OUTSOURCING IN HUMANITARIAN LOGISTICS IN THAILAND

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Abstract
Purpose: Humanitarian relief organisations (HROs) may outsource their logistics needs to logistics service providers (LSPs). The purpose of this paper is to determine to what extend LSPs are used in humanitarian logistics in Thailand.

Design/methodology/approach: A literature research was conducted LSPs and commercial outsourcing of logistics services, and outsourcing as a strategy in humanitarian logistics. Logistics officers of HROs located in Bangkok, Thailand were interviewed about their usage of LSPs.

Findings: Of those HROs interviewed that have needs to transport or store goods in Thailand, some used their own vehicles for regular transportations, but all outsourced to commercial truckers for irregular transportations such as for donation goods or in emergency situation. Their decisions are based on financial reasons, or level of control. From initial observation it can be said that the criteria under which HROs outsource their logistics needs is not different from commercial companies.

Research limitations/implications: This research has been conducted with interviewees based in Thailand. Even though many HROs interviewed are international organizations, the findings may not be generalizable.

Originality/value: To our knowledge, no such research has ever been conducted in Thailand. It is an important research as part of the mapping of the role of commercial logistics providers in humanitarian logistics. A practical model has been developed to help understand the mechanism of the decision-making process, which can be used as a guideline for Thailand-based HROs and also logistics companies interested in providing services to them.

Paper type: Research paper

Introduction

There is ongoing humanitarian effort in Thailand, which is a developing middle-income country located in South-East Asia. Thailand is higher developed than the neighbouring countries Cambodia, Laos and Myanmar, which are classified as Least Developed Countries (UN, 2013). The relatively higher economic development, the existing infrastructure and the geographical location makes Thailand, and the capital Bangkok in particular, and ideal location for regional offices of the UN, the ICRC and many NGOs.

Humanitarian efforts in the region include disaster relief operations, such as in the aftermath of the Indian Ocean Tsunami 2004, Cyclone Nargis in Myanmar 2008, or the floods in Thailand, Laos and Cambodia in 2010. In addition, there are refugee camps on the Thai-Myanmar border sheltering ethnic tribes. These humanitarian operations require logistics for relief goods, medicine and food.

This research asks how these goods are moved to the locations were they are needed or consumed. A difference is made between regular transportation, such as for daily food needs, and emergency response.

Literature Review

In the commercial world, logistics services are often outsourced to specialised logistics service providers (LSPs). One research suggests that 77% of the Fortune 500 companies in the US outsource their logistics needs (Lai et al., 2004). The reasons for this have been identified as cost savings and

improving performance, and access to skills that are not available in-house (Beaumont and Sohal, 2004).

If a company gives the important logistics function into outsider's hands, they have to carefully weigh the criteria. Banomyong and Supatn (2011) identified 24 attributes which they classified into six dimensions: reliability, assurance, tangibility, empathy, responsiveness and service cost, where "accuracy of the documents" (which falls under reliability) is the most important dimensions for the customer, followed by "reasonable cost". The relationship between the customer and the LSP can be viewed as relationship-based (Panayides and So, 2005), in which the integration between customer and LSP plays an important role (Panayides and So, 2005a), or as resource-based (Lai, 2004). He classified the LSPs into four categories: Traditional freight forwarders (TTF), transformers (TMR), full service providers (FSP) and nichers (NCR). This was expanded by Lai et al. (2004) to develop an empirical taxonomy but no reference to HROs was made.

There is little literature on how Humanitarian Relief Organisations (HROs) or the military use outsourcing in logistics. Wal-Mart made headlines when it delivered relief goods to the victims of hurricane Katrina in 2005 in the US, but they were not officially contracted as an outsource. On the other hand, Banomyong et al. (2009) developed a model for Thailand in which the government's control center directly contracts discount stores for supply and logistics in a disaster situation. A fast response is required in emergency logistics (Banomyong and Sopadang, 2010). Discount stores have many of the required supplies on stock anyway, and they have supply chains including warehouses, distribution centers and transportation set up all over the country and are therefore suitable to respond quickly (Banomyong et al., 2009). However, this model has not been implemented in practice.

The United Nation's World Food Program is delivers 5 million metric tons of food per year, have 60 aircraft in the air, 40 ships on the water, and 5,000 trucks on the road on any given day (Quinn, 2010). However, not all of this is handled in-house; WFP has been working closely with commercial logistics service provider TNT since 2002 (Jones, 2003; TNT 2012). In the aftermath of the Japan tsunami in 2011, WFP received logistics support from Agility Logistics, UPS, TNT and Maersk (Agility, 2011).

The United Nations Office for Coordination of Humanitarian Affairs (UN OCHA) closely cooperates with DHL to form Disaster Response Teams (UNOCHA, n.d.; DHL 2013).

According to Agility (2008), commercial logistics companies were first integrated into a WFP Logistics Cluster during the relief efforts after Cyclone Nargis in 2008. The idea of the Logistics Emergency Teams (LET) was created by the World Economic Forum in 2008 (WEF, 2013). These teams consist of volunteers employed by the commercial logistics companies Agility, AP Möller-Maersk, TNT and UPS (Logistics Emergency Teams, 2013).

DHL, TNT and Agility provided logistics support to UN OCHA in Dubai for the floods in Pakistan (The National, 2010).

The concept of Logistics Clusters, along with clusters in other operational areas, was introduced by the UN Emergency Response Coordinator in 2005 through UN OCHA (Logistics Cluster, 2013). WFP was appointed as the lead agency which in the areas of operations, information management, coordination, training and tools between UN agencies, international organisations and I/NGOs. In this context, non-governmental organisations do not only mean humanitarian organisations, but also commercial companies, as part of Logistics Emergency Teams (LETs).

Logistics Emergency Teams provide the following services as part of the Logistics Cluster lead by the WFP, as described by Frank Clark of Agility, head of the Logistics Emergency Teams:

1. **Secondments of individuals (to a cluster member)**
2. **Specific functions (e.g., airport management, road transport management, warehouse management, customs management, information/communication, etc.)**
3. **Service provisions (e.g., full transportation services from one location to another, including all relevant elements such as warehousing, transport, etc.)**
4. **Asset deployments (e.g., warehouse/truck capacity, forklifts, pallets, etc.)**

Table 1: Services provided by the LETs
Source: Clark (2010)

There are different types of Logistics Emergency Teams, listed here:

The Logistics Emergency Team concept can support as follows:

(1) **Advance storage provision – Support to the pre-positioning of critical relief material and supplies, support to the HRD concept**
(2) **Air Freight Emergency Teams – Support to airport handling operations at the selected airport near the disaster zone: receive relief goods/unload airplanes, manage inventories, organise logistics solutions to next staging posts**
(3) **Transport Emergency Teams – Support to coordination and contracting of fleets in disaster prone zones. This could also involve pro bono services from L&T companies with their own local capacities**
(4) **Warehouse Emergency Teams – Support to storage and value added services palletising/labelling/etc at the airport and at the first staging posts in the disaster zone. This could also involve pro bono services from L&T companies with their own local capacities**
(5) **Supply Chain Emergency Teams – Support with specific logistics expertise to enhance the overall efficiency of the 'supply chain' for emergency relief in areas like the management of sourcing and collecting supplies, packaging, customs, information technology, communication, reporting, etc**

Table 2: Types of LETs
Source: Clark (2010)

It is therefore an established fact that today, commercial companies are part of international humanitarian logistics efforts. The question remains how involved local and multinational logistics companies are in the local humanitarian activities, and what this means for the beneficiaries.

Methodology

Semi-structured interviews were conducted with 11 Bangkok-based officers of humanitarian relief organisations. This included four UN agencies (UNICEF, IOM, WFP and FAO), five International NGOs (World Vision, CRS, Oxfam, Plan International and Save the Children the latter based in Singapore), the local office of the ICRC, and one Thai NGO (School for Life). The questions focussed on why or why not they involved commercial logistics companies, and what was the reason for their decision.

Findings

One organisation does not have any ongoing projects in Thailand but their Thailand office only serves as the regional office. Therefore, they do not have any transportation needs.

One organisation does not have operations in Thailand, but they do have operations in Laos and ship donated goods via Laem Chabang port inThailand (Laos is landlocked and does not have any seaports). They use commercial truckers to transport the goods from Laem Chabang to Laos, and the frequency is about one or two times per year.

Three organisations focus on education and development and have no need for the transportation of goods.

Of the seven organisations that have needs to transport goods, there was a difference as to whether they had regular transports or not. All of these organisations that had needs to transport goods only in emergency situations outsourced these to commercial truckers. The reason mentioned was that it would not make financial sense to keep and maintain vehicles if they are not used on a regular basis.

Organisations that receive donations on an irregular basis have two options: Either they hire a trucker to ship the goods to the site where they are needed, or they ask the donor (or the supplier, in case they buy the goods) to deliver to the site. In one case, they outsource to a regular trucker which charges below the market rate, which in itself is a donation of trucking services. One agency that

sometimes uses an outsourced trucker and sometimes asks the supplier to deliver the goods advised that the decision will be based on time, especially in an emergency situation such as the Thai floods in 2010. One organisation responded that they will always ask the donor to deliver the donated goods to the site.

Three organisations own trucks. Two of them own pick-up trucks, and one uses it to deliver mail to the post office, the other to pick of foodstuff from the market and deliver home-grown herbs and spices to the market. Both of them outsource to commercial truckers when they need to move donated goods. The third organisation is the only one that responded that they own trucks (including 6-wheel trucks) to move the goods, as this way, they have more control over the transportation resources. The respondent of this organisation is based in Mae Sod on the Thai-Myanmar border, where the availability of commercial trucking services is more limited than in Bangkok.

Only one of the HROs interviewed store goods in Thailand. This is rice, which needs to be bought on regular basis and will be bought in larger quantities than the daily fresh foodstuff. They store the rice on their own premises and do not outsource this to a commercial company.

Conclusions

HROs in Thailand with transportation needs will use their own trucks for regular transportation needs, such as daily foodstuff pick-up, will own vehicles for two reasons: Firstly, it makes financial sense, and secondly, they have more control.

HROs in Thailand that have irregular demand for transportation needs (either for irregular donations or only in emergency situations) will not own vehicles as it does not made financial sense and they received good response when they need trucking resources.

Those HROs that do not own vehicles may outsource their transportation needs to commercial truckers, or they may ask the donor to deliver the goods. The decision is either based on the organisation's policy (they might not want to get involved in the logistics), the speed (in case of emergency) or the required level of control over the transportation resources.

We can summarise the findings as follows:

Transportation needs and method used	Number of HROs interviewed using this method
No operations in Thailand	1
Operations but no transportation needs	3
Using own vehicles for regular transportation	3
Using outsourcing for regular transportation	1
Using own vehicles for donations	1
Using outsourcing for donations	2
Asking the donor to deliver	1
Using own vehicles in emergency response	0
Using outsourcing in emergency response	3

Table 1: Own vehicles vs. outsourcing by HROs in Thailand
Source: The authors

Modelling these findings into a decision tree, we arrive at the following graph:

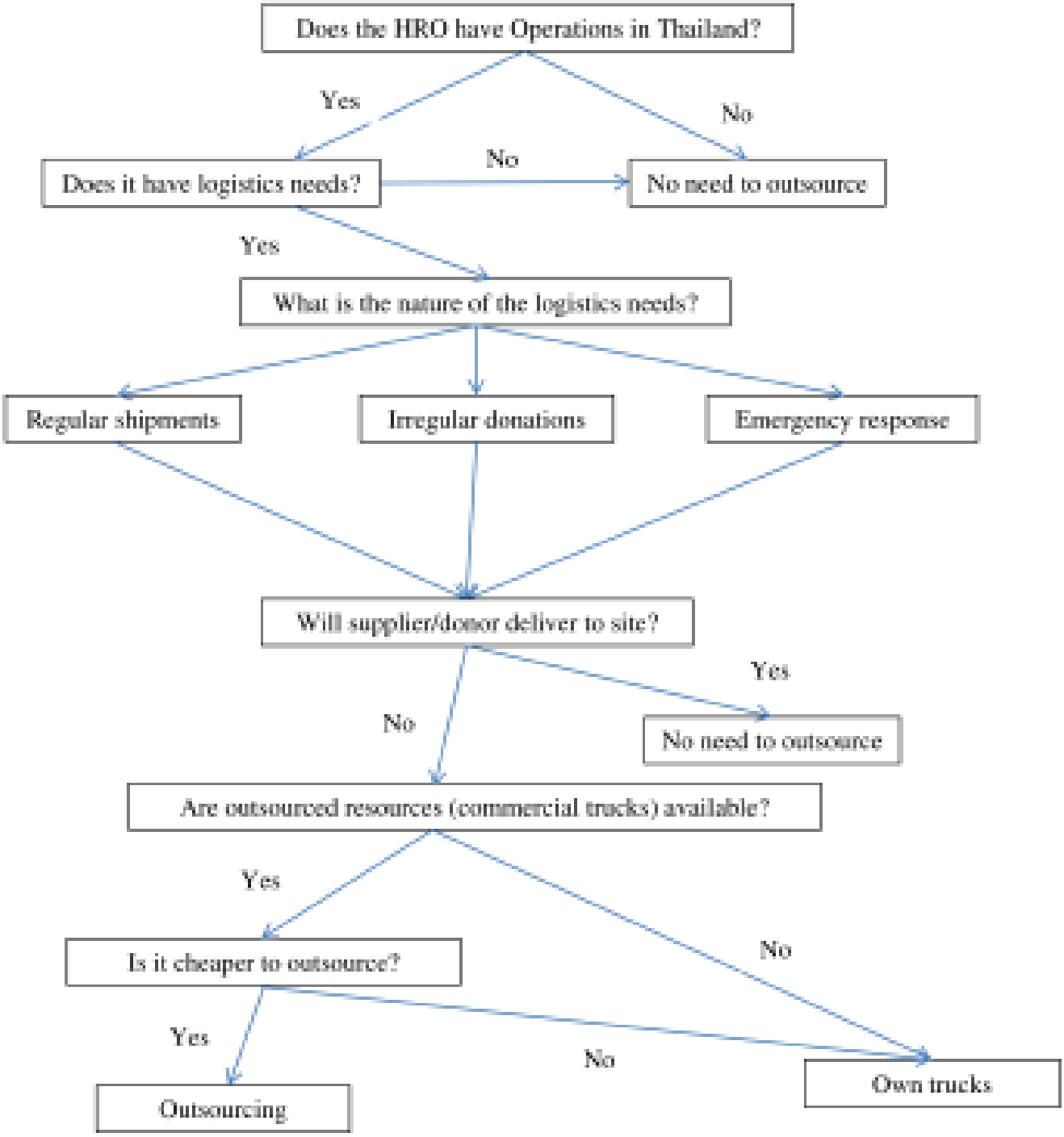

Figure 1: Outsourcing considerations
Source: The authors

It is obvious that those organisations that do not have operations in Thailand or do not move any goods will also not have any logistics needs. The logistics needs that of those HROs that need trucking services fall into three categories: Regular shipments (this includes food deliveries to camps or orphanages), irregular donations, and emergency response. The decision whether to own vehicles or to outsource is based on two factors: Availability of commercial trucks and cost. If vehicles are not easily available, for example in remote areas or in emergency situations where speed is of the utmost importance, own vehicles are chosen. If vehicles are available, cost will be considered as the key factor.

This decision tree is not much different from how a commercial company, for example a factory, would decide. However, the environment is different, as a commercial company would seek a location where the infrastructure is developed and trucks are readily available, whereas the HROs chose locations where their services are needed. This is often in areas where the infrastructure is not as developed. Therefore, it is more likely that the HROs will encounter non-availability than commercial companies would. Therefore, while the decision tree is similar, the results will be more likely for the HROs than for commercial companies to own and maintain trucks for their own shipments.

In conclusion, we can say that from initial observation the decision-making process for HROs whether to outsource their trucking needs is the same as for commercial companies.

Limitations and future research

The limitations of this research is that it is focused on Thailand, which is a middle-income country with a relatively developed commercial trucking infrastructure.

Future research should include the neighbouring least-developed countries, where there is more regular activity by HROs and a less developed commercial trucking and warehousing infrastructure. Furthermore, a future research in the region should have a larger sample size to verify the initial observation.

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PERFORMANCE OF TRANSPORTATION SERVICE PROVIDER: A LITERATURE REVIEW

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Introduction
An effective and efficient logistics system played an important role in achieving business goals of the organization that is crucial in the current situation of intense competition in the global business. Nowadays logistics has a tendency of rapid long-term growth driven by the occurrence of global international logistics market and the continuation of outsourcing in the field of manufacturing. Outsourcing has made moving business and economically and efficiently ways. The cost of labour is the primary motivator for outsourcing of the organizations. There are many factors involving the growth of logistics outsourcing, such as the globalization of business, which is viewed as the most famous driving force (Foster and Muller, 1990; Rao et al., 1993; Sheffi, 1990; Trunick, 1989). Consequently, the third party logistics (3PLs) has led to more complex supply chains Bradley (1994) and a greater need for transportation and distribution management in international logistics. Currently, the widespread use of logistics service provider (LSP) has been increasing because of the globalization of supply chain and firm outsourcing the demands for LSPs (Ellinger et al., 2008). Consequently the LSP role is extending rapidly as the number of firms outsources their logistics function to LSPs has increased (Lai et al., 2008). These have extended to the role of LSPs from transport business to logistics service provider business. Some recent logistics literature has focused on understanding the roles and competitive advantages of LSPs (Fabbe-Costes et al., 2009; Wong and Karia, 2010) suggest that it is necessary for LSPs to increase and transform the right resources into significant logistics performance (Lai et al., 2008; Yang et al., 2009; Wong and Karia, 2010). It is important for LSPs to consider these different approaches for achieving sustainable competitive advantage through operating at lower cost and managing better than other competitors. In a recent day, there are many different types of outsource. The purpose of this paper is to propose a new framework to measure the performance of TSPs to affecting on customer satisfaction. The remainder of this paper includes: review of performance measurement, research on logistics service provider (LSP) and measuring the performance, the propose framework for measuring the performance of transportation service providers, hypothesis, methodology and conclusion.

Review of Performance Measurement
Performance has focused on determining the effect of business process in supply chain members on performance. It helps providing the information on how resources and efforts should be allocated to ensure effectiveness. However, concerning the appropriate performance, outcomes was appeared when measuring the effectiveness of such initiatives (Anderson and Oliver, 1987; Lewis and Lambert, 1991; Kumar et al., 1992). Mentzer and Konrad (1991) defined performance measurement as effectiveness and efficiency in accomplishing a given task in relation to how well a goal is met. Performance measurement is critical to the success of most any organization because it creates understanding and improves competitiveness. Fawcett and Cooper (1998) and Neely et al. (2002) defined performance measurement as the process of quantifying the effectiveness and efficiency of action. Effectiveness is the extent to which a customer's requirements are met and efficiency measures how economically a firm's resources are utilized. Chan (2003) described the feedback of performance measurement or information on activities with respect to meeting customer expectations and strategic objectives. It reflects the need for improvement in areas with unsatisfactory performance.

There are many studies about the performance measurement tools. Gunasekaran et al. (2001) and Espino-Rodriguez and Padron-Robaina (2004) classified performance measurement tool into two groups; financial (e.g. cost, ROI) and non-financial (e.g. quality, flexibility). Chan (2003) identified performance measurement based on quantitative such as cost, and resource utilization and qualitative such as quality, flexibility, visibility, trust, and innovativeness. In addition to, many researchers studies on the relationship of the various factors that affect to performance. Beamon (1999) presented an overview and evaluation of the performance measures used in supply chain models and also presents a framework for the selection of performance measurement systems for manufacturing by identified three types of measure, namely resources, output and flexibility. Result showed that flexibility is an important consideration in supply chain performance. Stank et al., (1999) used structural equation model for studied relationship between service quality and profitability in service operation. They founded that factors impact on service supply chain performance consistent quality, productivity and

efficiency respectively. Guan and Ma (2003) studied the role of the seven innovation capability consist of learning, R&D, manufacturing, marketing, organizational, resources exploiting and strategic. This study used multiple regression analysis. They confirmed that reliable, delivery and the shortening lead-times are correlated significantly and positively with a firm's performance. While, Wilding and Juriado (2004) investigated customer perceptions on key logistics outsourcing. It found that the use of 3PLs has usually had a positive impact on companies' performance on cost.

However, there are some studies on the factors that affect to the performance of logistics services provider. Yeung (2006) found a relationship between a shipper and third party. The results reveal that the timeliness of the service; pricing; and the quality of delivery of 3PL service providers are positively related to the users' logistics and or export performance. Afterwards, Yeung et al., (2012) further studied about the impact of third-party logistics providers' capabilities on firm's performance. This study used structural equation modeling to empirically test. Results showed that 3PL providers' augmented capabilities and exporters' competitive advantage are strong mediators, supporting the theorized model underpinned by RBV. Furthermore, Bolat and Yilmaz (2009) studied the impact of outsourcing, and to examine the relationship between the outsourcing process and organizational performance in hotels. The result founded that outsourcing process has factors effect to firm performance consists; organizational effectiveness, productivity, profitability, quality. This study used a paired-sample t test, correlation and regression analysis to analyze the data.

Research on Logistics Service Provider (LSP) and Measuring the Performance.
Research on logistics service providers focus on the firm's core competencies (Bhatnagar et al., 1999; Bolumole, 2001; Lim, 2000) has stated that firms that used to adopt the approach are beginning to realize that having a provider take charge of the company's overall supply chain presents a more effective and efficient way of managing the logistics of the business. They pointed out that performance is essential for firm to successfully operate efficient and effective international facilities networks. Stank et al., (2003) suggested that reliability and cost performance are order qualifiers instead of differentiators in the eyes of users. In the logistics service industry, provider adds value to user by improving operation efficiency and/or sharing resource and information (Berglund et al., 1999). A logistics service provider (LSP) is a provider of an industrial logistics service that specializes in providing various types of logistics such as transportation, warehousing and freight forwarding (Karia, 2011; Murphy Jr., 2004; Lau, 1999). These definitions are further expanded by Ellinger et al. (2008) who describe LSPs or 3PL as firms that specialize in managing a wide range of service-related logistical activities for clients, included warehouse management, shipment consolidation, customs brokerage, transportation/distribution management and customer service (Daugherty and Pittman, 1995; Mentzer et al., 2000). The concept of 3PL has been developed from the need to provide transportation services by transportation companies to its customers. Basically, 3PL might be identified as outsourcing of transport and logistics activities to outside (Vasiliauskas and Jakubauskas, 2007).

Transportation Service Providers (TSPs) has been a source of competitive advantage and a common practice by most companies. TSPs have currently diversified by offering various services and activities. Most companies refer to greater flexibility, operational efficiency, improved customer service levels, and a better focus on their core businesses. More investigation on competitive advantage of TSPs is needed (Lai et al., 2002 & 2004) as well as theories and solutions for TSPs to achieve sustainable competitive advantage (Wong and Karia, 2010). For this reason, previous performances are important to select TSPs to meet the needs of businesses looking to take the lead in the competition. However, up to date, the issues have not been received enough concentration.

Venkatraman and Ramanujam (1986) identified two dimensions of business performance: operational performance (i.e. quality, flexibility, on time delivery) and financial performances. Huo et al., (2008) suggested that operational performance can be further classified into two major dimensions: cost and service performances. Cost performance is related to cost and price, while service performance is related to service reliability, speed, variety, and so forth. Stewart (1995) identified four key operational areas including delivery, flexibility and responsiveness, logistics cost, and asset management to evaluate performance. Consistent with the study of Sink et al., (1996); Larson and Kulchitsky (1999); Skjoett-Larsen (2000); Brah and Lim (2006); Yeung (2006) use the flexibility factor for performance measurement. Daugherty et al. (1996) identified six areas used to measure the performance; customer service, quality, productivity, costs, strategic focus and cycle time. Hensher and Brewer (2001) pointed out that many factors included reliability; cost and delivery times are key performance

indicators that providers use in promoting their services and facilities. Lai et al. (2002) investigated measures for evaluating supply chain performance in transport logistics based on the supply chain operation reference model. They point out that factors impact on supply chain performance in transport logistics consists: service effectiveness (e.g. reliability, responsiveness and flexibility) and operation efficiency (e.g. cost and assets). Lai et al. (2004) used the same factors to study in three transport logistics industry, i.e. air and sea transport, freight forwarding and third-party logistics services. They performed a one-way analysis of variance (ANOVA).

Brah and Lim (2006) studied the effect of technology and TQM on the performance of logistics companies. Previous studies used cost factor to studied view point of financial performance for measure the performance of logistics provider (Closs and Thompson, 1992; Skjoett-Larsen, 2000; House and Stank, 2001; Vaidyanathan, 2005; Panayides and So, 2005a&b; Yeung, 2006). Furthermore, Tan and Wai (2012) pointed out those four criteria such as delivery, cost, quality and flexibility important for decision making select a 3PL provider. The analytical hierarchy process (AHP) was used to compute the criteria weights. The researchers studied the performance measurement of logistics provider by using reliability (House and Stank, 2001; Panayides and So, 2005a&b; Yang et al., 2009). Some researchers using responsiveness to measure the performance consists (Gunasekaran and Ngai, 2003; Knemeyer and Murphy, 2004; Panayides and So, 2005a&b). At the same time, Yang et al. (2009) used assets (ROI) for studied the performance measurement.

From literatures reviews, the measurement of performance from the users of LSPs such as cost, customer service, delivery, quality, productivity and strategy has been accepted (Daugherty and Pittman, 1995). Moreover, Myers et al. (1996) recommend innovation, cost and customer service (flexibility, delivery and quality). Fawcett and Cooper (1998) measure logistics performance in terms of cost, service, productivity, asset management, and customer and employee satisfaction. Larson and Kulchitsky (1999) propose relations, customer service, efficiency and flexibility as logistics performance measures for users of LSPs. Some of the literature from the provider perspective has tried to measure various types of performance (e.g. Lai and Chen, 2003; Chapman et al., 2003; Mentzer et al., 2004; Stefansson, 2006; Fabbe-Costes et al., 2009), and examine the roles of physical and information technology in adding value (Lai et al., 2006; Lai et al., 2008). Some examine the roles of relationship orientation (Panayides and So, 2005a & b; Panayides, 2007a & b).

According to the literature reviews of logistics service provider performance measurement, there are two gaps of the study needed to be explored. The first gap, the literature reviews finding the important factors that affect to performance of logistics service providers only on customer perspective or provider perspective. For this research, it will be led to study simultaneously customers' and providers' perception. The final gap is that previous logistics literature has examined the impact of service effectiveness and operation efficiency on customer satisfaction.

The Propose Framework for Measuring the Performance of Transportation Service Providers

Transportation Service Providers (TSPs) performance are two elements definition which consists of effectiveness and efficiency. Effectiveness relates to the preference of the end-consumer and the sole indicator is consumer satisfaction. Efficiency indicators measure an output level against an input level (Wang and William, 2007).TSPs indicators are grouped into two main categories. First, service effectiveness consists of six sub-elements such as reliability, responsiveness, flexibility, quality, delivery and time. Second, operational efficiency indicators include two sub-elements such as cost and assets. A research model is formulated to identify the direct and indirect factors influencing to impact of the TSPs performance. Figure1 shows the framework of the TSPs performance affects to customer satisfaction. The indicators of performance are defined as follows:

Reliability, poor reliability can definitely decrease customer satisfaction and their repeat consumption in both short and long term. It may also damage the image of the company from customer point of view and even reduce the sales revenue (Chan et al., 2006).

Responsiveness, the willingness of transportation service providers to help customers and provide prompt service (Parasuraman et al., 1988). According to Supply-Chain Council (2006) responsiveness refer to order fulfilment cycle time that mean the average actual cycle time consistently achieved to fulfil customers order.

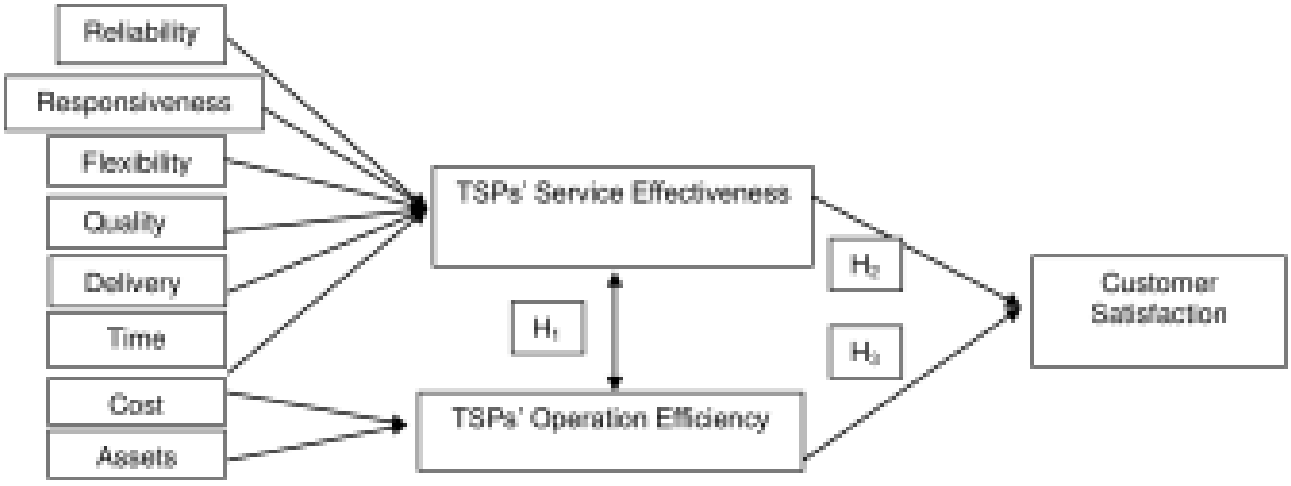

Figure1: The framework of the transportation service providers (TSPs)

Flexibility, shows the degree to which the supply chain can react to a changing environment and unusual customer requests (Beamon, 1999; Aramyan et al., 2007). According to Vickery et al. (1999), flexibility has a close relationship with environmental uncertainly, overall firm performance and functional interfaces; therefore, it should be understood by managers and all employees of company when making decision in all aspects (Chan et al., 2006).

Quality, indicates the ability to achieve low defect rates, offering safe products and creation of environmentally friendly products had consistently been felt as a very important competitive priority (Grunert, 2005). According to Neely et al. (2005), quality has been defined in terms of conformance to specification and hence quality-based measures of performance have focused on issues such as the number of defects produced and the cost of quality.

Delivery, Novich (1990) mention the various factors that cab influence delivery includes vehicle speed, driver reliability, frequency of delivery and location of depots. Stewart (1995) explains the increase in delivery performance is possible through a reduction in lead time attributes. Another important aspect of delivery performance is on-time delivery that reflects whether perfect delivery has taken place or otherwise and is also measure of customer service level. Tan and Wai (2012) explain delivery refers to on-time delivery, right quality and right place delivered.

Time, has been described as both a source of competitive advantage and the fundamental measure of manufacturing performance (Stalk, 1988; Drucker, 1990). Under the just-in-time (JIT) manufacturing philosophy the production or delivery of goods just too early or just too late is seen as waste (Potts, 1988). Similarly, one of the objectives of optimized production technology (OPT) is the minimization of throughput times (Goldratt and Cox, 1986). Chan et al.(2006) mentioned that time must be considered since more cost is involved if more time is spent. Time is also important to reveal the degree of improvement since dynamic environment may reduce its effectiveness.

Cost, the lower cost of production can enhance their competitiveness and organization should have an abundant amount of capital for continuous operation. Measurement is based on the ability to provide an adequate sum of capital for continuous operation. Cost must be considered for both long and short-terms operation. In short-term, cost of the alternative is important in terms of improving the existing situation only. Long-term operation of the alternative may affect the future strategy and development (Chan et al., 2006).

Assets, specificity indicates "a specialized investment that cannot be redeployed to alternative uses or by alternative users expect at a loss of productive value" (Williamson, 1996). Transaction-specific assets invested by the provider enable the usage of efficient processes and procedures to generate third-party services (Williamson, 1996). Moreover, assets specificity is a precondition to meet the specific requirements of the customer and to efficiently support recurrent transactions (Williamson, 1984; Williamson, 1985). According to Chan et al. (2006), assets show the efficiency in utilizing assets can enhance productivity at a competitive price and quality.

Hypothesis

The propose framework for measuring the performance of TSPs in this study is presented in Fig. 1. The customers' and providers' perception of service effectiveness and operational efficiency are portrayed as co-varying antecedents of satisfaction. While the literature provides little guidance on the relationship between service effectiveness and operational efficiency, it is reasonable to anticipate that performance on these items will move together. This expectation leads to first hypothesis.

H_1: Service effectiveness has a positive relationship with operational efficiency.

The literature reveals a link between service effectiveness and operational efficiency and customer satisfaction. Service effectiveness and operational efficiency are positively highly correlated measures for supply chain performance (Lai et al., 2002 & 2004). These finding provide the theoretical basis for two hypotheses.

H_2: Service effectiveness has a positive relationship with customer satisfaction.

H_3: operational efficiency has a positive relationship with customer satisfaction.

In summary, this model focuses on intermediate relationships as a first step in understanding the relationship between service effectiveness and operational efficiency on customer satisfaction. The model is bases on the assumption that service effectiveness and operational efficiency performance in TSPs may direct impact business performance through the customer satisfaction linkage.

Research Methodology

This study has combined both qualitative and quantitative methodologies which mixed research method or methodological triangulation (Gill and Johnson, 2010). Creswell and Plano Clark (2007) classified the triangulation design into five main types, in this study use a one-phase model, the convergence model. The convergent parallel design (also refered to as the convergent design) occurs when the researcher uses concurrent timing to implement the quantitative from questionnaire survey and qualitative by interview based on semi-structure interview, strands during the same phase of the research process. The data collection focuses on transportation service providers (TSPs) in Thailand. This concurrently meets the research objective for understanding the factors impact of the performance of TSPs using customers' and providers' perception. It means that the research context is TSPs. The data analysis used to formulate the descriptive statistics, factor analysis and use SEM for analyzing the relationship between latent variable affect to customer satisfaction. The population frame for this research is constructed from the directory of 240 Transportation Service Providers (TSPs) from Thai Federation on Logistics and their customers. In this research, the sampling in this research is all of population.

Conclusion

This paper reviews the main factors influencing the performance of TSPs and proposes a new framework to measure the performance of TSPs which effects the customer satisfaction. This proposal is focused on the views of both service provider and service user perception. The proposed framework for measuring the performance of transportation service provider is designed to identify the direct and indirect impact of the TSP performance. The TSP performance indicators are grouped into two main categories: the service effectiveness and the operational efficiency indicators. The service effectiveness consists of six sub-elements including reliability, responsiveness, flexibility, quality, delivery and time. The operational efficiency indicators include two sub-elements: cost and assets. In particular, the measurement of the performance of Thai transportation service providers will be able to help the improvement and development TSPs in Thailand further.

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SUPPLY CHAIN NETWORK DESIGN UNDER RFID ADOPTION

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Introduction

Due to the global sourcing and markets, international companies commonly use multi-echelon supply networks to support their manufacturing and distribution. For example, Wal-Mart and Target have complex supply networks in the United States. When products arrive at international seaports, they are delivered to retail stores through multi-echelon supply networks. The design and management of multi-echelon supply network in today's competitive business environment is one of the most important and difficult problems that managers face.

Several studies have focused on the area of supply network design. Shen (2007) conducted a complete review of the supply chain design literature and discussed future research topics. Recently, Pujari et al. (2008) used a continuous approximation (CA) procedure to determine the optimal number and size of shipments when considering issues of location, production, inventory, and transportation. Murat et al. (2010) provided a CA framework for solving location-allocation problems with dense demand. Li and Ouyang (2010) provided a continuous approximation approach for solving the reliable facility location design problem under correlated probabilistic disruptions. Murat et al. (2011) formulated the two-facility location–allocation problem as a multi-dimensional boundary value problem and developed a multi-dimensional shooting algorithm to solve this problem. Tsao and Lu (2012) designed a supply chain network considering both distance discount and quantity discount for transportation cost. In this paper we use a continuous approximation technique to formulate the supply network model. The proposed solution defines the input data in terms of continuous functions and can formulate these functions for a data set of any size.

Radio-frequency identification (RFID) is the use of a wireless non-contact system that uses radio-frequency electromagnetic fields to transfer data from a tag attached to an object. Ngai et al. (2008) has presented an excellent literature review of academic journal papers that were published on the RFID subject between 1995 and 2005. Sarac et al. (2010) has made a review about the impacts of RFID on the supply chain management. They concluded that RFID technologies could improve the level of supply chain management through reduction of inventory losses and increase of the efficiency and speed of processes and improvement of information accuracy. RFID has being adopted in many supply chains, especially for the universal of Internet of Things (IoT). IoT deals with integrating and enabling information communication technologies including RFID, wireless sensor networks, machine-to-machine systems, mobile apps, etc. RFID is said to revolutionize supply chain management, releasing great values. Therefore, it is essential to consider the RFID adoption when designing a supply chain network.

The main purpose of this research attains a four-fold goal: First, we want to highlight the importance of RFID adoption in the supply network design problem. Second, we incorporate the RFID adoption decision into the supply network design model. Thirdly, we want to discuss the effects of RFID adoption on the supply network design. Fourth, we want to provide solution procedures for solving the supply network design problem considering RFID adoption. The objective of the model is to determine the optimal distribution center influence area, replenishment cycle time and RFID adoption decision to maximize the total profit.

Model Formulation

The network studied in this paper is a three-echelon supply chain with an outside supplier selling goods to DCs. The DCs are located at level two, and help to consolidate shipments arriving from the supplier and deliver them to the retailers. The retailers at the downstream meet the demands from end customers. Goods flow from upper-stream facilities to the downstream facilities. This study uses the following notations:

T_i : replenishment cycle time for each DC in cluster i, where i=1,2,…,n (decision variable)

A_i : influence area for each DC in cluster i, where i=1,2,…,n (decision variable)

F : facility cost of opening each DC

δ_i : store density in cluster i, where i=1,2,...,n

λ_i : demand rate for retail store in cluster i, where i=1,2,...,n

ξ : length of the planning horizon

c_T : transportation cost per unit distance per item

f : constant that depends on the distance metric and shape of the DC service region

S: ordering cost for DC

h: inventory holding cost for DC

C_i : service area in cluster i, where i=1,2,...,n

c: unit purchasing cost

p: unit selling price

t : unit RFID adoption cost

θ : efficiency of the replenishment process with respect to satisfying consumer demand

μ_N : the mean of the lead time without RFID adoption

σ_N : the standard error of the lead time without RFID adoption

μ_{RFID} : the mean of the lead time with RFID adoption

σ_{RFID} : the standard error of the lead time with RFID adoption

υ : factor by which order quantity must be increased relative to demand when RFID is not used, where $\upsilon \geq 1$

r : unit process cost for reverse logistics

χ : fixed fraction of items needing to go into reverse logistics process

t_N : average process time for reverse logistics without RFID adoption

t_{RFID} : average process time for reverse logistics with RFID adoption

The mathematical model in this study is based on the following assumptions:

1. Demand per unit time for retail store in cluster i is an independent and identically distributed Poisson process with rate λ_i.
2. Each DC's influence area is close to circular. Moreover, each DC is located in the center of the influence area.
3. Each retailer is assigned to a particular DC and served only by that DC.
4. RFID technology can improve information sharing, cut logistical operations time and reduce lead-time. In this paper the mean of lead time and the standard error of lead time under RFID adoption are assumed to be less than those without RFID adoption, i.e. $\mu_{RFID} < \mu_N$ and $\sigma_{RFID} < \sigma_N$.
5. Without RFID adoption, the products are subject to shrinkage due to damage, theft, or other incidents. Therefore, the DCs should replenish more products when RFID is not adopted. This means $\upsilon > 1$ when RFID is not adopted.
6. The average process time for reverse logistics without RFID adoption is larger than the average process time for reverse logistics with RFID adoption, i.e. $t_N > t_{RFID}$.
7. RFID adoption affects the efficiency of the replenishment process with respect to satisfying consumer demand. When RFID is adopted in the supply chain, $\theta = 1$; otherwise, $0 < \theta < 1$.

This study uses a continuous approximation technique (Tsao et al., 2012) to divide the network into smaller regions over which the discrete variable can be modeled using the slow varying functions. Using the method the given service region is covered with clusters i, i=1,2...,n. Clusters i, i=1,2,...,n, exist within the given service region such that the store density is nearly constant over each cluster.

The total network profit is

$$\Pi(A_i,T_i)=\begin{cases}\Pi_N(A_i,T_i), & \text{if RFID is not adopted;}\\ \Pi_{RFID}(A_i,T_i), & \text{if RFID is adopted.}\end{cases} \quad (1)$$

The total network profit without RFID adoption $\Pi_N(A_i,T_i)$ is

$$\begin{aligned}\Pi_N(A_i,T_i)=&\sum_{i=1}^{n}(p-uc)\theta\xi\lambda_i\delta_i C_i-\sum_{i=1}^{n}\left(F\frac{C_i}{A_i}\right)-\sum_{i=1}^{n}\left(c_1 f\sqrt{A_i}\theta\xi\lambda_i\delta_i C_i\right)\\&-\sum_{i=1}^{n}\left(\frac{h\theta\xi\lambda_i\delta_i C_i T_i}{2}+hZ_\alpha\sqrt{\mu_N\theta\xi\lambda_i\delta_i\frac{C_i^2}{A_i}+\sigma_N^2(\theta\xi\lambda_i\delta_i C_i)^2}\right)\\&-\sum_{i=1}^{n}\left(\frac{S}{T_i}\frac{C_i}{A_i}\right)-\sum_{i=1}^{n}r\chi\theta\xi\lambda_i\delta_i C_i-\sum_{i=1}^{n}hu_N\chi\theta\lambda_i\delta_i C_i\text{, where } i=1,2,\ldots,n.\end{aligned} \quad (2)$$

The total network profit with RFID adoption $TNC_{RFID}(A_i,T_i)$ is

$$\begin{aligned}\Pi_{RFID}(A_i,T_i)=&\sum_{i=1}^{n}(p-c-\tau)\xi\lambda_i\delta_i C_i-\sum_{i=1}^{n}\left(F\frac{C_i}{A_i}\right)-\sum_{i=1}^{n}\left(c_1 f\sqrt{A_i}\xi\lambda_i\delta_i C_i\right)\\&-\sum_{i=1}^{n}\left(\frac{h\xi\lambda_i\delta_i C_i T_i}{2}+hZ_\alpha\sqrt{\mu_{RFID}\xi\lambda_i\delta_i\frac{C_i^2}{A_i}+\sigma_{RFID}^2(\xi\lambda_i\delta_i C_i)^2}\right)\\&-\sum_{i=1}^{n}\left(\frac{S}{T_i}\frac{C_i}{A_i}\right)-\sum_{i=1}^{n}r\chi\xi\lambda_i\delta_i C_i-\sum_{i=1}^{n}hr_{RFID}\chi\xi\lambda_i\delta_i C_i\text{, where } i=1,2,\ldots,n.\end{aligned} \quad (3)$$

The crucial decisions are the location of the DCs, the manner in which to assign retail stores to DCs, inventory policy at DCs, and the RFID adoption decision to maximize total profit. Since each DC is assumed to locate in the center of the influence area, the location and allocation decisions can be decided by determining the DC influence areas.

Decision Making

The problem analysed here is to determine the optimal influence area for each DC A_i^* and replenishment cycle time for each DC T_i^* to maximize total network profit $\Pi(A_i,T_i)$, $i=1,2,\ldots,n$. The problem is a two-branch nonlinear function with 2n variables. To solve the problem, we first find the maximal values of $\Pi_N(A_i,T_i)$ and $\Pi_{RFID}(A_i,T_i)$ respectively. Then the optimal A_i^* and T_i^* are chosen to maximize $\Pi(A_i,T_i)$, i.e. $\Pi^*(A_i^*,T_i^*)=\max[\Pi_N(A_i^A,T_i^A),\Pi_{RFID}(A_i^R,T_i^R)]$, where A_i^A and T_i^A are the values to maximize $\Pi_N(A_i,T_i)$ and A_i^R and T_i^R are the values to maximize $\Pi_{RFID}(A_i,T_i)$. This is $\Pi^*(A_i^*,T_i^*)=\mathrm{Max}[\Pi_N(A_i^A,T_i^A),\Pi_{RFID}(A_i^R,T_i^R)]$.

Numerical Example

To illustrate the algorithm described above, consider the parameters of a commodity in a supply chain: F=5000, n=3, C_1=8000, C_2=10000, C_3=12000, h=1, c_1=5, r=2, S=500, f=0.01, τ=0.4, λ_1=11, λ_2=10, λ_3=9, ξ=12, δ_1=0.06, δ_2=0.05, δ_3=0.04, $Z_{0.05}=1.645$, u=1.05, μ_{RFID}=0.5, σ_{RFID}=0.05, μ_N=1, σ_N=0.1, χ=0.02; r_{RFID}=1, r_N=1.5. When adopt RFID technology (θ=1), the influence areas for DCs in cluster 1, cluster 2 and cluster 3 are A_1^R=1017.63, A_2^R=1215.75 and A_3^R=1501.14

respectively; the replenishment cycle times for DCs in cluster 1, cluster 2 and cluster 3 are $T_1^{\diamond}$=0.352, $T_2^{\diamond}$=0.370 and $T_3^{\diamond}$=0.393 respectively; the total profit Π_{RFID}=289418. When θ=0.9 (without RFID adoption), the influence areas for DCs in cluster 1, cluster 2 and cluster 3 are A_1^{Δ}=1088.66, A_2^{Δ}=1300.76 and A_3^{Δ}=1606.32 respectively; the replenishment cycle times for DCs in cluster 1, cluster 2 and cluster 3 are T_1^{Δ}=0.359, T_2^{Δ}=0.377 and T_3^{Δ}=0.400 respectively; the total profit Π_N=254821. Therefore, in this case, the maximal profit is $289418 when the RFID is adopted.

Conclusion

This study designs a supply chain network models considering RFID adoption. The crucial decisions are the location of the DCs, the manner in which to assign retail stores to DCs, the manner in which to set the inventory policy at DCs, and the RFID adoption decision to maximize total profit. This study formulated the supply chain network design problem as a two-branch nonlinear model and proposes a solution approach to solve the problem. Numerical study demonstrated the solution procedures. Further research on this topic may consider other practical scenarios, such as capacity limitations on DCs or deteriorating item supply networks.

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TARGETING INDUSTRY FOR THAILAND EAST-WEST ECONOMIC CORRIDOR

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Abstract
Greater Mekong Subregion's East-West Economic Corridor is the physical logistics and investment linkage of Myanmar, Thailand, Lao PDR and Vietnam. Where Thailand is geographically located in the center and posses high potential in terms of economic and industry, the research aims to identify the target industry for this regional development. The identification criteria includes key production factors and national policy, with 3 constructing steps of selection, i.e., (i) Preliminary Screen, (ii) Policy Screen and (iii) Industry Selection. The study leads to 2 targeting industries, i.e., foods and energy. In addition, other strong industries are also identified.

1. Introduction

1.1 Greater Mekong Subregion

Greater Mekong Subregion (GMS) is an Asian Development Bank (ADB) program that aims to cooperate economic of 6 countries along Mekong river, i.e., Cambodia, the People's Republic of China (PRC, specifically Yunnan Province and Guangxi Zhuang Autonomous Region), Lao People's Democratic Republic (Lao PDR), Myanmar, Thailand, and Viet Nam (see Figure 1). Whilst the area is bounded together, it covers more than 2.6 million square kilometers and a combined population of 326 million. GMS program launched in 1992 with the collaboration in the area of transport, energy, telecommunications, environment, human resource development, tourism, trade, private sector investment, and agriculture. With the plentiful human and natural resource, GMS is one of the global economic's great potential. [1][2]

Figure 1: Greater Mekong Subregion
Source: [3]

Upon GMS economic development, the development of so-called "Economic Corridors" is one of the key projects bywhich it can leads to improve and enhance investments in multi-sectors, i.e., transport,

energy, telecommunications, tourism, trade, private sector investment, and agriculture in the subregion. The economic corridor development is not only focusing on strategic nodes particularly at border crossings between two countries, it highlights specific regional area, to concentrate infrastructure development and to simplify and borderlessen the area. [1][2][4]

The GMS's Economic Corridors were officially agreed to 3 economic corridors, i.e., [1]

1) The North-South Economic Corridor (NSEC) involves three routes along the north to south axis of the GMS geography:
   (i) The Western Subcorridor: Kunming (PRC) – Chiang Rai (Thailand) – Bangkok (Thailand) via LAO PDR or Myanmar
   (ii) The Central Subcorridor: Kunming (PRC) – Ha Noi (Viet Nam) – Hai Phong (Viet Nam) which connects to the existing Highway No. 1 running from the northern to the southern part of Viet Nam
   (iii) The Eastern Subcorridor: Nanning (PRC) – Ha Noi (Viet Nam) via the Youyi Pass or Fangchenggang (PRC) – Dongxing (PRC) – Mong Cai (Viet Nam) route.
2) The East-West Economic Corridor (EWEC) runs from Da Nang Port in Viet Nam, through Lao PDR, Thailand, and to the Mawlamyine Port in Myanmar.
3) The Southern Economic Corridor (SEC) comprises the following subcorridors and intercorridor link connecting major towns and cities in the southern part of GMS:
   (i) The Central Subcorridor: Bangkok-Phnom Penh-Ho Chi Minh City-Vung Tau;
   (ii) The Northern Subcorridor: Bangkok-Siem Reap-Stung Treng-Rattanakiri-O Yadov-Pleiku-Quy Nhon;
   (iii) The Southern Coastal Subcorridor: Bangkok-Trat-Koh Kong-Kampot-Ha Tien-Ca Mau City-Nam Can; and
   (iv) The Intercorridor Link: Sihanoukville-Phnom Penh-Kratie-Stung Treng-Dong Kralor (Tra Pang Kriel)-Pakse-Savannakhet.

Of interest of the paper is the East-West Economic Corridor (EWEC) that run across from Viet Nam, through Lao PDR, Thailand, and to Myanmar.

1.2 East-West Economic Corridor

The economic corridor is created based on a road of 1,450 km with the west end at port city of Mawlamyine (Myanmar), crossing Kayin Division, Thai provinces of Tak, Sukhothai, Phitsanulok, Phetchabun, Khon Kaen, Kalasin and Mukdahan and Laotian provinces of Savannakhet, Vietnamese provinces of Quang Tri, Thua Thien-Hue Province and Da Nang city as the east end. [5]

The specific objectives of EWEC development are to further strengthen economic cooperation and to facilitate trade, investment, and development among these four countries; to reduce transport costs in the project area by making the movement of goods and people more efficient; and to reduce poverty by supporting economic development in rural areas and border regions, especially via agro-industry and tourism.

ADB as well as 3 countries estimateldly invest in the establishment of EWEC on infrastructure and related development at US$ 2.5 billion. Such projects are, for example, road rehabilitation, development of Special Border Zones and deep-sea port. [6]

Figure 2: Greater Mekong Subregion's East-West Economic Corridor
Source: [6]

1.3 Thailand's East-West Economic Corridor

In Thailand, of interest in this paper, EWEC cut across 9 cities, ie, Tak, Sukhothai, Phitsanulok, Phetchabun, Chaiyaphum, Khon Kaen, Mahasarakham, Kalasin and Mukdahan. Table 1 summarises basic information and economic of these cities.

City	Area (Sq.km.)	Population (1,000 person)	GPP (million THB)	GPP per Capita (THB)
Tak	16,406	535	34,550	64,610
Sukhothai	6,596	630	33,440	53,058
Phitsanulok	10,815	851	63,984	75,157
Phetchabun	12,668	1,041	57,856	55,562
Chaiyachum	12,778	1,201	46,899	39,049
Khon Kaen	10,886	1,896	155,272	81,884
Mahasarakham	5,291	1,031	41,000	39,776
Kalasin	6,946	1,012	43,293	42,775
Mukdahan	4,194	346	18,732	54,170

Table 1: Summary of Basic Information and Economic of Thailand EWEC Cities – 2011
Source: [7]

All 9 EWEC cities are very distinct in term of area, population and economy. EWEC cities cover 17% of area of Thailand and 13% of total population of Thailand. However, comparing to the whole country GPP per capita at 164,512THB, EWEC cities are rather poor. Yet, with the opening gateway to the East and West with this EWEC, EWEC cities are possessing high potential and connectivity.

2. Target Industry Selection Criteria

Based on industry database of Ministry of Industry, currently, there are 21 industries, i.e., chemical/ chemical product, furniture, wood/ wood product, printing, electronic/ electric appliances, machine/ mechanics, basic metal, paper/ paper product, metal, petroleum, agricultural, plastic, non-metal, automotive/ components, leather/ leather product, rubber/ rubber product, textile, garment, drink, food and other industries. At present, classified in these 21 industries, there are 7,193 factories registered in EWEC area. [8]

Of interest of the study is the selection of the targeting industry where the promotion policy should be placed. Therefore, the basic requirement of the selection is the industry potential. Whilst the promotion can be divided into phase such as urgent, short-term, long-term, the study focus on the urgent. Here, the strong industry should be selected as the offensive policy is needed. Therefore, it is the task to identify the dominant industry. Hence, how to identify.

Where the criteria can be vast, the multi-criteria selection and screening process are used. The selection process is therefore design as; (i) Preliminary Screen, (ii) Policy Screen and (iii) Industry Selection. Figure 2 illustrates process of selection.

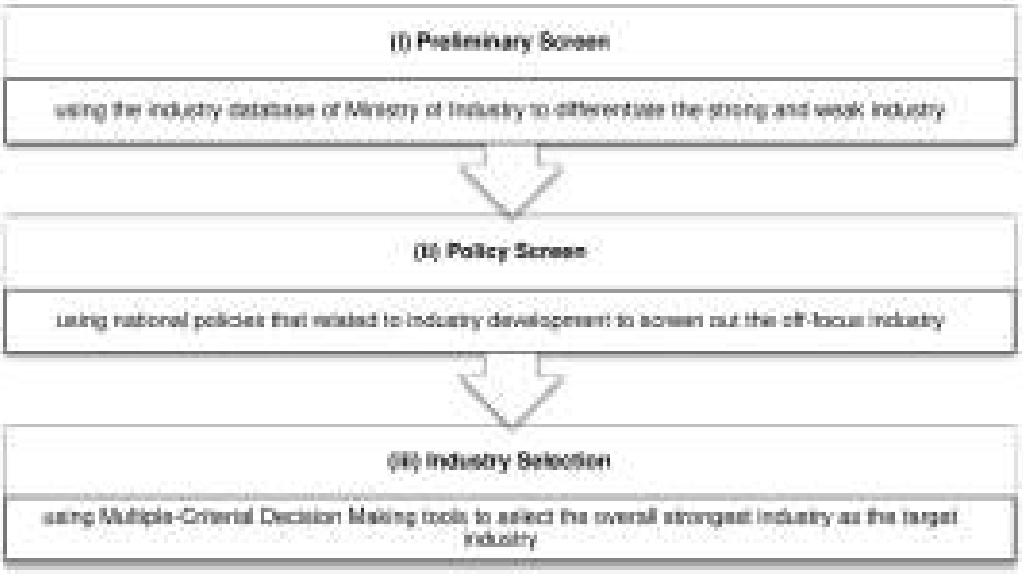

Figure 2: Industry Selection Process

The following topic elaborates the selection process and result.

3. Result

3.1 Preliminary Screen

Process of preliminary screen use the industry database of Ministry of Industry to identify the current strength of those registered 22 industry. The selection criteria of the screening is based on key information available on the database itself, i.e., number of factory, machine cost, revolving fund, investment cost, machine horse power and number of labor. These criteria are more-or-less reflect the current status of each industry.

Whilst each criteria possess different indicators, e.g., number of factory, THB, hp, number of people, therefore, the comparison on multi-dimension are not possible. Here, the ranking of each criteria is used. Then the combine rank of each criteria is used to summarise overall rank (see Table 2).

Industry	(a)	(b)	(c)	(d)	(e)	(f)	Summation of Rank (a+b+c+d+e+f)	Overall Rank
Chemical/ chemical product	13	13	19	15	17	17	94	18
Furniture	9	19	16	19	13	9	85	15
Wood/ wood product	8	10	13	12	8	11	62	10
Other	6	1	3	2	2	6	20	3
Printing	16	21	20	20	21	21	119	21
Electronic/ electric appliances	18	15	5	10	18	8	74	11
Machine/ mechanics	7	18	14	16	12	13	80	13
Basic metal	21	17	4	11	9	18	80	14
Paper/ paper product	15	3	9	5	4	14	50	8
Metal	5	14	15	13	14	15	76	12
Petroleum	17	11	18	17	16	19	98	19

Industry	(a)	(b)	(c)	(d)	(e)	(f)	Summation of Rank (a+b+c+d+e+f)	Overall Rank
Agricultural	1	5	2	3	3	4	18	2
Plastic	12	16	17	18	15	12	90	17
Non-metal	3	6	7	7	7	5	35	4
Automotive/ components	2	9	6	6	10	7	40	5
Leather/ leather product	20	12	12	14	20	10	88	16
Rubber/ rubber product	14	20	21	21	19	20	115	20
Textile	11	7	11	9	5	2	45	6
Garment	10	8	10	8	11	1	48	7
Drink	19	4	8	4	6	16	57	9
Food	4	2	1	1	1	3	12	1

Note: (a) Rank of Number of Factory, (b) Rank of Machine Cost, (c) Rank of Revolving Fund, (d) Rank of Investment Cost, (e) Rank of Machine Horse Power and (f) Rank of Number of Labor

Table 2: Criteria Rank and Overall Rank of Industry

Here, 12 weak industries (ranked 11-21) are screened out. Therefore, only 10 industries, i.e., food, agricultural, other, non-metal, automotive/ components, textile, garment, petroleum, drink and wood/ wood product will be considered in the next step. However, when inspect these 10 industries in detail, there are some adjustment made as follow:

- When talking about textile, garment is always included. [9] Therefore, it is then textile and garment industry.
- When talking about food, , agricultural and drink is always included. [9] Therefore, it is food industry.
- When inspecting into other industry (ranked 3), most of the industry are energy related. Therefore, it is then called energy industry.

Here, only 7 industries are considered in policy screen process, i.e., food, non-metal, energy, automotive/ components, textile/ garment, petroleum and wood/ wood product.

3.2 Policy Screen

After the preliminary selection, the policy screen is conducted. Bywhich national policies that related to industry development is used to screen out the off-focus industry, the following summarises the findings.

Here, national policies of interest are Thailand's Industry Master Plan 2012-2031, Thailand's 11th National Economic and Social Development Plan 2012-2016 and Thailand's 2trillion THB logistics infrastructure investment plan. Where the Industry Master Plan highlight the development of food, automotive/ component, garment and energy, the economic and social development plan address directly to food and energy industry as the target industry of Thailand. On the other hand, the logistics infrastructure investment plan does not rule out or promote any industry in specific. [9][10][11][12][13] Therefore, the preferred industries, for the next selection step are food, automotive/ component, textile/ garment and energy.

3.3 Industry Selection

The industry selection is based on Multiple-Criteria Decision Making tools. It is to select the overall strongest industry as the target industry. Where 5 factors of interest are 1) material, 2) labor, 3) investment and machine, 4) market and cluster and 5) economic, social and environment. In detail, there are 20 sub-factors constructing these 5 factors. (see Figure 3) It shall be noted that these criteria are agreed based on literature [14][15][16] and upon the Ministry of Industry agency who is funding the project as well as stakeholders upon interviews.

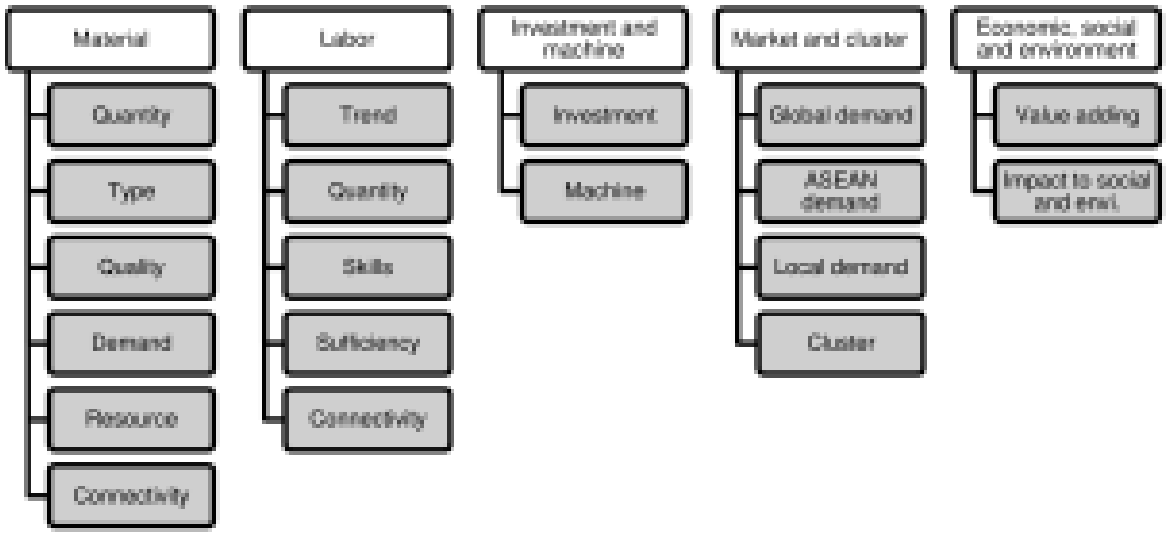

Figure 3: Industry Selection Criteria

Here, technique of Fuzzy Analytical Hierarchy Process (FAHP) is used for determine the significance of each factor. [17][18][19] The AHP pair-wise questionnaires is developed and distributed to stakeholders in these EWEC cities. Upon the data collection, seminar on related topics and interviews, 35 questionnaires are completed. The consistency ratio is tested and the result is to be accepted. Figure 4 illustrates weight per AHP pair-wise calculation.

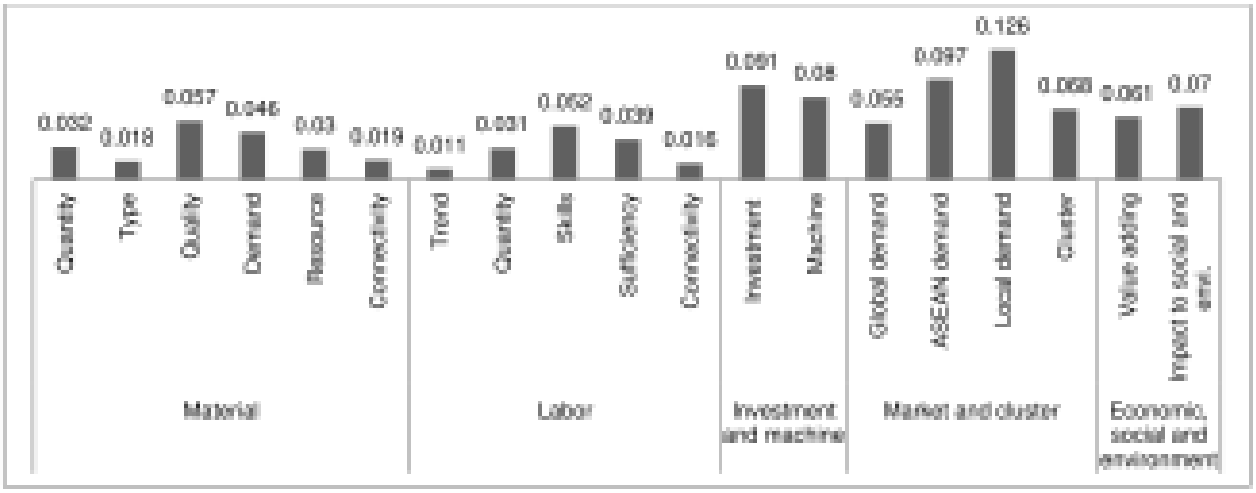

Figure 4: Sub-Factors Weight

Then, another questionnaire is developed to collect the perception to each factor of interest. The score level of 1-5 is used to reflect the strength and weakness of each industry in each sub-factor. The potential of the industry is determined by the total score, which is a summation of score multiply by weight (from FAHP) of each factor. The result is shown in Table 3.

Factor	Sub-Factor	Total Score (weight x score)			
		Food	Energy	Automotive/ Component	Textile/ Garment
Material	Quantity	0.010	0.009	0.006	0.006
	Type	0.008	0.004	0.003	0.003
	Quality	0.021	0.014	0.011	0.011
	Demand	0.019	0.011	0.009	0.008
	Resource	0.011	0.008	0.005	0.006
	Connectivity	0.006	0.006	0.003	0.004
Labor	Trend	0.003	0.003	0.003	0.002
	Quantity	0.010	0.007	0.007	0.007

Factor	Sub-Factor	Total Score (weight x score)			
		Food	Energy	Automotive/ Component	Textile/ Garment
	Skills	0.015	0.013	0.011	0.014
	Sufficiency	0.011	0.010	0.007	0.010
	Connectivity	0.005	0.005	0.003	0.003
Investment and machine	Investment	0.023	0.029	0.019	0.020
	Machine	0.023	0.022	0.014	0.021
Market and cluster	Global demand	0.016	0.015	0.011	0.014
	ASEAN demand	0.026	0.033	0.020	0.018
	Local demand	0.038	0.049	0.023	0.017
	Cluster	0.021	0.018	0.014	0.015
Economic, social and environment	Value adding	0.017	0.018	0.014	0.013
	Impact to social and environment	0.019	0.021	0.018	0.012
Total Score		**0.302**	**0.294**	**0.201**	**0.204**
Rank		**1**	**2**	**4**	**3**

Table 3: Industry Selection – Multiple-Criteria

Here, it can be seen that food is ranked 1 at total score of 0.302 and energy is ranked 2 at total score of 0.294. Here, it can be seen that food and energy industries are generally and comparatively strong in terms of material, labor, investment and machine, market and cluster and economic, social and environment.

Textile/ garment and automotive/ component are ranked 3 and 4, at score 0.204 and 0.201, respectively. These two are also strong, in comparison to other screen-out industries in earlier steps.

4. Conclusion

The research aims to identify targeting industry in Thailand EWEC cities. Where strong industries are to be promoted for EWEC development, the multi-criteria selection and screening process are used. The process starts from the preliminary screen that uses the industry database of Ministry of Industry to differentiate the strong and weak industry. Therefore, 7 strong industries are identified. Then the policy screen that uses national policies that related to industry development to screen out the off-focus industry. 4 industries are selected. Finally, with the industry selection that uses Multiple-Criterial Decision Making tools to select the overall strongest industry as the target industry, food and energy industries are selected.

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THE ANALYSIS OF INFORMATION ARCHITECTURE MODEL OF TOURISM LOGISTICS WEBSITES

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Purpose: This paper analyse information architecture of top tourism logistics websites in order to develop the most efficient framework. In tourism industry, each web needs a different architecture to suit their users. The information architecture influences the performance of information flow. The efficient information flow can enrich information sharing across the supply chain. It is clear to see that the information flow provides opportunities and challenges for the tourism industry. Information is often distributed via common tools include travel documents, television advertisements, online videos and websites. Among those tools, websites are the most common one.

Design/methodology/approach In this paper, the top tourism website is analyzed based on the research methodology applied from SAM (Software Process Analysis Method) which is previously applied for the analysis of well-known software processes and e-commerce websites. Firstly, detailed information architecture of the websites is elaborated via elaboration process. Secondly, the main components of information architecture are discovered from the normalization process. Lastly, the abstract model of tourism website is generated.

Findings: This paper proposes conceptual model for building of tourism website based on their processes and elements.

Practical implications: The model obtained can be used as a recommended model for adopters. The models suggest key characteristics needed for a tourism website. As a result, design and development time as well as required labour are reduced. This further results in cost reduction and more customer satisfaction.

Originality/value: This paper applies an existing analysis method onto the domain of tourism logistics.

Keywords: Tourism website, Travel website, Tourism logistics, Tourism logistic supply chain, Information flow, Information system, Information architecture model

Introduction

Logistics was introduced before 1950s and was first implemented in procurement, maintenance and transportation processes (Ballou 2007). However, its usefulness and applicability encourage the adaptation in other areas, i.e. hospitality, catering and tourism (Kordel 2008).

It is obvious that tourism is the key force that drives the world's economy (Cooper 2008) and destinations' economy. The fact that tourism industry is extremely competitive (Crouch & Ritchie 1999) comes at no surprise. Therefore, tourisms destinations or tourism companies are influenced by the competitive environment and are forced to take advantages of information technology in order to enrich their competitive and economical advantage (Zhang et. al 2009). Examples in using information technology in tourism businesses include seeking destination and car rental information, comparison of airfare costs, booking accommodation, and etc. One of the recommended strategies for increasing competitiveness is applying supply chain management concepts to tourism (Zhang et. al 2009). TSCM (Tourism Supply Chain Management) is a set of approaches to manage the process of tourism supply chain (TSC). The generic tourism supply chain model that shows flows and processes of TSCs (Piboonrungroj & Disney 2009) is shown on Figure 1. The TSC model represents three flows. It starts with the customer flow that is initiated since customers make decisions for a trip. Thus, stimulates the information flow and physical flow.

An efficient information flow can enrich information sharing across the supply chain. Besides, the further the information flow penetrates to the upstream (i.e. suppliers), the better the improvement in the supply chain's behavior. It is clear to see that the Information flow provides opportunities and challenges for the tourism industry (Gupta 2012). Furthermore, the faster and easier information flow increases confidence in customer flow (Nath & Menon 2005). Undoubtedly, he Information flow effects performance of the whole supply chain (Yang & Burns 2003).

There are several advantages when users have control over information flow via the information system (Ariely 2000), i.e. improves task performance and users can be more confident in decision making tasks. Ariely (2000) performed experiments on levels of control over information flow. The results showed that the increase in performance is associated to increased information control rather than because of the agent or task.

The information flow involves giving and receiving data and information via distribution tools. Common tools include travel documents, television advertisements, online videos and websites. More and more online tools are accessed and used daily for travel and tourism purposes, since information technology becomes readily available and easier for almost everyone. Among those tools, websites are the most common one.

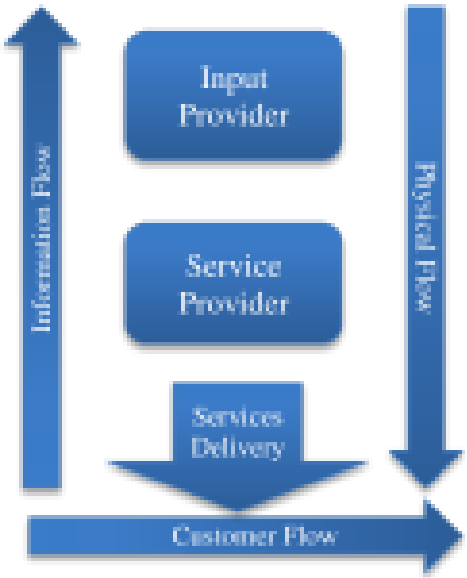

Figure 5: The generic tourism supply chain model (Piboonrungroj & Disney 2009).

Website Evaluation

Websites should be evaluated from time to time to ensure the usefulness of contents and that it meets usability goals (Law et. al. 2010). General measures for website evaluation are efficiency and effectiveness (Morrison et. al. 2005). Law and colleges (2010) report that there are over 70 studies on evaluation of tourism websites during 1996-2009. These studies implement various approaches for website evaluation. Yet, their successes were moderate. There are still searches for the suitable evaluation approach to gain sufficient insight into web performance.

Website evaluation reflects comprehension and how well the websites function, and allow us to learn more about the problems. The solutions to those problems are not always known. While website evaluation is an act to find out what is the current status of the existing information infrastructure, the other approach known as information architecture, that emphasizes in building a solid structure of website, is an entirely different act that tackles website from the development stage where the foundation of usefulness and efficiency can be initiated. When such foundation is in place, the ultimate goal of information architecture development, and that is findability, can be accomplished. Findability can also be accomplished on usable websites. Hence, it is reasonable to suggest that websites with well-planned information architecture can result in usable websites, and therefore encourages findability.

Information Architecture

Each website has a blueprint like buildings have architectures. Hence, each website needs a different architecture. A good website information architecture is simple and clear to make it easy for users to use a website (Van 2003). Poor websites cause problems such as not finding information or lack of details. The worst case is giving up on it before the whole page is downloaded, or leaving for another website after scanning the first few lines on the page.

Information architecture of websites covers organization, navigation, labeling, searching and indexing.

It represents physical architecture, terminology, connection and how pages can be found. The organization system defines the physical appearance shared across the site, logical grouping and relationship between content items. The navigation system provides evidences of findability and availability of choices. Labels and indexes focus on representation of information to enable efficient communication. Well-organization information architecture significantly benefits customers (customer flow) and providers (physical flow) (Moville & Rosenfeld 2006).

Tourism websites

The term "Tourism website" is sometimes used interchangeably with "travel website" in many publications. For example, Judith and Susan (1999) used these words for the same meaning. They classified tourism/travel websites into groups based on similarity and functionality, i.e. mega sites, travel information, accommodation and transportation. Alternatively, Palboonrungroj and Disney (2009) identified distinct and related activities between tourism industry, hospitality industry and travel industry. While hospitality industry focuses on providing accommodation, food and recreational services for tourists, travel industry focuses on transportation. Tourism industry deals with destination, destination marketing, travel trading, planning and development. The links between tourism industry and the other two industries are also provided in their model.

In this paper, tourism websites are chosen based on the definition of tourism given by Palboonrungroj and Disney (2009). A tourism website referred in this paper is, therefore, defined as a website that offers information concerning destinations, marketing of destinations, and support in tourism planning and development.

The tourism websites are chosen from the world's top tourism destinations ranked by UNWTO (United Nations World Tourism Organization) 2013 edition (UNWTO 2013). Countries are ranked by international tourist arrivals. In this study, we chose to analyze the information architecture of Franceguide.com (US version), as France is the world #1 by tourist arrivals. The findings are presented and discussed after methodology section.

METHODOLOGY

SAM (Software Process Analysis) is a method originally designed for the analysis of software development models (Ramingwong et al. 2009). The analysis was performed on well- known software development including Waterfall model, Spiral model, Extreme programming, Scrum, for examples. The findings revealed the true characteristics of the models, and served as a recommendation for software development model selection and adoption. In the original method, SAM classified all software processes into six phases, i.e. Planning, Specifying, Designing, Coding and Testing, Delivering, and Supporting.

In previous studies, the final model is based on a reference model called abstract model. However, in this study, the reference model is not yet available. Consequently, the model obtained from this study is used as the reference model which shows the structure of information on the website being analyzed. The model can be modified later to reflect well-defined information architecture.

In this work, SAM involves three steps: (1) elaboration, where each navigation item is mapped cover details specified on the page it is linked to, (2) normalization, that involves replacing unfamiliar terms to common terms, and (3) Abstraction, involves combining similar items and from clusters of information that will turn to a model.

Analysis of Tourism Websites Information Architecture

Firstly, the content items on website are identified and their labels are recorded in the content inventory. Secondly, the organization, navigation, labeling, searching and indexing scheme are identified and analyzed based on information architecture's components defined from the book by Moreville and Rosenfeld (2006). Each system is broken down into subcategories, which are described next.

Organization schemes define how information can be divided. Websites may have an exact organization scheme, less exact scheme or hybrid scheme. The three most used exact schemes are alphabetical, chronological and geographical schemes. Unquestionably, exact organization scheme

schemes are easy to use. The less exact organization schemes include topical, task-oriented, audience-specific, metaphore-driven. Despite the fact that less exact organization schemes may be difficult to use, people find it more useful.

Several types of navigation systems are often used in a website. Even though the principal navigation system is hierarchical, there are limitations. A global navigation system is often used in addition to the hierarchical navigation. Local navigation systems may be used to support the global navigation system. Occasionally, ad hoc links are used alongside other navigation systems. A navigation system can be implemented using navigation bars (hyperlink/graphic/frame-based) or pull-down menu. Alternatively, users may navigate websites from other navigation elements such as table of contents, indexes and guided tour.

Labeling systems deals with labels that are typically used in two ways, either as part of a navigation system or as headings. Labels could be used within a navigation system, as index words or as links.

Whereas organization, navigation and labeling systems put emphasis on creating the effective browsing system, searching systems concentrate on techniques to make searching works. Recommended techniques are (1) joining searching and browsing systems, (2) offering different kinds of information search, (3) making search options stand out and clear, (4) choosing an appropriate search engine for users, (5) displaying search results wisely, (6) relevancy search, (7) providing feedback and (8) creating search zone.

In this paper, the organization and navigation systems are analyzed. Searching and labeling systems are not covered in this paper. Table 1 and 2 shows the analysis result of Franceguide.com based on SAM.

Original content labels	Normalized labels	Abstracted labels
Home	***Home***	***Home***
- News	- News	- Regions
- Articles on France from the American press	- Publications	- Travel
- Discover France	- Regions	- Activities
- Lost in Francelation	- Trip Planning	- Trip planning
- Organizing your trip	- Weather	- Weather
- Weather forecast	- Social network	- Latest information
- E-News letter	- Recommended activity	- Travel trade
- Join the Franceguide communication	- Updated information	- Marketing
- What to do	- User personal information	- News
- France by Islands	- Travel trade	- Publications
- Stay up to date	- Marketing	- Social networks
- Publication	- Website in another language	- Users
- Organize your trip		- Information
- MyFrance		- Feedback
- France for Professionals		- Other language
- Language		
Destinations	***Destinations***	***Destinations***
- Region	- Region	- Region
What to do	***Recommended Activities***	***Activities***
- Art & Culture	- Art & Culture	- Art & Culture
- Cities	- Cities	- Regions
- Cruises	- Recreation	- Recreation

- Golf
- Mountain air
- Winter mountain
- Nature
- Overseas
- Seaside resort
- Wine & Cuisine
- Youth
- Wellbeing
- Gay
- Romance
- Special needs
- Spring in France
- Ecotourism
- Religious tours
- Jewish

- Sport
- Attractions
- Local destinations
- Accommodation
- Food
- Healthcare
- Specific travelers
- Highlight

- Sport
- Attractions
- Accommodation
- Food
- Healthcare
- Travelers
- Highlight

Deal & Contests

- Top deals
- Flight deals
- Package deals
- Accommodation
- While in France
- Contests

Deal & Contests

- Travel deals
- Transport deals
- Accommodation
- Recommended activities

Promotions

- Travel
- Transport
- Accommodation
- Activities

Practical Info

- Transportation
  - Transportation in France
  - Flying to and around France
  - Renting a car and driving in France
  - Traveling to, from, and around France by train
- Know Before You Go
  - Entry requirements
  - French diplomatic bureaus in the United States
  - French public and school holidays
  - Regional climates in France
  - Accommodations – Hotel information
  - Financial matters
  - Tourism tax
  - Other FAQs
- While in France
  - Tax-Free shopping
  - Prices of everyday items in France
  - Meals

Practical Info

- Transportation
  - Ground transport
  - Air transport
  - Driving and car rental
- Travel preparation
  - Entry requirements
  - Local calendar
  - Accommodation information
  - Financial information
  - Tax
  - FAQ
- During your stay
  - Shopping
  - Living expenses
  - Meals and specialties
  - Emergency contacts
  - Healthcare information
  - Communication information
  - Entertainment information
  - Time information
- Regions
- Latest information
- Recommended activity

Practical Info

- Transportation
  - Ground
  - Air
  - Driving
  - Car rent
- Travel preparation
  - Entry requirements
  - Calendar
  - Financial
  - Emergency contacts
  - Healthcare
  - Communication
  - Time
  - FAQ
- Travel planning
  - Accommodation
  - Transport deals
  - Accommodation deals
  - Shopping
  - Meals
  - Entertainment
  - Events & Planning

- In case of emergency
- Staying healthy during your visit to France
- Keeping in touch by Mail, Phone, Internal, and Fax
- Entertainment
- Time zones
- Discover Regions
- Stay up to date
- What to do
- Multimedia
- My France
- Fly over France
- Organize your trip
  - Plane
  - Train
  - Hotel
  - Apartment/Villa
  - Restaurant
  - Need help?
  - French specialist
- Plan your events
  - Events & Festivals
  - Tickets
- Publications
  - Brochures
  - E-newsletter
  - Franceguide Magazine

- Additional multimedia
- User personal information
- Map
- Trip planning
  - Transport deals
  - Accommodation deals
  - Restaurants
  - Travel agents
  - Events
- Publication
  - Destination information and promotion

  - Restaurants
  - Travel agents
- Regions
- Latest information
- Activities
- Media
- User information
- Map
- Publication
  - Destination information
  - Promotion

Magazine

- Where you can find our magazines
- Our Cartes postales
- Club France
  - Subscribe to our E-newsletter
  - Browse our e-news archives
  - Events & Festivals
  - RSS feed
  - Post your comments
- Other online publications
  - Franceguide for Jewish traveler
  - Franceguide for Gay traveler
- Brochure by regions
- Download FranceGuide
  - Franceguide in English
  - Franceguide in Spanish
  - Franceguide for Jewish

Publication

- Where to find?
- Brochure order
- Community
  - E-newsletter
  - News achieve
  - Events
  - Updated news & development
  - User feedbacks : Comments
- Others
  - Guide for specific audience
- Brochure by regions
- Guide Access
  - in other languages
  - for specific audience
- User feedbacks : Survey
  - in other languages

Publication

- Location
- Brochure order
- Community
  - Newsletter
  - News
  - Events
  - Updated information
  - User feedbacks
- Guide for specific audiences

traveler
- Franceguide for Gay traveler
- Our reader survey
  - Take our survey in English
  - Take our survey in Spanish

Table 1: Content Inventory of Franceguide.com

Page **Organization scheme**	Home	Navigation item	Destination	Navigation item
Alphabetical				
Chronological	X	Articles on France		
Geographical			X	**Regions**
Topical	X	Global navigation		
Task-oriented	X	Trip planning, Regions, Marketing	X	**Trip planning**
Audience-specific	X	Global		
Metaphor-driven	X	Body		
Frequency	6		2	

Table 2: Analysis of organization scheme and navigation systems of Franceguide.com

Findings and Conclusions

Table 1 presents the information from Franceguide.com with the original navigation labels, normalized labels and abstracted labels. The abstract labels obtained establish the baseline for tourism websites. The main page, which is called home, should be presented with regions information, travel planning information (activities, weather, latest information and travel trade) and marketing tools (i.e. news, publication, social networks). User information and language should also be noticeable.

Before reaching the home page, users should be presented with localization options; thus, users would be redirected to the content organized for their country. This is an example that demonstrates the extent to which international success can be contributed from localization.

It is interesting to note that a tourism website audience should encourage as much specific information (i.e. religious, ecotourism or special need travelers) as possible. It is essential for international tourism destinations to serve a wide variety of user needs.

The home page should emphasize the main aspects of tourism and the selected tourism website covers that very well. Hospitality, travel and other logistics information should also be presented nearby where users can easily reach when they want to. In this study, these information are found to be directly linked on from the home page and can be found on the bottom of each page.

Finally, publication information should be available both online and offline. Users should be able to choose how to receive tourism information and a tourism website should provide them the way they can interact with the website. In this case, the selected tourism website allows users to give comments and upload videos.

In this paper, the information architecture, especially the organization and navigation systems of the top tourism website, Franceguide.com, is studied and modeled. The abstract model provides insights to what kind of information a tourism website should host and how they can be represented. To serve different needs and purposes, a hybrid organization scheme should be developed.

A future study should be done with other elements of information architecture, and more websites should be studied. Thus, more insights could be gained.

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THE CONCEPT OF HALAL LOGISTICS – AN INSIGHT

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Introduction

Recently, the market of halal products has received much attention worldwide. Therefore, the demand for halal products is increasing tremendously not only from Muslim countries but also non-Muslim countries.The term of halal logistics has arisen in the logistics industry in Malaysia since 2000, in fact some of the logistics service providers have also offered halal logistics services such as MILS SdnBhd and KontenaNasionalSdn Bhd. Meanwhile, the Malaysian government have also given incentives to the companies that venture into the halal industry. Halal hub, which is a dedicated area in each state in Malaysia, has been designated in assisting the halal products producers to boost the halal industry. In addition, the halalandtoyyiban assurance pipeline (HTAP) is the Malaysian standard for halal logistics that cover the warehousing, transportation, and retailing aspects.

The component of halal industry can be classified into three areas,namely services, food and non-food(Ministry of Industrial and Trade, 2006). Therefore, halal logistics is categorized in one of the components, namely the service component.

Figure 1. The component of halal industry (Ministry of Industrial and Trade, 2006).

Meanwhile, the development of halal industry is not only concentrated in the ASEAN countries such as Thailand, The Philippines, Malaysia, and Brunei, but it has also expanded to theMiddle Eastern

countries such as United Arab Emirates, Western countries such as the United States of America, and Europe such as France, which are also really keen in the halal market. Despite the potential growth of the halal industry, the concept of halal logistics is not really understood by the logistics service providers. Therefore, this study is deemed important to develop a conceptual framework and suggest the most feasible terminology for halal logistics. Finally, the paper will discuss the issues and challenges in providing a more concrete and focused concept of halal logistics.

Background of the study

Understanding the Concept of Halal

Halal is an Arabic word that means lawful or permissible. The term halal is used by the religion of Islam to guide Muslims in everyday life. Muslims believe that Allah (The God) is the Creator and Muhammad (The Prophet) is the final Messenger of Allah. Halal refers to all that is permitted and Haram refers to all that is prohibited according to the guidelines given by Allah in the Qur'an and explained (Sunnah) by the Messenger of Allah (PBUH). The Islamic dietary laws are derived primarily from the Qur'an and the Sunnah of the Messenger of Allah (PBUH). The basic principle is that all foods are halal except those prohibited in the Qur'an and the Sunnah. This reflects that no one has an authority to declare halal and haram except Allah. The foods that are not permissible are namely swine or pork and its by-products, carrion or improperly slaughtered halal animals, animals killed in the name of anyone other than Allah, carnivorous animals with fangs such as lions, dogs, wolves, and tigers, birds of prey such as falcons, eagles or owls, snakes, domesticated donkeys, mules and elephants, pests such as rats and scorpions, insects excluding locusts, blood and blood by-products, alcohol and intoxicants of all kinds, all poisonous plants and poisonous aquatic (unless the poison is removed before consumption), and food which is contaminated with any of the products mentioned above (Lodhi, 2010). In Islam, each of these foods has its own argument of why it is forbidden to the Muslims as Islamic dietary laws strictly adhere to quality, cleanliness, and safety of the food that they consume. Generally, the specific reasons of Haram in Islam are to (1) preserve the purity of the religion, (2) safeguard the Islamic mentality, (3) preserve life, (4) safeguard property, (5) safeguard future generations, and (6) maintain self-respect and integrity (Ahmad, 2008).

Nevertheless, recently Muslims realize that the halal concept is not only confined to food as it also includesthe process of distribution, handling, packaging, and storage. The concept of halal and also toyyiban as 'wholesome' as stipulated in Islam covers nutrition, quality, cleanliness, and safety for everyone and not meant only for the Muslim society which can be practised in food production. For instance, the halal authentication of food products must cover the source of raw materials to the consumers. Accordingly, any activities along the supply chain such as handling, storage, and distribution must be shariahcompliant in which halalantoyyiban concept can be applied. Any halal products cannot be mixed with haram products and must be segregated (Jaafar et al., 2011a). This has formed the halal supply chain as significant, broadly accepted, and acquired by the consumers that will also increase the demand for halal logistics among the halal food industry players.

In addition, recently consumers are not only concerned on the halal status of the product itself but also the processes that are involved with it. Consumers choose to buy the particular halal products as the productshave gone through the halal process. Therefore, the main issue which can be seen today are the issues related to halal logistics, where the industry players do not clearly understand the concept of halal logistics and is frequently being misunderstood by the industry players. For them halal logistics means adding extra cost such as compartmentalizing the warehouse, food segregation according to its nature, and others. Thus, companies will be reluctant to apply for halal logistics and this is will create a barrier tothe implementation of halal logistics in the halal food industry. Furthermore, awareness of halal logistics needs to beinculcated and exposed to the industry players and as well as to the public.

In 2000, various authors (Arham, 2010; Sandikci &Rice, 2011; Sula, Kartajaya, 2006; Wilson & Liu, 2011; Wilson, 2012)had identified that the Islamic marketing is an innovation in the social science discipline. The Islamic marketing highlights the shariahcompliance of the marketing function (Alserhan & Alserhan, 2012), marketing of Islamic brand (Alserhan, 2010) and the need of the Muslim markets (Temporal, 2011). Similarly, halal logistics has also created a new contribution and knowledge to the logistics and supply chain discipline.

Previous studies on halal have looked into the aspects of intention on halal purchase (Shaari & Arifin, 2009), satisfaction towards halal products (Danesh et al., 2010), institutional issue (Othman et al., 2009), quality aspects of food industry(Omar et al., 2008; Talib et al., 2009),traceability in the meat chain (Gellynck et al., 2002), slaughtering influencing product quality (Petracci et al., 2010), and consumption of halal food (Hamlett et al., 2008).Meanwhile, in the area of food research, studies have been done on the effective management of food safety and quality (Manning & Baines, 2004), quality assurances in the food supply chain (Manning et al., 2006),the traceability of datamanagement for food chains (Folinas et al., 2006), andagri-food (Da Xu, 2011;Hobbs & Young, 2000). Halal logistics research focused on information technology (Bahrudin et al., 2011), applying halal in the supply chain management (Tieman, 2011), the integration of supply chain (Nik Muhammad et al., 2009) and halal processed food (Kamaruddin et al., 2012), halal logistics innovation (Jaafar et al., 2011b), human resource (Pahim et al., 2012a, Pahim et al., 2012b), and halal supply chain focusing on food(Omar&Jaafar, 2011). As a result, this research differs from other studies on halal and food chain which have been identified previously.

From the publications that have been reviewed from 2004 until 2013 (Table 1), only 11 publications have been published based on the main theme of halal logistics.Since there are not many academic journals in the area of *halal* logistics, this paper goes further into publications which emphasize on halal supply chain. Therefore, these concepts need to be explored further in other types of publications including theses, proceedings, and other published articles. This is important to address the confusion of terminologies, concept, and practices of *halal* logistics. Indeed, it is shown that due to limited publication in the area of halal logistics, it has been revealed that the area of halal logistics and supply chain largely contributes to the gap and adds to the body of knowledge through the knowledgeadvancement in the logistics and supply chain discipline. In addition, several authors consider Islamic marketing as an innovation in the social science discipline (Arham, 2010; Sandikci&Rice, 2011; Sula & Kartajaya, 2006; Wilson, 2012). This has also created a new contribution to the logistics and supply chain discipline.

	2004 - 2013	
Types of publication	Halal Logistics	Halal Supply Chain
Journal	5	6
Proceeding	6	3
Total	11	9

Table 1: The Number of Publication Reviewed Based on the Area of Halal Logistics and Halal Supply Chain

Since research on halal logistics is practically lacking, therefore, most concepts are borrowed from the logistics literature and the Islamic law will be applied to the logistics discipline. Although the concepts of logistics and halal are overlapping, it does not appear to be many interactions between the Islamic and logistics researchers exploring this topic.Tieman and Ghazali (2013)also highlightedthe role of purchasing in the halal food supply chain and the value chain has been largely understudied and poorly understood. Due to the above reason, Mohamed Amin (2010) hadhas stressed that the areas of growth or potential opportunities in freight logistics will be halal logistics, contract logistics, and reverse logistics. Thus, halal logistics is also one of the components on the Malaysia Logistics Council Agenda 2010. Indeed, there are various initiatives done by the Malaysian government in order to turn out Malaysia to be a global halal hub such as stated in the Tenth Malaysia Plan, Third National Agricultural Policy (1998-2010), Small and Medium Industries Development Plan (2001-2005), Ninth Malaysia Plan (2006-2010), and the Third Industrial Master Plan (2006-2020).Thus, this paper integrates the logistics and halal area of discipline,namely halal logistics.

Halal logistics include the physical activities of storing and transporting, which provide a set of data for communication and management between successive links (up and down) along the food supply chain(Kamaruddin, Iberahim, & Shabudin, 2012) and apply the shariahconcept along the chain. On the other hand, the basic principal of halal logistics is to ensure the segregation of halal cargo from non-halal cargo. This is to avoid cross-contamination and ensure that the logistics system is aligned to the expectations of Muslim consumers and the halal integrity is thus protected along the whole supply

chain (Ministry of Industrial and Trade, 2006).Hence, the most feasible terminology for halal logistics is the application of shariah law to the logistics process. Starting from the beginning of the logistics process until the final consumers,the shariah law must be followed. This is to ensure the halal product that is halal must also go along the halal logistics and in ensuring the halal logistics, the halal integrity among the channel members must be applied. This will include proper segregation and proper logistics system of the products throughout the logistics process.

Halal logistics could be referred to the application of the *halalantoyyiban* principles along the supply chain activities, which means that all the activities ranging from the source of supply, storage, transportation, manufacturing, handling, and distributing should adhere to the concept of *halalantoyyiban* as underlined by Islamic law. This means that the *halal* products should not be mixed with the non-*halal* products throughout the logistics activity to ensure that the *halal* status of a product could be maintained. As a result, figure 2 envisages the proposed conceptual framework of the *halal*logistics.

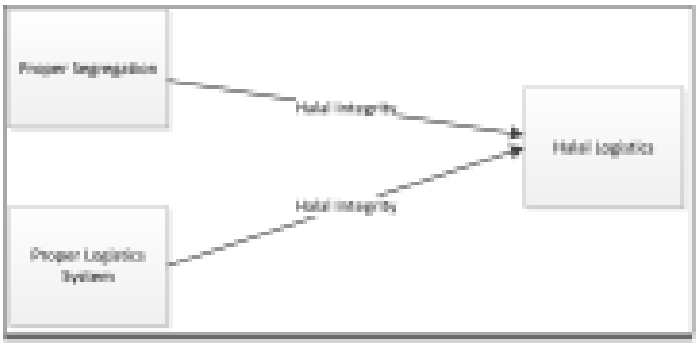

Figure 2. Proposed conceptual framework of the *halal*logistics

Moreover, halalantoyyiban supply chain is the concept of applying syariah principles in the supply chain management. The concept of halalantoyyiban along the supply chain will begin from the sourcing aspect to the point of consumption. In the halalantoyyiban supply chain activities, all aspect of halal and toyyib must be deliberated (everything must be halal and toyyib) in order to ensure final consumers will be getting halalantoyyibanproducts.Indeed, halal logistics is part of supply chain in order to ensure the whole concept to be realized, halalantoyyiban supply chain supply chain would be the most feasible term compare to halal logistics. In applying the halal logistics or halalantoyyiban supply chain concept become realize various issues and challenges will be facing by the industry players, consumers and the government.

Issues and Challenges

In ensuring the implementation of halal logistics, the logistics players, consumers, and government will be facing various issues and challenges such as the following:

1. The legal status of halal and the protection of halal status are always unclear in the logistics activities. Therefore, it is difficult for the Muslims to ensure the integrity of the halal products.

2. Not many industry players are really keen to practise the halal logistics due to incurred additional cost in the logistics. Thus, the expected standard of halal is not practised by the industry players as well as food industry players.

3. About 90 per cent of halal products are being produced in non-Muslim countries; therefore, the halal status and halal logistics of the halal products are uncertain. This is because halal products are a lucrative market to the industry players.

4. There are not many experts in the halal logistics and therefore the training for halal logistics is important to the employees that are involved in handling halal products. The three dimensions that have been highlighted by Pahim, Jemali, and Mohamad (2012) as important in the need for training in halal logistics are people, demand, and level of awareness.

5. The traceability of halal products is deemed important in ensuring the status of halal products during the process of halal logistics.

Conclusion

This paper develops a conceptual model that takes into consideration the halal and logistics aspects.Notwithstanding lots of research and review from the literature and problems being identified in the industry, more studies still need to be done on the logistics industry of developing countries, particularly Malaysia. Prior studies which have been carried out in other countries can be used as a parameter in establishing the halal logistics industry.

The concept of halal can be applied to all and not meant for Muslims only. Therefore, when there is a need for halal products definitely it means creating new and more business for producers, suppliers, and others. The need is to evaluate whether the existing process is already halal whereas consumers are unaware of it. In case it is considered as halal, then the information needs to be disseminated to the consumers.

In conclusion, the logistics players who want to venture into the new area as well as sustaining in the market are recommended to offer halal logistics services. This is to capture the new demand from the consumers towards the halal products that goes along the halal logistics in ensuring that only halal products with halal logistics will be accepted by the consumers worldwide. Currently, the concept of halal logistics which has been implemented by existing logistics players has increased the attention of the consumers especially from the Middle Eastern countries. Due to the reason, it ishas been suggested to the logistics providers to invest more in the halal logistics as it is a worthwhile investment. Therefore, it is recommended that proper strategies for the halal logistics need to be developed for use by the global halal industry.

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THE CONCEPTUAL FRAMEWORK OF LEAN LOGISTICS IN MALAYSIA

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Introduction

The term "Lean production" was first identified by Jim Womack, Daniel Jones and Daniel Roos (1991), The Machine That Changed the World. In the book, based on a five-year research, USD5 million study of the automobile industry, Womack, Jones and Roos took an in-depth look at the Japanese manufacturing system, exemplified by Toyota, which combined the best features of craft production (high-quality, individualized, custom-made products) with mass production (manufacturing in large quantities to satisfy broad consumer needs at lower prices). The book, which was one of the first to thoroughly examine Toyota's highly successful business system, concluded that Toyota was dominating the automobile industry because it optimized the value delivered to customers while minimizing the time, human effort and capital required creating this value. Lean Logistics was basically derived from the Toyota Production System (TPS). In the early 1930's Toyota Motors of Japan aimed at reducing costs, coupled with continuous improvement, and finally customer satisfaction right from its offices through the entire production line until the delivery of the vehicle to its customers. In order to realize this vision, TaiichiOhno, conceptualized a system where all these Toyota Motor requirements could be met. Now, TPS has set a benchmark in production for all automotive companies that produce repetitive and high value goods (Ohno, 1988).

Logistics Background in Malaysia

Malaysia has a well-developed logistics relevant infrastructure, support and systems. However,comparing with other developed countries like United Kingdom and USA, Malaysia still has toimprove significantly in terms of its logistics operations.

The logistics and distribution sector in Malaysia traditionally operates at a very low cost as comparedto other countries in the region, with comparable performance. The vehicles and handling equipmenttend to be aged, maintained to a standard that keep them just roadworthy. The education level of thedrivers are low, and many of them lead a 'semi-nomadic' living i.e. living with their vehicle and thissector also has a reputation for pilferage and organized theft including hijacking.However, during the past five (5) years, there has been some notable changes in this sector:-

- The emergence of increasingly professional suppliers with improved tracking and performance monitoring capabilities;
- Increased policing of non-roadworthy and over-loaded vehicles;
- Abolishment of duty on imported goods vehicles; and
- Increased service expectations, spurred on by the arrival of demanding foreign retailers and tighter economic environment.

'Lean' in Logistics Services – No Longer Just for Manufacturing

A new logic was examined by Womack & Jones (1996). A natural starting point is with value creation – from the customer's perspective the only reason for a firm to exist. If subjected to a careful review, many of the steps required in the office to translate an order into a schedule and many of the steps required in the factory physically to create the product, add little or no value for the customer.Jones, D.T., Hines, P. & Rich, N. (1997) in their article 'Lean Logistics' discussed about the 'new business solution' created over the past 15 years where each has contributed a new perspective, andassume that each of them have their own business solution. These include:

- the Tom Peters approach which brought the customer back into prime focus and told us to "thrive on chaos" and break up traditional management structures;
- the TQM movement, often incorrectly labelled Japanese management, which advocated the power of variance analysis and control and the necessary involvement of shop floor teams in eliminating root causes of variance;
- the production control perspective which sought to solve the chaos and variance problems in supply chains by better forecasting and materials requirements planning (MRP)-type planning and control systems;
- the purchasing emphasis, which involved a transformation to partnerships with suppliersrather than the previous adversarial style relationships; and
- the business process re-engineering (BPR) viewpoint which stressed the importance of the process and offered ways of automating these processes to cut costs.

'With hindsight, all of these tended to be partial solutions focused somewhat narrowly on particular aspects of the complex process of running a business'. Popular criticisms of such approaches are that:

- Total quality management (TQM) raised morale on the shopfloor but could not cumulate the gains to real bottom-line savings while buyer-supplier partnerships again often failed to deliver;
- MRP and MRP II created monolithic systems that cannot respond to rapidly changing demand or unpredictable interruptions and add cost while failing to improve process utilization; and
- BPR's credibility was undermined because it was used as a crude headcount reduction device, particularly in the USA.

The concept and acceptance of 'lean' concept as a set of principles is fairly rooted in the literature(Jones et. al., 1996; Womack, 1990; Kralcik, 1988; Monden, 1983) cited in Lamming (1996). Theprinciples behind lean production are not in themselves new which many of them can be traced back to the work of pioneers such as (Deming 1986; Taylor, 1988; Skinner, 1969) and more recently in the United Kingdom such as (Hill, 1993; Voss, 1994; Lamming, 1993). However, although the concept of lean production as now understood could have modeled from this literature, it was not until the Japanese auto industry was studied (Jones, 1996), that the total concept became clear.

The Conceptual Framework – Overview

The lean concept has established a framework for increasing quality and economic competitiveness ofan organization. To date, this concept has primarily been limited to manufacturing operations. Many hanges are occuring in the supply chain that is creating opportunities to apply lean concept throughout manufacturing, distribution and logistics. As a result of several factors, the traditional arenas of manufacturing and distribution will merge and bring new value-add processes into distribution.

Lean is one such factor. Taylor (2002) summarized his write-up on 'lean' where he found that the roots of lean were established in the Japanese automotive industry in the early 1970s by Toyota.Lean, originally labeled 'Just-in-Time' was used as production strategy to reduce inventory, shortencycle times and improve quality. Lean is also commonly described as a process to eliminate wastewherewaste can be divided into seven (7) categories: processing, waiting, motion, overproduction,inventory,transportation and defects.
Applications of lean concept have spread widely to construction, administration and distribution sector. Published examples of lean in distribution sector are limited but shall grow substantially with market demands and increased understanding of successful applications. There are current best practices in distribution centers that fit the definition by eliminating waste of time and motion.

Kleber (2003) stated that transformed service companies will have significantly reduced lead-time and costs, improved productivity and improved customer responsiveness. Jayaraman (1995) also came out with the same opinion as Kleber where he described in his paper that service logistics aims at the most efficient utilization of facilities, minimizing the cost of excess capacity, while making the service more responsive to customers' demand.

A microeconomic study describes how the firm seeks to maximize profits given resources constraint(Eckert, 1997). Logistics organizations regularly face with the dilemma of determining appropriate level of service, the output of logistics. In an effort to set themselves apart from rivals, firms are increasingly looking to logistics-driven customer service as their competitive weapon.

While there are some voices of discontent (Gordon, 1995; Berggren, 1992), cited in Lamming (1996) to the adoption and ultimate effectiveness of lean production, nonetheless many case examples exist to demonstrate how companies are changing their production methods and management practices to become leaner and fitter. Indeed lean manufacture has been extended to encompass the whole spectrum of activities in the business such as world-class companies are seeking to become "lean enterprise" (Lamming, 1993; Harrison, 1992; Jones; 1994).

The desirability of transferring manufacturing logic and practices to service operations, strongly advocated by (Levitt, 1972) cited in Lamming (1996) in two (2) classics Harvard Business Review articles, is now commonly challenged by both service researchers and practitioners (Bowen, 1996). Inthe early 1970s, the services sector has largely been ignored by management scholars, who were long accustomed to basing their research and models of management on studies of manufacturing firms. This had made sense, because the economy had, to that point, been dominated by manufacturing. However, in the 1970s, services were on the rise, as there were frustrations over inefficiencies, poor quality and low productivity characteristics of the sector. Unfortunately, services management models were emerging much more slowly than the sector, itself. In this context, Levitt argue that services would benefit from the efficiency-oriented thinking of mass manufacturing.

Levitt (1972) cited in Lamming (1996) maintained that services were primitive and inefficient relativeto mass production manufacturing operations. This inefficiencies derived from a "long standing service culture of servitude and ministration" (Bowen, 1996). Levitt's conclusion to his production-line approach to service (1972) contained the summary argument for transferring manufacturing logic to service.

"...If customer service is consciously treated as manufacturing in the field, it will get the same kind ofdetailed attention that manufacturing gets...More important, the same kind of technological, labour-saving, and systems approaches that now thrive in manufacturing operations will begin to get a chance to thrive in customer service and service industries".

Increasingly, service companies need to focus on delivering service and quality that meet or exceedcustomers' expectations. Customers, of course, expect no less, and inevitably, they will go where theycan get it (Alwayet.al., 2002). Service companies that deploy the lean approach rapidly gain controlof the key processes that deliver customer service, apply sustainable breakthrough improvements totheir processes, and generate tangible benefits for customers and measurable cost-benefit for the organization (Alwayet.al., 2002).

The lean framework shall illustrates what is called the dominant model in logistics (Whitley, 1984); logistics practice affects an organization's performance, but how is does so is mediated by environmental factors. The foundation of this approach is that good or interesting practices maybe identified by those which give good or interesting results. Figure 1 shows the basic model to form the lean conceptual model:-

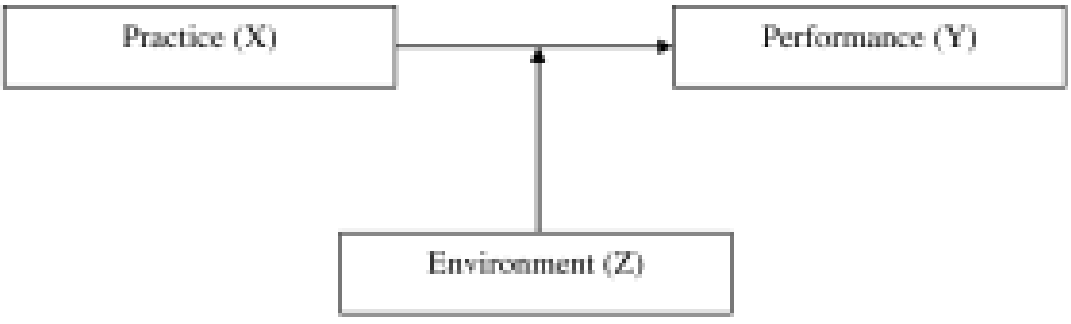
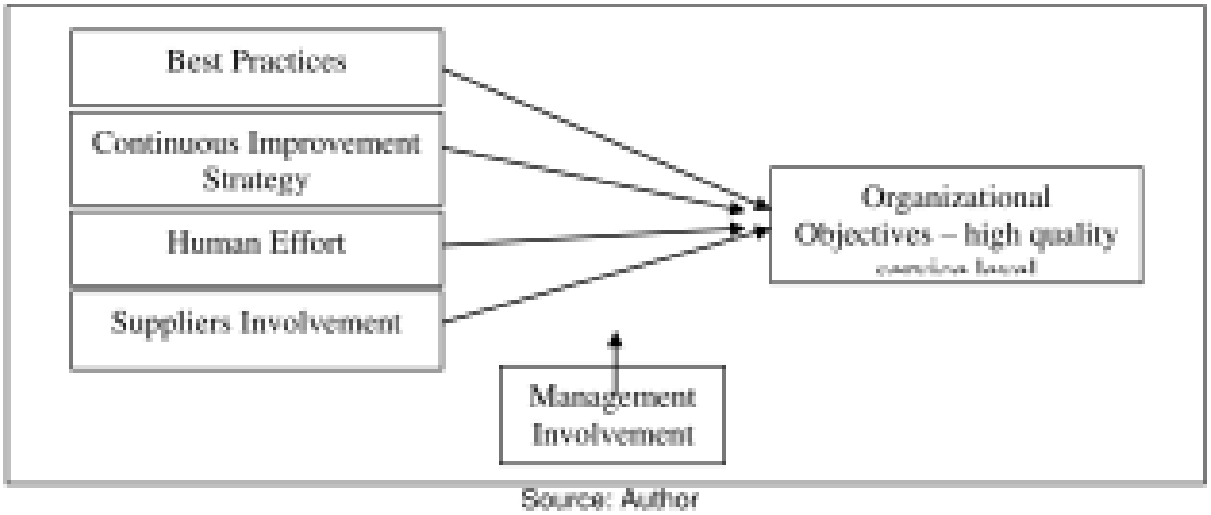


Figure 1: Dominant Logistics Model (X causes Y, mediated by Z)
Source : New, S.J. (1995)

Via this model, managers may choose different type of practice. Some of the practices may be the 'best' practices and will provide optimum level of performance for the business, but may have to be adapted to different situations. This model shall define and measure performance; identify and idealizing practice; deciding on what aspects the environments are important.



Source: Author

The Lean Logistics Company – The Transformation

The lean enterprise concept represents a new paradigm in the way businesses are managed in highly competitive market environments. This concept embodies a collective set of principles, tools and application methodologies that enable companies to remove waste from the system and achieve dramatic competitive advantages in speed to market, cost, quality and delivery performance.

Lean enterprise uses time and the 'relentless pursuit of waste elimination' as competitive leverages. It also seeks to make value flow from raw material through consumption i.e. using lease amount of resources including time, people and material. In long-term, lean enterprise creates a culture of never-ending improvement at all organization levels.

In the Toyota Production System (TPS), Ohno (1988), reveals that there are two (2) significant ways to increase efficiency: (1) increase production quantity or (2) reduce the number of workers.

The characteristics of the lean company and the lean supply chain are described clearly in the book *Lean Thinking – Banish Waste and Create Wealth in Your Corporation* by Womack and Jones (2000).This book provides a vision of a world transformed from mass production to lean enterprise. The authors highlight the huge amounts of waste that occur in most organizations and show that a systematic attack on waste, both within companies and along the supply chains, can have tremendousbenefits to the short run profitability and long term prospects of companies and organizations. *Lean Thinking* by Womack (2001) distils the essence of the lean approach into five key principles and shows how the concepts can be extended beyond automotive production to any company or organization, in any sector, in any country. The five lean principles are listed down as follows:-

1. Specify (what does and does not create value from the customer's perspective and not from the perspective of individual firms, functions and departments)
2. Identify (all the steps necessary to design, order and produce the product across the whole value stream to highlight non value adding waste)
3. Make those actions that create value flow without interruption, detours, backflows, waiting or scrap
4. Only make what is pulled by the customer.
5. Strive for perfection by continually removing successive layers of waste as they are uncovered.

These principles are fundamental to the elimination of waste. They are easy to remember (although not always easy to achieve!) and should be the guide for everyone in the organization who becomesinvolved in the lean transformation.

For service sector, if we take the Toyota Production System's definition of waste, many activities carried out within a service provider such as a bank, insurance firm or retailer add no value. However, as many of these activities are useful, they might be referred to as service value adding even if strictlyspeaking they are reducing the (potential) cost to the customer rather than adding value. They could,therefore, be included within the necessary non-value adding category. The reason why they shouldnot be included as value adding activity is that this will direct attention away from their long term improvement or development.

Conclusion

In this paper, it represents the overview on conceptual framework of lean logistics in Malaysia. It also represents the first application of lean logistics model to the logistics service industry in Malaysia. Logistics has, in the past, been considered a narrowly-defined functional activity concerned with tasks such as transportation, warehousing, inventory and materials management. Changes in the logistics capabilities and management techniques have allowed logistics to become a primary mechanism for integrating and coordinating activities across the stages of supply chain. The competitive environment for logistics firms has changed drastically and considering this factor, one should develop a framework to further improve the current way of doing things i.e. through best practices and 'perfect process'.

It is viewed that the changes in the competitive environment necessitate a rethinking of the role of logistics. This paper has proposed a framework that will provide a conceptual basis for research to explore this area empirically. The results of this research shall enable the development of concepts that explains how lean logistics can provide a competitive advantage in today's changing business environment.

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Author's Biography

Azlina Hj Muhammad graduated in BBA (Transport) from UiTM in 1996 and pursued a degree in MSc International Transport from Cardiff University of Wales, United Kingdom and graduated in 1998. She has gained a tremendous industry experience when she joined KontenaNasionalBerhad (KN) in 1999. Early in her career, she was trained as a strategic and corporate planning professional and moved on to a new and higher level later on within the industry. Her industrial background consists of more than 10 years of successful experience and skills in strategic and corporate planning field. She was also responsible for the setting-up of the Halal Business Unit at KNB and managed to obtain the recognition for KNB as the first Halal logistics provider in the Country. Whilst in the industry, she was heavily involved in the development of various projects via her feasibility studies skills and expertise. Some of the projects that she involved directly were the feasibility study on Cross-border logistics between Malaysia and Thailand, establishment of dry port at HiepPhuoc Vietnam and development of temperature-controlled distribution centre facilities in Japan. She was also involved with various Government agencies representing KontenaNasional for her inputs in the initial establishment of ASEAN Multimodal Framework and other works related to ASEAN initiatives. Azlina set herself up as a strategic and corporate planning professional and progress her passion in the same field for getting a job well done. She is also a member of the Chartered Institute of Transport and Logistics (CILT) since 2002.

THE DELAY COST OF TRUCK AND FREIGHT PRICING PRACTICES

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Abstract:

This research analyses the pricing and delay cost of truck on the Interstate highway 15 (I-15) in Utah. A practical framework uses the data source form Utah Department of Transportation (UDOT), Freight Analysis Framework version 3 (FAF^3) and American Transportation Research Institute (ATRI) to estimate the delay cost of truck. Compared with Uship, the online shipping marketplace in the US, and the average truck operating costs per mile, the markup of freight price can implicitly be derived. The seasonal factor is also introduced to adjust a regular freight price, particularly during the winter season. The empirical studies have indicated that a trucking company could lose a profit on the Washington-Box Elder route because a significant delay cost is imposed. On the Washington-Salt Lake City, Iron-Davis and Iron-Weber routes, a truck operator is taken an opportunity cost by cutting or providing limited services during the winter season. The results of this study are primarily to support freight transport research and policies and to provide a more accurate cost of annual truck congestion for commercial vehicle operators on the interstate highways.

Keyword: delay cost of truck, Average Annual Daily Truck Traffic (AADTT), markup pricing, delay cost estimation, seasonal adjustment factor

1. Introduction

The objective of this research represents a practice for estimating the delay cost of truck and analyzes the markup of freight price on the Interstate highway 15 (I-15) in Utah, the United States. To perceive a benefit of congestion and traffic variation database, three majority sources of data: UDOT, FAF^3 and ATRI are undertaken in a process of valuation. The outcome points out the critical links of traffic cost and O-D aggregate links effected to markup pricing. According to U.S. Department of Transportation (U.S.DOT, 2004) Utah is the 15th of top capacity bottlenecks on freeways used as intercity truck corridors in 2004. The collecting data show the bottleneck location and the essential information: number of lanes, Average Annual Daily Truck (AADT), Average Annual Daily Truck Traffic (AADTT) and the percentage share of truck, and annual hours of delay by all truck. The result points out the area closed to the county of Weber that is the most of traffic congestion, and 25% accounted for trucking. The annual of delay time by trucks shows 48,088 hours. AADTT by Utah Department of Transportation (UDOT, 2007) provides the 2007 AADTT surveyed data and 2040 data estimation. Each individual link of all 221 links provides a distance range, average speed, AADT, AADTT and Functional Class (FClass) due to the speed regulation design. The directed transport costs of truck are described by American Transportation Research Institute (ARTI, 2008). ATRI develops a beta-tested and distributes a survey to a cross-section of for-hire motor carriers for representing the predominant industry sectors. Survey responses are aggregated and analyzed in the costs per mile (CPM) then converted to costs per hour (CPH) by using an industry accepted average operating speed. The result shows a total marginal cost for the industry $1.73 per mile and $83.68 per hour (Trego, 2010). The vehicle's value of time (VOT) has been evaluated more than 40 years, since it was one part of the economic transportation analysis to the difference objectives (Bruzelius, 1979). The VOT for trucks is estimated between $20 per hour to $190 per hour (Wheeler, 2010). In contrast to a value of freight travel time savings in congestion, the survey studies with freight carriers in California categorized by 4 types of industry group. The result estimates value of travel time saving with the commodity time sensitive. The value is found in a range between $144.22 and $192.83 per hour (Small et al, 1999). Smalkoski and Levinson (2002) indicate the considerable importance of freight transit time and cost. They estimate VOT for commercial vehicle operators in Minnesota to quantify the effects of spring load restrictions policy. In contrast to the cold region areas the government policy usually focuses on the pavement design for the severe winter condition. Due to the season of spring in Minnesota, thaw of roadway introduces a saturated condition of the soil under the pavement. The load-bearing capacity on the saturated road is reduced a burdened limit because over load truck can cause an additional damage of pavement. The interview method survey is conducted by using an Adaptive Stated Preference (ASP) to estimate value of time in dollars per hour and $49.42 explains in a fleet operation.

The research also quantifies freight cost under the restriction of policy. The comparison shows a marginal operating cost of commercial vehicles: shift the seasonal timing of shipments, reduce load size per vehicle (resulting in more trips), change vehicle type or change routes (to longer but less restricted roadways) and the benefit of extending time to repair and maintenance the pavement damage. Haning and McFarland (1963) explain the speeds improvement. An increasing speed can be contributed more profit of vehicle movement. The difference between the base condition and the improved speed condition is the value of time saving. Two additional methods for estimating cost of time are determining the cost of providing time saving and the willingness to pay methods (Adkins, Ward and Mc Farland, 1967). The Puget Sound Regional Council (PSRC, 2008) interested in the traffic choices study and began to collect Global Positional System (GPS) data since year 2005. They study the driving behavior of truck responded to the variable of toll costs. The data are analyzed and identified the VOT represented to the verity of market segments. The result reveals by the PSRC regional travel demand forecasting model. The estimated truck VOT is identified in a range of $28 to $73 per hour. Brownstone and Small (2005) work with two projects of California road pricing in areas of I-15 High Occupancy Toll (HOT) Lanes, San Diego and the State Route 91 (SR91) facility in Orange County. The estimate VOT saving is improved by travel time reliability. The empirical results confirm the estimated VOT $20-$40 per hour. The most important cost drivers of road transport are: distance, vehicle speed, type of road, drivers' characteristics (driving behavior, experience, speeding), traffic speed and volume, time of day (day/night) and interaction with weather conditions (ERSO, 2008).The directed transport costs of truck are described by American Transportation Research Institute (ARTI, 2008) The details based on the result of the analysis are shown in the Table 1. This ARTI estimated will be applied to calculate delay cost on I-15 in this study.

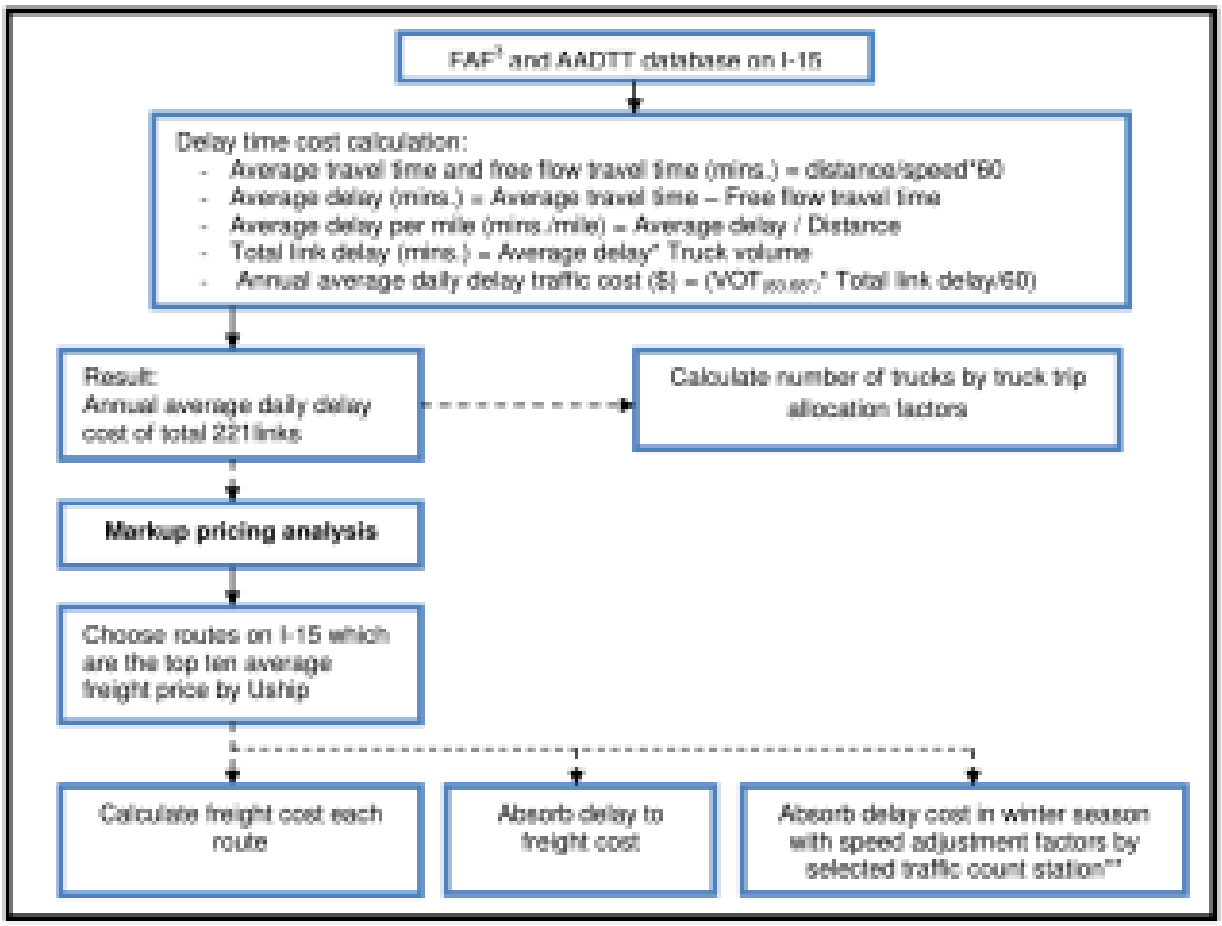
Table 1 The component of marginal costs in the United States

Motor Carrier Marginal Expenses	Costs per mile	Percentage per mile	Costs per hour
Vehicle-based			
Fuel-oil costs	.634	36.65	$33.00
Truck/trailer lease or purchase payments	.206	11.91	$10.72
Repair and maintenance	.092	5.32	$4.79
Fuel taxes	.062	3.58	$3.23
Truck insurance premiums	.06	3.47	$3.12
Tires	.03	1.73	$1.56
Licensing and overweight-oversize permits	.024	1.39	$1.25
Tolls	.019	1.10	$.99
Driver-based			
Driver pay*	.441	25.49	$16.59
Driver benefits	.126	7.28	$6.56
Driver bonus payments	.036	2.08	$1.87
Total marginal costs	**$1.73**	**100**	**$83.68**

* CPH figures are based on respondents' actual driver hourly pay rates

Congestion cost affected to transportation is a one part of the external costs. Business owners could not take that cost to the accounting record. But congestion cost is helpful for decision making of business operation especially price quotation which due to businesses' profit and loss. In addition the estimated value of congestion cost also benefits for government policy. The best practice to estimate congestion cost is based on speed-flow relations, value of time and demand elasticity. Incident of Congestion is due to the capacity and density of transport system also depending on the mode of transport, type of users, infrastructure characteristics, local travel time, and activity alternatives. Travel time increasing is the majority factor of congestion. The standard valuations of travel time show 90% of total economic congestion costs. Under situation of congestion, vehicles consume 10% additional fuel costs under stop-and-go conditions by normal free flow traffic (IMPACT, 2008). The estimation of congestion fee computes by total delay or access costs (INFRAS, 2004). The best estimation practice of congestion costs is based on speed flow relations, value of time and demand elasticises. In generally the Marginal External Congestion (MEC) cost represents a current traffic volume in vehicle per hour. MEC cost depends on the price elasticity of demand and the slope of speed flow function. Speed flow variation describes the effect of the additional vehicle on the transport system due to the transport cost. Speed flow curves depend on infrastructure characteristics, topography, whether conditions, the network arrangement, available travel alternatives, regulations (speed control, ramp metering, etc.) and driving habits. The result fulfils the condition that the demand or willingness to pay curve equals the average time cost plus the MEC costs.

University Transportation Center for Mobility (UTCM, 2011) evaluates the Value of Delay (VOD) for commercial vehicle operator due to highway congestion. The VOD is primary information of construction and tolling policy. It includes affecting factors such as direct operational cost, travel length, travel time variation, inventory holding and warehouse management. Two methods are adapted to estimate VOD: Stated Preference (SP) survey and the carrier fleet operational simulation. The congestion reveals a range of VOD from $94/hr. to $121/hr. in a case of central depot and $80/hr. to $84/hr. in a case of two depots. Gillett (2011) calculates a delay cost for long haul single unit and combination trucks to assess the highway performance by identifying the congested locations where current or future delay are likely to occur. An Interstate-75, 160 miles from Macon to the Georgia-Florida border is studied. The delay cost is calculated by taking speed, volume, distance, types of truck, and types of commodity into account. In order to obtain the value of freight by truck and commodity types, the FAF^3 is used as the data source together with the average truck speed surveyed by ATRI and traffic volume collected by Georgia Department of Transportation (GDOT). To calculate the delay cost and markup pricing analysis, the AADTT, FClass and average speed each link from UDOT, the 43 Standard Classification of Transported Goods (SCTG) commodity flow survey moved by truck from FAF^3. For this research approximate 401 miles corridor are used to estimate value cost of delay combining data source by UDOT, ARTI, and FAF. The methodological framework shows in Figure 1.



* According to American Transportation Research Institute (ATRI) estimated truck operation cost for one hour travelling is $83.68 reference year 2008

** The AADTT traffic volume from November to February 2007 survey data by UDOT are used to calculate seasonal adjustment factors in winter condition

Figure 1 Methodological and Experimental method

2. Data collection

Truck traffic volume

According to the input data for calculating delay cost, FAF^3 and UDOT data extraction; AADT and AADTT 2007 surveyed base and 2040 estimated data are initiated for analyzing truck traffic volume on each network links. Figure 2 shows the comparison of total average traffic count on network link between AADT, AADTT and FAF^3 on I-15 in Utah. The difference of volume between

AADTT and FAF[3] depends on the method of collecting data. AADTT data are collected flow surveys by the station positioning of traffic counters while FAF[3] data are collected traffic volume by commodity flow survey. FAF[3] truck volumes are allocated to highway links by using TransCad GIS-based transportation planning software. However, it is clearly that the numbers of AADT, AADTT and FAF[3] are increased more than double in 2040. In this study the AADTT 2007 is decided to be the database for estimating the delay cost of truck on I-15 because it is the survey counting data and UDOT also provides the data of average speed on highway. To combine with the result on previous studied FAF[3] commodity flow data are applied to estimate the number of trucks by type on I-15 using truck allocation factors. 12.90% and 87.10% are used for estimating single and combination unit type of trucks.

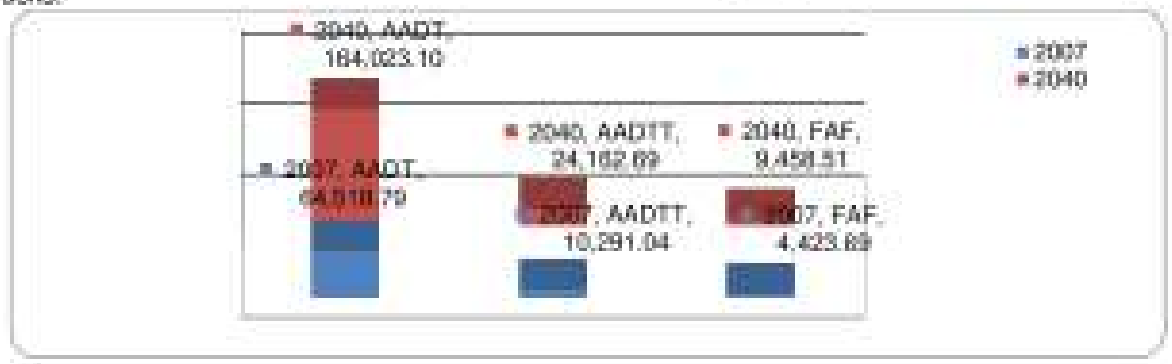


Figure 2 The AADT, AADTT and FAF[3] vehicle volume for I-15 in Utah by year 2007 and 2040

Climate affected on I-15

A wintertime research program in Salt Lake area aims to improve models predictions and understanding of precipitation in a region that is very difficult to observe and forecast. Between the 1990 and 2000 national censuses, the five fastest growing states belonged to the Intermountain West are Nevada, Arizona, Colorado, Utah and Idaho. For Utah experienced a 29.3% increases in population during this 10 years period. As a result, intermountain winter storms impact a growing population and regional economy (Schultz *et al.*, 2002). In Figure 3 shows the contour in Utah, it can be seen that the I-15 is parallel to the mountain area. Driving in snow and icy condition on elevation area is more difficult than plain area. In addition, Utah is the unique desert climate area with the state lying in the path of large Pacific storm, every year Utah usually gets the enforcement of the winter storm and cold temperature started from the end of October until end of February. Especially, between December and February the temperature can drop down below freezing. The precipitation annually I-15 corridor receives approximately 15 inches snowfall. Then the drivers have to pay more attention and reduce the speed driving. According to the climate of Salt Lake City Figure 4 shows the average low and the recorded low temperature in Utah between 1981 and 2010 compared with climate data for U.S. average daily mean considered with Figure 5 shows monthly average snowfall in Utah. It can be seen the severe of weather condition in Utah between November and February. Winter driving condition on the road surface especially snow and ice dramatically affect the braking distance of a vehicle. The driver's capability to complete a smooth and safe stop is severally limited due to reduced tire traction. Driving risk levels in different winter conditions are frost, snow and ice, especially black ice sometimes called clear ice; thin coating of and grime on a roadway surface occurs the temperature dropped in freezing point. Clear ice is a relatively common occurence by freezing temperature and not depended on snowfall. To support the assumption in this study which the delay cost could be affected by weather condition, the seasonal adjustment factors are used to apply.

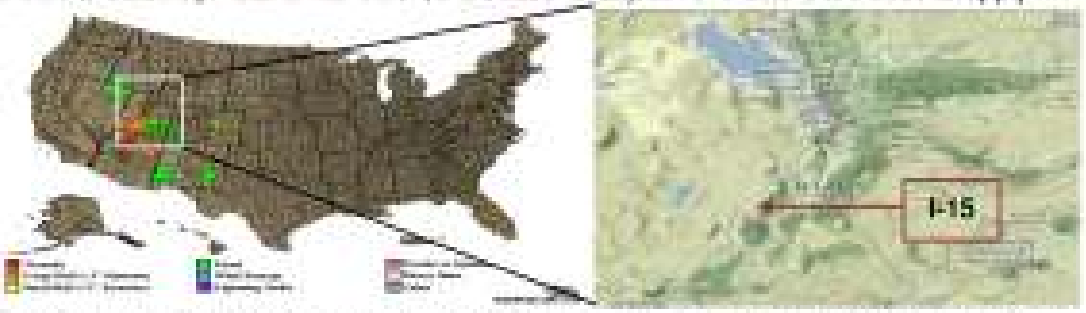
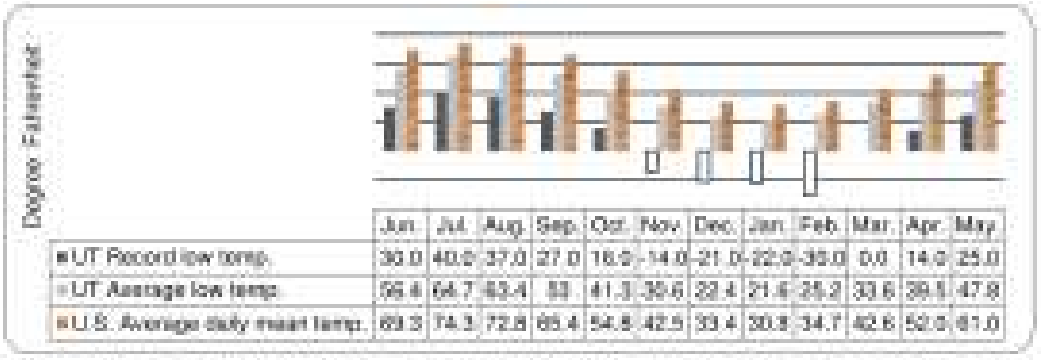


Figure 3 Contour in Utah 2012 (source: United States Department of Agriculture Natural Resources Conservation Service)



	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May
UT Record low temp.	30.0	40.0	37.0	27.0	16.0	-14.0	-21.0	-22.0	-30.0	0.0	14.0	25.0
UT Average low temp.	56.4	64.7	63.4	53	41.3	30.6	22.4	21.4	25.2	33.6	39.5	47.8
U.S. Average daily mean temp.	69.3	74.3	72.8	65.4	54.8	42.5	33.4	30.8	34.7	42.6	52.0	61.0

Figure 4 The climate monthly for Utah compared with U.S. average daily mean in degree Fahrenheit (1981-2010) (source: wikipedia.org)

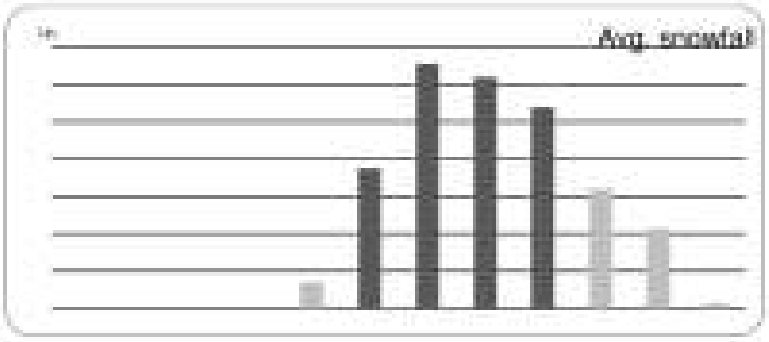


Figure 5 Monthly average snowfall for Salt Lake City international airport (source: wikipedia.org)

Figure 6 Snow plow working in winter condition for Utah (source: UDOT)

Driving in snowing requires many skills e.g. watchful eyes and common sense for winter conditions. Especially, the areas which crossing mountains a weather driving conditions change rapidly as storms pass through. For that reasons UDOT attempts to maintain crews on the job statewide plowing, applying, anti-icing and deicing chemicals, applying sand where needed to keep Utah's roads safe for winter driving. Together with the real time information as a current weather and road way temperature also additional information as winter driving tips are provide on UDOT website. Picture in Figure 6 shows the crews when they operate their job in winter condition. To capturing the climate affects on the pavement for calculating adjustment factor to delay cost in the winter condition, we assume that the delay cost varies opposite of the traffic volume and speed in the winter condition. From the literature review the drivers reduce the speed to pay more attention and carefully drive and avoid accident with snow plow vehicle on the difficult pavement. In addition the increased of delay cost is concern with an opportunity cost as; a risk of customer satisfaction, loss and damage of perishable goods, and the opportunity to get more travel trips. An accident, depreciation and fuel cost are also increasing in winter condition Due to FHWA's road weather management program summarizes the various weather evens affected to driver capabilities and traffic flow. The reduction of road way capacity can be caused by snow accumulation and wind-blow also in winter condition. Weather events can reduce mobility on arterial routes, speed reductions can range from 10-25 percent on wet pavement and from 30-40 percent with snowy or slushy pavement. Average arterial traffic volumes can decrease by 10 to 30 percent depending on road weather conditions and time of day. Saturation flow rate reductions can range from 2-21 percent. Travel time delay on arterials can increase by 11-50 percent (Goodwin, 2002). Kim *et al.*(2008) study the spatial and temporal analysis of urban traffic

volume explores traffic patterns in the Twin cities metropolitan area from 1997-2006. In terms of the monthly traffic volume pattern, August has the highest traffic volume whereas January has the lowest traffic volume. The difference in monthly fluctuation is mainly due to weather conditions. The traffic volume in the winter season (November-February) is relatively lower than traffic in other seasons. The average traffic volume in the winter season is 0.5 percent lower than average of other seasons. Iowa Department of Transportation and Iowa Highway Research Board (IIHR, 1998) collect the storm data from I-29 and I-80 by hourly traffic counts over two days for storm even and for one week later for understanding how snow effects traffic. The hypothesis is approved when traffic volume data is reduced in the number of trip and also the decreasing of the traffic speed because of the decreased friction on the road surface. Due to the assumption of this study the collecting data of traffic volume by UDOT's traffic count on I-15 in Utah between November and February 2007 are applied for calculating speed adjustment factors to delay cost in the winter condition. According to traffic count data, the average daily vehicle is calculated by using 3 traffic station counters on I-15 in Utah shown in Figure 7. The result in Table 2 shows the percentage of speed adjustment factors separate approximated centroid by county for applying to delay cost on network links in the winter condition.

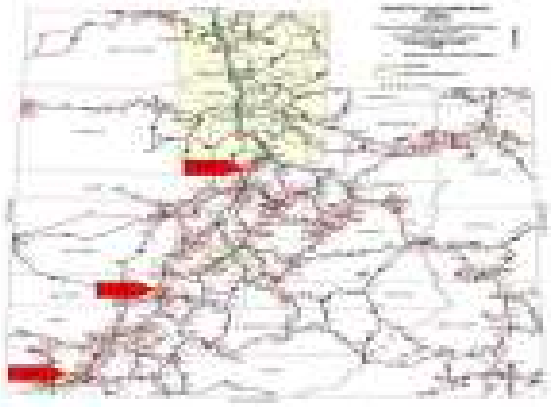


Figure 7 The traffic station counters which are chosen (source: UDOT)

Table 2 Speed adjustment factor

Station	Mileage Range		County Area		Speed Adjustment Factors (%)
	From	To	From	To	
401	0	42.170	Washington	Iron	12.72
403	42.171	242.460	Beaver	Juab	17.90
349	242.461	400.592	Utah	Box Elder	12.75

Truck speeds

To calculate delay time of each link, ATRI's average traffic speed is used for the input data. The speed capturing is recorded by the pavement traffic counters. Each station uses the Global Positioning System (GPS) equipments for tracking and reporting vehicle movements. ATRI coordinates working with the Federal Highway Administration (FHWA), the individual truck speed is recorded by three mile intervals every hour to capture direction and day of week for year 2009. The available average speeds compared with the speed limit by regulation are used to analyze traffic flow perspective and congestion. I-15 in Utah, the speed permit for trucking is 65 mph. in the cities and 75 mph. elsewhere areas. Only two zones of are considered rising permit to 80 mph. as a test and although still be posted as experimental. Functional Class (FClass) data is used to determine the speed limit area on each link; they also provide county route name, route number, total miles of route, type of area (Urban or Rural) and including a number of lane. There are only 2 types of FClass; FClass 1 for speed limit 65 mph. and FClass 11 for speed limit 75 on I-15.

3. Average freight price

The delay cost of truck is practiced analysis by freight price of UShip. Because it is the world's largest and most trusted transportation marketplace, primarily serving the freight, household goods and vehicle shipping markets. Consumers and business owners can compare and book upfront quotes by posting their name and own price or receive auction-style bids from 300,000 customer-reviewed transportation service providers. The auction system matches independent owner-operators with the largest freight carriers and brokers by ranking. Freight price used to practice in this study, full

Truck Load (FTL) and average weight 40,000 lb are defined on website to estimate price between 10 O-D pairs county by country and zip codes are used to define the position of county on I-15. Table 3 shows the average freight price and their distance provided from website.

Table 3 FTL average freight price and distance between 10 counties

County			Average Freight Price (U.S. dollars per truck trip)									
			1	2	3	4	5	6	7	8	9	10
			Washington	Iron	Beaver	Millard	Juab	Utah	Salt Lake	Davis	Weber	Box Elder
Average Distance (miles)	1	Washington		189	580	956	963	1,058	903	864	864	920
	2	Iron	84		232	841	838	777	1,003	920	920	877
	3	Beaver	116	92		463	566	751	851	971	855	957
	4	Millard	208	146	96		253	538	698	811	777	874
	5	Juab	230	167	118	49		197	395	606	588	645
	6	Utah	276	224	164	98	45		194	378	448	502
	7	Salt Lake	310	247	198	115	79	45		237	235	206
	8	Davis	344	293	229	160	110	76	38		186	420
	9	Weber	345	294	245	176	126	92	52	14		272
	10	Box Elder	371	307	259	190	140	106	69	31	29	

4. Empirical results

The result of annual average daily delay cost of truck compared with average speed from 221 links is shown in Figure 8-A and 8-B. The top 3 links which most costly delay cost are link number 186, 181 and 185 close to Salt Lake City. Their total length is only 0.87 mile but the amount of AADTT delay cost is 3.18 million of dollars. Compared FClass 11 speed allowed 65 mph, with average speed is only 0.5 mph, it can be shown the problem of the traffic congestion. Maps in Figure 8 identify the position of congestion area by map window GIS program.

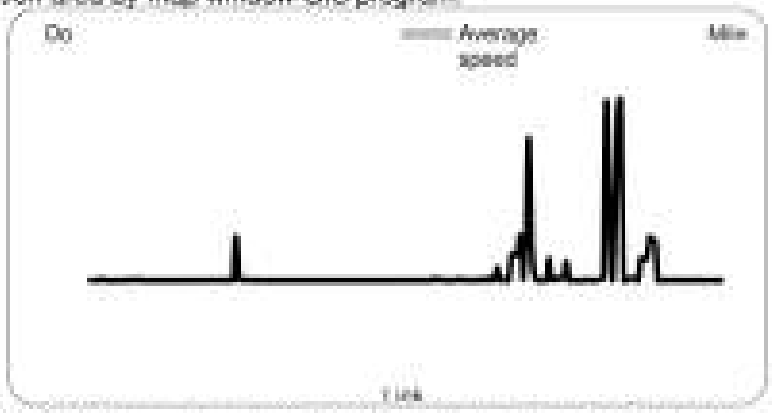


Figure 8-A Average speed and AADTT delay cost and FClass in each link

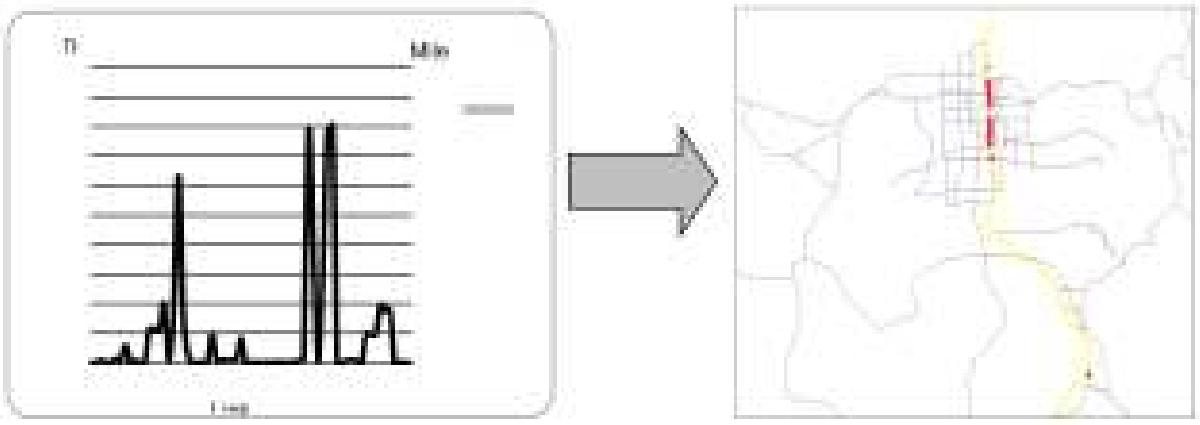


Figure 8-B Average speed and AADTT delay cost on I-15

Figure 9 shows the number of single and combination unit type of trucks from the percentage of truck trip allocation by our previous study. Because of top 5 commodities moved in Utah; coal, nonmetal mineral products, gravel, waste and scrap, and gasoline shown in Figure 10 using the majority combination unit type of truck transported within Utah. Consider with valuation of product based on their perishability potential and/or use (Small *et al.*, 1999), almost of all top ten commodities moved in Utah are the categories of moderately time sensitivities product except cereal and grains, and mixed freight categorized in a highly time sensitive. The moderately time sensitivity products are construction and energy product using bulk and liquid vehicles; coal, nonmetallic minerals, gravel, gasoline, fuel oils, crude petroleum and coal-not elsewhere classified. It can be seen that 9 by 10 commodities moved in Utah are time sensitive products and supported the assumption to adjust delay cost by seasonal adjustment factors under the weather condition.

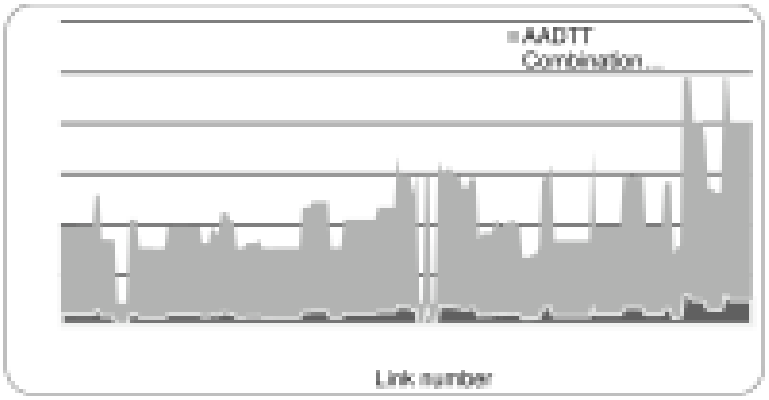


Figure 9 Single and combination unit type of trucks by FAF[3] truck type allocation factors

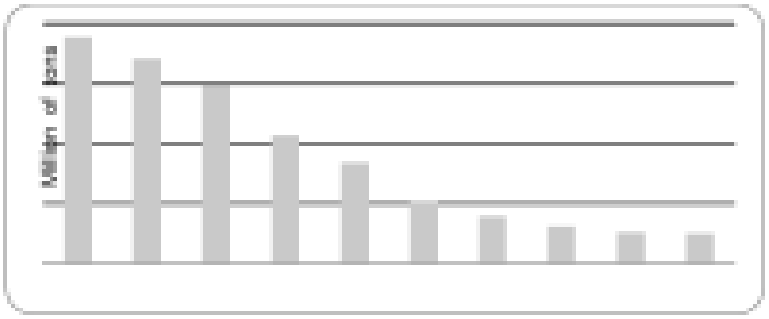


Figure 10 FAF[3] top 10 Commodity flow survey by year 2007

Figure 11 shows top ten O-D route by freight price, freight cost is calculated by $1.73 per mile according to ATRI cost estimation. It can be seen that a highest percentage markup is O-D Washington-Millard 208 mileages length accounted for 62.36% of markup. In contrast to O-D Washington-Box Elder 371 mileages length is the less markup accounted for 30.24%.

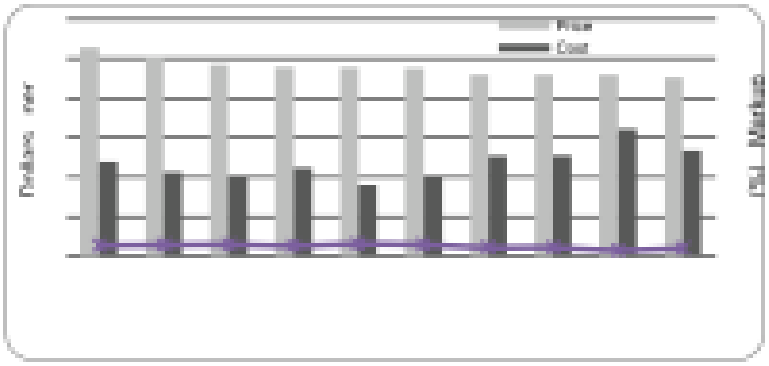


Figure 11 Top ten O-D routes by Uship freight price on I-15 in Utah

Continue with cost absorbed delay time in Figure 12, the result shows that cost in O-D Washington-Box Elder is the critical route to get loss. Because of that part is the longest distance of O-D route passed though the county close to mountain area along I-15 combining with the number of vehicle transported in Salt Lake City and also vehicle passed though Utah from other states, due to the raising of delay cost over freight price.

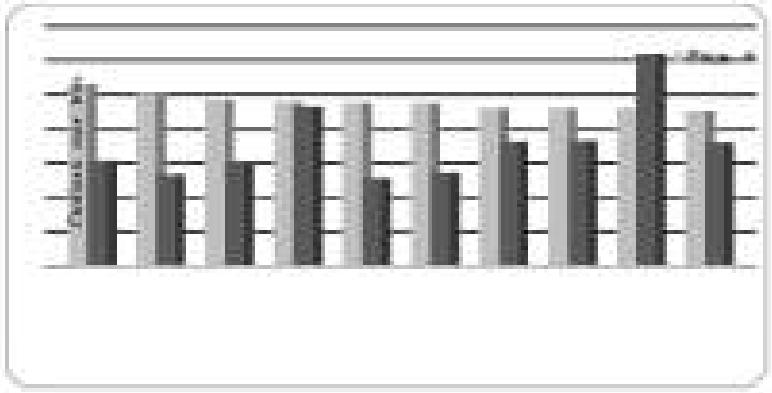


Figure 12 Comparative price and cost absorbed delay time

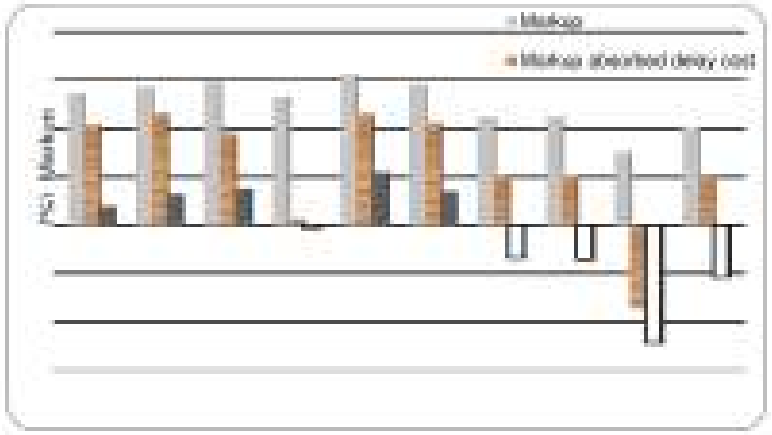


Figure 13 The percentage markup comparison

The result in Figure 13 shows the comparative percentage of markup pricing in 3 situations; regular cost, absorbed delay cost, and absorbed delay cost and a seasonal adjustment factor in winter condition. The delay time and seasonal factor effect to the reducing trend of markup all O-D route especially O-D route Washington-Box Elder, moreover O-D Washington-Salt Lake City, Iron-Weber and Iron-Davis get loss from the affect of seasonal adjustment factor.

5. Conclusions

Traffic congestion is recognized in transportation cost and significant factor in transport network system. Various methods are used to quantify congestion costs; consumers' willingness to pay, the marginal impacted vehicle entering the traffic on the road, the speed flow relationship of each road segment. The performance to evaluate and analyze delay cost is one method to quantify for congestion cost. The delay cost can be the guideline for applying this practice in transport planning decision and truck policy analysis; road capacity, pollution emissions and toll surcharge designed. Moreover, to quantify the full transportation cost of truck, the delay cost can be benefit for vehicle users and operators because it increases the vehicle cost, travel time and crash cost also the risk of customer satisfaction and opportunity cost. This study is a unique study area and provides cost explained economic evaluation techniques and how to apply them. The result represents delay cost all links on I-15 it can be seen the critical link on the roadway. To absorb the vehicle operating cost by delay and compared with freight pricing specific critical route, the markup pricing is derived. The

weather condition is also used to represent the interaction of traffic delay cost in this area. The decreased of markup pricing for trucks is affected by traffic volume on a transportation network and due to average speed and weather condition factors affected to the pavement. Identifying the type of truck-specific commodity and O-D routes markup pricing raises the awareness to construct the critical link. Although this study shows illustrative practice to calculate delay cost of truck and markup analysis specific area in Utah, the finding will be useful for applying in the state policy point of view. Moreover, it also points out the critical O-D link on I-15 which can be get loss in the difference of condition for providing a more accurate cost of annual truck congestion for commercial vehicle operators on the interstate highways.

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