinking to 35 and 32 million tons, respectively, in 2014. International freight is now dominated by containers (71% of freight tonnage in Kobe port and 88% in Osaka port). The number of international

containers handled in Kobe port remains on the same level after the earthquake at around 2 million TEU, while this number in Osaka port has been steadily increasing to 2.2 million TEU in 2014 (Figure 4).

Collectively, the Hanshin port has 19 container berths - 10 in Kobe and 9 in Osaka - and provides 382 container services per month linking to the rest of the world with 87 routes (Table 1). Domestic feeder networks also offer 94 services per week to 32 ports (mainly from/to Kobe port). A ferry network links to 14 ports with 99 services per week.

Route	Number of service	Frequency /month
North America West Coast	5	20
North America / Europe	3	16
Europe / Mediterranean	2	8
Oceania	5	22
South East Asia	32	132
China	29	122
Korea	10	60
Nakhodka	1	2
Total	87	382

Table 1: Container routes and frequency of Hanshin port
Data: Kobe-Osaka International Port Corporation

Strategy of modal shift
Review of environment policy in Japan
Based on the environment policy of the national government, municipal governments develop their own programs. Regarding GHG emissions, after the Kyoto Protocol in 1997, the Japanese Government set its target reduction rate by 6% on average from 2008 to 2012 compared to the base year 1990. This commits all businesses and organisations in Japan to take part in reducing emissions. Kobe City and Osaka City have formulated plans to reduce the emissions with target rates as shown in Table 2.

	2010	2015	2020	2050
Japan	▲ 6% *	-	▲ 25%	▲ 80%
Osaka City	▲ 7%	-	▲ 25%	▲ 80%
Kobe City	▲ 6%	▲ 10%	▲ 25%	▲ 80%

* Average rates from 2008 to2012.
Table 2: Target rates of the reduction of greenhouse gases emissions
(carbon dioxide equivalent, compared to the year 1990)

According to the "National Greenhouse Gas Inventory Report of JAPAN (2015)", the total GHG emissions in the FY 2013 were 1,408 million tonnes (in carbon dioxide equivalent) with carbon dioxide (CO_2) emissions accounting for 93% with 1,311 million tonnes in which fuel combustion has a 95% share. As for the breakdown of CO_2 emissions within the fuel combustion, energy industries make up 43% followed by manufacturing industries and construction at 26%, transport at 16%, and all other sectors at 10%. In comparison to the FY 1990, total CO_2 emissions increased by 13% and emissions from transport increased by 8%. The main factor of the increase in the transport sector is passenger vehicles and personal use. This has been compensated by a decrease in emissions from freight transport, where the initiatives in the transport sector are to promote highly energy-efficient vehicles, such as hybrid vehicles, and greater public transport utilisation for passengers.

Freight transport or logistics is required to improve the efficiency of their system and promote "modal shift". Modal shift refers originally to a change of transport mode from truck to rail or ships that are called eco-friendly transport modes. The concept of the modal shift in Japan has expanded to the use of rail or marine transport (Lee 2014). Since the modal shift has long been considered as an initiative to increase eco-friendly transport, and subsequently to reduce the GHG emissions, the Japanese government established a certification of modal

shift with “Eco-Rail Mark” and “Eco-Ship Mark”. In addition, national and local governments offer subsidies to encourage modal shift.

Encouragement of modal shift

Osaka City has offered subsidies to encourage the modal shift from 2005 and Kobe City from 2006 using its domestic feeder transport network. A company can take a subsidy of 2000 yen per TEU (up to 10 million yen) when it changes the transport mode from trucks to ships via the ports of Osaka or Kobe. When it newly uses a maritime transport via the port, or even increases the freight volume through the port, it is also eligible for subsidies. The cities expanded the range of modal shift subsidies after it was designated a strategic international container port in order to implement dual objectives of collecting container freight and reducing the GHG emissions. Today, there are four contents of the modal shift for container freight from/to Kobe port: use of marine transport; use of railway transport; reduction in trucking distance; and round-use of containers (round-use will be described the next section).

The subsidy by Kobe City has increased container freight by 142,064 TEU and reduced GHG emissions by 121,294 tons for seven years (Table 3). For Osaka City, the policy attracted 205,087 tons of freight to Osaka port and reduced emissions by 20,106 tons in the first three years. Government subsidies for modal shift can attract container freight to the Hanshin port and can reduce the GHG emissions.

	Number of Cases	Amount of the subsidy (000 yen)	Reduction of the emissions (ton-CO2/year)	Increase of freight (TEU/year)
2006	3	3,117	7,534	6,187
2007	3	8,375	8,089	14,038
2008	10	18,284	17,758	18,955
2009	10	30,934	34,413	21,084
2010	20	n.a.	25,300	22,300
2011	22	28,654	10,700	19,100
2012	30	51,126	17,500	40,400
Total	98	n.a.	121,294	142,064

*Predicted figures in 2011 and 2012

Table 3: The results of modal shift subsidy from Kobe City
Data: Kobe City press release on web pages

Strategy of an inland port

Container round-use

In general, containers for international trade are carried between ports and shippers’ points. The import containers landed at a port are delivered to shippers’ point by drayage truck. After discharging, empty containers are hauled back to a container terminal in the port. Meanwhile, exporters need to pull empty containers from the container terminal when they load cargoes, and the full containers then travel to the port. The Japanese government has promoted the round-use of containers to reduce the transport of empty containers. The “round-use” means a use of containers for export cargo after unloading import cargo (Figure 5).

Another round-use was investigated in 2010 with the relocation of containers in the Hanshin port. Since Osaka port has more import container trade than export container trade and Kobe port has more export container trade, empty containers need to be moved from Osaka port to Kobe port. An experiment of modal shift - from trucks to barges - for the relocation of about 6,000 empty containers in the Hanshin port created the estimation of the effect for GHG emission reduction. The result shows a possible reduction by 78% (Kinki Transport Bureau).

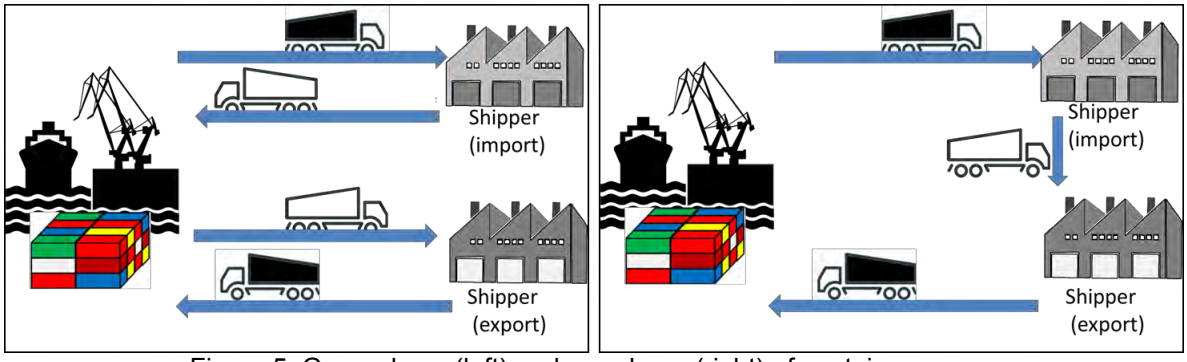


Figure 5: General use (left) and round-use (right) of containers

According to a report from Japan Institute of Logistics System (JILS), about 53,000 empty containers are annually transported to/from the Hanshin port with about 5,000 tons of the GHG emissions. If those empty containers are round-used, considerably more GHG emissions will be reduced.

Hanshin inland container depot

The Hanshin port has been reviewing its existing land transport system for maritime container logistics with the construction of an inland port as the collection base of container cargo. It is working on the reinforcement of its cargo collection functions in order to reduce the logistics costs of shippers and improve the efficiency of logistics. As a first step, in 2012 the Hanshin Inland Container Depot (ICD) - about 100 km away from the port shown in Figure 6 - was established in *Shiga* Prefecture to support the round-use of containers (City of Osaka 2015).

Figure 6: Location of the Hanshin Inland Container Depot

It is expected to reduce GHG emissions since the empty containers do not need to be carried back to the port and stocked in the ICD. Road transport will decrease in kilometres or/and ton-kilometres, which results in the reduction of emissions. The ICD may foster a modal shift because the shippers can gain easy access to maritime containers and so cut the logistics costs. In addition to the handling of containers in the port, traffic congestion around the port would be relieved. With those objectives, the use of ICD has been encouraged by additional subsidies from Osaka City and Kobe City.

Strategy of innovations and regulations

Innovation in ships and port facilities

In addition to encouragements of modal shift and the round-use of containers, innovations for ships and port facilities have been developed in Japan. For instance, energy-efficient ships called “Super Eco Ship (SES)” appeared. The number of SES is currently 23 and most of them are tankers. Regarding container ships, NYK (Nippon Yusen Kaisha)’s environment-friendly ships “NYK Super Eco-ship 2030” received a frontier design award at the 2009 Good Design Awards organized by the Japan Industrial Design Promotion Organization. “NYK Super Eco-ship 2030” is currently under development aiming to reduce GHG emissions by 69% with the use of clean energy such as LNG-based fuel cells, solar cells and wind power.

In ports, the use of shore power for docking ships has been introduced. Ships keep burning fuel even when at a berth in a port. When ships can use shore power, such as electricity instead of burning fuel, the GHG emissions from ships can be reduced. In the Hanshin port, a demonstration experiment was conducted at the Osaka port in 2009 and it ended up merely as an experiment. According to calculations by Ministry of Land, Infrastructure and Transport (MLIT), shore power can lead to a cut of CO_2 emission by from 40 to 50% and nitrogen oxides

(NOx) and sulphur oxides (SOx) by 98%. One million tons of GHG emissions are expected to decrease annually if all coastal ships use the shore power while at berth.

Hybrid cranes for containers are also encouraged. A hybrid crane is expected to reduce the energy consumption by 40% and to reduce 60 to 70 tons of emissions per year. Although there are a few transfer cranes of hybrid type in the Hanshin port, it is difficult to force business to replace all cranes with a hybrid type because of the high capital costs involved.

Regulations of air pollution from transport

After the effectuation of MARPOL 73/78 Annex VI (Regulations for the Prevention of Air Pollution from Ships), the Japanese government has regulated air pollutants, including NOx and SOx, from ships. For land transport in Japan, the Automobile NOx PM Control law (1992) restrains traffic of diesel-powered automobiles that are not equipped to filter NOx and particulate matter. Since Kobe City (2004) and Osaka City (2009) enacted their own regulations to prevent the access of substandard automobiles, all drayage trucks to/from the Hanshin port are already equipped with filters to reduce pollutants.

Towards a green port

Strategies of the Port of Long Beach

The Ports of Los Angeles and Long Beach comprise the largest port complex in the United States where they handle a fourth of all container cargo traffic in the United States. Acting as a major gateway for US–Asian trade, the Port of Long Beach (POLB) occupies 13 km^2 of land with 40 km of waterfront in the city of Long Beach. The Green Port Policy was adopted by the POLB in 2005 in an effort to reduce pollution in the growing region of Los Angeles/Long Beach. The guiding principles of the Green Port Policy are to protect the community from the harmful environmental impacts of port operations, to distinguish the port as a leader in environmental stewardship and compliance, to promote sustainability, to employ the best available technology to avoid or reduce environmental impacts, and to engage and educate the community. In 2007, the Port of Long Beach continued its environmental efforts by implementing the Clean Air Action Plan, an air quality program adopted by the Ports of Long Beach and Los Angeles.

In recognition, the Clean Air Action Plan was given the most prestigious award from the American Association of Port Authorities, the Environmental Management Award, in 2007, and this is one indicator that POLB is one of the world leaders in “green ports”. The Clean Air Action Plan also tackled truck emissions when the port's Harbor Commission approved a Clean Trucks Program that banned old diesel trucks by October 2008. The program, outlined in the San Pedro Bay Ports Clean Air Action Plan, is expected to modernise the port trucking industry and reduce truck-related air pollution by 80% by 2012. Diesel-powered harbour short-haul (drayage) trucks are also a major source of air pollution so the Clean Trucks Program called for drayage truck owners to scrap and replace old, polluting trucks working at the port, with the assistance of a port-sponsored grant or loan subsidy. The program includes truck concession requirements to identify "clean" trucks, ensure reliable short-haul service, and improve air quality, security, and safety. Trucks that meet the US Federal 2007 emission standard produce 80% less air pollution than older trucks. As most of these older, polluting trucks would remain on the public roads for many years, the port offered financial incentives and optional financing plans to encourage truck owners to scrap and replace their older trucks.

The Green Flag Incentive Program was set up to encourage ships to slow down in order to improve air quality. This program had provided a 15% dockage fee reduction to vessel operators who slow their ships to 12 knots (22 km/h) or less from 20 nautical miles (approximately 37 km) of the harbour and expanded a 25% discount and 40 nautical miles. In the first three years, more than 90% of ships voluntarily reduce their speed to 12 knots, reducing air pollution by more than 650 tons a year. The program now prevents more than 1,000 tons a year of air pollution.

The POLB has constructed landside infrastructure for shore power. A California law, Shore Power Regulation, mandated in 2014 that half of all shipping lines must use shore-side electricity at berth and each fleet must reduce its total emissions by 50% and 80% in 2020. Shipping lines face financial penalties for not complying with the regulation.

Each year the Port conducts an annual inventory of air emissions from port-related sources, using the latest data and methodologies, to track progress for improving air quality. Sources of port-related emissions include ocean-going vessels, heavy-duty trucks, harbour craft, cargo-handling equipment and railroad locomotives that emit diesel particulate matter, NOx and SOx, all of which have been known to affect human health and contribute to the formation of smog. From 2005 to 2013, the POLB has cut diesel particulates by 82%, nitrogen oxides by 54% and sulphur oxides by 90%. Greenhouse gases were lowered by 20%. The reduction in pollutants came despite a slight increase of 0.3% in containerised cargo activity in the same period.

Hanshin port's issues in comparison to Port of Long Beach

Benchmarking is a management term about comparing an organisation's policies, services, programs and strategies based on similar industry organisations. The aim is to use comparisons on performance to check areas where there are improvements to be made in terms of greater efficiencies. Benchmarking took hold as a business tool following the release of a research paper by Kaplan and Norton (1992). Therefore, we aim to compare the strategies of Hanshin port's with those of POLB to stimulate further endeavours that might reduce GHG from ships and trucks.

As clarified above, it is possible to find regulations and subsidies/incentives both in the Hanshin port and in the POLB. However, subsidies in Japan have been provided primarily to shippers not transport operators. Drayage trucks and shipping lines are only targets of air pollution regulation. In addition, too many subsidies have been poured into encouraging modal shifts. Since modal shift in Japan has long been considered as one of the most significant environment measures, the Hanshin port tends to attach a high value at modal shift, i.e. a change from container truck transport to container ship transport, and the container trucks are only regulated to improve the emissions. Shippers can enjoy various subsidies for modal shift. For example, MLIT distributes incentives under the names of the Modal Shift Promotion Program, the Green Logistics Partnership Program and the CO_2 Emission Control Program. Many cities, as port authorities, also encourage modal shift with some subsidies. Furthermore, similar subsidies are in fact competing against each other.

It is preferable to invest in objects that can directly contribute to reduce the GHG emissions from ships. One option is an introduction of incentive program to vessel operators such as the Green Flag Incentive Program. The Environmental Ship Index, identified by World Ports Climate Initiative, could be also useful as an incentive for shipping lines. Another option is port facilities such as shore power. Estimates of the costs to provide shore power are US$3.5M per terminal and US$1.5M per berth (based on evidence from the Port of Los Angeles in 2006). In the retrofitting of ships there are a number of factors to consider, including age and type of ships. Conservative estimates put conversion costs at greater than US$1M per ship. Shore power is most beneficial when vessels are at berth for extended periods of time. It would be a way to redistribute port authorities' subsides from modal shift to retrofitting of ships to accommodate shore power.

Conclusion

Ports throughout the world face the challenge of reducing their environmental footprint, including reducing greenhouse gas emissions. The metropolitan regions of Kobe and Osaka (the recently designated Hanshin Port) have provided a case study of the issues with greenhouse gases (GHG) emissions from ships and container trucks as one specific environmental impact of ports. The aim of the paper was to identify the Hanshin port's present strategies for the reduction of GHG emissions and to compare these strategies with those adopted by the Port of Long Beach California (POLB) – regarded as one of the world's leaders as a "green port" – thereby to improve port performance and efficiency. The research methodology was to review port authority documents that have been published or are readily available on the ports' websites, and to conduct semi-structured interviews with port officers in Kobe and Osaka.

We have given a brief description of the Hanshin port focusing on its logistics. The strategies of modal shift to encourage the reduction of GHG emissions have been outlined – primarily through subsidies. The Hanshin port has another strategy that was described: the

development of an inland port – the Hanshin Inland Container Depot in *Yasu* City, *Shiga* Prefecture. This is expected to reduce GHG emissions since the empty containers do not need to be carried back to the port and can be stocked in the depot. The facility measures to reduce GHG emissions in the Hanshin port were described noting the promising future developments of on shore power for docking vessels and the substitution of hybrid cranes. Finally, best practice adopted by the POLB was summarised and contrasted with the strategies in the Hanshin Port. In Japan, subsidies have been targeted primarily towards shippers and not to transport operators. Drayage trucks and shipping lines are only targets of air pollution regulation. In addition, too many subsidies have been poured into encouraging modal shifts. The Port of Long Beach, California, has invested in objects that can directly contribute to reduce the GHG emissions from ships, such as shore based power supply.

The research reported in this paper represents some preliminary reporting of a large comparative study of Sydney ports (Port Jackson and Port Botany), Gothburg port (Sweden), the Los Angeles ports and the Osaka port. We are concerned with the wider impacts of containerisation and logistics on urban systems (see for example, Rimmer and Black, 1982; Black and Styhre, 2015). More specifically, in terms of the impacts that container ships and container trucks have on GHG emissions we plan to conduct a comparative study of ships in these four ports. The aim of these comparative, "benchmarking" studies is to further improve the environmental efficiencies of port and associated logistics.

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THE CHANGES OF THE AIR TRANSPORT MARKET AND THE INTERNATIONAL TRANSPORT AROUND THE REPUBLIC OF KOREA

Sunsook Kim
Doshisha University, Kyoto, Japan

Introduction

In the last 10 years' period, the air transport market of this region has been expanding, including both passengers and freights as Figure1 & Figure2. The international transport between China and Korea, China and Japan has been extended. The market share of new entry airlines (called LCCs in Korea) still continues to grow, such as Asia-Pacific region increased from 4% in 2004 to 21% in 2013.

Furthermore, the International Civil Air Organization (ICAO, 2014) reported that the 7 airports in Asia-Pacific by freight tonnes handled make 47.2% share of the top 15 airports in the world. All of the 7 airports located around Korea (Republic of) as Table 1. Focus on Northeast Asia Transport Market includes top 7 airports which an improvement of efficiency in international transport is sought after.

These are also target of 'The CHINA-JAPAN-KOREA Ministerial Conference on Transport and Logistics'. The 5th conference announced that the Northeast Asia Logistics Information Service Network (NEAL-NET) has started its public trial of pilot ports service since August 2014. And the conference continue to make efforts to realize 'seamless logistics' through standardized logistics system among Japan, Korea and China while considering logistics with other regions like Southeast Asia, Australia and so on. Especially, Sea & Air multi-transport attracted attention between China and Japan, China and Korea. Background of that, the first, there are insufficient infrastructure related transport and logistics inter-China. Secondary, there are different of logistics system due to technical capabilities. Lastly, there is no choice using land transport cross the border.

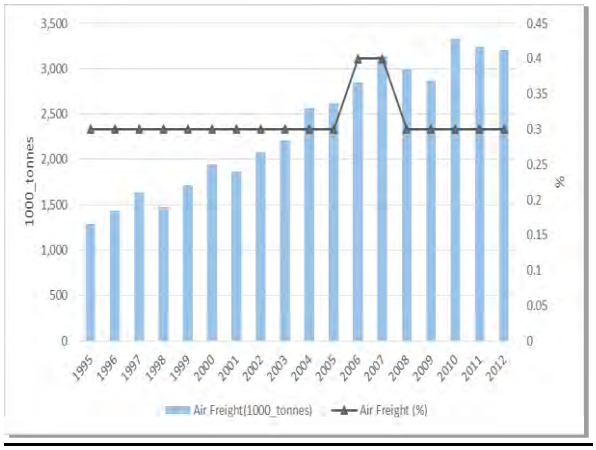

Figure 1: International air freights in Korea
source: MLIT

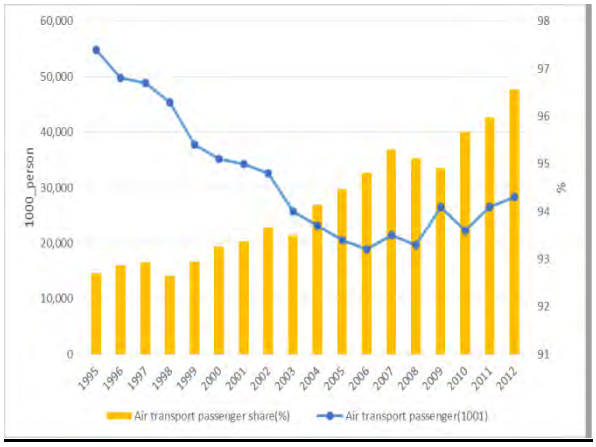

Figure 2: International air passengers in Korea
source: MLIT

	City	ICAO-code	Freight tonnes(1000)
1	hongkong	HKG	4,127
2	shanghai	PVG	2,856
3	seoul	ICN	2,395
4	tokyo	NRT	1,980
5	singapore	SIN	1,850
6	beijing	PEK	1,844
7	taipei	TPE	1,556

Table 1: Top 7 airports in Asia-Pacific region by freight tonnes handled (ICAO,2014)

The role of spoke airports and ports in Asia-Pacific region is increasing. It depends on the existence of the difference seen in this local logistics system, which is the problem for efficient logistics systems between Asia-Pacific region and other areas.

Previous Studies on Northeast Asia Transport Market

Many countries in Asia-Pacific region have liberalized their freight sectors first. The first step was de-linking air freight from passenger services, and removing entrance restrictions, and lifting the restrictions on third, fourth, and fifth freedom capacity. Since 2000, almost all of them in these regions introduced the so-called 'Open Sky Policy'. KIM, *et al.* (2012) reported Air transport market in Korea is currently facing with a new competitive system different from the formal by the two major airlines (Korean Air (KE), Asiana Airlines (OZ)).

The Sea & Air multi-transport developed annually with more than 50% due to the rising trade between Korea and China since 1990s. Even though the increasing rate of the Sea & Air multi-transport was slowdown, the demand for air freight transport has increased between China and Korea (Figure 1) (MLIT (2014), Jung, *et al*. (2012)). Demand for Sea & Air intermodal transport has increased between north-China coastal cities and Incheon since China's international airline network was still under development (Chung and Han, 2010).

Trace, *et al.* (2009) focuses on air transport market in the Archipelagic Southeast Asia region[9]. The markets has been under pressure for change to expand air transport market in the world. By this

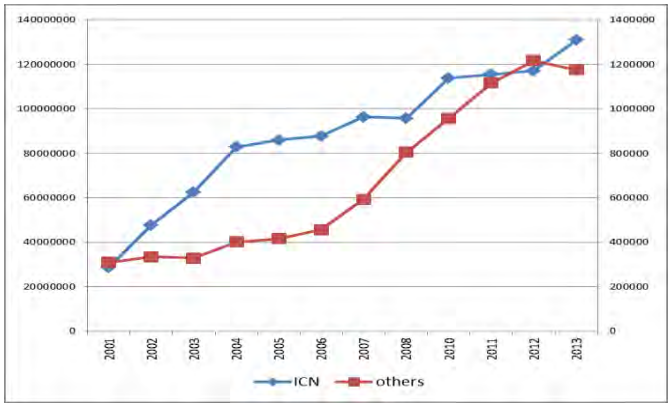

Figure 3: The air freight volume of ICN and other airports in Korea
source: The Korea International Trade Association (KITA)

tendency, this region bring about an aviation industry that provides improved connectivity. They note as valid that changes in logistics systems by increase in access through Sea & Air multi-transport between islands in this region.

[9] Archipelagic Southeast Asia covers five Association of Southeast Asian Nations (ASEAN) member countries - Brunei Darussalam, Indonesia, Malaysia, the Philippines, and Singapore - together with Papua New Guinea and Timor-Leste (Trace, *et al.* (2009)).

Many reports were announced around 2009 concerning about Korea air transport market. Chung and Han (2010) analysed the freight demand of Incheon's Sea & Air multi-transport. This paper discussed the port and shipping environmental changes and the logistic situation of China. Open Sky Policy and Direct-Call Service have been carried out between China and other countries (i.e. North America). Incheon could imagine a loss of competitiveness in Sea & Air multi-transport due to the enhancement of the connectivity of Chinese airlines and shipping lines. This study shows that the Sea & Air multi-transport volume will have either slight increase or decrease in the recent situation. Chung and Han's study offered that Road Feeder Service expansion and system & service improvement through strong ties with major cities in China[10].

Jung, *et al*. (2012) estimated the volume of Sea & Air multi-transport by the data from the years 2007 to 2012 on the ARIMA-model, and volume will produce approximately 33,000 tons in the 2015. As a result, this study shows that 'Sea & Air multi-transportation-related information system policies' and 'the construction of consolidation logistics center' are the most important factor among the principle criteria.

Air Freight Transport Market after the Participation of New Airlines

The new entry airlines took a strategy based local airport that they established after the deregulation in Korea. An airport works not only for passengers and freights, but for local economic development. Even though the economic depression and new high speed rail way began, air transport continued to increase its demand both for hub airports such as Incheon international airport (ICN) and regional airports. The new airlines and local government which have above regional airports have made efforts to increase a demand for air transports. But, local airports still have been operated chiefly by central government as well as airport facilities, expansion and improvement of the airport, innovation of the airport system, development of international routes, and so on. Other airports in Asia-Pacific region have the similar problems except some other cases.

The new entry airlines which have been established in 2004. Table 2 shows 9 regional airports which started international air freights in 2005. Practically, international air freight handled started in 2006. The air freight volumes of regional airports had increased from 2007 until 2012 as Figure 3.

Compare changes of air freight volumes with growth rates of trade, Figure 4 does not show effective relations between air freight volumes and growth rates of trade. I expect trading in Korea would use
shipping near 97% of International transport (Figure 1).

	airports	new	out
2001	10		
2002	9		1
2003	10		
2004	10		
2005	10	9	
2006	18		1*
2007	13		3
2008	12	2	
2009	13		
2010	17	1	
2011	13		
2012	15		
2013	14	2(1*)	
2014	14	1	

Table 2: The airports of international air freight handling in Korea

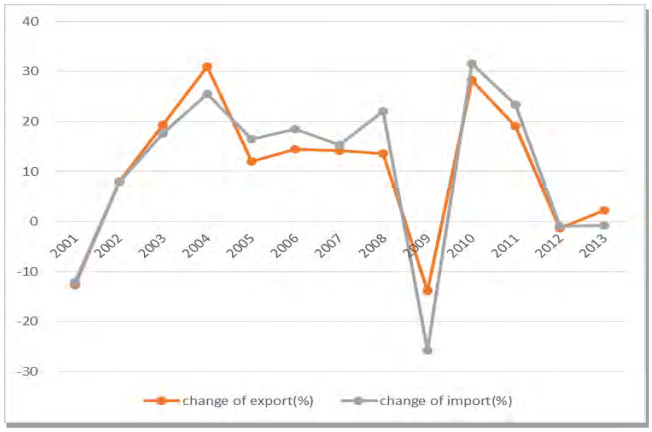

Figure 4: Growth rates of trade in Korea
Source: MTIE(2014)

[10] Shanghai, Weihai, and Yantai.

source: KOSIS

	KOREA	ICN	PUS	CJU	TAE	CJJ	GMP
2001	-23	—	-29	5	-25	208	—
2002	16	61	12	23	-24	-94	-80
2003	25	25	3	128	-16	48	-46
2004	27	27	19	-12	-36	93	36
2005	5	6	-7	-7	-41	3958	307
2006	6	6	2	13	-12	76	1065
2007	10	10	3	-23	-49	-33	18
2008	0.3	0.3	3	45	177	28	349
2009	-12	-12	-17	58	-35	-46	-34
2010	29	29	32	-2	12	-59	21
2011	6	6	-1	-21	17	3549	197
2012	-2	-2	-34	-21	363	45	14
2013	8	8	-11	-16	6222	-100	-1
2014	4	4	2	-38	-26	121	-6

Table 3: Change rates of international air freights; top 6 airports in KOREA
source: KOSIS

There is a dramatic change in the rates of international air freights by top 6 airports in Korea as Table 3. Some of airports were often beyond 100%. One of them, Chungju international airport (CJJ) especially attracts attention. During a period of 13years, the change rate of was five times beyond 100%. CJJ announced it would become a hub airport of air freight in Northeast Asia region. In 2012, CJJ tied MOU (Memorandum of Understanding) with new airlines, Eastar Air (ZE, since 2007)[11]. And CJJ was asked for privatization in 2012, but the project was not realized (2013)[12].

From the above research, it is apparent that air freight transport in regional airports had kept increasing volumes until 2012 since the introduction of Open Sky Policy. But, this study can reveal that international air freight transport from/to regional airport performance has not been stable. It is apparent that we should notice the data that transit freight marked over 50% on the international air freights.

Summarization

A remarkable increase on the international air freight transport and international air connectivity was improved. The efficient developments of international transport in Asia-Pacific region are required in various fields. My previous studies suggested system and service improvement and expansion, and mutual efforts by China, Japan and Korea standardized logistics systems. International Air Freights concentrate on Incheon and Pusan, and new entry airlines keep expanding their markets in the field of domestic air freight transport. Consequently, I consider it my major work to do further research on more effective development in Sea & Air multi-transport system.

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THE INFLUENCE OF QUANXI ON SUPPLY CHAIN COLLABORATION

ZHANG Chi, Ph.D. candidate
Research assistant, KEDGE Business School,
Email : chi.zhang03@kedgebs.com
HONG Seock-Jin, Ph.D.
Professor of Air Transport and SCM, KEDGE Business School
Email : seockjin.hong@gmail.com
OHANA Marc, Ph.D.
Professor of OB & HRM, KEDGE Business School
Email : marc.ohana@kedgebs.com

1. Introduction

Thanks to the development of Chinese economics and the increase of production capacity of Chinese local companies, more and more Chinese local companies have been moved aboard to look for new business opportunities. Since numerous Chinese investments go board into the European market, the way of Chinese people doing business (or Chinese business culture) need to paid attention when establish cooperative business relationship between Chinese oversea firms and European local firms.

In previous literatures, a Chinese concept *guanxi* (personal relationship or connection) has been regarded as a key cultural factor that influence deeply the way of Chinese doing business. However, most of these researches were taken in Chinese local market and focus mainly on Chinese to Chinese relationships. Nowadays, since more and more Chinese companies move to European market, the influence of guanxi practice on Chinese – European relationship based business performance need to be rediscovered.

In this age of globalization, supply chain management is becoming more and more important than ever. The competition within supply chain node companies has transformed to the competition among different supply chains. So in this context, many companies are changing their way of doing business by exceeding the border of standalone and individual actions toward collective actions. They are looking forward collaborative relationship with other companies within the supply chain. Companies could be befit from supply chain collaboration by sharing risks and knowledge, decreasing traction cost, enhancing negotiating powers, etc. And considering the dominate position of guanxi culture in Chinese companies, a study concerning the influence of guanxi on supply chain collaborative behaviors and supply chain performance should be examined.

2. Literature review

2.1 Guanxi

Guanxi has been discussed in western management publications for many years. It appeared firstly at 1980s to advise western company to consider guanxi as a cultural factor when doing business in China. And guanxi culture, which is deeply rooted in Chinese society, has gravely influenced the way of doing business in China.

Guanxi could generally translated as 'personal relationship' or 'connection' (Yi & Ellis., 2000; Leung et al., 2005). However, Researches have noticed that guanxi is different from pure relationship in terms of three dimensions: reciprocity, utilitarian rather than emotional, and long-term orientation (Chen et al., 2011). Functionally speaking, western literatures compare guanxi as a version of relationship marketing (Davies et al., 1995). Unlike simply transactional relationship, guanxi has some things in common with relationship marketing: trust and mutual understanding, cooperative behavior, development of networks, long-term orientation, etc. (Abramson & Ai., 1997; Wang, 2007). However, guanxi has big difference with western relationship marketing in terms of its personal, particularistic, emotional characteristics (Wang, 2007). Although guanxi is establish on reciprocal obligations, it's indeed a personal affiliation and based on affection commitment (Lee et al., 2001; Wang, 2007).

Guanxi's culture has a huge influence on Chinese people daily live, especially Chinese business behavior. Many scholars regard guanxi as a deep-seated cultural fact of Chinese society (Yang, 1994; Davies et al., 1995; Yi & Ellis., 2000). Guanxi can be seen as a product of confusion values (Fan, 2002,11,71) which present the thinking of relational society, harmony, collectivism, clan-like network, etc. (Park & Luo., 2001; Lee & Humphreys,2007).

And because of the uncertainly of business environment and legal system (Park & Luo., 2001; Lee & Humphreys, 2007), Chinese people rely more on guanxi as an informal rule to counter potential risks (Cai et al., 2010). So in some literatures, guanxi is viewed as an institutionally defined system (Guthrie, 1998; Chen et al., 2011), and contemporary political socio-economic system (Fan, 2002).

In business context, guanxi practice refers to find business solutions through personal relationship. In essence, this guanxi practice are a series of reciprocal but unequal exchanges (Yi & Ellis., 2000). And these exchanges are expressed as a series of social interactions including exchanging of gifts, favors and banquets, giving face, trust and commitment, and dinning & winning (Yang, 1994; Guthrie, 1998).

People try to be involved into guanxi network for several reasons. Firstly, becoming a 'insider' could help obtaining information and having the privilege to access to insider information (Yi & Ellis., 2000; Fan, 2002; Lee & Humphreys, 2007; Gu et al., 2008). Such information could be the information on market trends, business opportunities, or decode government policy intents (Yang, 1994; Gu et al., 2008). Secondly, guanxi provides insurance against environmental uncertainty (Abramson & Ai., 1997; Fan, 2002). A good guanxi between companies helps to decrease the risk of interruption of collaboration caused by opportunism (Yi & Ellis., 2000). Thirdly, since become an insider of a guanxi network, guanxi partners could only access to some key information, but also some rare resources (Davies et al., 1995; Fan, 2002).

2.2 Supply chain collaboration

In this age of globalization, supply chain management is becoming more and more important than ever. The competition within supply chain node companies has transformed to the competition among different supply chains. And in the same time, because of the globalization (Simatupang & Sridharan, 2005), unpredictable environment (Cao & Zhang, 2011), and the demand uncertainty (Ramanathan, 2014), supply chain management is becoming more and more complicated. So in this context, many companies are changing their way of doing business by exceeding the border of standalone and individual actions toward collective actions to increase its competitive. So the idea of supply chain collaboration emerges as times require.

Different literatures define supply chain collaboration in different ways. In this paper, the supply chain collaboration can be defined as a cross organizational boundaries business form, in which interdependent companies are bind in an integrative and collaborative partnership through working together for a common supply chain goal (Monczka et al, 1998; Simatupang & Sridharan, 2004; Simatupang & Sridharan, 2005; Cao & Zhang, 2011). In order to achieve a well-integrated collaboration, independent companies need to fulfil each's obligations to reach joint-decision making, Knowledge creation, joint effort, and etc. (Simatupang & Sridharan, 2002; Simatupang & Sridharan, 2005). And these obligations for each companies could be called as collaborative practice. The collaborative practice include sharing cost, benefits and resources, combining business activities, having relational communication, etc. (Simatupang & Sridharan, 2002; Simatupang & Sridharan, 2004; Montoya-Torres & Ortiz-Vargas, 2014; Ramanathan, 2014). People believe through supply chain collaboration, single companies could gain different competitive advantages (Simatupang & Sridharan, 2002): financial advantage as higher profits and lower cost (Fisher, 1997; Simatupang & Sridharan, 2005; Cao & Zhang, 2011), meet customer's needs and improve business performance (Simatupang & Sridharan, 2004; Simatupang & Sridharan, 2005).

Supply chain collaborative behaviors or supply chain collaborative practices refer to the interactions between supply chain node companies that will promote or strength their supply chain collaboration.

According to the literature reviews, the supply chain collaborative behaviors include these seven different dimensions as fellows: goal congruence, collaborative planning, resource sharing, communication, system synchronization, incentive alignment, and long-term orientation (Monczka et al., 1998; Mentzer et al., 2001; Barratt, 2004; Chen & Paulraj, 2004; Cao & Zhang, 2011;Montoya-Torres & Ortiz-Vargas, 2014;Ramanathan,2014).

2.3 Hypothesis proposed

Based on the previous literatures, three hypothesis have been proposed:

Hypothesis 1: Guanxi has a significant positive effect on supply chain collaboration practice.

Hypothesis 2: Guanxi has a significant positive effect on supply chain collaboration performance.
Hypothesis 3: Supply chain collaboration practice has a significant positive effect on supply chain collaboration performance.

3. Research methodology

3.1 Questionnaire development

In the questionnaire, three main dimensions are tested: guanxi, supply chain collaborative behavior, and supply chain performance.
Guanxi is measured in three sub-dimensions: personal emotion, reciprocity and social interaction. Personal emotion refers to the emotional closeness between people, affective commitment and favoritism (Gu, Hung, & Tse, 2008; Lee, Pae, & Wong, 2001; Zhuang, Xi, & Tsang, 2010). This personal emotion characteristic differentiate guanxi from business relationship, because guanxi is more personal and social instead of impersonal and commercial (Yang, 1994; Davies et al., 1995; Wang, 2007). Reciprocity means that the establishment of guanxi between two parties is based on mutual interests and benefits. These two parties have the reciprocal obligations to exchange favors (money, business opportunities, confidential information, etc.) (Yang, 1994; Davies et al., 1995; Park & Luo, 2001; Lee, Pae, & Wong, 2001; Fan, 2002; Lee & Humphreys, 2007;Wang, 2007; Chen, Huang, & Sternquist, 2011). The social activities could be seen as the practices to promote guanxi. These rituals include exchange of favors, banquets, winning and dinning (Yang,1994; Wang, 2007; Gu, Hung, & Tse, 2008).
As for the supply chain collaborative behaviors, it's measured in seven different sub-dimensions according to the literatures: goal congruence (Cao & Zhang, 2011; Mentzer et al., 2001), collaborative planning (isher, 1997; Monczka et al., 1998; Simatupang & Sridharan, 2005; Cao & Zhang, 2011; Nyaga, Whipple, & Lynch, 2010), resource sharing (Cao & Zhang, 2011; Hudnurkar, Jakhar, & Rathod, 2014; Ramanathan & Gunasekaran, 2014), communication (Monczka et al., 1998; Mentzer et al., 2001; Barratt, 2004; Chen & Paulraj, 2004; Cao & Zhang, 2011;Montoya-Torres & Ortiz-Vargas, 2014;Ramanathan,2014), system synchronization (Mentzer et al., 2001; Barratt, 2004; Simatupang & Sridharan, 2005), incentive alignment (Barratt & Oliveira, 2001; Park, Mezias, & Song, 2004; Simatupang & Sridharan, 2005), and long-term orientation (Mentzer et al., 2001; Ramanathan, 2014).
In terms of supply chain performance, different literatures give various measurements. In this survey, the supply chain performance is measured by these six criteria: customer satisfaction (Monczka et al., 1998; Mentzer et al., 2001; Ramanathan,2013), financial performance (Simatupang & Sridharan, 2005; Cao & Zhang, 2011; Ramanathan,2014), inventory performance (Simatupang & Sridharan, 2005), market performance (Monczka et al., 1998; Simatupang & Sridharan, 2005), production performance (Monczka et al., 1998; Cao & Zhang, 2011;), and resources acquirement (Park, Mezias, & Song, 2004; Cao & Zhang, 2011).

3.2 Sampling and data collection

Based on the literatures, this questionnaire contains 60 likert scale questions plus 8 background information questions. In order to increase response rate, this questionnaire has three different language versions: Chinese, English and French.
The questionnaires have been emailed to 200 Chinese companies in France .Among these respondents, 50 Chinese companies in France have returned their responses. And among these 50 questionnaires, 33 of them (66%) comes from Chinese version, 13 of them (26%) comes from English version, and 4 of them (8%) comes from French version. This table below (table 2) shows the descriptive statistic of the sample.
Table 1 Descriptive statistic

Classification		Number	Percentage
Title of respondent	High level	22	44.90%
	Middle level	15	30.61%
	Low level	12	24.49%
	Sub total	49	100.00%
Main business area	Wine produce	17	34.00%
	Wine trade	12	24.00%
	General produce	9	18.00%

	General trade	5	10.00%
	Other	7	14.00%
	Sub total	50	100.00%
Respondent's nationality	Chinese	33	66.00%
	French	17	34.00%
	Other	0	0.00%
	Sub total	50	100.00%
Length of relationship	< 2 years	14	29.79%
	2 ~ 5 years	15	31.91%
	6 ~ 10 years	3	6.38%
	> 10 years	15	31.91%
	Sub total	47	100.00%

Seeing from this table, among these 50 respondents, nearly half of them (44.90%) are in high position of each companies. Their job titles include CEO, chef manager, deputy general manager, president and vice president. 30.61% of respondents are in middle level of each companies. Most of them are department managers. And 24.49% of respondents are employees.

3.3 Correlation test

In order to check the correlations between these three main constructs (guanxi, supply chain colla behavior and supply chain performance), a correlation test was made by using SPSS.

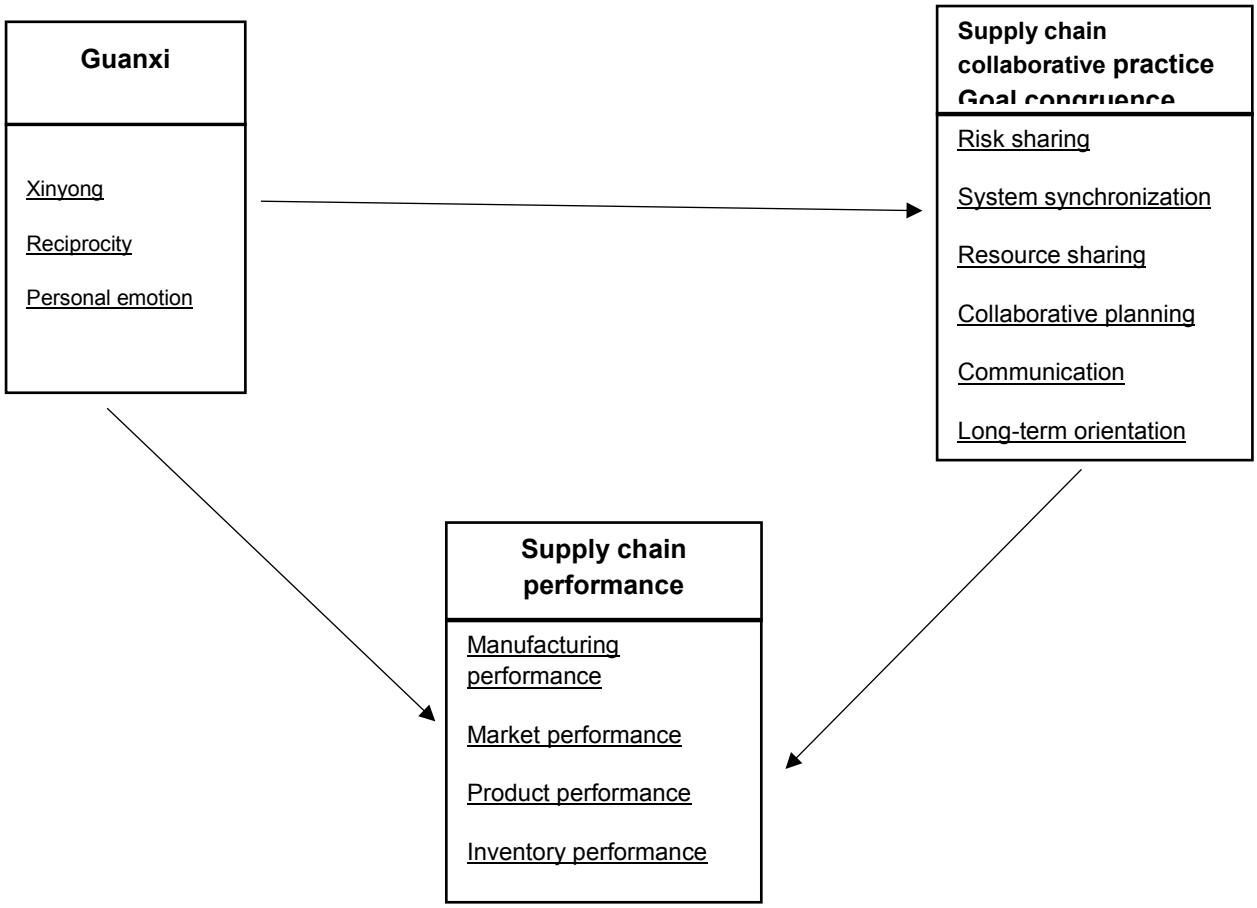
Seen from the result, it comes the conclusion that guanxi is highly related to the supply chain collaborative behaviors (Pearson correlation equals 0.561), and the supply chain collaborative behaviors are highly related to the supply chain performance (Pearson correlation equals 0.375). However, the correlation between guanxi and supply chain performance is not significant (Pearson correlation equals 0.074).

3.4 Exploratory Factor Analysis and Conceptual framework

Based on the 50 questionnaires (60 scales questionnaires each), an exploratory factor analysis is did by using SPSS. According to the result of EFA, the guanxi construct is divided into 3 dimensions: trust, reciprocity and personal emotion. All the standardize loading of each questions in guanxi are bigger than 0.6. And the Cronbach's alpha of each dimensions are 0.761 (trust), 0.747 (reciprocity) and 0.71 (personal emotion). As for the supply chain collaborative behaviors, it's divided into eight dimensions: risk sharing (0.901), system synchronization (0.828), resource sharing (0.825), collaborative planning (0.716), communication (0.682), long-term orientation (0.598), goal congruence (n/a), and information sharing (0.584). As for the supply chain performance, there are four dimensions: manufacturing performance (0.918), market performance (0.891), product performance (0.821), and inventory performance (0.806).

Based on the result of exploratory factor analysis, each construct has found its dimensions. It helps to establish a more complete conceptual framework for future study (Structural equation modeling).

Table 2 Conceptual model



4. Conclusion

This study aims at investigating the impact of guanxi (a special Chinese business cultural) on supply chain management for Chinese oversea companies. Most previous guanxi's studies focus on Chinese local market, but this research consider firstly Chinese oversea companies in the French market. This paper use quantitative method used to test the relationships between three main constructs: guanxi, supply chain collaborative practice and supply chain performance. Based on the literatures, a survey was conducted to all the Chinese companies in France. Three-language version questionnaires were sent to 200 Chinese companies in different industries. And 50 respondents have returned their questionnaires. By using these 50 data, this paper uses correlation test to check the relationships between guanxi and supply chain management. And it uses exploratory factor analysis to establish conceptual model for future studies. According to the result of correlation test, guanxi practice is significantly related to supply chain collaborative behavior, and supply chain collaborative behavior is also significantly related to supply chain performance. It concludes that, though guanxi practice (personal social activities and affection investments) between buyers and suppliers, more supply chain collaborative behaviors between upstream and downstream companies will be. And in this way, supply chain performance will be improved. So for the purpose to have a better supply chain collaboration, mangers should encourage boundary employees to build a good personal relationship with the ones from their supply chain partners. Based on the limited data (50) and exploratory factor analysis, a conceptual model is established. In the future, with more data collection, a structured equation modeling could be used to test this model.

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THE CAPABILITY EVALUATION OF AIRLINES IN THAILAND AND EAST ASIA COUNTRIES

Varattaya Jangkrajarng
Department of Management, Faculty of Business Administration, Chiang Mai University, THAILAND

Ekkaphon Jaiyen
Department of Industrial Engineering, Faculty of Engineering and Excellence Center in Logistics and Supply Chain Management, Chiang Mai University, THAILAND

1. Introduction

The Asean Economic Community or AEC is a collaboration of South East Asian countries. The purpose is to unite the market and manufacturing of every country into a single unit, allowing Asean countries to be more competitive in the global economy. The AEC lists the first 12 leading industries as open market, as shown in Figure 1, which includes agricultural, fisheries, rubber manufacturing, textile and apparel, automotive, wood products, electronics, information technology, healthcare, tourism, airline industry, and logistic.

The air transportation industry is one of the 12 open market industries for Asean countries, and is under the coordination responsibility of Thailand. Now, the air transportation industry is vital to the world economy, moving people and goods from one place to another either for business, work, education or tourism. In addition, the air transportation industry is also tightly related to the tourism industry.

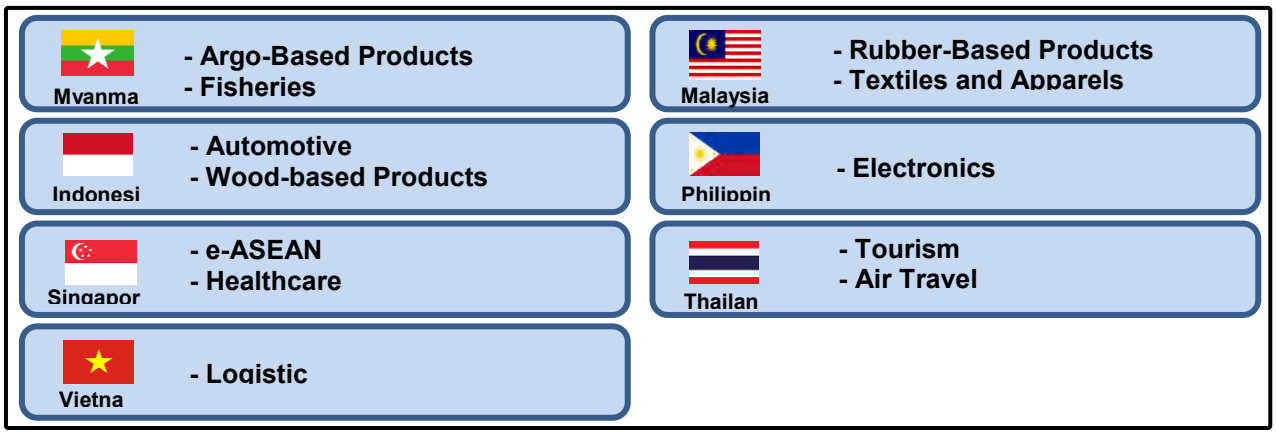


Figure 1: Industries that are under an open market policy within AEC
Source: Department of Trade Negotiations in Thailand, 2013

The air transportation industry in South East Asian region enjoyed a rapid growth recently, mainly resulted from the expansion of Low Cost Airlines. The Center for Aviation (CAPA) reported that the Low Cost Airlines currently have more than 50% of the market share in this region. Out of 5 new airlines launched in South East Asia, 3 are Low Cost Airlines – Air Asia Philippines, Singapore Scoot Airline, and Indonesia Mandala Airline, which was converted down from the Full Service Carrier. In Thailand, Thai Smile Airline was introduced. And in Laos, Laos Central Airline was competed in the market. Nevertheless, there is still a large market expansion opportunity for the Low Cost Airlines, especially in Myanmar and Vietnam. Currently, the airline business in Thailand is very competitive. Between 2009 and 2013, total revenue of all Thailand airlines increased on an average of 9%. Of those, the majority was from the Low Cost Airlines at 31.5%, while the Full Service Airlines only gained 6.9% (SCB Economic Intelligence Center 2014).

Based on the rapid growth of the airline business in the past and the potential of a large expansion in the future, we are interested in a research of which factors are relevant to the decision of passengers toward selecting their flights, and the evaluation of airline potential.

This research can help airlines to improve their popularity and to provide better services to their customers.

2. Theories and Literature Reviews

2.1 The Multi-attribute Decision Making or MADM

The MADM method is a decision making method where all possible results are evaluated based on selection criteria and are then ranked accordingly (Gunhawan 2008). This is one of the best ranking method and can be carried out with various techniques. For example,

1. A Simple Additive Weighting or SAW is the least complex method. This method compares compound weights from each possible solution, where the weight is a summation of multiplication of each criteria weight and its significant factor.
2. An Analytic Hierarchy Process or AHP is a very famous and accurate method. This method is suitable for a complex problem and can be applied for both quantitative and qualitative applications.
3. A Technique for Order Preference by Similarity to an Ideal or TOPSIS is an excellent numerical analytic tool. This method calculates positive ideal and negative ideal values and figures out how far each solution is from both values.
4. An Elimination and Choice Translating Reality or ELECTRE examines the correlation and non-correlation factors of the evaluation criteria, and then groups the relativeness of those factors for the analysis.

There have been several researches evaluating airline efficiency that uses the MADM method. For example, Chuang et al., 2001, evaluated the service quality of domestic airlines with the Fuzzy TOPSIS method. Or Tsaur et al., 2002, evaluated the service quality of Taiwan airlines with a multi factor selection method applying the AHP method for the weight calculation and the TOPSIS method for the airline ranking.

2.2 Factors in airline efficiency determination

The past research regarding factors that passengers consider when choosing airlines can be found at a World Best Airline 2013 result, published by SKYTRAX - a worldwide airline ranking agency, based on a survey and scores of 182 million people in 150 countries around the world. The study considered many factors, such as wait-time in various situations, comfort, seat quality, food and beverage, service attendants, etc. It found that the first three important aspects were Cabin Staff Service, Cabin Seat, and Onboard Catering, respectively. In addition, Zhang et al. 2008 proposed a model for Low Cost Airline evaluation based on 10 attributes, namely – Fares, Distribution, In-flight, Flight Frequency, Punctuality, Aircraft, Sectors, Airports, Growth, and Staff. There are also other researches on this matter, which can be summarized in the following Table 1.

NO.	Factor	Researcher
1	Fare	(Chuang et al., 2001) (Zhang et al., 2008) (Anton, 2012) (Praphasri, 2009) (Tanasubsin et al., 2010) (Pipatchaisiri, 2012)
2	Flight Frequency	(Chuang et al. 2001) (Zhang et al., 2008) (Yokklin, 2009)
3	Easiness in Ticket Purchasing	(Tsaur et al., 2002) (Chuang et al., 2001) (Feng et al., 2005) (Zhang et al.,2008) (Kankaew, 2012) (Yokklin, 2009) (Tanasubsin et al., 2010) (Pipatchaisiri, 2012)
4	Service and Amenities on Board	(Feng et al., 2005) (Tanasubsin et al., 2010) (Kankaew, 2012)
5	Punctuality	(Tsaur et al., 2002) (Chuang et al., 2001) (Feng et al., 2005) (Zhang et al., 2008) (Tanasubsin et al., 2010) (Anton, 2012) (Kankaew, 2012) (Pipatchaisiri, 2012)
6	Availability of Flight Connections	(Zhang et al., 2008)
7	Service of Flight Attendants	(Tsaur et al., 2002) (Chuang et al., 2001) (Feng et al., 2005) (Zhang et al., 2008) (Kankaew, 2012) (Yokklin, 2009) (Tanasubsin et al., 2010) (Pipatchaisiri, 2012)
8	Easiness in Check-In Process	(Pipatchaisiri, 2012) (Kankaew, 2012)
9	Luggage Services	(Feng et al., 2005) (Anton, 2012) (Pipatchaisiri, 2012)
10	Frequent Flier	(Chuang et al.., 2001) (Tanasubsin et al., 2010) (Anton, 2012)

NO.	Factor	Researcher
	Program	
11	Classes of Services	(Tanasubsin et al., 2010)
12	Safety	(Tsaur et al., 2002) (Chuang et al., 2001) (Feng et al., 2005) (Anton, 2012) (Kankaew, 2012) (Yokklin, 2009) (Tanasubsin et al., 2010) (Pipatchaisiri, 2012)

Table 1: Summary of factors in airline efficiency evaluation

Here is a procedure for ranking airlines efficiency, based on the Technique for Order Preference by Similarity to an Ideal Solution or TOPSIS, depicted in the following Figure 2.

First step

The first step includes a study and a literature review of factors in airline selection. This step studies and collects secondary data of the factors and airline efficiency from researches and institutes (shown in the Section 2).

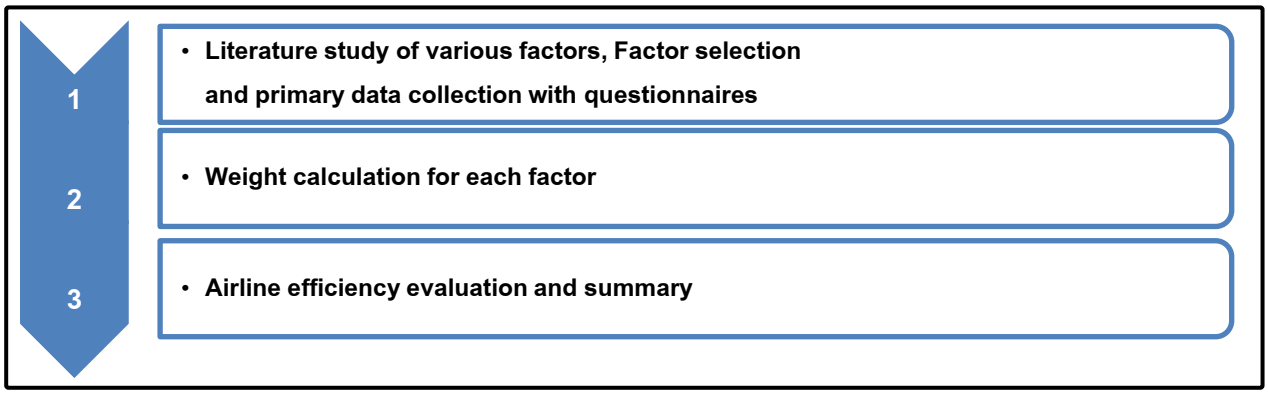


Figure 2: Research Procedure

Next, listing factors that affects a choosing of Full Service and Low Cost Airlines. Then, a survey is developed to collect primary data, which comprises of two parts. The first part is to collect basic information, including country of residence, nationality, occupation, age range, travel frequency, past destination countries, purpose of travel, and travel experience. The second part is to collect factors that affecting the airline selection, based on a 5 level rating scale.

Second step

The second step involves calculating weights for each factor collected from the second step. The weights are calculated by these following steps (Sopadang 2009).

1. Obtain average relevant coefficients for each factor.
2. Rank the coefficients from the highest value to the lowest value.
3. Use the ranking for a weight determination with formula (1)

$$w_j = \frac{\frac{1}{L_j}}{\sum_{j=1}^{M} \frac{1}{R_j}} \quad (1)$$

where w_j is weight for each factor $j = 1, 2, \ldots, M$
and R_j is ranking for each factor $j = 1, 2, \ldots, M$

Third step

The third step involves airline efficiency evaluations by the Technique for Order Preference by Similarity to an Ideal Solution or TOPSIS. The calculation is performed as follow.

1. Data size adjustment by Vector Normalization method based on Equation (2) and (3).
   - For factors that are of Benefit Criteria

$$r_{ij} = \frac{A_{ij}}{\sqrt{\sum_{i=1}^{N} {A_{ij}}^2}} \quad (2)$$

- For factors that are of Cost Criteria

$$r_{ij} = \frac{\frac{1}{A_{ij}}}{\sqrt{\sum_{i=1}^{N} (\frac{1}{{A_{ij}}^2})}} \quad (3)$$

where r_{ij} is a normalized data for each selection $i = 1, 2, \dots, N$ and criteria $j = 1, 2, \dots, M$

and A_{ij} is a primary data for each selection $i = 1, 2, \dots, N$ and criteria $j = 1, 2, \dots, M$

2. The weight for each factor is multiplied with the normalized data from the previous step in Equation (4).

$$V_{ij} = W_j * r_{ij} \quad (4)$$

3. The maximum and minimum values for each factor $j = 1, 2, \dots, M$ are located by Equation (5) and (6).

$$V_j^* = Max\,(r_{1j}, r_{2j}, \dots., r_{Nj}) \quad (5)$$
$$V_j^- = Min\,(r_{1j}, r_{2j}, \dots., r_{Nj}) \quad (6)$$

4. The summation of Positive Ideal Value and Negative Ideal Value for each factor is then calculated from Equation (7) and (8).

$$S_i^* = \sqrt{\sum_{j=1}^{M} (V_{ij} - V_j^*)^2} \quad (7)$$
$$S_i^- = \sqrt{\sum_{j=1}^{M} (V_{ij} - V_j^-)^2} \quad (8)$$

5. The efficiency evaluation can be performed by ranking the result from the 4th step above as following
   - From S_i^*, the values are ranked from the smallest to the largest values.
   - From S_i^-, the values are ranked from the largest to the smallest values.

   From the ranking of $S_i^*$and S_i^-, if both rankings are analogous, we can conclude here. Or we can also analyze the result furthermore in the next step.

6. The analysis ranking can also be found from the Equation (9) by listing the factors with the smallest to largest values.

$$C_i^* = \frac{S_i^-}{S_i^* + S_i^-} \quad (9)$$

The efficiency evaluation can be performed by ranking the S_i^* , S_i^- and C_i^* from Equation (7) to (9), whose results can be interpreted if
- An airline with the largest S_i^* value means it has the best efficiency.
- An airline with the smallest S_i^- value means it has the best efficiency.

But if the result from S_i^* and S_i^- are not analogous, the value $C_i^*$is then used, where airlines with the largest C_i^* value means it has the best efficiency.

On our analysis, we divided airlines into 3 groups. Group 1 consists of Thailand Low Cost Airlines, including Nok Air, Thai Lion Air and Thai Airasia. Group 2 consists of Thailand Full Service Airlines, including Bangkok Airways and Thai Airways. Group 3 consists of Full

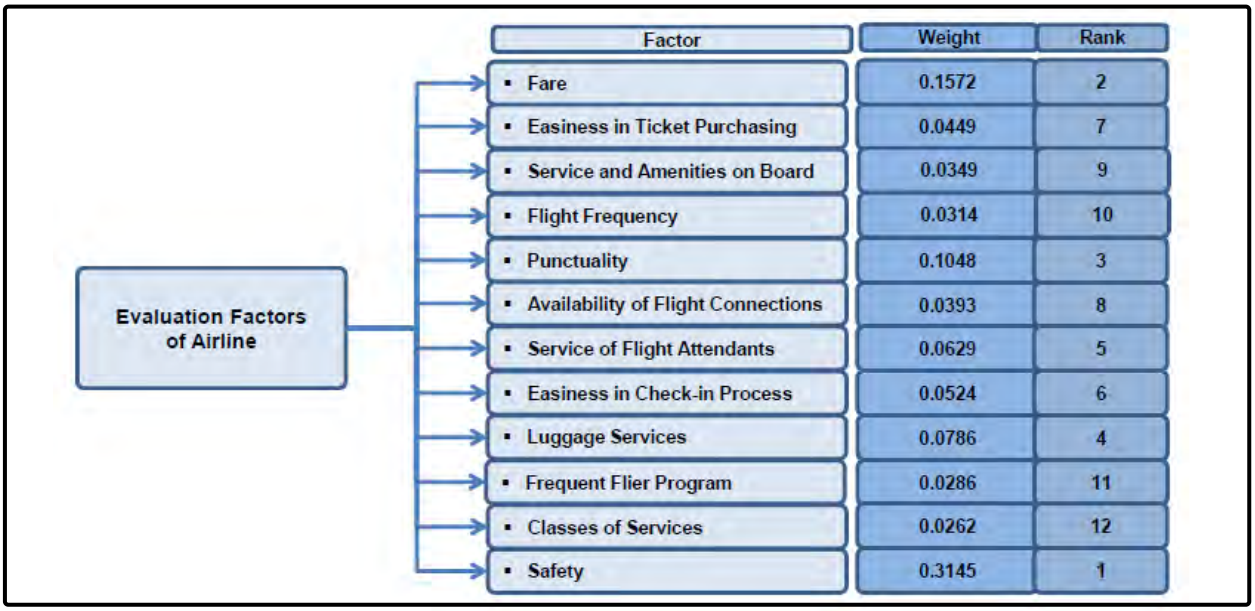
Service Airlines in Thailand and abroad, including Singapore Airline, Cathay Pacific Airline, Korean Air and Thai Airways. This is shown in Figure 3.

Figure 3: Airlines that are part of our study and research

4. Results

4.1 Results of factor selection and their weights

Factors that are important for airline business were first assembled from past research studies, and were further refined from interviews with several airlines. We found 12 factors that were relevant to airline business. Those included fare, easiness in ticket purchasing, service and amenities on board, flight frequency, punctuality, availability of flight connections, service of flight attendants, easiness in check-in process, luggage services, frequent flier program, classes of services, and safety. And from the surveys of airline professionals and 352 passengers, each factor weight was calculated from the Equation (1). Here, we found that passengers ranked safety as their highest priority at 31%, following by fares, punctuality, and luggage services, at 16%, 11% and 8% respectively. The full result is shown in Figure 4.



Factor	Weight	Rank
Fare	0.1572	2
Easiness in Ticket Purchasing	0.0449	7
Service and Amenities on Board	0.0349	9
Flight Frequency	0.0314	10
Punctuality	0.1048	3
Availability of Flight Connections	0.0393	8
Service of Flight Attendants	0.0629	5
Easiness in Check-in Process	0.0524	6
Luggage Services	0.0786	4
Frequent Flier Program	0.0286	11
Classes of Services	0.0262	12
Safety	0.3145	1

Figure 4: Factors and their weights in the airline efficiency evaluation

4.2 Results of airline efficiency evaluation

The primary data from airlines and the weights of each factor from the Section 4.1 were employed in the efficiency evaluation with the Technique for Order Preference by Similarity to Ideal Solution or TOPSIS, in order to gain insights of how airlines can improve on their competitiveness. The data size adjustment result from the Vector Normalization in Equation (2) is shown in Table 2 and Figure 5. The airline efficiency evaluation result calculated from Equation (4) to (9) is shown in Table 3.

5. Conclusion

The airline ranking result in the Section 4 concluded that, for the Group 1, Thai Airasia ranked first, Nok Air ranked second, and Thai Lion Air ranked third. The result showed that Thai

Airasia ranked first on almost every factors, except fares and luggage service, while the weakness of Thai Lion Air were on their frequent flier program and flight frequency since it only started operating in 2014. In Group 2, Thai Airways was strong in every factors, except their flight frequency was less than Bangkok Airways, resulting in Thai Airways ranking first and Bangkok Airways ranking second. In Group 3, Thai Airways had the cheapest airfare, following by Cathay Pacific Airline and Singapore Airlines, while Korean Air had the most expensive airfare. Singapore Airline allowed the most luggage weight without any extra fee, as well as the best service quality and availability of flight connection. This resulted in Singapore Airline ranking first, Thai Airways ranking second, Cathay Pacific Airline ranking third, and Korean Air ranking fourth.

NO.	Factor	Low Cost Service (THA)			Full Service (THA)		Full Service (INT)			
		Nok Air	Thai Lion Air	Thai Airasia	BKK Airways	Thai Airways	Thai Airways	Korean Air	Cathay Pacific	Singapore Airline
F1	Fare	0.5965	0.5755	0.5594	0.6218	0.7832	0.6668	0.5162	0.3088	0.4400
F2	Easiness in Ticket Purchasing	0.5145	0.5145	0.6860	0.7071	0.7071	0.5000	0.5000	0.5000	0.5000
F3	Service and Amenities on Board	0.5971	0.4938	0.6322	0.6842	0.7293	0.4840	0.5031	0.4528	0.5546
F4	Flight Frequency	0.5221	0.1149	0.8451	0.7277	0.6859	0.4337	0.4394	0.6792	0.3969
F5	Punctuality	0.6247	0.4685	0.6247	0.6585	0.7526	0.5000	0.5000	0.5000	0.5000
F6	Availability of Flight Connections	0.6047	0.5183	0.6047	0.6644	0.7474	0.5207	0.4628	0.4243	0.5785
F7	Service of Flight Attendants	0.5145	0.5145	0.6860	0.7071	0.7071	0.4811	0.4510	0.4510	0.6014
F8	Easiness in Check-In Process	0.4264	0.6396	0.6396	0.6247	0.7809	0.5522	0.4417	0.4417	0.5522
F9	luggage services	0.7071	0.7071	0.0000	0.7071	0.7071	0.4236	0.4236	0.4872	0.6354
F10	Frequent Flier Program	0.4472	0.0000	0.8944	0.6000	0.8000	0.6963	0.3482	0.5222	0.3482
F11	Classes of Services	0.3333	0.6667	0.6667	0.5547	0.8321	0.5000	0.5000	0.5000	0.5000
F12	Safety	0.6047	0.5183	0.6047	0.7071	0.7071	0.5000	0.5000	0.5000	0.5000

Table 2: Based Size Data using the Vector Normalization Method

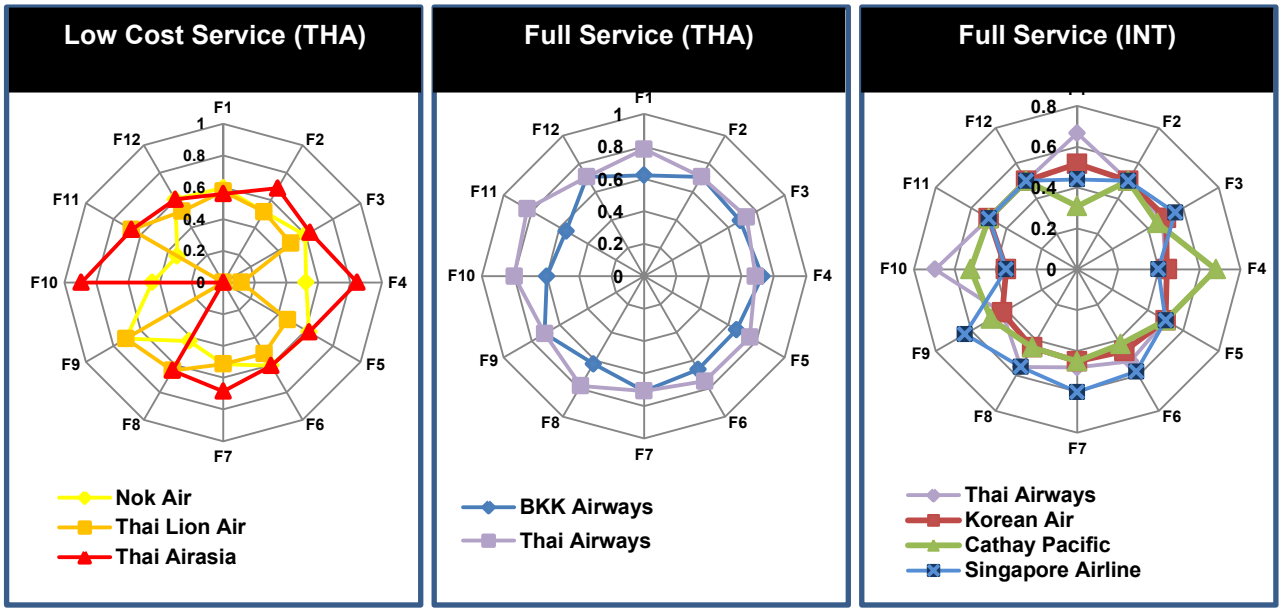


Figure 5: Based Size Data using the Vector Normalization Method on Radar Chart

Type	Airline	S_i^*	Rank	S_i^-	Rank	C_i^*	Rank
Low Cost Service (THA)	Thai Airasia	0.2478	1	0.3743	1	0.6016	1
	Nok Air	0.2508	2	0.3723	2	0.5974	2
	Thai Lion Air	0.3514	3	0.2793	3	0.4429	3
Full Service	Thai Airways	0.0362	1	0.2366	1	0.8673	1

(THA)	Bangkok Airways	0.2366	2	0.0362	2	0.1327	2
Full Service (INT)	Singapore Airline	0.1933	1	0.2755	1	0.5876	1
	Thai Airways	0.2239	2	0.2513	2	0.5288	2
	Cathay Pacific Airline	0.2749	3	0.1942	3	0.4140	3
	Korean Air	0.3063	4	0.1396	4	0.3130	4

Table 3: Ranking result of the airline evaluation

Comparing Thailand's airlines with the foreign airlines in the study, Thai Airways strength was in their fare, while their weakness was in service and amenities on board, service quality of flight attendants, and luggage allowances. However, Thai Airways were able to increase their fare, providing they increased their service quality to meet the upper level customer's needs.

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TRANSPORT COST DISTORTION: THAILAND TRANSPORTATION ON THE ROUTE OF NSEC

S. Tanratanawong[1], M. Pinitjitsamut[2], B. Panitchkarn[3], P. Pitchayapan[4] and D. Satirasetawee[3]

[1] Dept. of Civil Engineering, Naresuan University, Thailand
[2] Dept. of Economics, Kasetsart University, Thailand
[3] College of Logistics and Supply Chain, Naresuan University, Thailand
[4] Dept. of Civil Engineering, Chiangmai University, Thailand

Introduction

Located in the heart of the South-east Asia region, Thailand is expected to be extensively affected by the intensive trans-regional commercial competitive resulting from the ASEAN Economic Community (AEC), one of the three pillars under the Declaration of ASEAN Concord II that will be officially initiated within 2015. Aiming empower the economic strength and the competiveness of the region to level those of globalization, the transition to single market with free trading of such a scale, however, concerned the governments of members. The large gaps of the productivity, market size, competitiveness, including the local government policies of the members is likely to generate complicate issues, both socially and economically. One area concerned by Thai government is the logistics issues, especially the goods transportation costs, which play a very significant role in market competiveness. It is believed that there are a variety of hidden transportation costs absorbed and subsidized by different parties, depending on different policies and management methods employed by different local agencies and governments. The differences can be disadvantageous and probably crucial for some local business and industries who are located in the areas that regulate higher subsidiary in hidden costs, in terms of transportation cost which in turn reflects their total cost, selling price and finally profit, than those in lower rates of subsidiary.

This project is proposed to investigate the hypothesis described above. The study aimed to identify the transport costs distortions of the Thai industry using the North-South Economic Corridor (NSEC) route, which starts from Kunming of China (837 km.), Laos PDR (250 km.), Thailand (2,191 km.), and Malaysia (775km.) and ended in Singapore.

The industries expected to be beneficiary along the route include agriculture, contract farming and agro-processing industry, industries using local-natural resources, light industries, construction material industries and service industries, including tourism and logistics. There are several international agreements signed between Thailand and neighboring countries regarding to the NSEC. For example, the Agreement of China People Republic, Thailand and Lao People's Democratic Republic indicate that there will be cooperation and reduction of custom services concerning the transportation of both products and people via the borders. It is clear that there are efforts from ASEAN members and neighboring countries have been initiating forms of cooperation in order to reduce the logistics process and costs to assist the private industries and services in the region for some periods in preparation to eventually move into the actual borderless market.

Normally, the cost elements, namely the typical *Business Operating Costs (BOC),* are those incurred to the transportation of products and taken into accounted by private sectors who transport goods and products. However, the hidden *Non-business Costs (NBC),* which are not directly realized by the traders, but instead subsidized by other parties such as the government and the public, are usually neglected. The amounts and proportions of these costs not only affect the competiveness of the industries but also reflect the inequalities and subsidies taken by each region.

Methodology

Goods and product transportation cost, or *Full Cost,* is comprised of two types of expenses. In the current study, the typical *Business Operating Costs (BOC)* are those incurred to the logistics corporates who run the logistics business, and eventually transferred to the customers. The hidden *Non-business Costs (NBC)* are costs incurred by or related to the transportation activities of but absorbed or subsidized by other parties instead of the logistics corporates and customers. They can be written as:

Full Cost = [Typical *Business Operating Costs*] + [Hidden *Non-business Costs*] (1)

- **The Cost Structures**

Both types of cost can be broken into *fixed* and v*ariable* cost categories. In this study, there are 6 fixed costs and 5 variable costs for the *BOC*, while the *NBC* is comprised of 4 fixed costs and 4 variable costs. They are shown in the following table.

Types of Cost	Fixed Cost	Variable Cost
BOC	Vehicle Depreciation	Vehicle Maintenance
	Vehicle Insurance	Fuel
	Vehicle Registration Fee	Tire
	Driver Salary	Grease & Lubricant
	Supplies Expense	Goods Insurance
	Undeclarable Expense	
NBC	Road Construction	Road Maintenance
	Street Lighting Electricity	Traffic Services
	Traffic Planning	Accident Cost
	Land Value	Environmental Cost

While the values of most variables can be collected and analyzed straight-forwardly, there are some of those must be estimated using different models and techniques. Due to the limited space, two models of costs derived in the research were deliberately chosen and presented here. Firstly, the Accident Cost was calculated based on the models from Ozbay *et al.* (2007) and Berechman (2009), as follows.

$$C_{acc} = 127.5Q^{\,0.77}\,M^{0.76}L^{0.53} + 114.75Q^{0.85}M^{0.75}L^{0.49} + 198{,}900Q^{0.17}M^{0.42}L^{0.45} \quad (2)$$

Q = *Traffic Volume per day (unit)*

M = *Distance (km.)*

L = *Number of Traffic Lane*

The model is derived for the condition of the studied route as:

$$C_{acc} = AQ^{\,\alpha_2}\,M^{\beta_2}L^{\emptyset_2} + BQ^{\alpha_2}M^{\beta_2}L^{\emptyset_2} + CQ^{\alpha_2}M^{\beta_2}L^{\emptyset_2} \quad (3)$$

or,

$$Ln_{C_{acc}} = 4.280103 + 0.701182Ln\ \_L - 0.393079Ln\ \_QH - 0.566836Ln\ _{N} \quad (4)$$

Then, the Environmental Cost was defined in the current study as the impact and cost caused by carbon emission values.

$$C_{air} = Q\,(\beta_0 + \beta_1 F) \quad (5)$$

Q = *Traffic Volume (unit/month)*

F = *Fuel Consumption (litre/km.)*

β_0, β_1 = *Constant Coeffients*

The values of β_0 and β_1 are based on the values of carbon emissions that in turn are dependent to types and conditions of vehicles. Semi-trailer trucks was chosen to be the representative of traffic vehicles type .The volumes of the CO_2 Emission produced in yearly average value therefore can be calculated based on the CO_2 conversion factors from The Department for Environment, Food and Rural Affairs of UK, which indicated that the emission rate of as much as 2.63 kilo-carbon was produced from every litre of diesel truck with 0.33 litre per km. consumption rate.

For CO emission rate, the calculations from *A Modal Comparison of Freight Transportation Effects on Gener,* UK were applied and shown as follows.

$$CO = 0.085\ (g/metric\ ton - km.) \quad (7)$$

The price of carbon based on EU market in the 2010, which was 20 Euro per ton carbon and 40.2938 Baht per Euro at the 2010 currency rate were adopted for the analysis.

- **Data Collection**

Sets of data were collected from the related and participated 40 government and private organizations in 5 countries along the NSEC route. The values of both transportation costs was analyzed and modeled. The full and distortions of cost elements were then revealed and compared.

Results

The typical *Business Operating Cost* and hidden *Non-business Cost* values based upon the assumptions and analysis mentioned above are shown and compared in the following tables. It clearly shows that the most costly item is the truck's *Fue*l cost which costs the business more than 38%, while the *Street Lighting Electricity, Traffic Planning and Traffic Services* costs are accounted for less than 0.1% in each category. Note that although total *BOC* accounts for the majority of proportion of the full cost, with approximately 22.16 Baht per km., the *NBC, however*, is proportionally significant with approximately 3.72 Baht per km., or 14.36% of full cost.

Cost Item	Cost (Baht/km)	% of Full Cost
Vehicle Depreciation	2.84	10.98 %
Vehicle Insurance	0.64	2.47 %
Vehicle Registration Fee	0.13	0.50 %
Driver Salary	3.06	11.83 %
Supplies Expense	1.95	7.54 %
Undeclarable Expense	0.08	0.31 %
sum of fixed BOC	**7.94**	**30.68 %**
Vehicle Maintenance	1.39	5.37 %
Fuel	9.90	38.26 %
Tire	1.36	5.26 %

Grease & Lubricant	0.34	1.31 %
Goods Insurance	0.47	1.82 %
sum of variable BOC	**13.46**	**52.02 %**
total BOC	***22.16***	***85.64 %***

Cost Item	Cost (Baht/km)	% of Full Cost
Road Construction	1.11	4.30%
Street Lighting Electricity	0.02	0.07%
Traffic Planning	0.01	0.05%
Land Value	N.A.	N.A.
sum of fixed NBC	**1.14**	**4.41%**
Road Maintenance	1.74	6.70%
Traffic Services	0.08	0.03%
Accident Cost	0.25	0.91%
Environmental Cost	0.60	2.31%
sum of variable NBC	**2.57**	**9.95%**
total NBC	***3.72***	***14.36%***

Conclusion

The total transportation cost was founded to be 25.88 Baht per km. The majority of cost, which is 85.64%, is the typical *Business Operating Cost,* which comprised of 6 fixed and 5 variable cost elements. The hidden *Non-business Cost*, comprised of 4 fixed and 4 variable cost elements were estimated to be 14.36%. These findings are valuable for the policy makers who are responsible for policy and strategic planning and therefore crucial for the country's productivity and competitiveness, especially in terms of logistic costs. The policies that are imposed to increase or reduce the proportion of the distorted costs will definitely affect the prices of both import and export products, hence, the competitiveness of the country. In addition, the details of cost structure also provide useful information for both public and private sectors in production and service industries for further logistics cost improvement, business planning and administrative purposes.

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TRACING OF HALAL MEAT SUPPLY CHAIN WITH CLOUD TECHNOLOGY FOR ENHANCING CONSUMER SATISFACTION

Onthida Khamsiriwong, Salinee Santiteerakul, Aicha Sekhari, Harlina Suzana Jaafar
College of Arts Media and Technology, Chiang Mai University
Chiang Mai University, 239 Huay Kaew Road Suthep, Chiang Mai, 50200, Thailand
Email: onthida_k@hotmail.com
Excellence Center of Logistics and Supply Chain Management,
Chiang Mai University, 239 Huay Kaew Road Suthep, Chiang Mai, 50200, Thailand
Email: salinee@eng.cmu.ac.th
DISP Laboratory Université Lumière Lyon 2, Bron, 69676 France
Email: aicha.sekhari@univ-lyon2.fr
Malaysia Institute of Transport, Universiti Teknologi Mara, 40450 Shah Alam, Selangor, Malaysia
Email: harlinas@salam.uitm.edu.my

Introduction

The world's population by the sharing of religious group, the second huge religious group is Muslim which was estimated around 1.6 billion or 23 percentage of the world's population (Hackett et al., 2012) and it continues growing up through the birth-rate from 1.1 billion in 1990 to 1.6 billion in 2010. They also forecast that Muslim population will be one per three world person which is estimated around 2.2 billion in 2030 (Pew Research Center's Religion & Public Life Project, 2011) while Halal supply is still not enough for their demands (Lever and Miele, 2012). This situation is one of the reasons that push Halal food supply chain as a critical. Halal food is the religious requirement of Muslim community. It is the principle for Muslim's diet and Halal food is accordance to Halal (permissible – Syariah compliant) and Toyyiban that means wholesomeness (healthy, safe, nutritious, quality) (Alqudsi, 2014). Thus Halal food is difference from the conventional food that has not concerning only of safety and cleanliness which are the basic requirement of food but it is also lawful which is the requirement that made Halal food is unique. Halal food is served to Muslim consumers as the permitted food but for non-Muslim Halal food is recognized as an alternative benchmarking for a safety, hygiene and quality assurance under the production of Holistic Halal Assurance Management System. Nowadays, Halal food is concerned and more aware (Ambali and Bakar, 2014) especially on Halal meat segment. Nakyinsige et al. (2012) added that Muslim consumers are concerning about a number of issues on meat and meat product because meat products are a risky segment of Halal status breaching. Accordingly to Omar and Jaafar (2011), they explained that Halal supply chain is a process that must be Halal started from the source of supply until reached to the customer hands. It means that making Halal food is not focused only just the production but the whole supply chain from the farm and retain the purity of Halal until delivered to the consumer. Moreover, it is effortlessly for adulteration and frauds upon a technological advance in the meat processing industry due to monetary benefits (Nakyinsige et al., 2012). Thus, Halal meat product is the critical segment which the risk of cross-contamination can happen on the whole Halal meat supply chain such as in a part of raising animals, slaughtering, production, and distribution. Therefore, ensuring the purity of Halal meat product, the auditing is needed to carry out. From the Muslims' point of view, Halal status is the criteria for a decision making to choose one food product over the others (Nakyinsige et al., 2012). The importing countries and domestic markets, the verification of Halal control, and the assurance are important to guarantee the reliability and to create the trust for the consumer (Spiegel et al., 2012). Although the auditing was done to verify the purity of Halal, the transparency and traceability of relevant information are significant for both assuring in Halal meat product history and the investigation case. Spiegel et al., (2012) mentioned widely accepted audit methods should be established and the obtained audit information should be transparent and traceable for all actors in the supply chain. Furthermore, Halal food consumers become more aware and concern on the integrity of Halal status. They also curious about all the activities involved along the supply chain (Zulfakar et al., 2012; Ambali and Bakar, 2014). A various channels which provide information of Halal food product to the consumer come from product's label and advertisement. The consumers are restricted of Halal food product's information only from those channels. In fact, the consumers deserve to access more information to make the suitable decision for buying food. Thus Halal traceability system should be further developed (Spiegel et al., 2012) in order to satisfy the consumers by the transparent of information. Consequently, Halal food market in this scenario, there are various meat products which were increased by the consumer's lifestyle. Currently in the competitive society, people spent their life hastily. This results to the change of consumption needs such as the instant food, processed food and ready-to-eat food. As these kinds of food, there are multi-ingredients foods that are cause of

complicated product labels which is made difficulties to expose clearly information. In contrast, more complicated information resulted more clearly for consumer's perceptions. Therefore, traceability system which can provide the location of product's ingredients integrated with cloud technology represented by web application can be a channel for providing Halal meat product's information which was mentioned that is a complicated and critical segment of Halal food by the characteristics of traceability system and the advantages of web application on cloud that could provide clear and reliable information to satisfy consumer in perspective of information transparency.

Literature review

Important of Halal Meat Supply Chain

Since a food chain becoming longer and more complex, Muslim consumers are taking an interest on the ingredients of their food which is increasingly imported across the world (Bonne and Verbeke, 2008; Spiegel et al., 2012). Several ingredients such as mixtures, fragrances, and savours are needed the laboratory testing which can help them find the forbidden they could not see by a general auditing. For example, pork fat can be used in making bread as a sub-stance of emulsifier (Spiegel et al., 2012). Bonne and Verbeke (2008) explained that Halal production cannot be measured analytically, including animal welfare, the ritual slaughter method, treatment and separation of Halal animals, cleaning and disinfection, separation of Halal and Haram food at all stages of the Halal food supply chain, and low concentrations of Haram contaminants. They result in the authenticity issue mentioned that Muslim consumer is the need to determine whether the meat products from Halal species have not been mixed with a cheaper non-Halal species, or a similar material (Nakyinsige et al., 2012). Form the above issues related to Halal meat product reveal that Halal meat supply chain is very delicate and should be concentrated from the origin of Halal animals segment to the store shelves, since the losing of Halal status could be happened even in unobvious activities. Besides, Halal meat product is covering the origin, species, production system, slaughter procedure, and the processing method of the meat. All these characteristics are invisible and could not be verified by the consumers during the pre-purchase stage (Nakyinsige et al., 2012). Moreover, Bonne and Verbeke (2008) defined that Halal Control Points (HCPs) as steps following Halal food supply chain for reducing and avoiding risks of losing Halal status. As such Halal breeding, animals bred for meat must be acceptable species and the breeding of animals should be Halal as well (feeding naturally or vegetarian diet). The HCPs third to seventh are the critical points in slaughter process which are the animal welfare. To start with stunning, Islam supports that animals deserve humane treatment during the before, during, and after slaughter process. The stunning in the Islamic dietary laws does not prohibit; they are only forbidden to consume blood and dead animals, but they support humane handling. However, most of Muslims oppose the stunning since they believe it is strictly prohibited by Islamic rulings. Next, the knife used in the slaughter must be sharp to avoid cruelty and help the animal did not feel any pain while doing a slaughter with or without stunning. Fifth, a slaughter person must be a sane adult Muslim. Sixth, the animal should be slaughtered by cutting from the front part of the neck, severing the carotid, jugular, trachea, and esophagus. Seventh, the invocation, the slaughter person must invoke the name of Allah immediately while cutting. The usual formula is ''In the name of Allah; Allah is the greatest''. Eighth, packaging and labeling for Halal meat need to be labeled properly as Halal and it must be evaluated by a reputable supervisory organization for all Halal control points. Ninth, retailing, distribution and retailing of Halal meat is also a critical issue, in order to aware cross-contamination. There are three distribution channels including the Islamic butchers, the supermarkets, and the farms or slaughterhouses. All of nine Halal control points have been presented the concerning along with the Halal meat supply chain unquestionably. Nevertheless, Omar and Jaafar (2011) emphasized the critical meat segment of Halal supply chain in the food industry. They mentioned that it is important and needed to concern from Halal animal feed dimension to ensure only Halal things were fed to the animals, then a proper slaughtering to meet the vital requirement accordance to the Sharia Islamic principles, and proper segregation to avoid a turning back to non-Halal caused by a contamination. Thus, Halal meat is the significant segment to focus on. Meat is an important ingredient of almost Halal food especially in processed food and instant freezing food which are demanded from the current market to respond the hastily lifestyle. Besides, the various conditions of properly slaughter and production of Halal meat and the risk of easily transforming to non-Halal in every single phase of Halal meat supply chain as well.

Consumer Satisfaction

The awareness issue of Halal meat product could be the cause from Muslim consumers is concentrating on the origin of the ingredients, which imported from aboard, used for cooking their food (Bonne and Verbeke, 2008, Spiegel et al., 2012). Despite consumers need to ensure that the status of

the ingredients or the mixtures is made from Halal permission sources, they cannot be completely sure that the meat they are going to purchase is Halal. They have no choice but they still purchase it as a face value (Alqudsi, 2014). Interestingly, in general, the awareness refers to one exists as an individual with private thoughts about the state of something. Therefore, in the context of Halal, the awareness means having experience of something and/or conceptualized as the informing process to increase the level of consciousness toward for what is permitted for Muslims consumption. For example, awareness describes human perception and cognitive reaction to a condition of what they eat, drink and use (Alqudsi, 2014). Moreover Ambali and Bakar (2012) pointed out the awareness of the Muslim and non-Muslim consumers as describing their perception and cognitive reaction to products or foods in the market. Accordingly, increasing the level of consciousness, perception and cognitive, the focusing on the process of information transparency is significant. A study done by Ambali and Bakar (2012) concerning about the sources of Halal awareness shown that the interesting source is exposure; the educating can help people exposing and making the right choice for their daily consumption. People can be educated in everyday life through channels of communication; newspaper, television, radio, and internet which play the important role by providing the information and exposure. Besides, their understanding about Halal is based on their exposures; seeing and hearing, through advertisements. Thus, the exposure can serve as a source of awareness on Halal related to Muslims' consumption. Omar and Jaafar (2011) suggested that encouraging consumers to consider Halal, the information is needed to be disseminated. Ambali and Bakar (2012) also emphasized that the decision to purchase Halal meat is based on the information provided by Halal butchers. Hence, the information can influence consumer purchasing or consumption decisions. For example, if there are two kinds of Halal meat product and both kinds of product have the difference brand, the brand providing a clearer and more reliable information can get more opportunity to be selected (select = to carefully choose). Furthermore, the individual and environmental factors that have impacted specific properties such as marketing, information, situation, and food determine the consumers' attitude and behavior towards food (Ambali and Bakar, 2012). There is a relationship between exposure (providing information) and the consumption (purchasing decision). Whenever their knowledge or experience is matched with a permission from their religious (Sharia and/or Toyyiban principle), this process will result the increasing of positive perception or cognition, reliability, and trust. In the same way, if the product can ensure and satisfy their customer that it is Halal, this product will be purchased.

Tracing of Halal Meat Supply Chain Technology

The issues of information are highly competitive in the current business scenario including a supply chain of Halal. As Bahrudin et al. (2011) stated that a technology is one of the biggest revolutions in supply chain on reducing costs and for completing the necessity of modern supply chain world, tracking and tracing technology are counted. Especially in Halal meat supply chain which is needed ensuring as the most important issue. The obtained audit information should be transparent and traceable for all actors that Halal traceability system should be further developed to confirm the absence of Haram contaminants in a case of unclear information on the documents used for deciding upon Halal approval (Spiegel et al., 2012).

(1) Traceability and Tracing technology

Tracing is the ability to trace back and forward by using the tracking technology along with the supply chain, for instance, from the consumers to the producers, or from the suppliers to the producers. The ability of tracing can provide the history of a product and can afford to the related problems such as monitoring, informing and updating data, or a product's status (Bahrudin et al., 2011). Furthermore Opara (2003) emphasized about the advantages of tracing. The instant products can be traced back to their raw materials and the original producer as well as the previous handlers in the chain. In the same way, forward traceability is also essential to guarantee the location of the products and facilitate their recall when safety and quality standards have been breached. That is an essential feature of food quality management system. Thus, Halal meat supply chain can be gained the benefits of tracing of the transparency identifying the farm where it was grown, the origin country of animals, the locations of food ingredient, or the source of contamination. It is likely to increase consumers' trust in a term of the proven transparency of meat history. Additionally, Bahrudin et al. (2011) suggested that Radio Frequency Identification (RFID, which is the technology for tracking Halal supply chain, is a technology based on wireless communication in radio frequencies to uniquely identify tagged the object or people. This technology offers the integration with the other systems, or the enterprise support systems, in order to solve a problem or serve some specific purposes.

A basic RFID system consists of three components: transponders (tags), antennas and readers, and a host computer loaded with the necessary software to fully utilize RFID's capabilities (Kima and Garrisonb 2010). There are three types of RFID tag. To begin with, passive RFID tags which have no power source and require an external electromagnetic field for starting a signal transmission. Second, active RFID tags which contain a battery and can start signals once an external source which has been successfully identified. Third, semi-passive RFID tags which require an external source to wake up but have a higher significant forward a link capability providing a greater range (Chawathe, Krishnamurthy et al. 2004).
There are different shapes and sizes of RFID reader and it is worked on different frequencies from 100 kHz to 5.8 GHz. The higher range of frequency is the higher reading range capacity. Also, the size of the tag's antenna determines the ability to read the signal at the certain distances. In the case of many tags are in range of the reader and the protocols have been developed to read the tags sequentially by allowing only tags with the appropriate serial number to respond (Bahrudin et al., 2011).

Add-on / **Stage**	**Syariah Law**	**Radio Frequency Identification (RFID)**	**Integrated System**
Raw Material	Livestock being feed with good, clean, permitted and legal nutritious food. Slaughter according to Islamic guidelines	Active	Monitoring System
Inbound Logistic	Monitoring the flow of inbound vehicle (truck/ container). If needed, doing samak to certain truck or container.	Semi Passive Active	Monitoring System Inventory System
Warehouse	Monitoring Halal product from mixed with non-halal product. (ex: segregate by zoning)	Passive Semi Passive	Monitoring System Inventory System
Production	Repackaging by production house, using Halal equipment and worker practice the concept of hygiene permitted by Islamic law.	Passive Semi Passive	Monitoring System Inventory System
Storage	Monitoring the Halal product from mixed up with non-Halal product.	Passive Semi Passive	Monitoring System Inventory System
Outbound Logistic	Monitoring the flow of inbound vehicle (truck/ container). If needed, doing samak to certain truck or container. Need to do segregation in the container if the product is non-Halal and Halal product.	Semi Passive Active	Monitoring System Inventory System
Retail and Shop	Maintained the freshness, cleanliness and product safety to be sold.	Passive Semi Passive	Monitoring System Inventory System
Customer Service	Look up for any complaint from customer. To enhance/ improve service quality.	Passive	Inventory System Customer Portal Website

Table 1: The detail of category in technological Halal supply chain framework (Bahrudin et al., 2011)

Bahrudin et al. (2011) compared and proposed the suitable types of RFID for using in Halal supply chain to achieve the specific objective of each stage showing on the table 1 the technological Halal supply chain framework which is obtained upstream and downstream management. The table describes the detail of implying RFID technology for the suitable specific stages and Sharia law compliance. From the suitable RFID technology types in the specific stages on Halal supply chain,

started from raw material stage which is concerned about feeding of livestock until the stage of customer service. At this point, the integration between a traceability system methodology and web application on cloud service can be the solution for enhancing consumer satisfaction by providing the convenient channel and the meet of modern lifestyle (connecting to the internet at all time) to prove the transparency of Halal meat at the whole supply chain.

(2) Cloud technology

Cloud computing revolution has surrounded by the ICT industry and added new concepts. Cloud application is one of the new concepts developed and designed to be hosted by software as a service (SaaS), which is one of a cloud computing service delivery models. (Elsanhouri et al., 2012) According to National Institute of Standards and Technology (NIST) stated a definition of cloud computing that is "a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources such as networks, servers, storage, applications, and services that can be rapidly provisioned and released with minimal management effort or service provider interaction." Moreover, five essential characteristics of cloud computing also described as below:

- On-demand self-service. A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service provider.
- Broad network access. Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms (e.g., mobile phones, tablets, laptops, and workstations).
- Resource pooling. The provider's computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand. There is a sense of location independence in that the customer generally has no control or knowledge over the exact location of the provided resources but may be able to specify location at a higher level of abstraction (e.g., country, state, or datacenter). Examples of resources include storage, processing, memory, and network bandwidth.
- Rapid elasticity. Capabilities can be elastically provisioned and released, in some cases automatically, to scale rapidly outward and in ward commensurate with demand. To the consumer, the capabilities available for provisioning often appear to be unlimited and can be appropriated in any quantity at any time.
- Measured service. Cloud systems automatically control and optimize resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service (e.g., storage, processing, bandwidth, and active user accounts). Resource usage can be monitored, controlled, and reported, providing transparency for both the provider and consumer of the utilized service.

Cloud offers three service models including: Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS) (NIST, 2012).

- Software as a Service (SaaS). The capability provided to the consumer is to use complete application functionality that running on a cloud infrastructure. The consumer does not manage or control any cloud infrastructure (network, servers, operating systems, storage, or even individual application capabilities).
- Platform as a Service (PaaS). The service provided to the consumer is to deploy consumer-created or applications on the cloud infrastructure by using programming languages, libraries, services, and tools supported by the provider. The consumer does not manage or control the cloud infrastructure (network, servers, operating systems and storage) but has a control over the deployed applications and possibly configuration settings for the application-hosting environment.
- Infrastructure as a Service (IaaS). The capability provided to the consumer is a full computer infrastructure (processing, storage, networks, and other essential computing resources). The consumer also has a control over operating systems, storage, and deployed applications.

Methodology

The aim of this paper is to focus on PaaS which is suggested to choose for using in the proposed framework. Therefore, PaaS offers the services which support the deploying application on the cloud infrastructure. This feature of the service model PaaS serves the convenient on scalability which developers mostly do not concern. Moreover, PaaS is flexible to use the infrastructure services without concerning about the complexities, or the technical details as using services for developing another service to provide one more service.

From the figure 1, the integrated traceability system of Halal meat supply chain with cloud technology framework shows that Halal meat supply chain applies with RFID technology according to the technological Halal supply chain framework that was proposed by Bahrudin et al. (2011) and integrated this tracking system into a web application for the tracing ability on PaaS that supports the application running on cloud technology.

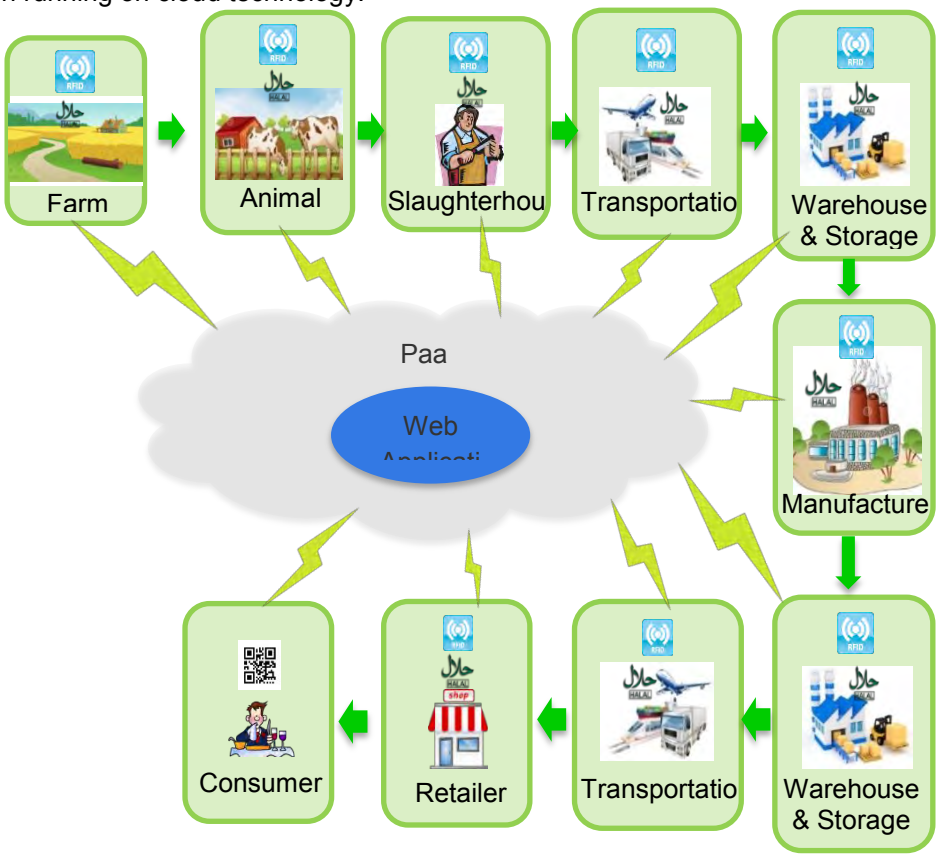

Figure 1: The integrated traceability system of Halal meat supply chain with cloud technology framework

Stages	Radio Frequency Identification (type)	Technology
Farms and Animal farms	Active (for monitoring)	RFID, Web application on cloud
Slaughterhouse	Active (for monitoring)	RFID, Web application on cloud
Manufactures	Passive (for monitoring), Semi Passive (for inventory)	RFID, Web application on cloud
Warehouse & Storage	Passive (for monitoring), Semi Passive (for inventory)	RFID, Web application on cloud
Transportations	Semi Passive (for monitoring), Active (for inventory)	RFID, Web application on cloud
Retail	Passive (for monitoring), Semi Passive (for inventory)	RFID, Web application on cloud
Consumers	-	Quick response code (QR code), Web application on cloud

Table 2: The classification of RFID and technologies for traceability in Halal meat supply chain

Table 2 the classification of RFID and technologies for traceability in Halal meat supply chain shows the suitable category of the RFID that proposed by Bahrudin et al. (2011) for each stage of Halal meat

supply chain and the technologies that support the tracing of information relevant Halal meat product. This integration is combined the notable of RFID that is the efficient technology for tracking and tracing solution on supply chain. It is a promising technology that is intended to replace the conventional barcode system by enhancing the ability of automatic identifying, tracking, and trace products throughout the supply chain. It also support related problems including monitoring, informing and updating data or product status (Bahrudin et al., 2011) and cloud technology with a real time updating, a one channel communication throughout the supply chain (from farm to fork), reduce time and investment (cost and resources), no limitation for accessing (anytime, anywhere and any device) and consumers can get the convenient channel for accessing to product's information, history, even giveback an opinion and etc.

Conclusion

Accordingly, Islam is a religion governed by rules and customs. Muslims are supposed to make an effort to obtain a good quality of Halal food. It is the religious obligation consuming only Halal food (Alqudsi 2014). Moreover, the increasing awareness of Muslims all over the world on their obligation to consume food, based on Islamic dietary requirements (Ambali and Bakar, 2012) and the critical segment in Halal food is Halal meat. When Halal meat requires the complex condition according Sharia and Toyyiban and more increases especially consumers' lifestyle changed. Halal meat supply chain is a significant segment not only the issue of needs concerning in Halal meat supply chain procedure itself but demands from the current market where the consumption of processed food or instant freezing food responded their hastily life. Since, the meat which is a main ingredient is always complex in its history, the solution is the transparency. The transparency is the essential factor which can (1) increase the positive perception and cognition, and (2) build trust of the product by (1) providing the reliable and clear information, (2) facilitating the access of the channel contained the necessary information as well as (3) the exposure source of Halal awareness which is being a requirement for traceability system in Halal meat supply chain.

These result the combination between *RFID technology* being used for Halal meat tracking system in the specific procedure of each stage in Halal meat supply chain and the *web application on cloud technology* being used for tracing the information related to Halal meat product through the whole supply chain. Furthermore, the advantages of both tools can fulfill the lack of reliable source and response to the modern lifestyle which reveal the essential of internet.

Therefore, the framework of tracing of Halal meat supply chain with cloud technology for enhancing consumer satisfaction attempts to show the importance of the unique requirement of Halal and the necessary of technology. According to Ambali and Bakar (2012), the consumption of Halal which is not only an obligatory in serving Allah but obedient to Halal shows that material and ingredient are not harmful to health. Since, Allah permits them only what is good for human existence, the hygienic, safety and cleanliness are strongly emphasized in Islam via Halal. Technology then, is become to be necessary in the modern scenario and has to be concerned as a critical issue along with their religious.

Further, empirical studies which emphasize on the development and deployment stages can be carried out to validate the needs of tracking and tracing system of Halal meat supply chain on the cloud technology.

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TRACEABILITY AS AN INTEGRAL PART OF SUPPLY CHAIN LOGISTICS MANAGEMENT: AN ANALYTICAL REVIEW

Dharmendra K. Mishra[1], Sebastien Henry[2], Aicha Sekhari[1], Yacine Ouzrout[1]
[1] University Lyon 2 Lumiere, DISP Laboratory, France
[2] University Claude Bernard Lyon 1, DISP Laboratory,France

Introduction

Success of company depends on its ability to compete in global market. The competitive markets require that business supply chains are highly agile, effective and efficient (Helo p. Et al., 2014). To achieve the above goal, company need to determine the status (Identity, location, processing history, physical status etc) of the product in supply chain. Every stakeholder either the manufacturing team, distributer, supplier, retailer or the users in the business supply chain must know the products information throughout its life cycle. Traceability is a system companies use to know the status of the product in supply chain. The global traceability system is among them which manufacturers use in order to control their production processes. According to Webster's Dictionary, "Traceability is the ability to follow or study out in detail, or step by step, the history of a certain activity or a process". Thus product's traceability can be defined as the ability to follow the product's data and information from its conception to end in the supply chain. Traceability helps the industries in optimizing supply chain, knowing market status, improving product's quality etc. It also makes consumers safer by providing detailed information about where an item comes from, what its components and origin are and about its processing history (Regattieri A et al., 2007). The EU legislation to keep traceability system makes food industries mandatory to implement the traceability system. But to keep the traceability system just to satisfy the legal requirements will be a financial burden for the companies. It is necessary to make aware the companies that traceability is something more that helps them to sustain in the market. It helps not only to control the production process but also to make the market strategy, set dynamic pricing and quality control. There must be a proper balance between order processing, inventory management, manufacturing, warehousing and distributing to sustain in the competitive environment. Logistics management helps the companies to meet these requirements for which every actor must know the product's data and information at every point in supply chain. The supply chain is complex today and thus there should be an efficient system to integrate the whole production process that trace and track the product's and process information in the business supply chain. And thus traceability is an integral part of the supply chain logistics. In this paper we analyse the literatures related with logistics and traceability and give our recommendation based on the research gap that will be helpful for further researchers to develop and implement such system.

Traceability

The supply chain has become more complex as the products move up and down more frequently from/to various points. There are many actors involved in the product supply chain and hold lots of information and data. The industries need to maintain product's quality to protect their brand as well as to sustain in the competitive market. A sudden recalling of product can save people's life when a product which are directly related with their health, are found contaminated or with low quality standard. In this case, the manufacturers must identify the origin of the problem and location of the product. These are some issues which demand the visibility of the products in whole supply chain and traceability is a system which supports to address all these issues.Traceability is the ability to trace the history application or location of an entity by means of recorded identification throughout the supply chain (ISO 8402:1995).
Traceability is often discussed as two linked process:

1. **Track:** Ability to physically locate articles or items inside a facility - to a specific location or to identify articles or items used to fulfill an outbound sales order *(e.g., where it is and where it went)*.It is the process of finding the product in downstream in the supply chain.
2. **Trace:** Ability to search historical records identifying manufacturing processes and the source of ingredients or components, etc. *(e.g., how it was processed and what was done).* It is the process of finding the products data in upstream in the supply chain.

Traceability is also discussed in terms of internal and external traceability. In the internal traceability, the traceability partner receives one or more traceable items that are processed internally to create another one or more traceable item(s) (GS1). The internal process may include processing raw materials, packaging, storing in the warehouse, or destroying. External traceability is the term used to

describe the flow of the product in supply chain. Here, a traceability partner receives a traceable item and handed over to one or more traceability partner(s) (GS1). That is, external traceability tracks the location of the product in the supply chain during its physical flow. Traceability is also defined by considering three parameter space(s), time (t) and volume (v) (Samarasinghe R., 2009). By space it is meant that the traceability system finds the location of the products and process. Similarly by the term t means when the information is traced and finally v reflects the volume of the information traced.

Benefits of traceability

To have the product's information from its conception to end is the key to success of any company and traceability system is a best tool to access and disseminate the information. It helps every actors in the supply chain to add value on the production and distribution system from planning to disposal of the product and thus to achieve innovation in product designing process. Some of the key benefits of the traceability system are described below.

1. Transparency: The actors in the supply chain need to know the product's know how status to plan and act. Users of the product must have to know all the details of the product like ingredients of the product, processing history, date of manufacture and country of origin etc. The product manufacturing process from conception to end should be transparent so that the actors access these information whenever needed. Traceability helps to maintain the transparency throughout the supply chain.
2. Quality Control: Customer satisfaction is key for the company to sustain in the market. The customer satisfies when they have confidence in using the product and can get every information about the product when they need. Company need to adopt zero tolerance in the quality control mechanism during the product manufacturing process. Whenever a quality related issue is brought into the notice of any actors in any point of supply chain, a proper and immediate action need to be taken to improve the design and manufacturing process so that proper remedy action can be taken in the next lot or batch of the production. For this, the actors have to trace back in the supply chain and have to find at which point and what errors in the production has been occurred. A traceability system with trace back capability helps the actors to manage the quality control process.
3. Reduce time to market: Traceability system tracks all the related information on every point in the supply chain creating a bond between every departments of a company from order processing through inventory management, processing, packaging, warehousing and despatching. This information helps the actors to act on time so that all the ordered products are manufactured and sent to market on time. This helps in overall cost reduction of the production process and thus increase the profit of the company.
4. Fighting Product Counterfeiting and protecting brand: A company gains brand through years of experience of designing innovative product, maintaining the quality and thus by winning the customer satisfaction. This brand will be collapsed in a second when some fraud products with same brand having low quality appear into the market. Traceability helps to track the original product in the supply chain and thus helps the actors in fighting product counterfeiting.
5. Improvement in SCM: Traceability system helps to improve the efficiency of supply chain management process by reducing the cost mainly logistics, providing all the information from product conception to retail in the market (Bosana T. and Gebresenbet G., 2013). This improvement increases the collaboration among the supply chain actors and thus develops their economic and technical competence.
6. Increase intactness with consumers: As discussed before customer's satisfaction is key to business success and the satisfaction is achieved when we reach to the customers. More the product information we provide to customers more will they close to the product and manufacturers. With a proper traceability system, consumers can access the product related information anytime they need and thus help actors to intact with them.
7. Increase competence: To know customer's buying behaviour for a company is necessary to manufacture the product in needed time and launch accordingly in the market. For a retailer the traceability database allows him to know which product is sold in which quantity and in which season. Similarly he also knows about the type and brand of the product sold and thus he can accordingly decide what volume of specific product he should order in which time so as to meet the customer's requirements. This helps him to increase his confidence to compete with the competitors. It also may be the source of competitive advantage of supply chain

partners because the traceability system helps to increase efficiency of SCM by solving the product's safety problems, enabling the company to understand its logistic system and enabling them to produce the quality products on time (Bosana T. and Gebresenbet G., 2013).

The above are some of the benefits company can take by implementing the traceability system. In the next section we present the analysis of related works.

Related Works

A company witness a huge financial and brand loss if it does not able to deliver the product on right time in the market. Proper production control process not only helps to manage the order but also helps the company to innovate the product designing process and logistics traceability is best tool to achieve this. Automatic traceability system has great impact on the supply chain from reducing the profit loss to the quality control (Sahin E., Dallery Y. Et al. 2002). In their work, the authors opine that traceability system helps the actors to analyse the customer behaviour and gives the proper knowledge of out of stock situation (Sahin E., Dallery Y. Et al. 2002). In their work X. Wang and D. Li opines that to have the traceability system to just meet the legal requirement will add extra cost burden to companies (Wang X. and Li D. 2006). And thus they discus to integrate the traceability system with supply chain process. The traceable data can be used to innovate the business process to achieve and implement better production control and inventory management. The authors also opine that the benefits of the traceability system include production efficiency through overall quality improvement, promotion management and dynamic pricing and improvement of supply chain logistics and distribution process (Wang X. and Li D. 2006). In another work, a RFID based traceability system is implemented to manage the logistics process of aftermarket automotive parts distribution of a Tibetan company (Liu C.S., Trappey C.V. et al 2008). In this work the author compared the as-is model with the to be model of the logistics process from make order through make invoice, pick and sort goods etc to transportation and proved that the proposed traceability model reduces the time spent on these process by 60%. J. Zhang, P. Fenget et al identified the requirements of traceability system and proposed EPC/RFID based traceability process and architecture model (Whang J., Feng P. Et al. 2008). The supply chain is complex today and as such every actors must act effectively to make the supply chain efficient. R. Samarasinghe et al in their work identified that due to the complexity of supply chain, there should be an efficient system to integrate the whole production process and to trace all the product and process information to maintain the quality and thus they opined that traceability is an integrated part of supply chain management (Samarasinghe R., Nishantha G.G.D et al 2009). In this work, authors implemented a central traceability system where an interface is made to connect the stakeholders enabling the total traceability that is vertical and horizontal traceability. In phase one, a solution was proposed for the SME's where the paper records are scanned and put in the local data base which is then connected with database of the main company for the purpose further tracing the production process (Samarasinghe R., Nishantha G.G.D et al 2009). A traceability system based on EPC global network was developed to collect RFID data and RFID events to trace and record the logistics information (Minbo L and Chen C. 2009). Many works suggest that RFID is important and efficient tools to develop the traceability system. An RFID system consists of an antenna and a transceiver, which read the radio frequency and transfer the information to a processing device, and a transponder, or tag, which is an integrated circuit containing the RF circuitry and information to be transmitted. The required product's information are stored in the RFID tag which are traceable by the RFID reader at any point in the supply chain within 10 meters range. Unlike barcodes, there does not need to be direct line of sight between the tag and reader. An integrated logistics based on RFID and barcode for the dairy products was proposed by Y. Zhang et al. Here the information from raw material gathering, processing, packing, storing and distributing is traced and stored in the database for further access by the stakeholders in supply chain from product manufacturer to consumers (Zhang Y. and Wang L 2009). People are more concerned to know the quality information specially for the food product before using it. So a proper system must be implemented that will provide all the information to the

users on the requested time. Bosona T et al in their work opines that traceability is an integral part of logistics management and propose a new definition of food traceability stating that it is the part of logistics management that capture, store and distribute the adequate information (Bosona T., Gebresenbet G. et al 2013). In this work the author analyzed the driving force, benefits and barriers of implementing food traceability system and suggested that chain traceability is required which is the part of integrated logistics system. They also suggested that further researches have to be done on the sector of technological aspects, link between traceability system and production system, standardization of information exchange, awareness creation and the efficiency of traceability system (Bosona T., Gebresenbet G. et al 2013). The general impression is that traceability is highly beneficial for the optimization of production process and it will be more beneficial if this system is integrated with logistics management due to the complex nature of the supply chain.

Analysis and Practical Issues

The literatures presented in the above section mainly focus on developing the traceability system is beneficial to the company and suggest developing such system based on RFID. There are very few works that have discussed about the complexity issue of supply chain. No work addressed to manage such issue.

The supply chain is very complex today. There are multiple layers of actors both horizontally and vertically. A manufacturer is producing more than one product and at the same time it has more than one supplier for the same products or the parts of the product. Fig 1 below shows the multiple layers of the supply chain.

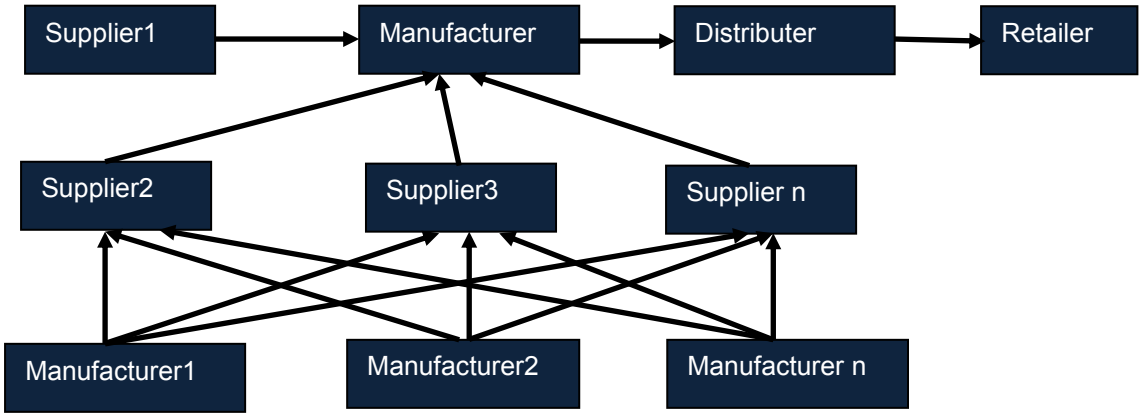

Fig. 1: Complex Supply chain

As shown in the figure, there is more than one manufacturer giving the parts or the product to the same supplier. Likewise there is more than one supplier supplying the same products or its parts to one manufacturer. This complexity could go further deeper in two directions. From the traceability point of view, these actors have two types of data viz. private and public. Public data is shared among all the actors but they don't want to share the private data globally. Fig 2 below shows the interrelation between the data of the multiple trading partners in 2 levels. To make supply chain effective, efficient and agile, the data and information of the product at every point of the supply chain must be traceable. For example, if a product is found faulty in any point of supply chain from initiation to the use phase, it must be needed to identify the causes of the problem for which actors must supply all the related information either it is private or public. In the global supply chain, where trading partners are dispersed across the globe may not know each other and in this case it does not give some information for example processing history of the product to other partner. But this information must be needed to identify the cause of the problem. This is a major challenge in current supply chain management process. In order to make the supply chain agile the actors must act in collaboration but

there are two reasons which make actors not to act in collaboration. First is , there is a level of mistrust between the actors because every actors don't know every other in the global supply chain and the second is all the actors have their own traceability system and thus there will be data alignment problem. There is a problem of the information extraction between the actors. A common understanding is needed among the actors to use same standard for their traceability system but it is really difficult to make it possible. Similarly, there exists some SMEs in the supply chain which don't have enough budget to implement the IT system. They are still using the paper based traceability information and in this case again there will be the problem of information extraction.

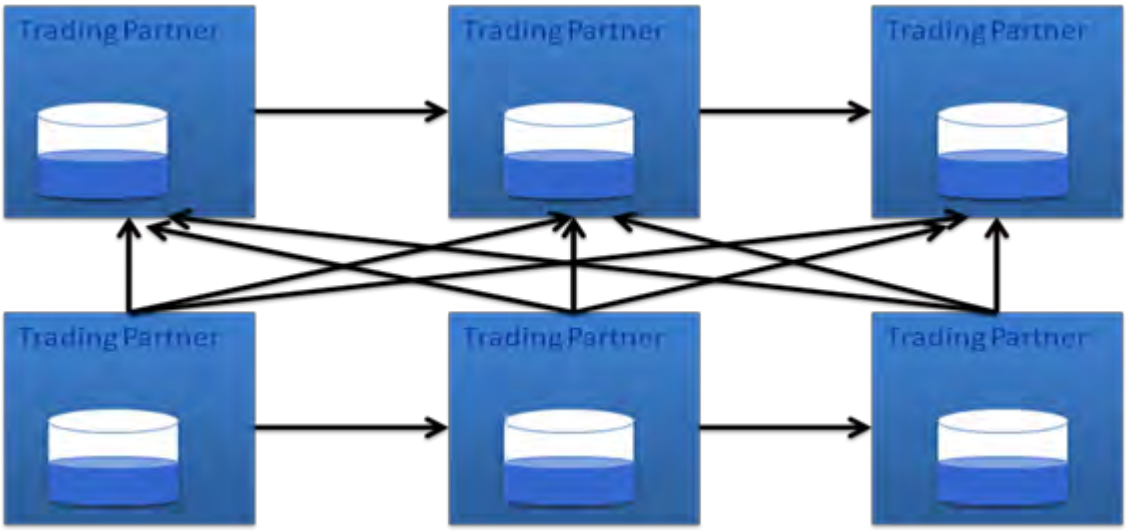

Fig 2: Information exchange model

Based on the above discussion we find three issues which are needed to be solved.

1. How to make collaborations among multi-stakeholders in supply chain?
2. How to align the Information systems among the stakeholders?
3. How to effectively store the data to maintain privacy and security (Location Transparency)?

A proper model must have to be designed to address the above stated issues. Fig 3 shows an integrated traceability model.

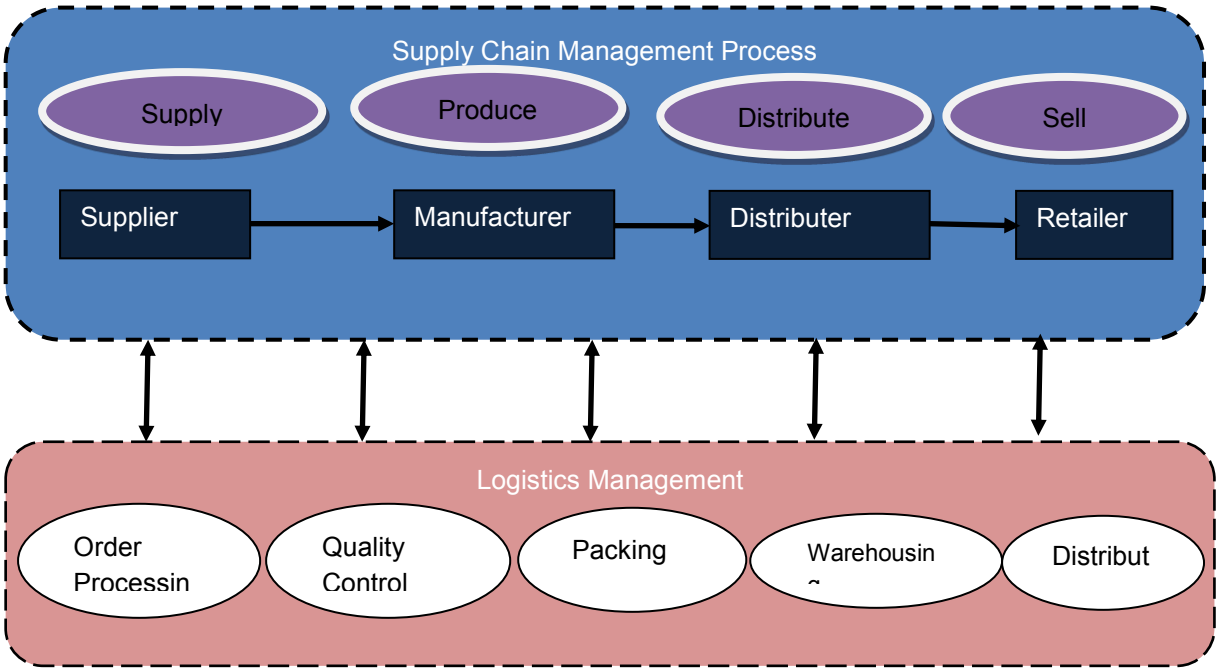

Fig. An integrated traceability Model

An integrated traceability model with logistics management have to incorporated because company's success depends not only on just to have the products data but also it is needed to use those data in the logistics management which help them to manage all the process from order management through processing, quality control, packaging, warehousing, to distributing. This is a key for the company to sustain in the market and accordingly succeed.

Conclusion

Growing competitive markets demand the companies to have their supply chain management process agile, effective and efficient. To achieve this companies need the product's data and information throughout the supply chain. An automatic traceability system allows them to track the location of product in downstream and trace the processing history and other treatment of the product in upstream in supply chain. But the supply chain is complex today and all the actors are dispersed geographically around the globe. They don't know and trust each other and thus don't want to share some crucial information globally. This is a major challenge of implementing an efficient traceability solution. In this research we analyse the existing literatures about traceability system in the supply chain management process. Identify the major issues to be addressed to make the solution effective and finally we propose an integrated model with logistics management process to manage the overall production control mechanism. This work is useful for the further researchers to develop some model to address the issues discussed.

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TOURISM LOGISTICS STRATEGY WITH SUSTAINABLE DEVELOPMENT: IN CASE OF BANG SAEN BEACH, AS ECO-TOURISM DESTINATION IN THAILAND

Taweesak Theppitak
Faculty of Logistics, Burapha University, Thailand
E-mail : *taweesak99@hotmail.com*

Introduction

Nowadays, tourism has become a significant industry to Thailand's economy growth. It generates high revenues as compared with the revenues from exporting. The paper focuses on how to design and develop Bang Saen Beach, Choburi province, Thailand, to become eco-friendly tourism destination. Bang Saen Beach is an important and popular tourist destination, just out 80 kilometers from Bangkok, capital of Thailand.

This study applies principles of tourism logistics management to the tourism industry under the hypothesis that moving tourists from Bangkok to Bang Saen Beach more efficiently and effectively, including providing an effective transport networking system, would increase and support the tourism on Bang Saen Beach. A demand forecast was statistically calculated in order to provide recommendations for the improvement of infrastructure systems and facilities. The use of logistics in the tourism industry is currently recognized as a strategic tool for enhancing tourist satisfaction in relation to lower travel costs, one-stop services, other conveniences and safety.

However, the research study (Briguglio 1995; Bryden 1973) shows that traveling destinations, using tourism logistics concept is key success for developing destination sustainably. It is starting point for planning and developing infrastructure systems and facilities, including formulating strategies for transport networking and logistics systems to support the future sustainable growth of tourism industry.

Literature Review

This study reviews the literature related to the role of tourism to the economic growth of Thailand. It also considers the adoption of logistics management in the tourism industry, especially the beach tourism. Two relevant sources (Acharya 1995; Briguglio 1995; Bryden 1973) point out that logistics management contributes to the success of sustainable tourism development. These sources also review definitions of logistics and logistics management as they pertain to sustainable development of tourism, but no research identifies exactly what tourism logistics is and how it contributes to tourism success.

Logistics is mostly understood in term of business industries, with only a few research studies done exclusively in relation to tourism (Briguglio, Butler, Harrison and Filko 1996). People typically relate logistics (Bowersox & Closs 1996; Lambert, et al. 1998) to transportation or warehousing, particularly connecting it to aspects of material goods or information flow (Butler 1980; Theppitak 2006). As such, logistics is understood as a service-oriented process related to movement of physical and information flow. To apply logistics to tourism, people, or tourists, shall be considered as physical flow from one point to another, and examined in terms of lower costs, higher safety and more convenience through excellent coordination and collaboration (Bowersox & Closs 1996).

The authors (Butler 1980; Briguglio 1996) points out that before logistical planning for tourism infrastructure and facilities can be achieved, there needs to be an accurate demand forecast developed. Demand forecasting for tourism into the next decade is statistically calculated in order to provide improvement for infrastructure systems and facilities, which can in turn support growth and expansion. However, very few researches have been done in area of tourism logistics (Butler 1980; Conlin and Baum 1995). It also reveals patterns of tourist behavior and other factors influencing travel decisions, as well as identifies problematic issues with tourist destinations (Conlin and Baum 1995).

Conlin and Baum (1995) states that there is a relationship between adoption of logistics management in the tourism industry and the success of sustainable tourism development. For instance, logistics management can be used to consider moving people, or tourists, from one point to another point (Theppitak, 2006). It provides tools for facilitating how to prepare accommodations, how to build transport networks between and within locations to support sustainable tourism (see Figure 1). However, there is the gap for application logistics in tourism. This study applies a logistical approach to the tourism industry under the hypothesis that moving tourists from Bangkok to Bang Saen Beach

more efficiently and effectively, including providing an effective transport networking system, would increase tourist satisfaction on Bang Saen Beach.

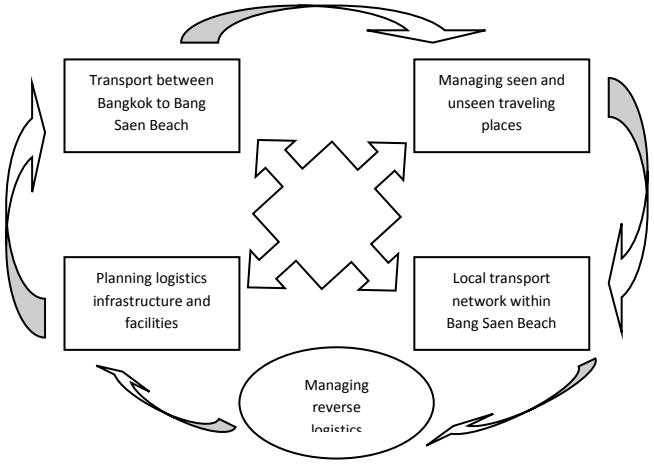

Figure 1 Relationships between activities in tourism logistics

When considering the factors affecting adoption of logistics management and planning in tourism, in particular, tourism on a beach, the literature points out the major factors are economic and political realities (Thor 1994). The research (Conlin and Baum, 1995) highlights the relationship between such factors and the adoption of logistics management, like fluctuating tourist counts and tourist satisfaction.

It concludes there is a literature gap related to the examination of issues related to adoption of logistics management (and its effectiveness) within the tourism industry, and specifically for a beach. It would be examined the factors contributing to the logistics adoption phase and the factors influencing sustainable tourism development. This study therefore proposes a theoretical framework (Figure 2) derived from a previous study (Theppitak 2006).

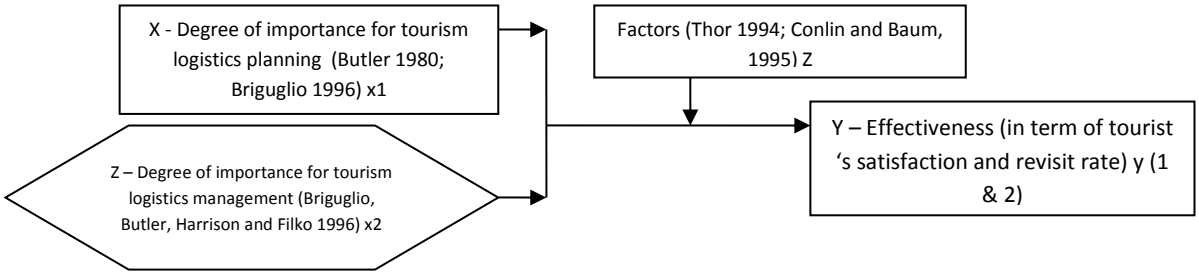

Figure 2 Theoretical Framework of the study

Figure 2 shows the theoretical framework of variables in this study. The literature review revealed that designing and building a sustainable tourism industry, especially tourism on a beach, required widely applied logistics concept and strategies. Success of sustainable tourism development requires a high priority of importance on logistics planning. The research points out that more importance placed on the logistics planning, the more effectiveness is gained for developing tourism (on a beach) in term of tourist satisfaction. A main objective is to find ways to improve tourist satisfaction.

This study examines relationship between variables (*X*, *Y, Z*), defining degree of importance to the adoption of logistics planning and logistics management as *an independent variable* (V*ariable X1* and X2) and defining the effectiveness of logistics management to tourism on Bang Saen Beach, in terms of tourist satisfaction (i.e. convenience, safety for transport network, infrastructure and facilities on Bang Saen Beach), and return rate of tourist as *a dependent variable* (*Variable Y1 and Y2*).

Furthermore, it discovered that factors, (i.e. economic and political) were significant to tourism logistics management and planning. These factors are defined in the framework as *an intervening variable,* (Variable Z), which influences both the independent variable (V*ariable X*) and the dependent variable (V*ariable Y)*. It was therefore assumed that the level of such influencing factors would have a correlation to the degree of adoption of logistics management, as well as to the effectiveness of any logistics used on destination.

Research Methodology

This study initially focused on issues related to design and develop of tourism in logistics perspective, including the examination of problems and opportunities occurring while development to tourism destinations. The objective was to investigate a relationship between variables related to the adoption of tourism logistics to Bang Saen Beach, as well as the effectiveness of logistics management for building sustainable eco-friendly tourism. The study collected data in *two* following dimensions: first, a *literature review* was conducted in various fields related to tourism logistics management. Secondly, *questionnaire survey and in-depth interview method* was used. Two pre-testing were conducted with Cronbach's alpha (α) at 0.91 and 0.92 respectively. To obtain the data, the study used a sample of 270 randomly selected tourists, which included both Thai and foreign tourists traveling on Bang Saen Beach. This number of face-to-face questionnaires was based on a randomly stratified sampling. The rate of response was very good, with 245 respondents, or 90.74 percent.

To answer the above issues, the study sought to define following questions; first, how are behaviors of tourists used to design infrastructure and facilities on Bang Saen Beach? Secondly, what are factors influencing the design and implementation of tourism logistics strategy on Bang Saen Beach? Finally, what are efficiencies and effectiveness of tourism logistics management? Under the questions,

hypotheses are established in order to examine a relationship between tourism logistics planning and management and the effectiveness of improving tourism on Bang Saen Beach.

H_1 = There is a relationship between tourism logistic planning and a degree of tourist satisfaction.

H_2 = There is a relationship between tourism logistic management and increasing return rate of tourists to Bang Saen Beach.

Finding Results

After conducting surveys with tourists in Bang Saen Beach over several months, it was found that most of these tourists well supported the rationale of this survey. The survey covers demographical data related to attitudes and behaviors of tourists when visiting Bang Saen Beach, including examining hypotheses. Implications related to transport modes; logistics infrastructure and facilities were discussed.

The result shows that gender of respondents. Male tourists made up the greatest number of respondents in the sample at 56.8 percent, followed by female tourists at 43.2 percent. The study represented real information for tourism on Bang Saen Beach and showed that the male tourists became a major target. When considering to the age of targeted tourists visiting to Bang Saen Beach. The result showed that 63.9 percent were between the ages of 13 to 28 years. Most of them, or 38.9 percent, had an age between 21 and 28 years. Secondly, 25.2 percent had an age between 13 and 20 years. The figure shows that the major targeted groups of tourists on Bang Saen Beach are now adolescent and young adults. It also shows the nationality of tourists. The survey revealed that most tourists came from Asian countries, 86.2 percent. Of this number, 68.2 percent were Thai tourists, with the remainder coming from other Asian countries (e.g. China, Taiwan, and South Korea) at 18 percent collectively. The result also showed a smaller percentage of tourists coming from western countries, especially European tourists. This result reflected that Thai tourists currently make up the major tourist group.

It shows to marriage status of tourists and reveals that the major tourist group, at 68.5 percent, was of single status. Only 27.9 percent of surveyed tourists were married. The result indicates that infrastructure and facilities on Bang Saen Beach should be considered accordingly, to support relevant activities, behaviors and lifestyles. It also points out to educational level of tourists that most of tourists or 87.4 percent have educational level lower than a bachelor's degree, and 12.6 of them were at postgraduate level. The results point to relevant expectation levels regarding lifestyles, traveling activities, facilities and infrastructure on Bang Saen Beach.

When considering to a career of respondents, the result reveals that major tourist groups were private employees (47.7 percent) and students (30.6 percent), for a combined total of 78.3 percent. This information points to a corresponding approach to infrastructure and facilities, which should be prepared and developed on Bang Saen Beach to facilitate these targeted groups. The study represents the average incomes of tourists and reveals that average income of most tourist groups, or 63.9 percent, was lower than 20,000 baht. The greatest number, or 23.4 percent, had income between 5,000-10,000 baht. This income data should facilitate researchers to design and develop proper infrastructure and facilities on Bang Saen Beach, consistent with targeted tourists' income. It also reveals the frequency of travel to Bang Saen Beach per tourist (excluding their current trip at the time

of the questionnaire). The result showed that most tourists, or 44.8 percent, had traveled to Bang Saen Beach several times. Only 22.4 percent of them had traveled there only one time. This frequency of tourism to Bang Saen Beach reflects an overall perception of satisfaction for tourists in Bang Saen Beach. For traveling period to Bang Saen Beach, the result revealed that most tourists, or 67.8 percent, visited between October-December. This period defines a peak seasonal period of tourism.

When considering to traveling behavior of tourists, it indicates that the greatest percentage of tourists, or 71.2 percent, came with their friends. Only 19.8 percent came with family. This information will help facilitate relevant designs and patterns of transport, as well as for infrastructure and facilities to support sustainable tourism on the beach. For the number of people per tourist group, it shows that the greatest number of tourists or 58.6 percent identified that their group had one to five tourists. Next, 22.5 percent of them identified six to ten tourists per group. This information points to how building infrastructure and facilities should be built consistent with targeted tourist groups. The pattern of vehicle to Bang Saen Beach is revealed that most of the tourists, or 33.3 percent, traveled by personal car, 30.6 percent of them visited by bus, and 17.1 percent by tourist bus, respectively.

The result shows the pattern of stay overnight in Bang Saen Beach and it points out that most of the tourists, or 87.0 percent, did not stay overnight. The tourists pointed out that proper infrastructure and facilities for overnight stays in Bang Saen Beach were unavailable and/or inconvenient. Only 13 percent of surveyed tourists indicated that they stayed overnight in Bang Saen Beach, typically for a long weekend or special holiday. For types of accommodation on Bang Saen Beach, it shows that the greatest number of tourists, or 58.1 percent, chose to stay at resorts. Next, 25.8 percent of them chose a hotel, and 16.1 percent stayed at private residents. This information reveals tourists' expectations regarding the pattern of accommodations on Bang Saen Beach.

Table 1 Summary of testing hypothesis and relationship between variables

Variable		Correlation	p-value
Independent	Dependent		
X1	Y1	+0.724	0.000
X1	Y2	+0.645	0.000
X2	Y1	+0.714	0.000
X2	Y2	+0.580	0.001
Z	Y1 & Y2	+0.340	0.001

Table 1 shows summary of hypothesis testing. The result reveals that adopting tourism logistics planning (X_1) would have positive relationship with tourist satisfaction (Y_1) and promote increasing tourists' return rate to Bang Saen Beach (Y_2). It also shows that effective tourism logistics management (X_2) have positive relationship with tourist satisfaction (Y_1) and promote increasing tourists' return rate to Bang Saen Beach (Y_2). Further, effective tourism logistics management (X_2) would increasingly encourage tourism activities and promote increasing tourists' return rate to Bang Saen Beach (Y_2). In term of tourism Logistics planning covers properly matching demand of tourists and services supply on the beach, including organizing logistics networks (e.g. linking between seen and unseen traveling places, transport, accommodation) within destination. Tourism logistics management covers how well logistics management is used to create and promote tourism industry on Bang Saen Beach, including providing reasonable costs, satisfying tourist need.

The result shows that factors, such as economic and political, were significant to tourism logistics management and its effectiveness. These factors, as *an intervening variable* (Z), influence both the independent variable (*X*) and the dependent variable (*Y)*. They (Z) have moderately relationship with logistics management and effectiveness.

Discussion and Implications

Logistics in the context of tourism would be defined as "the management of the flow of physical (including tourists or vehicles) and information (information related tourism)." In this definition, tourists are being considered as "goods," being moved from point to point. Transport system(s), between mainland and the beach, as well as within the beach, would need to be designed to support

the move of tourists in terms of lower costs, safety, comfort and convenience. Therefore, scope of tourism logistics also covers functions i.e. transport, infrastructure and facilities. (in Figure 1)

To support and foster more and better tourism on the beach, infrastructure (e.g. electricity, water and internet) must be readily available. Also, future tourist facilities (for all travel activities and including currently undeveloped areas) must be well planned and organized. These facilities should include hotels and other accommodations. If tourists are the goods, then hotels and resorts can be considered as warehouses or distribution centers. Proper demand forecasts of tourist behaviors and lifestyles are critical. In-depth and accurate logistics is the only proper way to prepare for future tourist accommodations, facilities and traveling activities.

Tourism logistics also includes reverse logistics activities. Reverse logistics can be defined as the management of the flow of materials or information back to a desired point. This methodology covers the management of garbage, or unusable materials, by tourists. Normally, there are many methods to manage garbage, with different costs occurring, including non-monetary costs like pollution. This study can also be used logistically to incentive and support sustainable, more eco-friendly tourism on Bang Saen Beach.

To improve transport systems between Bangkok and Bang Saen Beach, it would improve in two ways. First, reengineering existing transport systems by focusing on hardware (i.e. vehicle, facility, infrastructure and road network), software (i.e. information to tourists, programme) and peopleware (i.e. training serviced people with service-minded). Second, new efficient and friendly environmental transport system (i.e. cable car and underwater car) would be considered.

The result shows that importance level and satisfaction level which tourists have when travelling within Bang Saen Beach. Surveyed tourists revealed they had high expectation for the destination in respect to beauty and atmosphere, cleanliness, security and safety. As they are satisfied with these aspects of the beach. However, they indicated some dissatisfaction with cleanliness and sanitary system, as well as some concern for the safety of security systems used at some places of destination.

Managing tourism logistics in term of existing destinations is not considered only lower costs and higher services level, but it also means to manage the destination in routes and vehicles. Unseen travel places would be effectively established and promoted. Obvious and clear signs between destinations become a source of satisfier.

When considering the levels of importance and satisfaction tourists place on transport (and related logistics) while visiting on Bang Saen Beach. This study asked the tourists to rate the transport systems from Bangkok to Bang Saen Beach, as well as the transport systems within Bang Saen Beach, in various relevant areas. Most of the tourists indicated high expectations related to safety and the expense of transportation. The study also found that they were mostly satisfied with the availability and comfort of transport systems to Bang Saen Beach. However, they were somewhat dissatisfied with the safety of transport systems to Bang Saen Beach.

When considering the transport system within Bang Saen Beach, tourists had high expectations for price standardization, as well as for comfort and availability of transport. But, they were dissatisfied to actually find a lack of price standardization of transport within Bang Saen Beach. Logistical implication would consider in a whole system, and then set standard prices in each destination. The difficulty is how to communicate and motivate to local people for following to same standard without their resistance and conflict.

Infrastructure required for supporting tourism on the beach, it included electricity, road, water, and telephone systems. Survey results revealed that most of the tourists (more than 75 percent) did not stay overnight in Bang Saen Beach, but rather returned to stay overnight in Pattaya. The question is that why tourists did not stay overnight on Bang Saen Beach. The results showed that most of tourists identified to unavailability and inconvenience in term of shortage, including high prices compared with earned services. They had high expectations for the costs and availability of tourism infrastructure in Bang Saen Beach. But, they were dissatisfied with the actual fees charged for services and the availability of infrastructure.

These results reflect that there is a need to rethink and analyse a whole system. It would commence with forecasting future demand to provide properly infrastructure and facilities. The study examine an appropriate methods and found that seasonal time series would be the demand forecasting model which fits to tourism on Bang Saen Beach. One of potential problems is garbage and pollutions occurring from tourism (appropriate 6-12 tons a day). Now the issue is increasingly becoming serious problems to friendly environmental tourism. It needs to apply concept of effective reverse logistics for creating and enhancing sustainable, eco-friendly tourism on Bang Saen Beach.

In summary, the *main research finding* reveals that:

- tourism logistics planning (X_1) would have positive relationship with tourist satisfaction (Y_1) and promote increasing tourists' return rate to Bang Saen Beach (Y_2).
- effective tourism logistics management (X_2) has positive relationship with tourist satisfaction (Y_1) and promote increasing tourists' return rate to Bang Saen Beach (Y_2).
- These factors, as *an intervening variable* (Z), influence both the independent variable (*X*) and the dependent variable (*Y)*. They (Z) have moderately relationship with logistics management and effectiveness.
- Factors (Z) (i.e. economic, and political) have a moderate and positive relationship to tourist satisfaction (Y_1 and Y_2) and they influence to decision making for traveling at Bang Saen Beach.
- Lacking of effective demand forecast method creates problems in mismatching between supply and demand, preparing infrastructure and facilities.
- Transport (between Bangkok and Bang Saen Beach, and within Bang Saen Beach) contributes to tourism's satisfaction and tourism promotion success.
- Bang Saen Beach effectively lacks tourism logistics planning and management in term of sustainable development.
- Garbage from tourists is increasingly becoming serious problem, it needs to design effective and efficient reverse logistics systems.
- Finally, it concludes that effective tourism logistics management is a key success to tourism on Bang Saen Beach.

Conclusion

The results show that using a logistics concept for tourism, especially on the beach, would increase effective, sustainable, eco-friendly tourism. A demand forecast of tourism for the next ten years must be considered to effectively design and develop smooth flow patterns for future tourists, along with providing sufficient and appropriate infrastructure and facilities. It points out that a seasonal time series would be an appropriate model of demand forecasting. It reveals that in the next decade, tourism in Bang Saen Beach would increase to twice its current level. This result must be taken into consideration for designing transport (and related logistics systems) from Bangkok to Bang Saen Beach.

Today, more than 300 street food shops in Bang Saen Beach are increasingly complex and sophisticated to tourism management. Effective design for future infrastructure systems and facilities must support sustainable tourism in Bang Saen Beach. Likewise, development plans and redesign for new destinations must be included an appropriate action plan to managing environmental pollution. Finally, garbage management could be effectively planned using a reverse logistics system, as rapidly increasing garbage has become a problematic issue related to the logistics of maintaining a green, eco-friendly environment.

It provides valuable information for stakeholders, especially tourism related government agencies and Tourism Authority of Thailand, to plan and develop infrastructures and facilities for beaches, and specifically Bang Saen Beach. Logistically planned transport management can facilitate growing tourist travel to and from Bang Saen Beach, providing hotel, resort and residential-accommodation owners with consistently increasing demand, while also preventing the unrestrained destruction of natural resources and environments on the beach. This study leads to the conclusion that strategic and integrated logistics management is required, with active participation from all relevant stakeholders.

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THAILAND TRANSPORTATION INFRASTRUCTURE PERFORMANCE: DEVELOPMENT AND MEASUREMENT

Krirkchai ASSAVAVIPAPAN, Sathaporn OPASANON
Sasin Management Consulting (SMC), Thammasat Business School

Introduction

Geographically, Thailand is located at the centre of the Indochina peninsula in South East Asia. With her strategic location, Thailand is emerging as a major logistics hub to South China and neighboring countries of Indochina. As more Thai businesses engage in international trade in light of the formation of Asian Economic Community (AEC), the improvements in transportation infrastructure and facilities will continue to be mandatory. Therefore, Thailand's government, along with private investors, have for several decades been investing in large civil infrastructure projects throughout Thailand, many of which are aimed at improving the efficiency of logistics operations. (Paraphantakul et al, 2012). Whilst massive investments have been made in the development and upgrading of transportation infrastructure, its performance is still questionable. To the best of our knowledge, no attempt has been made in aggregately evaluating the performance of Thailand's existing transportation infrastructure. This lack of infrastructure performance makes it difficult for Thailand's policy makers to make effective decisions on future infrastructure development projects (Thailand Infrastructure Annual Report, 2008).

This research addresses the problem of determining the efficiency of the existing transportation infrastructure in Thailand. Specifically, a set of performance indicators of Thailand's transportation infrastructure performance is proposed. Related available data are reviewed and gathered. A national composite index of transportation infrastructure performance is developed to account for the overall performance. The last part of the research is dedicated to aggregately investigating the performance of Thailand's transportation infrastructure during 2005-2010.

Literature Review

Thailand Transportation Infrastructure

Transportation infrastructure is one of the factors enhancing country's competitiveness. Thailand has been rated in the top four of infrastructure quality assessment including transportation infrastructure performance among ASEAN countries following Singapore, Malaysia and Brunei, respectively (Schwab, 2011). To account for all possible modes of transportation for both passengers and freights, the transportation infrastructure addressed in this research is decomposed into 5 categories including road, rail, air, water and transit.

Land transport is the most widely used mode of transportation in Thailand, accounting for approximately 80% of domestic transportation (Ministry of Commerce, 2011). In terms of international transportation, it tends to increase as there is demand for more linkages among ASEAN countries and China. Road infrastructure comprising motorways, national highway and all other highways, becomes the major mode for the movement of goods domestically, accounting for 80% (Ministry of Commerce, 2011). Rail infrastructure encompasses transportation by diesel engine railway on single, dual and triple rail tracks. This also includes all transport activities within the Inland Container Depot (ICD) at Ladkrabang and Bangsue Railway Junction. Air transportation infrastructure represents the infrastructure associated with six major international airports of Thailand, including Suvarnabhumi Airport (Samutprakarn), Donmuang Airport (Bangkok), Chiang Mai Airport, Chiang Rai Airport, Phuket Airport and Hatyai Airport (Songkhla). In 2011, international and domestic transportation of goods via airport accounts for 0.3% and 0.02%, respectively. It also takes up a 6% share of passenger transportation.

Waterway transportation infrastructure accounts for facilities in association with five main international ports in Thailand, including Bangkok Port, Laem Chabang Port (Chonburi Province), Mabtaput Port (Rayong Province), Sriracha Port (Chonburi Province) and Songkhla Port. In 2011, marine transport has a substantial share of 88% of international freight transportation (Ministry of Commerce, 2011). Mass transit transportation in Thailand can be classified into 3 categories, including public bus services, rail-based mass transit systems, and bus rapid transit (BRT) system. Transit transportation infrastructure covers infrastructure for public transport under the management of the Transport

Company Limited and Bangkok Mass Transit Authority, Metropolitan Rapid Transit system (MRT), Bus Rapid Transit system (BRT), Bangkok mass transit system (BTS) and Airport Link.

Transportation Infrastructure Performance Assessment

Many researchers have proposed transportation infrastructure performance measurement tools to assess the efficiency of existing infrastructure, to identify areas for improvement, and to use the obtained data to effectively communicate with relevant stakeholders. Bogetić and Fedderke (2006) conducted a comprehensive performance assessment of South Africa's infrastructure, one of which is transportation using the World Bank database. This research intends to systematically benchmark its infrastructure with other countries using objective and perception-based indicators. Since, it could identify such country's strengths and weaknesses relatively, the outcome is applicable to infrastructure development policy and its strategic direction.

Several researches focus on assessing infrastructure performance of a particular transportation mode. For instance, Humphreys et al. (2002) review current practice in the performance of airports comprising business, service and environmental aspects. The study identified the factors that have influenced the performance of airport such as traffic profile, location, and so forth. It concludes that a great understanding of an airport's context is prerequisite before conducting a performance measurement and comparing performance with other airports.

Langen et al. (2007) reviewed existing indicators and proposed a new set of indicators for measuring port performance by exploring indicators used in leading port authorities and similar infrastructure such as airports and industrial parks. It suggests that with the use of the most suitable set of indicators, performance measurement can play a critical role in enhancing the efficiency of the port.

Kunadhamraks and Hanaoka (2007) proposed fuzzy set techniques to evaluate the logistics performance of intermodal transportation in Thailand. They recorded data and structured them as hierarchy framework, based on 4 criteria, i.e. logistics cost, service quality, reliability and security. The results assert that the lack of coordination among modes limit the attractiveness of intermodal system.

Ahren and Parida (2009) studied the factors influencing the railway infrastructure performance. They developed a conceptual overall railway infrastructure effectiveness model to be applied with Swedish rail network. The model considers 3 dimensions including infrastructure availability, performance rate (total time), and quality rate (reliability and safety). The findings indicate that the proposed model can be implemented as a key performance indicator for supporting the decision making process.

Hermans et al. (2009) studied risk factors related to road safety performance, and proposed a procedure for constructing a road safety performance index. The methodological step includes selecting appropriate indicators, collecting and analyzing data, assigning a weight and aggregating indicators, testing the robustness of index, and computing the final index scores. This method provides a comprehensive tool in conducting performance measurement.

The U.S. Chamber of Commerce initiates a project to study the relationship between infrastructure performance and economic growth. The project started in 2010 to undertake the study of "Infrastructure Index: Measuring and Benchmarking Infrastructure Performance" under the Let's Rebuild America project, aiming to develop index to measure the efficiency of the U.S. infrastructure, and to determine how it affects the economy. The procedural steps for constructing the indices include defining each mode of transportation infrastructure, identifying representative samples, creating hierarchy model, selecting appropriate indicators, compile data and weighting, and lastly calculating the index. Indicators used for transportation infrastructure performance index of the United States of America are available in the study of "Measuring and Benchmarking Performance" (U.S. Chamber of Commerce, 2010).

Some Thai researchers studied the effect of infrastructure investment on economic growth. Bussarakam (2004) investigated the relationship between transportation infrastructure investment and Thailand's gross domestic product. The paper also analyzed the impact of private and public funds on 3 sectors including agriculture, industrial and service sector by using Ordinary Least Square Method. The result shows a variety of relationships, for example, public investment has no effect on industrial productivity while private does.

Jorsa (2008) studied how transportation infrastructure investment affects the growth of each economic sector (agricultural, industrial and service). It is concluded that not all the investment would go in the same direction as economic growth. For example, the investment of air transportation infrastructure will have an effect on agricultural sector growth after the investment has initiated for 3 years. However, it is found that the investment has no impact on industrial and service sector.

While the two previous research papers studied the relationship between transportation infrastructure investment and economic growth, they have yet to conduct an assessment of Thailand's transportation infrastructure performance.

Research Methodology

The methodology used in this research is based on the comprehensive seven-step process developed in the study of the U.S. Chamber of Commerce. To measure infrastructure performance, 3 criteria were set, comprising Supply (availability, proximity and coverage), Quality of Service (convenience, reliability and safety) and Utilization (capacity for future demand). These criteria are aligned with the objective of performance measurement, which mainly involves with effectiveness and reliability aspects (Bogetić & Fedderke, 2006).

Identifying Transportation Performance Indicators

In developing a set of performance indicators in the context of Thailand, there are some issues, which necessitate the adjustment of each indicator. Firstly, the measurement units used in Thailand is different from those used in the U.S. For example, in the case of Thailand, Railway Utilization is measured by 2 indicators: the number of passengers and freight volume per 100 track kilometer. Secondly, measurement in some indicators is not applicable in the context of Thailand. For example, the U.S. port congestion is measured by lock delay per tow whereas no lock is used in Thailand. As a result, unit of measurement is hereby altered to average waiting time for docking (Chavaviwat, 2012). Furthermore, the word "marine transport" is replaced by "waterway" in this study to include not only the sea and ocean transport but also inland water transport such as river. Lastly, unlike the U.S., intermodal facilities in Thailand are operated by railway authorities. That is, the ICD in Ladkrabang is under the management of the State Railway of Thailand, and therefore is included in the set of railway indicators.

After the TPI framework for Thailand is completely constructed, the next step is to collect past data for all performance indicators. The most critical issue arisen in the data collection process is the unavailability of data for some indicators in the TPI framework due to various factors e.g. no evidence of data collection exists in any associated government authorities. Consequently, some indicators that contain insufficient data were excluded.

Weighting Indicators

For index calculation, each indicator is to be weighted using a well-known multi-criteria decision analysis technique, the Analytical Hierarchy Process (AHP), based on select experts' managerial judgment and experience. The AHP was developed by Thomas L. Saaty for addressing problems that entail multiple criteria decision making. This technique has been implemented in various areas of research such as alternatives evaluation, resource allocation, planning and development, priority and ranking, forecasting, and performance benchmarking (Vaidya and Kumar, 2006). While the AHP consists of three key steps: (1) decomposition; (2) comparative judgments; and (3) synthesis of priorities (Korpela and Tuominen, 1996), only step 2 was adopted in this research to calculate indicator weights. The phase of comparative judgment is designed to determine the relative importance of each indicator through a series of pairwise comparisons.

In the process of weighting indicators, the AHP questionnaires were purposively sent out to Thailand's experts in the field of transportation and logistics to distinguish relative importance of each indicator. Particularly, the questionnaire sheet demands the experts to carry out pairwise comparisons of the indicators with respect to the level of importance based on a nine-point scale as suggested by the AHP. Data obtained from the questionnaires are then input into a matrix form to compute the weights (see Saaty (2002) for an overview of the AHP).

Research Findings

Framework of Transportation Infrastructure Performance Index (TPI)

Thailand Transportation Infrastructure Performance Index (TPI) framework developed in this research is shown in Table 1.

Mode	Criteria	Indicator Identification	Indicator	Source	Availability
Road	Supply	ID1	Road density	Department of Highways and Department of Rural Roads	2001-2010
	Quality of service	ID2	Road Travel Time Reliability		N/A (1)
		ID3	Road Safety		2001-2010
		ID4	Road Roughness		2004-2010
		ID5	Bridge Integrity	Bureau of Bridge Construction	2011 (2)
	Utilization	ID6	Road utilization	Department of Highways and Department of Rural Roads	1999-2010
Railway	Supply	ID7	Railway Density	The State Railway of Thailand	2000-2010
	Quality of service	ID8	Railway Safety		2003-2010
	Utilization	ID9	Passenger's Railway Utilization		2005-2011
		ID10	Freight's Railway Utilization		2005-2011
Airway	Supply	ID11	Proximity of airports (Access)	Airport Authority of Thailand and Department of Civil Aviation	N/A (1)
		ID12	Availability of airport services (Capacity)		2011(2)
	Quality of service	ID13	Airport Congestion		2011 (2)
		ID14	Airport Safety		N/A (4)
	Utilization	ID15	Air Transportation Utilization		2005-2010
Waterway	Supply	ID16	Waterway Density	Marine Department	2000-2010
		ID17	Proximity of Ports (Access)	Port Authority of Thailand and private operators of 15 terminals at Laem Chabang Port	N/A (1)
	Quality of service	ID18	Port Congestion		N/A (4)
Transit	Supply	ID19	Transit Density	The Transport Company Limited, Bangkok Mass Transit Authority, BTS, MRT, BRT	2004-2011
	Quality of service	ID20	Transit Safety		N/A (3-4)
	Utilization	ID21	Transit Utilization		2004-2011

Table 1: Thailand's Transportation Infrastructure Performance Index, Data source and Availability

Figure 1 demonstrates the assessed weights of the indicators as perceived by the select experts.

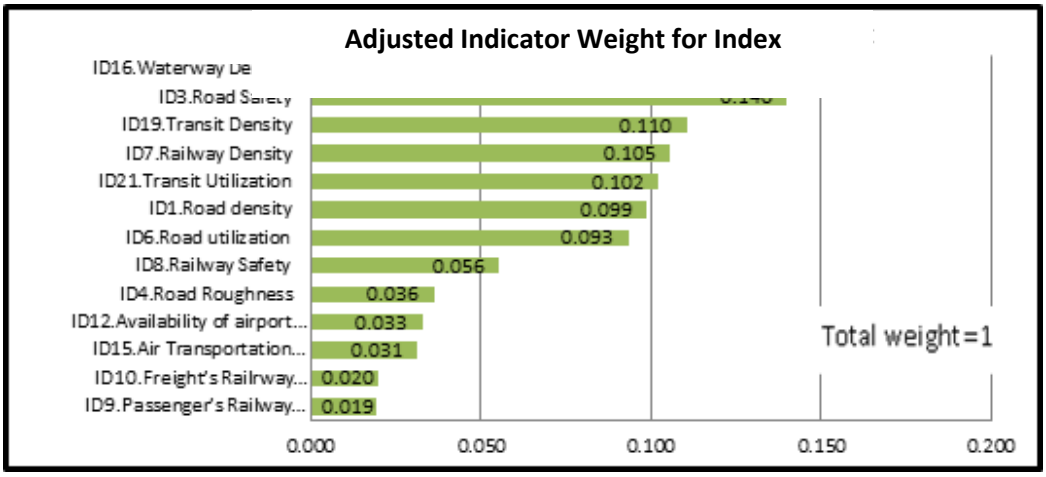

Figure 1: Indicator weights

Before calculating transportation performance index (TPI) for each year, which includes each indicator with its associated weight, all data must be normalized to transform indicators from original measures to a common scale. This step is crucial due to different scale and objective base of each indicator. For instance, higher road density indicates better performance while higher airport congestion reflects poorer quality of service. Hence, Simple Linearization Method as employed in the work of the U.S. Chamber of commerce (2010) is adopted to adjust each indicator to a scale from zero to one, where one represents the best performance. However, in this calculation, each indicator can be used only with available data including year 2005-2010.After conducting the analysis and developing Thailand Transportation Infrastructure Performance Index (TPI), the relative performance results for 2005-2010 are demonstrated in Figure 2.

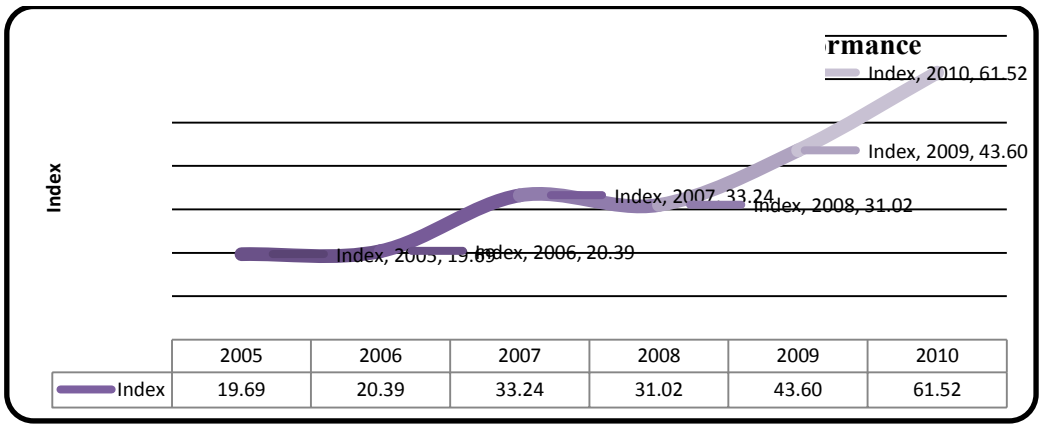

Figure 2: Thailand Transportation Infrastructure Performance Index

The result shows that TPI had been continuously increasing from 19.69 in 2005 to 61.52 in 2010. This positive growth results from the following factors:

- The government authorities had been focusing on infrastructure development in accordance w ith the country's logistics master plan under international cooperation framework, e.g. the Grea ter Mekong Subregion (Banomyong, 2008).
- The budget for investment had been increased in order to maintain, enhance, and increase th e efficiency of infrastructure. According to strategic objective of the Ministry of Transport, the b udget for developing the country's infrastructure was increased by more than 700,000 million b aht from 2006 to 2008 (Ministry of Transport, 2008).

Conclusion

One of the most crucial components affecting Thailand competitiveness and economy is transportation infrastructure performance. This research developed Transportation Infrastructure Performance Index (TPI) to assess the efficiency of Thailand's transportation infrastructure. According to the study, TPI had been continuously improving from 19.69 in 2005 to 61.52 in 2010, indicating significant performance improvement. However, some constraints encountered in the data collection stage, i.e. data unavailability, post limitations to the results of this research. Due to the incomplete data set, TPI in this research was calculated based on only 13 indicators.

As mentioned earlier, it is very significant that all relevant authorities should routinely collect all associated data, which comprise 21 indicators on transportation infrastructure performance framework, in a systematic manner in order to develop more comprehensive TPI. Moreover, realizing which type of infrastructure creates more impact on TPI could be beneficial for the improvement of overall transportation infrastructure performance. It provides the snapshot to help prioritize each infrastructure development plan. This area therefore should to be further studied and analyzed in the context of Thailand's transportation infrastructure.

In conclusion, benefits derived from this research consist of understanding of the tool to use as a measurement framework for assessing transportation infrastructure performance in the context of Thailand; recognition of the roles and responsibilities of the related agencies in collecting statistical data of each significant indicator and to compile all necessary data that has never been collected or completed. Future extensions include the development of a model that can investigate the relationship between TPI and Thailand's economy as well as emphasize its importance to Thailand's economic growth.

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3PL USAGE, PRACTICES AND DECISION PROCESS: BANGLADESH PERSPECTIVE

Nasrin Akter*, Prem Chhetri and Shams Rahman
School of Business IT and Logistics,
RMIT University, Melbourne, Victoria, Australia
Phone: 03 9925 1392 Fax: 03 9663 2517
**Email: nasrin.akter@rmit.edu.au*

Introduction

Third-party logistics (3PL) has experienced an unprecedented growth in international business (Langley, 2012). Global 3PL revenue, for example, has increased to US$703 billion worldwide (Langley and Capgemini, 2015). There has been a widespread use of 3PL as a strategic tool to reduce costs, improve efficiency and responsive, and expand geographic extent of business. Such rapid growth is largely driven by globalization and the resultant increased complexity of global supply chain networks (Chopra and Meindl, 2010). The spatial fragmentation of globalised production networks necessitates organisations to strategically partner with 3PL providers to help to increase market coverage, improve the levels of service, increase flexibility and customise services to specific customers' demand (Bowersox, 1990, Lieb, 1992, Sink et al., 1996). Arguably, organizations purport to gain strategic advantage by outsourcing of logistics functions that were previously performed 'in-house'. (Bowersox, 1990, Bagchi and Virum, 1998, Anderson et al., 1994, LaLonde and Cooper, 1989). However, such practices seem to vary across different markets, depending upon the economic conditions and business acumen to 3PL user or the future 3PL users. However, it is argued that every market behaves differently, so vary the use of 3PL. Thus, it is vital to gain market intelligence which will help organizations to improve decision making in a particular context. New 3PL users may have difficulties to obtain such customized information including firm specific statistics, usage patterns and trends of a specific country's 3PL market. Consequently, a considerable portion of 3PL literature considered the importance of the demographic factors (i.e. country and region) and also investigated the differences and similarities of 3PL trends, practices and decision making process among different countries and regions both from developed countries [United States (Lieb, 1992), Australia (Dapiran et al., 1996); (Rahman, 2011) UK, (Fernie, 1999); (Jaafar and Rafiq, 2005)] and developing country perspectives [Singapore (Bhatnagar et al., 1999), India (Sahay and Mohan, 2006), Ghana (Sohail et al., 2004), Saudi Arabia (Sohail and Al-Abadil, 2005) and Malaysia (Sohail and Sohal, 2003). Studies have been conducted form from the perspectives of cross-country (Sohail et al., 2006) and region (Peters et al., 1998a). However little has been known to understand the 3PL practices in the context of Bangladesh.

Bangladesh is experiencing an unprecedented growth in the garment sector where it has established itself as the textile and readymade garment powerhouse of the world, with almost all major global apparel brands outsourcing garment productions from Bangladesh. Despite this stronger export-oriented industrial base, lower-labor costs and convivial government policies for attracting foreign direct investment, the logistics cost are prohibitive and the logistics infrastructure and services to support seamless supply chains is poorly planned, build and maintained. However, little has been investigated to understand the current state of 3PL in Bangladesh and its impact on the ability of the logistic business to support an efficient and effective outsourcing future (Razzaque, 1997). The inadequate information regarding existing logistics services of Bangladesh is limiting the decision making capabilities of global logistics buyers. This implies that there is a lack of available information for global buyer to compare the logistics services of Bangladesh with other countries such as India and Pakistan who compete in the global outsourcing market on the basis of similar comparative advantage—Low labour costs. There is no comprehensive research on 3PL practices that can provide an understanding of the current status of 3PL in Bangladesh in comparison to world market practices (Razzaque, 1997). Unless it is understand, what is the current status of 3PL practices and trends in Bangladesh, it will hardly know how best to promote more informed 3PL usage and strong growth in logistics based industries compatible with global outsourcing practices.

This paper therefore, argues for conducting a comprehensive study that focus on understanding the logistics services demand patterns and 3PL usage in Bangladesh for three reasons. Firstly, Bangladesh has remarkable potential to be one of the emerging destinations for global outsourcing. Secondly, in spite of the high potential of this market, little has been explored regarding the usage pattern of 3PL services. Finally, such analysis has practical significance and policy implications for logistics practitioners and decision makers who opt for global outsourcing. This paper thus aims to

investigate the usage pattern relating to the extent of 3PL usage, 3PL decision making process, impact of 3PL and future trend of 3PL usage in Bangladesh. This paper is organized as follows. The next section presents a review of the prior literature in relation to the framework for measuring 3PL usage and practices. Subsequently, research methodology is outlined followed by the survey analysis results. Finally, the discussion and conclusion is presented.

The Framework for Measuring 3PL Usage and Practices

Extant research on 3PL practices and trend mostly explored four broad aspects: extent of the current 3PL services use, decision making process, impact of the use of 3PL services and future use 3PL of services. The four broad aspects as explored by prior research are primarily investigated through a framework based on the pioneer work of Lieb (1992). In this paper, we have adapted the framework of (Bhatnagar et al., 1999, Sahay and Mohan, 2006) so that the current 3PL practices and future usage patterns in Bangladesh can be examined. Prior empirical studies explored the extent of 3PL usage by using a number of dimensions such as employment characteristics of the 3PL user, number of 3PL provider used, length of users' 3PL usage experience, logistics services that are outsourced by the user, importance rating of logistic activities, users' commitment towards using 3PL services and amount of budget allocated by 3PL user for 3PL services (Lieb, 1992, Lieb and Bentz, 2004).

Six factors were identified in prior 3PL studies to capture the underlying 3PL decision making process. In particular, it is important to know first, firms '*reasoning'* behind outsourcing the logistics functions; second, the '*specific organizational level'* where the outsourcing decision are made; third, '*the extent of involvement'* of different functional area managers in outsourcing decision making process; fourth, '*the sources those made the 3PL user aware'* about the 3PL services; fifth, the *managements reservations* about using 3PL services; Sixth, the *selection criteria* considered by firm when selecting 3PL provider. It is important to measure the impact of 3PL use on client's business performance because a good match between the 3PL provider and the clients' corporate culture is an inevitable condition for successful contractual relationships (Bowersox, 1990). Majority of the prior research investigated the impact of using 3PL services on logistics system performance, customer satisfaction and employee morale (Lieb, 1992, Sohail and Sohal, 2003). Few prior research also investigated the types of training required for logistics personnel and percentage of full time logistic employees eliminated due to the use of 3PL services (Lieb, 1992). Measurement of client's overall satisfaction and intention to increase the 3PL use in future indicates the potential of further development of 3PL market in a single country (Bhatnagar et al., 1999, Bloomen and Petrov, 1996). Therefore information about the future trend of using 3PL services can offer valuable insights to both the clients and the 3PL providers in developing their future plans and strategies.

Research Methodology

We have adopted a quantitative approach to examine the 3PL practices and usage patterns. An online survey questionnaire is administered. This section outlines the survey questionnaire, the data collection procedures, and the respondent's demographic profile.

Survey Questionnaire

A cross-sectional 8-page self-administered questionnaire, containing 24 survey items, was conducted via survey. The questionnaire was divided in five broad sections. These include: a) characteristics of the respondent organization, b) the extent of current 3PL usage, c) impact of the use of 3PL services, d) 3PL decision making process and d) future usage intention of 3PL services. Most of the questions were presented in the multiple choice question formats. However, the questions pertaining to the impact of using 3PL services and the most cited advantages and disadvantages of 3PL usage were developed such that the responses to be given either on a five-point Likert Scale or rank order scale respectively. The survey instruments of this research were developed on the basis of the previous studies conducted by Bhatnagar et al. (1999) and Sahay and Mohan (2006).

Data Collection

During the last and first quarter of 2012 and 2013, the survey was administered. Initially an email was sent to the selected companies' contact person to collect the email address and phone number of the key personnel responsible for supply chain/ logistics operations. Soon an email containing a link of the survey questionnaire was sent to the email addresses. The respondents were requested to fill out the online survey that best capture the current 3PL practices of their organization. This results in 153 responses, manifest a response rate of 15.3 percent which is comparable with other studies

conducted both in developed and developing countries (Sahay and Mohan, 2006, Dapiran et al., 1996, Bhatnagar et al., 1999).

Survey Participants

The target population for this research are the business organizations those are registered with the federation of Bangladesh chambers of commerce and industry (FBCCI). A list of 1000 organizations was selected randomly as respondent companies. The random selection procedure was used due to the unavailability of a current and comprehensive database of Bangladeshi companies. As most of the business and economic activities are evolving around Dhaka (the capital city of Bangladesh) and Chittagong (the most important port city), the companies of these two major cities were selected as respondents. Both manufacturing and service organizations are selected and afterwards categorized under 14 industry classifications. One of the key persons responsible for supply chain/ logistics operations was approached from those organizations to participate in this research. In particular, majority of the respondents are from telecommunications, pharmaceuticals, banking, garment & textile industry. For convenience, the fourteen selected industries are broadly categorized into two: manufacturing and service industry. These two industries respectively represent 45.35 percent and 54.65 percent of respondents.

Results and Analysis

The study data is analysed by using SPSS 21 version. Frequency tables, cross tabulations, chi square test and a multiple regression are used to analyse the data. In the following we present the results of the data analysis which primarily focuses on the four broad domains.

Extent of 3PL usage

About 63 per cent of the 243 respondents indicated that their organisations use 3PL services; 37 per cent indicated that they do not use 3PL services. Among those organisations currently using 3PL services, more than 32 per cent reported that they have used them for more than five years and 31 per cent indicated that they have been using them between one to three years. Of the total respondents 49 per cent said they used 3PL for both domestic and international operations. Users of 3PL services indicated that their organisations use them for a wide variety of services, typically purchasing multiple services from one provider. Other logistic services outsourced by more than a quarter of the respondent companies include shipment consolidation, logistics information system, warehouse management, product return and packaging. However, services including carrier selection, fleet management and operations, HR recruiting, product assembly and installation are the less preferred services (less than 25 per cent of respondents use these services) for outsourcing to the 3PL providers. The use of the various available functions differed between manufacturing and service industries. In the manufacturing industry, shipment consolidation was cited as the most important 3PL service, followed by freight forwarding, warehouse management and packaging services. In the service industry, order fulfilment was the most frequently used service, followed by logistics information system, product returns and HR recruiting.

Although a significant number of organisations use 3PL, the degree of commitment to the services varies considerably. Over 42 per cent indicated that their organisation's commitment to 3PL services was moderate, while 36 per cent and 9 per cent respectively characterised the commitment as limited and very limited. Limited commitment is also reflected in each organisation's budget commitment. Up to 20 per cent of the logistics budget was allocated for 3PL use by 46 per cent of the respondent organisations; only four per cent spent more than 60 per cent. According to Lieb et al. (1993), the length of the relationship between 3PL users and their providers are positively related to the extent of 3PL use: the higher the level of relationship commitment between parties, the higher the willingness to allocate more budget to 3PL services. A chi-square test was conducted to investigate whether the level of commitment is related to the amount of budget devoted to 3PL use or the length of 3PL usage. The results show that both the relationship between the level of commitment and the amount of budget allocated to these services, and between the level of commitment toward the services and the length of 3PL use, are significant at $p<.05$ (Tables 1 and 2). In other words, organisations that are more committed to using 3PL services are more likely to allocate large proportion of their budget to finance these services. However, the value of Cramer's V is .174, which indicates a poor strength of association (Table 1). Cramer's V measures the strength of association within a value range of 0–1; a value close to 1 indicates strong association. This means that although level of commitment and budget allocation are associated with each other, the likelihood of increasing commitment with an increase of budget allocation is not very high.

Table 1: Cross tabulation of level of commitment and allocated budget to 3PL use

		Budget percentage		
		0–20%	*21–40%*	*41–60%*
Level of commitment to 3PL use	*Very limited*	7.1% (17)	1.3% (3)	.4% (1)
	Limited	19.6% (47)	12.5% (30)	5.6% (11)
	Moderate	17.9% (43)	20.4% (49)	5.6% (11)
	Extensive	1.7% (4)	3.8% (9)	6.2% (15)

Note: Chi-square test revealed an association between length of 3PL use and level of commitment to 3PL use when the categories 'extensive' and 'above 60%' are collapsed.

Table 2: Cross tabulation of length of 3PL use and level of commitment

		Level of commitment toward 3PL use (Percentage of use)			
		Very limited	*Limited*	*Moderate*	*Extensive*
Length of 3PL use	*Less than 1 year*	1.3% (3)	3.3% (8)	3.3% (8)	.4% (1)
	1 to 3 Years	2.5% (6)	14.6% (35)	13.3% (32)	.4% (1)
	More than 3 Years	2.9% (7)	11.3% (27)	10.8% (26)	3.3% (8)
	More than 5 Years	2.1%(5)	7.5% (18)	15.4% (37)	1.5% (18)

Note: Chi-square test (value: 25.018 and df: 9 $p<.05$) revealed an association between length of 3PL use and level of commitment toward its use. Cramer's V= .186.

Organisational factors affecting 3PL usage

Three organisational factors that influence the decision-making process are identified. First is the *organisational level,* where outsourcing decisions are made; second the *sources that made the 3PL user aware* of 3PL services; third the *extent of involvement* of different functional area managers in outsourcing decision making. Respondents were asked to indicate the organisational level at which the strategic decision to use 3PL services originated or was made. The majority of the respondents, over 63 per cent, indicated that the decision originated at the corporate level; 17 per cent traced it to the divisional level and 4 per cent to the local level. Another 15 per cent of total respondents indicated that their companies use multiple 3PL services and decisions to use them are made at different organisational levels. The source that made respondent organisations aware of 3PL services also varied considerably. By far the most frequently cited source was discussion with other logistics professionals (48 per cent), followed by sales contacts (40 per cent); however, it is worth mentioning that respondent organisations often were made aware of 3PL services by more than one source simultaneously. The growing integration and interdependence of logistics and other functional areas of business is clearly exhibited in the responses to a question that sought to determine whether other functional managers are actively involved in the decision to use 3PL. Typically, managers in several functional areas have shown a propensity to become involved in the decision process. More than half of the respondents indicated that managers from the marketing department are primarily involved in the 3PL decision-making process. Few organisations included legal managers in this decision. As evidenced in Table 5.3, marketing (53 per cent), purchasing (48 per cent) and information system (35 per cent) are the departments primarily involved in the selection of 3PL services and providers.

Benefits, limitations and impact of 3PL usage

The organisations using 3PL services typically appreciate multiple benefits. According to respondents' rankings, low cost (26 per cent), faster delivery (20 per cent) and accessibility to remote markets (19 per cent) are the greatest benefits. The least cited benefit is using a specialised work force; only 7 per cent of respondents mentioned about this. Other benefits reported by respondents include savings in time, being able to focusing on the core business, and having access to new technology. Almost one quarter of the respondents faced significant problems caused by 3PL providers' lack of understanding of the organisation's requirements. Leakage of competitive information (over 20 per cent) was given as the second most problematic aspect of 3PL use in Bangladesh. Lack of control over business operations, operational failures, the rise of fraudulent activities involving 3PL usage, improper documentation by 3PL providers and conflict between clients' and 3PL providers' workforces were other impediments to 3PL use mentioned. The users of 3PL services were asked to categorise the impact of 3PL services on logistics costs, internal logistic system performance, customer satisfaction and employees' morale. The use of 3PL services has a positive effect in all these areas. More than 70 per cent of the respondent organisations indicated that the effect is positive in each area except employee morale.

Future use of 3PL services

About 59 per cent of the respondents who have used 3PL services were at least satisfied with the performance of 3PL service providers. 2 per cent of the respondent organizations were very satisfied where only 1.2 percent was very dissatisfied. When the respondents were asked about how they would amend their use of 3PL services if they were given complete corporate responsibility to make that decision, more than 80 percent of respondents indicated that they would increase the use of 3PL services moderately or substantially. The remaining respondents indicated towards moderate to substantial decrease of the use of 3PL services. Chi square test between overall satisfaction and future 3PL usage revealed significant association between overall satisfaction and future tendency of 3PL use ($\chi 2$ value: 92.102 with 12 degrees of freedom). Similar positive relationship is found between overall satisfaction and the level of commitment (Table 3 and Table 4). The satisfied respondent organizations tend to have higher commitment toward current and future use of 3PL services.

Table 3: Cross tabulation of future usage and level of satisfaction

		Level of satisfaction regarding 3PL use		
		Dissatisfied	*Neutral*	*Satisfied*
Use tendency in future	*Moderately* ↑	2.6% (4)	39.6% (61)	61% (94)
	Substantially ↑	1.3% (2)	7.2% (11)	29.3% (45)
	Moderately ↓	2.6% (4)	4.5% (7)	5.2% (8)
	Substantially ↓	2% (3)	.7% (1)	.7% (1)

Note: Chi-square test (value: 92.102 and df: 12) revealed significant association between overall satisfaction and future tendency of 3PL use (when category of 'very dissatisfied' and 'very satisfied' collapsed)

Table 4: Cross tabulation of level of commitment and level of satisfaction

		Level of satisfaction regarding 3PL use		
		Dissatisfied	*Neutral*	*Satisfied*
evel of commitment toward 3PL use	*Very limited*	5.2% (8)	4.5% (7)	3.9% (6)
	Limited	2% (3)	28.6% (44)	26.7% (41)
	Moderate	.7% (1)	17.6% (27)	48.8% (75)
	Extensive	.7% (1)	1.3% (2)	16.3% (25)

Note: Chi-square test (value: 96.141 and df: 12) revealed significant association between overall satisfaction and level of commitment toward 3PL use (when category of 'very dissatisfied' and 'very satisfied' are collapsed).

A substantial number of previous studies conducted the correlation analysis to understand the extent of the relationships among the logistic system performance, end customer satisfaction employee morale and the overall satisfaction of 3PL use (Sahay and Mohan, 2006, Bhatnagar et al., 1999). The prevailing consensus of the relationships, puts forward the question whether the overall satisfaction to use 3PL services is predictable by logistics system performance, end customer satisfaction and employee morale. In response to this question, a multiple regression analysis was conducted to examine the relationship between respondent's overall satisfaction regarding 3PL services and four predictor variables: logistic costs; logistic system performance; end customer satisfaction and employee morale.

Table 5: Results of regression

Variable	Mean	Std. deviation	Regression weights		P value
			B	β	
Satisfaction 3PL usage	3.52	.501			
Logistic Costs	4.38	1.996	.012	.048	.460
Logistic System performance	4.26	1.369	.241	.658	.000**
End customer satisfaction	4.97	1.832	.005	.019	.721
Employee morale	4.41	1.237	-.066	-.163	.001*

Note: $p < .05$ ** $p < .01$* B = Unstandardised coefficient, β = Standardized coefficients

Table 5 summarizes the descriptive statistics and regression analysis results. The multiple regression model with all four predictors produced $R^2 = .619$, $F= 95.279$, $p < .001$. As can be seen in Table 7, the logistic system performance and end customer satisfaction had significant positive regression weights, indicating 3PL user who experience higher logistic system performance are expected to have higher level of overall satisfaction regarding 3PL services, after controlling for the other variables in the model. The same also happened between end customer satisfaction and the criterion variable. This indicates, the higher the level of end customer satisfaction, the higher the tendency of high level of overall satisfaction of the 3PL user regarding 3PL services. However, the regression model produced

for overall satisfaction with 3PL usage suggests that logistics costs and employee morale do not contribute to overall satisfaction with 3PL services.

DISCUSSION AND CONCLUSION

Third party logistics is critical for the economic development of export-oriented industrialization in Bangladesh, which is aided by competitive unit labour costs in the dominating garment industry and favoured by national regulatory reform (NBU, 2014). The export-oriented industrialization also stimulated the growth of freight forwarders and third party logistics providers in Bangladesh (Narayanan, 2013). The pervasiveness of readymade garments (RMG) sector in global outsourcing market has necessitated the outbound transportation services for cross broader product delivery. It is also reflected in the findings of current 3PL practices where freight forwarding was emerged as the most outsource service by organisations in Bangladesh. Transportation, shipment consolidation, warehousing and inventory are among the other important outsourced services. This usage trend is different when it is compared to the developed countries 3PL usage. For example, warehouse management is the most widely used 3PL service in Australia and USA (Rahman, 2011, Lieb and Bentz, 2004) and shipment consolidate is the most widely used 3PL service in Europe (Peters et al., 1998b). Whereas, outbound transportation is the most outsourced 3PL service in India (Sahay and Mohan, 2006). On the basis of evidence currently available, it seems fair to claim that transportation related 3PL services are more dominant 3PL service in the developing nations.

Bangladesh is consistently consider as significant outsourcing alternatives for the apparel retailers and fashion brands such as H&M, Wal-Mart, GAP, Levi's, Tesco, Zara, Carrefour, JCPenney and many more (BKMEA, 2015). Prominent presence of these top retailers and fashion brands in Bangladesh readymade garment sector require the outsourcing of 3PL services such as transportation and warehousing for both domestic and international purposes. However, in comparisons with other countries it is found that the organisations of Singapore are utilising 3PL services mainly for domestic purposes, while Malaysian organisations have reported 3PL use more extensively for international businesses (Sohail et al., 2006). During the period of 1994 to 2013 the average growth rate of GDP in Bangladesh was 5.6 per cent (BNWP, 2015). Against the backdrop of steady growth in GDP since 1990s, the overall structure of Bangladesh economy has been increasingly transforming as service based economy where the share of agriculture in GDP as steadily declined and the manufacturing and service sectors constantly contributing to the GDP (Ahmed et al., 2009). According to the WorldBank (2014), manufacturing sector is accounted for 27 per cent of total GDP (gross domestic product) in Bangladesh whereas, 58 per cent of total GDP originates from the service sector. The current usage of 3PL services between manufacturing and service industry is complementing the trend of economic reform from agro-based to service-based economy in Bangladesh. Though it is generally assume that, the outsourcing services mostly demanded by the manufacturing industries in a developing country context like Bangladesh; however, current usage of 3PL services is dominated by the service industry. This implies that changing economic patterns in Bangladesh is also reflected in the usage of outsourcing services by business customers.

Being a developing country, small and medium-sized enterprises (SMEs) are very important players in the economy. About 90 per cent of all industry in Bangladesh SMEs, contributed about 25 per cent to the GDP, employ about 31 million people and provide 75 per cent of household income (Hossain et al., 2009). The findings suggest that vast majority of respondents who are predominantly SEMs has greater use of 3PL services in comparison to the large organisations. SEMs that use 3PL services made up 75 per cent of total respondents thereby justify the prevalence and key role of the SEMs in economic growth in Bangladesh. This findings is similar to other developing countries such as India (Sahay and Mohan, 2006) however, contradicts that of developed country such as Australia (Rahman, 2011). Compare to the growth rate of global 3PL market, Bangladesh is still in the introductory stage in terms of its length of 3PL use, commitment to 3PL services and allocation of total logistics budget to 3PL services. Though it is expected that the more the length of the 3PL uses, the more the commitment toward 3PL usage or vice versa (Lieb, 1992), however, it found to be disproportional to each other in the context of Bangladesh. The focus of global 3PL industry has evolved sequentially from market through segmented, integrated, customer, differentiation and recently consolidation (Papadoppulo and Macbeth, 1998). As the 3PL industry has matured, global 3PL providers continually enhanced their ability to drive innovation and create value for their customers. At the same time, customers have significantly refined their effectiveness as buyers by enhancing their commitment to 3PL services and allocated greater budget for outsourcing services (Langley and Capgemini, 2015). According to the 2013 annual 3PL study, 65 percent of shippers are increasing their use of 3PL

services than before (Langley and Capgemini, 2013). Contrary to this, research findings indicate the expenditure and commitment to 3PL services by organisations in Bangladesh is moderate.

In this matured 3PL industry the users of 3PL services around the world has increasingly shifting their prime motives of outsourcing from cost reduction, emphasis on core business and improved services to operational flexibilities, accessibility of technology, techniques and expertise (Sohal and Rahman, 2013). In contrast, Bangladesh still considered low costs, accessibility to remote market and faster delivery are as the key motives of using 3PL services due to the dominance of garment and textile industry in export growth and its comparative advantage over low labor cost. Moreover, few negative attitudes toward 3PL services is posing challenges for 3PL providers of utilising logistics opportunities that can play a key role in Bangladesh's efforts to maintain strong growth in exports and logistics based industries. The leakage of competitive information by 3PL providers while serving competing companies simultaneously was emerged as major concern of 3PL use in Bangladesh.

Despite the negativity of few 3PL services, the results indicate majority of the organisations are satisfied with the 3PL services, which also implies the prospect of increased 3PL usage in future. Increased satisfaction with the performance of 3PL services is also expected to have a significant impact on the increased level of commitment and willingness of organisation's to increase future 3PL usage. A vast majority of previous 3PL studies reveals that the clients, who are satisfied/highly satisfied, intend to increase their use of 3PL services from moderate to substantial intensity in future. In particular, the study of Sohal and Rahman (2013) and Sohail et al. (2006) indicates that more than 80 per cent of the 3PL user expressed their increased interest in the future usage of 3PL. It is also found that the impact of 3PL services is positive where it reduces logistics costs, enhances customer satisfaction and improves logistics system performance. On a ranking of major logistics markets for the future, Bangladesh reached in 12th position in 2013 (NBU, 2014). According to the Agility Emerging Market Logistics Index (AEMLI) Bangladesh is considered as one of the 45 major emerging markets of the world (WTO, 2013). Therefore, there would be no compelling reason to argue that all of these findings supported the view that Bangladesh has potential to be an emerging global outsourcing destination.

This study contributed to the existing 3PL literature by a comprehensive description of 3PL environment in Bangladesh. This provide an information base for the 3PL users around the world to compare logistics practices of Bangladesh with other developing countries thereby filled an untapped perspective of logistics research in Bangladesh. It also enable decision-makers to benchmark their organisations' use of 3PL against other organisations in different countries. The use of 3PL is comparable to other countries so it is not a major concern for organisations in Bangladesh. However, the extent of 3PL use is rather limited when comparing with more developed countries such as Australia, UK and USA (Appendix 1). The results relating to the benefits and constrained of 3PL usage in Bangladesh are some of the indicators that would help the 3PL service providers to plan the depth and scope of their service offerings to user organizations in Bangladesh. Therefore, these comprehensive results related to 3PL environment coupled with further improvement in logistics infrastructure in Bangladesh can attracted more organisations to use 3PL for domestic and international business purposes. This can aided long-term development of logistics based industries and pave a way for Bangladesh to become one of the major global outsourcing destination.

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WORKER SELECTION WITH MULTIPLE SKILLS IN LABOR-INTENSIVE INDUSTRY

Teeraphattara Songsiri, Ronnachai Sirovetnukul
Department of Industrial Engineering, Faculty of Engineering, Mahidol University, Nakhonpathom, 73170 Thailand

Introduction

With the increasing of global competition, all manufacturing sectors have been forced to not only improve efficiency but also increase productivity gain along its supply chain. An efficient management on manufacturing resources is one key concern to be appropriately utilized and to reach the competitive advantage. In labor-intensive manufacturing environment, workforce plays an important role as a major resource that drives and control the entire system. By its nature, labor-intensive refers to an industry that requires a substantial involvement of worker especially in the operational level which directly impacts the overall production performance. Furthermore, the system mostly consists of small and inexpensive machines and equipment (Süer and Bera, 1998). Regarding to the importance of labor resource, worker's capabilities or skills have become an influencing factor since an individual worker will have different skills to perform a specific task. It is commonly agreed that workers with different skill levels will have different abilities in terms of operational understanding and response times, this highly effects the overall performance. To achieve a successful workforce management, the effective methods of evaluation and ranking for workers with different competencies are needed to select the most appropriate worker and place to the right task and it is the most challenging goal of all organizations (Güngör *et al*., 2009). However, in the workforce management literature, much of the existing studies has been focused the final workforce management decision in allocating worker-to-task problem which strongly pushed by the mathematical models, without respect to the real manufacturing practice. On the other hand, workforce management decision in the first stage, namely worker selection, is an essential decision that should be made effectively. It is found from the previous studies that there is a little attention paid in this stage. In worker selection management, an effective evaluation of worker performance is required to individually indicate worker's performance.

In order to fill the gaps, this paper aims to present a methodology of workforce management in selection stage, with the different perspectives drawn from academia to real manufacturing. The important worker selection criteria with multiple skills from previous literature and real manufacturing practice are identified and prioritized using the Analytic Hierarchy Process (AHP) as a Multi-Criteria Decision Making (MCDM) tool. Furthermore, the worker selection practice is also investigated through a case study of a labor-intensive industry to represent as labor-intensive sector which reflects the real world problem. The rest of the paper is organized as follows: literature review, proposed methodology, computational results of AHP model, and conclusions.

Literature Review

This paper focuses on the labor-intensive manufacturing environment in the operational level, which is operated by "workers". In literature review section, it is organized as follows: (1) skill gaps, (2) worker selection, and (2) analytic hierarchy process (AHP).

Skill Gaps

The skilled workers are the most powerful assets in achieving the business goals (Güngör *et al*., 2009). In labor-intensive environment, it is commonly agreed that worker skill has a strong impact on the manufacturing performance. Skill is defined as one's ability to apply knowledge and use the know-how to perform tasks well. Generally, skills may be cognitive (use of logical, intuitive and creative thinking) or practical (use of methods, materials and tools) (Chryssolouris *et al*., 2013). In the context of a learning process, skills generally involve the following elements, observation and replication of actions, task reproduction from instruction or memory, reliable execution independent of help, adaptation / integration of expertise to meet requirements and automated (Bloom *et al*., 1956). Smits (2007) classified worker skills into two types; (1) generic skills and, (2) industry-specific skills. It is important for worker to have not only skills in specific industry, but also generic skills that create a wide range of applicability. Heijke *et al*. (2003) explained that generic skills are defined from a combination of learning abilities, analytical abilities, and problem solving abilities. On the other hand, Hendarman and Tjakraatmadja (2012) categorized skills into two types, one is soft skills and the other is hard skills. Soft skills refer to personal attributes that enhance an individual's interactions with work performance, while hard skills are a person's skills set and ability to perform a certain task. The skill

list of Consoli and Rentocchini (2015) were drawn from the manufacturing which machines are the major resource. In this paper, worker skill is classified into two types; (1) general skills and, (2) technical skills. In whilst, general skills mainly refer to any fundamental skills which can be applied in different industry sector (i.e. analytical thinking, communication, learning), unlike technical skills which mainly focus on any specific skills used in operations of a specific industry sector (i.e. production and processing, quality control). In production planning and designing systems, workers are commonly assumed to be equal in their abilities and perform tasks at a steady pace (Bentefouet and Nembhard, 2013) and most of the mathematical models consider worker resource with only one skill (Wongwai and Malaikrisanachalee, 2011). Generally, these assumptions totally conflict the real world problem. Ignoring the impact of workers with various skills would result the effectiveness of services provided which lead to the organization's outcomes (Lee, 2004). In workforce allocation and scheduling problems, Warner *et al*. (1997) assigned workers to machines based on their human and technology skills. Wongwai and Malaikrisanachalee (2011) proposed an algorithm for resource scheduling which multiple skills had been considered. Fowler *et al*. (2008) studied decisions in workforce management with respect to differences in individual workers measured by general cognitive ability (GCA). The workforce flexibility was focused as an effective way to deal with the various variabilities in manufacturing systems. A mixed integer programming (MIP) model is used to determine different staffing decisions (i.e. hire, cross-train and fire) to minimize workforce related costs. It is seen that all of the afore-mentioned literature has emphasized on dealing with the differences of worker skills by generating skill level and placing it as a constraint in mathematical models. On the other hand, Mori *et al*. (2015) presented a quantitative approach for design and formation of workforce skills using simulations to achieve the efficient assembly. The skill of workers is one major cause of uncertainties. Demand fluctuations also cause the difficulty in maintaining the efficient skilled workers in machine tool production. From the literature review, it is found that there are a few studies on workforce management with the consideration of worker's multiple skills with regard to labor-intensive manufacturing nature. Thus, this paper aims to intensely investigate the influencing workforce skill required in labor-intensive industry sector.

Worker Selection

A lot of existing literature has been focused on workforce management problem which is carried out into different stages; e.g. worker evaluation, selection, allocation and worker scheduling in Majozi and Zhu (2005). This classification corresponds to Şen and Çınar (2010) which focused on worker evaluation and pre-worker allocation phase. In brief, evaluation refers to the performance measurement of workers (e.g. competency, experience). Selection refers to the question of "who" will be selected? (Nembhard and Bentefouet, 2014), and grouping is concerned with clusters of selected workers who have similar competencies. Worker allocation is concerned with "who works where?", but worker scheduling is concerned with "who works when?" (Majozi and Zhu, 2005). Worker allocation and scheduling problems are considered as the final workforce management decisions. They have been widely published in today's research with strong focuses on mathematical models. Meanwhile, there are prior activities in worker selection stage that has been still neglected in those study areas. In managerial viewpoint, the workforce management stage derived from the relevant literature is presented in Figure 1, consisting of selection, grouping and allocation. Each stage is connected by supporting the effective decision-making to another. In this paper, worker selection stage is only focused to response the question of "how to effectively select" worker with respect to their capabilities in the operational level of labor-intensive manufacturing. The most challenging goal of all organizations is to select the effective methods of ranking a group of workers with the different competencies (Güngör *et al*., 2009). It is evident that worker selection management plays a key role in achieving success of an organization through worker performance. To select workers, a proper performance evaluation process is required to identify strengths and weaknesses of each worker (Rani *et al*., 2014). Worker performance evaluation is considered as a critical operation in labor-intensive manufacturing since it strongly impacts the productivity gain.

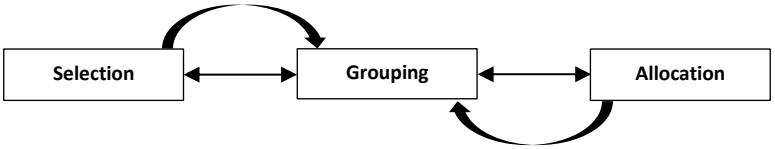

Figure 1: Workforce management stage

From the literature review, a few studies on worker selection in labor-intensive manufacturing are found. Most attention has been devoted to the capital-intensive industry which machine is a major resource in operations and worker skill is not seriously considered. Güngör *et al*. (2009) proposed a

worker selection system based on Fuzzy Analytic Hierarchy Process (FAHP) to achieve the best qualified worker dealing with both qualitative and quantitative selection criteria. The criteria are built-up into three main categories, general work factors, complimentary work factors, and individual factors. Majozi and Zhu (2005) presented a worker selection with a consideration of worker evaluation (grading) using an application of Fuzzy Set Theory (FST). The selection criteria are defined, expertise, skill, age, health, and availability. Similarly, Şen and Çınar (2010) used a combined fuzzy AHP and max-min approach to deal with worker selection based on worker's individual performance. The powerful criteria were determine by reaching consensus from manufacturing experts, it resulted in five main criteria, competency, experience, personal characteristics, assemble capability, and control capability. An actual application in an electronic industry is also studied. On the other hand, Rani *et al*. (2014) studied the performance evaluation based on six main criteria derived from previous literature, i.e. competency, experience and skill, teamwork and time punctuality, personal characteristics, capability, and outcome. The six different ranking methods were presented and applied in a food processing industry. It is found that output criterion is the most important factor in selecting worker. Furthermore, they revealed that AHP is the suitable method to evaluate worker performance from a case study of the real manufacturing environment. They presented worker performance evaluation and ranking method by comparing six different multi-criteria decision making methods include Analytical Hierarchy Process (AHP), fuzzy AHP (FAHP), ELECTRE, PROMETHEE II, Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) and VIseKriterijumska Optimizacija I Kompromisno Resenje (VIKOR). From this point, AHP is selected as an effective multi-criteria decision-making (MCDM) tool. Consequently, AHP is used in weighting and prioritization of the important worker selection criteria in labor-intensive manufacturing in this paper.

Analytical Hierarchy Process (AHP)

It is developed by Saaty (Saaty, 1980) which has found wide range of applications in today's studies and industry area. AHP is a simple tool to deal with complex, unstructured and multi-attributed problems using a hierarchical structure and utilizes pairwise comparisons. A core issue to influence the final decision choice in AHP is prioritization of the reciprocal matrix (Yuen, 2010). Furthermore, modeling the problem and identifying the decision hierarchy is the key factor in using AHP. In multi-criteria analysis, AHP is suggested as a tool for implementing a multiple criteria performance scheme (Güngör *et al.*, 2009). In AHP, verbal judgments are provided by decision makers, to be used in pairwise comparison, the reciprocal matrices are transformed from linguistic labels to numerical values (Yuen, 2010). The primary steps of AHP are provided as follows (Rani *et al*., 2014; Bhushan and Rai, 2004):

Step 1: Form a hierarchy consisting of the overall objective at the top, criteria, sub-criteria, and the alternatives at subsequent level of the hierarchy.

Step 2: Construct the pairwise comparison matrix based on Saaty's intensity importance table (as shown in Table1). The table is used by decision maker to prioritize the criteria, sub-criteria and decision alternatives within each sub-criterion.

Intensity of Importance	Definition	Explanation
1	Equal Importance	Two activities contribute equally to the objective
3	Moderate importance	Experience and judgement slightly favour one activity over another
5	Strong importance	Experience and judgement strongly favour one activity over another
7	Very strong or demonstrated importance	An activity is favoured very strongly over another. Its dominance demonstrated in practice.
9	Extreme importance	The evidence favouring one activity over another is of the highest possible order of affirmation
2, 4, 6, 8	Intermediate values between adjacent scale values	

Table 1: Intensity of importance (Saaty, 2008)

Step 3: The principal eigenvalue and the corresponding normalised right eigenvector of the comparison matrix give the relative importance of the various criteria being compared. The elements of the normalised eigenvector are termed weights with respect to the criteria or sub-criteria and ratings with respect to the alternatives.

Step 4: The consistency of the matrix of order *n* is evaluated. Comparisons made by this method are subjective and the AHP tolerates inconsistency through the amount of redundancy in the approach. If this consistency index fails to reach a required level then answers to comparisons may be re-examined. The consistency index, CI, is calculated as CI = $(\lambda_{max} - n)/(n - 1)$ where λ_{max} is the maximum eigenvalue of the judgement matrix. This CI can be compared with that of a random matrix,

RI. The ratio derived, CI/RI, is termed the consistency ratio, CR. Saaty (1980) suggested the value of CR should be less than 0.1.

Step 5: The rating of each alternative is multiplied by the weights of the sub-criteria and aggregated to get local ratings with respect to each criterion. The local ratings are then multiplied by the weights of the criteria and aggregated to get global ratings.

The AHP produces weight values for each alternative based on the judged importance of one alternative over another with respect to a common criterion. The prioritized criterion relies on the content of a pairwise comparison matrix which is used in worker performance evaluation regarding to its importance weight.

Proposed Methodology

The methodology in this paper is primarily carried out into three parts, (1) input/tools, (2) methodology and, (3) output which is illustrated in Figure 2. The study is introduced with the identification of worker selection criteria derived from previous literature and industry viewpoint. The important criteria are validated in the context of labor-intensive environment that considers workforce as a major resource of the entire system. After all selection criteria are validated, it is weighted and prioritized using AHP as a multi-criteria decision-making (MCDM) tool. Each criteria is individually weighted from the intensity of importance shown in Table 1 (Saaty, 2008), with the scale of 1 to 9 judged by an expert from labor-intensive manufacturing. This step contributes the important weights of each selection criteria which is used in worker performance evaluation. This paper examines worker performance evaluation with respect to the important weights of each criteria determined by AHP, the individual performance score of worker on all dimensions is assumed, given *n* equals 10 workers. Next, worker selection rules are then built-up using experiences to generate the worker selection model which can be effectively used.

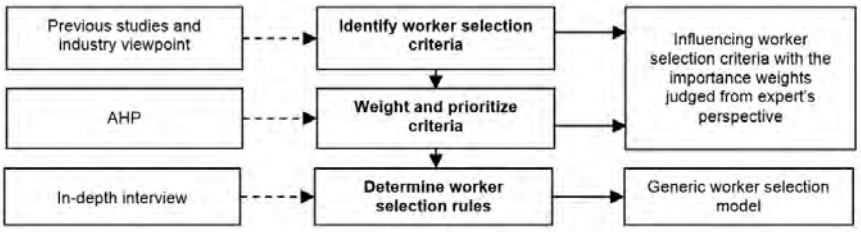

Figure 2: Steps of proposed methodology

Data Collection

To propose workforce management decision models in worker selection stage drawn from the academic standpoint to the real manufacturing standpoint, data collection is organized into two sections;

(1) *Primary data* refers to the data that highly relies on the real manufacturing practice. An expert who was frequently involved in worker-related activities in labor-intensive industry, is investigated, using an in-depth interview as a research tool to intensely draw worker selection practice from the real industry setting, which includes the following elements;

- Manufacturing nature
- Worker selection criteria
- Worker ranking method
- Impacts of worker skills
- Worker selection rules

(2) *Secondary data* refers to the data from previous studies on workforce management which consists of worker skills, worker performance evaluation, and worker selection model, in the context of labor-intensive manufacturing nature.

The summary of worker selection criteria derived from previous studies and industry viewpoint, is presented in Figure 3. The criteria are hierarchically structured. Main criteria are at the first level and sub-criteria are at subsequent level.

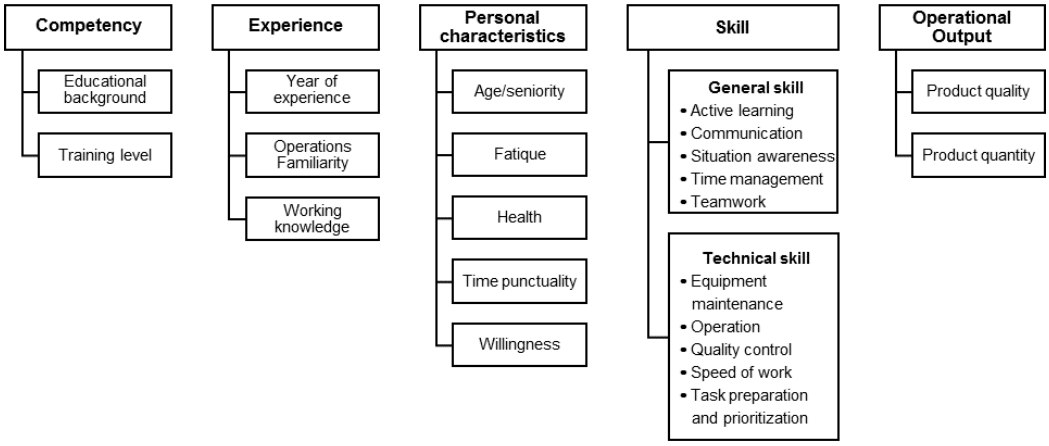

Figure 3: Worker selection criteria structure

Figure 3 illustrates the structure of worker selection criteria in the context of labor-intensive manufacturing. Both qualitative and quantitative criteria are defined to be individually considered in worker performance evaluation process. The hierarchical structure of selection criteria consists of five main criteria; namely competency, experience, personal characteristics, skill, and operational output formed as the first level of hierarchy. The main criteria are branched into sub-criteria which are in level 2 and 3. Descriptions of each criteria are provided in the following.

- *Competency* – It pertains to work mainly on the basis of educational background and previous job training achievements. There are two sub-criteria related to competency; namely educational background and training level.
- *Experience* – with the level of experience, the working performance can be predicted. As working basis, the operational performance of workers with high experience level can be quickly enhanced and compared to the lower ones. Three related criteria is taken into account; namely year of experience, operations familiarity, and working knowledge.
- *Personal characteristics* – They primarily introduce the individual qualifications in attitude, mind-set, and personal goal setting. Five criteria is associated with personal characteristics; namely age/seniority, fatigue, health, time punctuality, and willingness.
- *Skill* – Worker skills play a great role in the environment of labor-intensive manufacturing. It directly creates the enhancement on operational performance to achieve a sustainable manufacturing. In this paper, skill is categorized into two types, general skill and technical skill, where general skill is divided into five sub-criteria (level 3); namely active learning, communication, situation awareness, time management, and teamwork/cooperation. Similarly, the technical skill consists of five sub-criteria (level 3); namely equipment maintenance/repairing, operation and control, quality control, speed of work, and task preparation and prioritization.
- *Operational output* – According to the natures of labor-intensive manufacturing, the operational output which transforms from raw material to final products is the most important goal to be achieved for all organizations. The operational output represents how well the manufacturing is managed on cost reduction and service level improvements. Two sub-criteria is considered; namely product quality and product quantity.

In worker selection practice, the selection rules are needed to be determined. The selection rules here refer to the rules that were published by the organization, to determine the acceptance level of worker performance. A worker will be selected only if his/her performance complies with all selection rules. This paper investigates worker selection rules from a manufacturing expert in labor-intensive area, given in the following;

Rule 1: Competency performance of a selected worker must be equal or greater than 70%
Rule 2: Experience performance of a selected worker must be equal or greater than 80%
Rule 3: Personal characteristics performance of a selected worker must be equal or greater than 70%
Rule 4: Skill performance of a selected worker must be equal or greater than 80%
Rule 5: Operational output performance of a selected worker must be equal or greater than 80%
Rule 6: Overall performance of a selected worker must be equal or greater than 80%

AHP Model of Worker Selection Criteria

According to the proposed methodology, AHP is presented as MCDM to weight and set priorities for each worker selection criteria. The preliminary steps are organized as follows: (1) all selection criteria used for worker performance evaluation process are identified. (2) worker selection criteria is structured into AHP hierarchy, (3) each criterion is weighted by using the intensity of importance from Table 1 which includes the numerical values from 1 to 9. In this step, the pairwise comparison matrix is used, and (4) the importance weights computed from the eigenvector of the comparison matrix that is determined with respect to the consistency ratio. Traditionally, there are many ways to process data, including by hand, spreadsheet program, or the specialized AHP software. Regarding to worker selection problem from many criteria, this paper uses the specialized AHP software called Super Decisions to process the data. Super Decisions developed by Thomas Saaty is a decision making software based on AHP. Priorities are derived through pairwise comparisons on the criteria of the problem. The structure of AHP is illustrated in Figure 4.

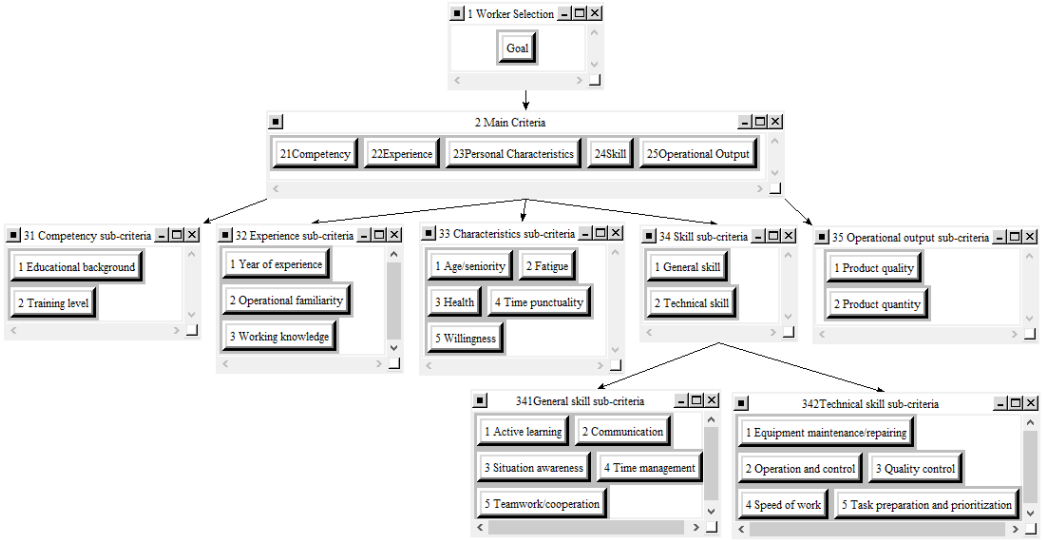

Figure 4: AHP model of worker selection criteria

The AHP model shown in Figure 4 is structured into hierarchy with four levels, worker selection is set as goal in the first level, followed by five main criteria in the second level, sub-criteria of each main criterion are constructed in the third level, and sub-criteria of general skill and technical skill are in the fourth level.

Computational Results of AHP Model

After the hierarchy structure of AHP model is constructed, the importance weight of each criterion is then calculated following the AHP steps explained in the previous section. The computational result of AHP model is shown in Table 2.

Worker selection criteria	Importance weight	Worker selection criteria	Importance weight
Competency	**0.080**	**Skill**	**0.210**
Educational background	0.143	*General skill*	*0.167*
Training level	0.857	Active learning	0.204
Experience	**0.471**	Communication	0.190
Year of experience	0.140	Situation awareness	0.206
Operational familiarity	0.528	Time management	0.179
Working knowledge	0.333	Teamwork/cooperation	0.221
Personal Characteristics	**0.038**	*Technical skill*	*0.833*
Age/seniority	0.031	Equipment maintenance/repairing	0.033
Fatigue	0.631	Operation and control	0.309
Health	0.207	Quality control	0.226
Time punctuality	0.071	Speed of work	0.365
Willingness	0.061	Task preparation and prioritization	0.067
		Operational Output	**0.201**
		Product quality	0.667
		Product quantity	0.333

Table 2: The importance weight of each criterion from AHP model

The results reveal that *experience* is the most important criteria in worker selection with the importance weight of 47.14%, in the context of labor-intensive manufacturing industry. The second rank is drawn by *skill* at 20.98% which is quite close to the *operational output* at 20.06%. The third and fourth ranks are competency at 8.03%, and *personal characteristics* at 3.79%, respectively. However, in the skill aspect, *technical skill* at 83.33% is considered to be more important than *general skill* at 16.67%.

Next, the performance of each worker is evaluated with respect to the determined importance weights. Figure 5 illustrates the worker selection rules model. Lines in the radar chart represent worker performances (*n = 10*). For example, the competency performance of worker 1 is calculated using the equation below;

$$P_{W1,\ competency} = [(0.143 \times S_{c1}) + (0.857 \times S_{c2})]$$

Where *W1* stands for worker 1, S_{c1} is score of criteria 1, and S_{c2} is score of criteria 2. The performance of each worker is computed by multiplying raw score of each criterion with its importance weights show in Table 2. After all worker performance is individually evaluated, the worker is ranked and selected with respect to the determined selection rules of the organization, as afore-mentioned. From Figure 5, the lines within the selection rules line represent workers with unsatisfied performance. In this example, worker 1, worker 3, worker 4, worker 5, worker 7, and worker 9 are only selected, but the rest of them are rejected.

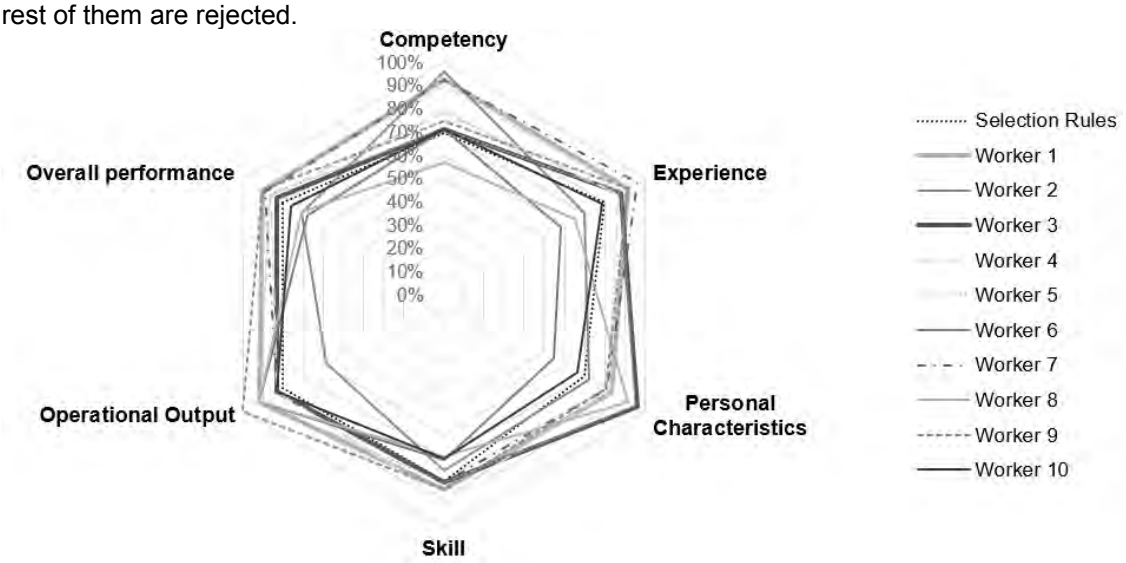

Figure 5: Worker selection rules model

This paper aims to contribute this worker selection practice to be applied in a wide range of the industry sector, especially in labor-intensive environment. Hence, the Overall Worker Performance (OWP) equation of a worker is originated as an effective worker selection tool for general use.

Overall Worker Performance (OWP) = $(W_{competency} \times S_c) + (W_{experience} \times S_e) + (W_{personal\ characteristics} \times S_p) + (W_{skill} \times S_s) + (W_{operational\ output} \times S_o)$

$= (\mathbf{0.080} \times S_c) + (\mathbf{0.471} \times S_e) + (\mathbf{0.038} \times S_p) + (\mathbf{0.210} \times S_s) + (\mathbf{0.201} \times S_o)$

Where *W* stands for the importance weight; S_c is score of competency, S_e is score of experience, S_p is score of personal characteristics, S_s is score of skill, and S_o is score of operational output.

Conclusions

In worker selection management, it is evident from the computational results of AHP model which reveals that experience is the most important criterion in worker selection practice. In labor-intensive manufacturing, it can be concluded that worker experience in terms of year of experience, operational familiarity, and working knowledge plays an important role in all worker-related operations. The skill and operational output criteria are followed as the subsequent important criteria which should be also taken into account in worker selection practice. For competency and personal characteristics criteria, it is not considered as the powerful factor in labor-intensive environment. However, the performance index is developed and named the overall worker performance (OWP) by previous equation. It is able

to be applied in a wide range of industry sector with respect to the determined importance weights that represent different priorities of each factor and satisfy the organization natures. As extension of the current study, comparing the proposed method with other well-known multi-criteria decision making methods is suggested. Furthermore, in the context of manufacturing viewpoint, there is a significant relevance within experience, skill, and operational output. The crossed relationship of the proposed criteria could be considered in the future research.

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