Application of Analytic Hierarchy Process for Location Analysis of Logistics Centers in Laos

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Abstract: There have been many efforts to improve transport connectivity in South-East Asia. Strategic location of integrated logistics centers can facilitate transportation, handling, storage and transshipment of goods moving in international trade. The paper proposes to consider additional factors for evaluation of location of logistics centers in addition to the commonly used economic and environmental assessment tools. The paper utilizes the analytic hierarchy process to analyze development of logistics centers in Laos which aims to transform itself into a “land-linked” country from a land-locked country. Location models are developed based on the feedback of related government officials and private sector transport service providers. The results show similarity in final priority ranking of the proposed logistics centers, However, some difference on the weights of the evaluation criteria were noted for the public and private sector model. Finally, some policy considerations are offered for development of freight transport and logistics.

Key words: Logistics Centers, Analytic Hierarchy Process, Freight Transport, Laos
INTRODUCTION

There have been many efforts to improve transport connectivity in South-East Asia that include initiatives like Greater Mekong Subregion\(^1\) (GMS)\(^1\), Association of Southeast Asian Nations (ASEAN) connectivity\(^2\) and ASEAN transport strategic master plan\(^3\). In order to foster seamless flow of goods in international trade the concept of integrated logistics is emerging that provides door-to-door services for freight. The concept embodies integration of various modes of transport, facilities and provision of transport related services at one location. The strategic objective of GMS programme is to complete transport corridors linking the subregion through improved logistics opportunities\(^1\). GMS region has received much foreign direct investment to improve transport infrastructure\(^4\).

Thus location of logistics facilities is an important consideration that would serve existing trade flow and consumption and production pattern. It is even more important for land-locked countries to develop such facilities in inland area that improve connectivity to ports, markets, production centers and other logistics centers. One of the focuses of the World Bank transport strategy is development of multimodal transport through corridor and logistics development\(^5\).

Laos, the only land-locked country in South-East Asia, has national logistics strategy to be a logistics hub for GMS and a land-linked country. More than 90% of Laos transit trade goes through Nongkhai, Thailand\(^6\). Therefore, it is important to develop logistics facilities to promote export and import to/from Thailand as well as to facilitate trade among GMS countries.

Further, development of intermodal transport and integrated logistics centers at strategic locations could be one of the ways to promote environmental sustainability. These facilities by integrating various modes of transport could encourage modal shift to greener modes of transport and reduce less-than-truck-loads trips through provision of consolidation and distribution services. Therefore, in addition to utilization of popular economic and environmental assessment tools other important factors need to be considered to evaluate locations of logistics centers.

In this context, the paper aims to analyze the facility location problem of logistics centers considering the case of Laos. We used the analytic hierarchy process (AHP)\(^7\) one of the multi-criteria decision analysis (MCDA) approach. We developed AHP location models based on the feedback of public and private sector stakeholders in order to prioritize and rank alternative locations of logistics centers. Finally, some policy thoughts are offered for development of logistics and freight transport in Laos.

2. LITERATURE REVIEW

Logistics centers are referred as geographical groupings of independent companies or bodies which are dealing with freight transport and with accompanying services including at least terminal\(^8\). The areas of logistics centers, freight villages and intermodal freight hubs, intermodal transport have been extensively researched in Europe and developed countries\(^9,\ 10\). The Marco Polo project aims to increase the share of rail freight in Europe\(^11\). Environmental benefits of intermodal transport in Asian context have also been evaluated\(^12\).

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\(^1\) GMS includes China, Cambodia, Laos, Myanmar, Thailand and Vietnam.
There are many stakeholders and issues that need to be considered while planning and developing logistics centers. Lack of clear policies and institutional arrangements, conflicting interest of stakeholders pose difficulty in selecting location of logistics centers. While some of established economic analysis tools such as cost benefit analysis, net present value, internal rate of return, environmental impact assessment can look at economic, financial and environmentally feasibility. These tools are commonly used to evaluate alternatives and make decisions based on economic parameters.

The principle criteria for location is to support movement of goods for industry, consumer and market and to minimize total freight ton-km travelled. In addition to those mentioned above, some of the common factors that affect the facility location are its proximity to ports, markets and manufacturing area, connections to other modes of transport, costs of development, operation and transport, potential of encouraging mode shift, CO₂ emissions reduction potential, delivery time, security, and existing government policies. However, many of these factors are subjective and cannot be quantified and thus make the facility location problem a complex.

MCDA has been extensively used to analyze problems that involve many stakeholders’ views and considers many factors including those involving location problems. MCDA was used to evaluate alternative options for environmentally sustainable transport system in Delhi (13) and assessment of transport projects (14). AHP and Analytic Network Process (ANP) were used to study and evaluate potential location of logistics centers/inland ports in China (15, 16), freight village in Greece (17) and intermodal transshipment and hub ports in Turkey (18, 19, 20). AHP was used to analyze location of wind observation station (21), to measure performance of intermodal transport in Thailand (22), infrastructure management (23), appraisal of transport projects in Korea (24), and prioritization of pavement maintenance activities (25, 26). AHP and ANP were applied for environmental impacts assessment and evaluation of transport policies (27, 28, 29).

Facility location of inland ports in the United States was analyzed with objective of minimizing vehicle-miles travelled and promoting regional freight transport (30). An agent based model was developed to analyze location of inland ports and hubs in Australia (31). AHP was used to prioritize transport projects (32), to select railway station site in Iran (33) and to select port in Nigeria (34).

Therefore, from literature it can be seen that the location problem can be analyzed by utilizing MCDA approach. The decision problem involves consideration of various factors and views of various stakeholders that include government decision makers as well private sector transport service providers. AHP one of the MCDA methodologies (35) can incorporate feedback of various stakeholders and utilizes this in prioritizing and ranking alternatives. The subjective as well as objective criteria and sub-criteria that are relevant to the problem at hand can be incorporated in AHP. AHP has been widely used for planning and resource allocation, prioritization of alternatives- which is the problem at hand (36). As many criteria and preferences could be conflicting- a set of solutions with ranking could be presented to the policy makers to assist in the decision making process.
3. LOGISTICS CENTERS IN LAOS

Laos, a land-locked country, is centrally located in the GMS within South-East Asia. It uses sea ports in Thailand and Vietnam for export and import of goods. One of the routes of the Singapore-Kunming rail project as well as the East-West GMS corridor linking Vietnam to Thailand and Myanmar also passes through Laos. Thus it has a potential to offer much needed land transport connectivity to China and Vietnam. Laos aspire to be seen as a “land-linked” rather than “land-locked” country with a vision to be a regional logistics hub in GMS.

Laos total import and export was US $ 1,092 million (equivalent to 1.67 million tons) and US $ 2,430 million (equivalent to 1.963 million tons) in 2009 (37). Figure 1 shows the steady growth of volume of foreign trade with its neighbors (38). It shows that more than 80% of its trade is with Thailand, followed by Vietnam with 13% and China with 8%. Interestingly the volume of trade with southern neighbour Cambodia is very low. Therefore, transport connection to and from Thailand is very important for Laos. Thailand is preferred to Vietnam as main transit route for Laos’s imports and exports (39).

![FIGURE 1 Laos foreign trade volume.](image)

Laos is well connected by roads with Thailand. Two bridges across Mekong have already been constructed at Thanalaeng and Savannakhet. Currently construction of other two Mekong bridges are progressing one at Huayxai and Thakhek. National Highway-13 (Asian Highway-12)
is the backbone of road transport. In addition to the roads there is one railway connection to Thanalaeng from Thailand. There are also plans to improve railway connectivity and feasibility studies of connection from Boten, China-Vientiane, Vienatine-Thakhek-Vietnam border are progressing (34). During data collection in Laos it was learnt the feasibility study of Boten-Vientiane was currently being reviewed. It was estimated that the construction cost would be high due to the mountainous topography and the need construct many high bridges and tunnels. Vientiane–Thakhek rail route is also in pipeline for development. It is expected that Laos railway network will expand in near future. The Mekong River is also used for water transport. The current mode share is 80% by road and 20% by water transport. ADB has estimated the freight demand for GMS 6.3 million tons for 2014 and 23.8 million tons for 2025 (40).

Laos logistics performance index (LPI) is 2.46 which is better than its neighbours Myanmar (2.33) and Cambodia (2.37) while China (3.49), Thailand (3.29) and Vietnam (2.96) have higher LPI. If we compare with other landlocked countries it is better than that of Nepal (2.2), Mongolia (2.25), Bhutan (2.38) and Afghanistan (2.24). However Kazakhstan (2.83 have higher LPI than Laos (41).

![FIGURE 2](image_url) Study area and location of logistics centers in Laos.

Improvement of logistics system and transport connectivity would be the core activity to materialize the vision of being a land-linked country. Laos current development plan forecast a 7% growth of freight that will reach 32 million tons and 2.2 billion ton-Km by 2015 and focus on development of special economic zones already established in Boten, Bokeo and Savannakhet (42). Thailand also has railway capacity enhancement plan that includes double tracking to Nongkhai, track rehabilitation and development of inland container depots in Nongkhai and
Ubon Ratchathani near border with Laos (43). Laos thus can use these facilities as well as the Lat Krabang ICD near Bangkok which is connected by railway to Laem Chabang port.

Laos national strategic logistics master plan (44) has proposed to develop three international logistics parks at Thanalaeng (Vientiane), Savannakhet and Luangnamtha and three regional logistics parks at Luangparbang, Thakhek and Pakse (Champasak) which are shown in Figure 2. Due to the importance of international trade, potential freight volume and transport connectivity with Thailand as well as GMS four logistics centers namely Thanalaeng, Thakhek, Savannakhet and Pakse are considered as cases in the current study. These four alternative locations have potential to serve international and transit as well as domestic freight. The salient features of these logistics centers are shown in table 1.

TABLE 1 Salient Features of Proposed Logistics Centers in Laos (44)

<table>
<thead>
<tr>
<th></th>
<th>Freight volume</th>
<th>Design Area</th>
<th>Costs</th>
<th>Functions and roles</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tons for 2015</td>
<td>Tons for 2025</td>
<td>sq. m</td>
<td>Mi US$</td>
</tr>
<tr>
<td>Thanalaeng</td>
<td>426,500</td>
<td>1,413,060</td>
<td>295,000</td>
<td>Road, rail and waterway, import and export to Thailand, limited transit to China, consolidation, transshipment and distribution</td>
</tr>
<tr>
<td>Thakhek</td>
<td>NA</td>
<td>79,000</td>
<td>23,300</td>
<td>Road and waterway, import, export and transit to/from Thailand and Vietnam, consolidation, transshipment and distribution, bridge to Thailand near completion</td>
</tr>
<tr>
<td>Savannakhet</td>
<td>36,000</td>
<td>151,000</td>
<td>51,100</td>
<td>Road and waterway, import, export and transit to/from Thailand and Vietnam through GMS East-West Corridor, consolidation, transshipment and distribution,</td>
</tr>
<tr>
<td>Pakse</td>
<td>106,400</td>
<td>296,000</td>
<td>115,900</td>
<td>Road and waterway, import, and export to/from Thailand, transit to Cambodia, consolidation, transshipment and distribution, Storage and distribution of agricultural products</td>
</tr>
</tbody>
</table>

Despite having logistics development plan Laos is finding it difficult to develop these logistics facilities. Prioritization of logistics facilities would help policy makers to take decision and mobilize resources according to the priority and gradually improve overall logistics system.
4. METHODS, DATA AND ANALYSIS

AHP can consider both quantitative and qualitative criteria and derive relative weights and prioritize alternate locations based on evaluation criteria selected. Using a systematic hierarchy structure, complex estimation criteria can be clearly and precisely represented (45). The AHP involves the following process:

(i) Hierarch development- defining goal, evaluation criteria and sub-criteria and alternatives;
(ii) Pair-wise comparison of criteria, sub-criteria and alternatives;
(iii) Weight derivation of criteria, sub-criteria and alternatives;
(iv) Synthesis- derivation of priorities;
(v) Consistency check.

4.1 AHP Model

The facility location problem is decomposed into four levels of hierarchy consisting of (i) one goal; (ii) five criteria; (iii) 12 sub-criteria; and (iv) four alternatives. Relevant criteria and sub-criteria are selected after reviewing the elements considered by earlier studies (15, 16, 17, 18, 19, 20, 33, 46, 47, 48). The criteria and sub-criteria were further refined after consultation with the related officials in Laos. The four alternatives selected are the location of real logistics centers proposed in the recent logistics study (44). The selected criteria and sub-criteria and the AHP model are shown table 2 and figure 2. This decomposition of decision problem makes it possible to judge the importance of the elements in a given level with respect to other elements in the same level. The number of main criteria has been limited to five in order to limit numbers of questions for pair-wise comparisons and to increase probability of receiving feedback on the survey. AHP assumes the criteria and sub-criteria should be independent of each other.

<table>
<thead>
<tr>
<th>Goal</th>
<th>Criteria</th>
<th>Sub-criteria</th>
<th>Alternatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prioritize and rank location of logistics centers</td>
<td>Development and operation costs (C1)</td>
<td>Land acquisition costs (C11)</td>
<td>Thanalaeng (A1)</td>
</tr>
<tr>
<td></td>
<td>Time (C2)</td>
<td>Total transport time from seaport (C21)</td>
<td>Savannakhet (A2)</td>
</tr>
<tr>
<td></td>
<td>Intermodal transport connectivity (C3)</td>
<td>Highways (C31)</td>
<td>Thakhek (A3)</td>
</tr>
<tr>
<td></td>
<td>Environmental impacts (C4)</td>
<td>Impacts from construction (C41)</td>
<td>Pakse (A4)</td>
</tr>
<tr>
<td></td>
<td>Regional economic development (C5)</td>
<td>Proximity to market, production centers and consumers (C51)</td>
<td>Government polices to develop</td>
</tr>
</tbody>
</table>
Relative weights of decision criteria and sub-criteria are derived by making pair-wise comparison for all the selected criteria at each level. The main objective of this process is to arrive at priority of the alternative locations based on the criteria and sub-criteria selected. The respondent is asked to indicate value judgment/preference in a 1 to 9 point Saaty’s scale while making pair-wise comparison. For quantitative criteria the corresponding values are estimated based on the available data from survey and the value assigned from pair-wise comparison are replaced. It may not be always possible to measure and present these factors as numerical values. Rather these factors are expressed as value judgment, preferred options based on criteria.

Individual judgments are combined to arrive at the group judgment typically by taking the geometric mean method (GMM) of the individual judgment \((49)\). The aggregate weight of individual judgments is calculated by the following equation.

\[
a_{i,j} = (a_{i,j}^1 * a_{i,j}^2 * a_{i,j}^3 * a_{i,j}^4 \ldots \ldots \ldots a_{i,j}^n)^{1/n}
\]
A judgmental matrix, $A = (a_{ij})$ such that $a_{ii}=1$, $a_{ij} = 1/a_{ji}$ for all $i, j \leq n$, is developed based on pair-wise comparison of priorities of criteria (50).

$$A = \begin{bmatrix} 1 & a_{12} & \ldots & a_{1n} \\ 1/a_{12} & 1 & \ldots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ 1/a_{1n} & 1/a_{2n} & \ldots & 1 \end{bmatrix}$$

(2)

Where, $n$ number of alternatives, $a_{ij}$ represents pair-wise comparison rating between the element $i$ and $j$ of a criteria with respect to goal being considered.

Then priorities of the criteria is estimated by calculating the principal eigenvector $W$ of the matrix $A$,

$$A \cdot W = \lambda_{\text{max}} \cdot W$$

(3)

Where, $\lambda_{\text{max}}$ is principle eigenvalue, when vector $W$ is normalized, it becomes vector of priorities of criteria of one level with respect to the upper level.

$$a_{i,j} = a_{i,k} \cdot a_{k,j} \quad \forall i,j,k.$$ 

(4)

After analyzing group judgment, the weights are derived by using by eigenvector method (linear algebra).

$$a_{i,j} = \frac{w_i}{w_j} \quad \text{(for } i,j, = 1, 2, \ldots, n)$$

(5)

The consistency index (CI) is calculated using equation (6).
\[ CI = \frac{\lambda_{\text{max}} - n}{n - 1} \]  

(6)

CI should be below 0.2 for the survey to be accepted, if CI > 0.2 indicates lack of consistency and warrants repeat of survey.

The Consistent Ratio (CR) is calculated using equation (7), generally CR ≤ 0.1.

\[ CR = \frac{CI}{RI} \]  

(7)

Where, RI is Random Index

The measure of consistency enables analysis to review the judgments, modifying them to improve the overall consistency.

4.3 Data Collection

Questionnaire survey for pair-wise comparison of criteria, sub-criteria and alternative locations was developed and refined based on the feedback received from researchers and government officials. The questionnaire involved 101 questions for pair-wise comparison and general information on the respondents.

Contact was maintained with transport and logistics related government officials, Laos International Freight Forwarders’ Association (LIFFA) and Lao National Chambers of Commerce and Industry (LNCCI) to develop a long list of potential respondents. From the long list 50 people were selected for the survey that included 23 government officials, all (22) members of LIFFA and 5 members of LNCCI.

Prior to the visit to Laos for survey, the questionnaire was sent to all 50 potential respondents. On site data collection was done during 6-12 July 2011 which also involved visit to all four alternative locations and meeting and discussion with freight forwarders, private sector representatives, and government officials. Total 21 responses were received with an overall response rate of 42%. The response of private sector was 33% (9 response from 27 requests) compared with government policy makers 52% (12 response from 23 requests). The respondents included government officials representing public works and transport, road, railway, transport, national transport facilitation committee, legal affairs, and officials of special economic zones. Private sector included members of LIFFA and LNCCI.

During the survey it was felt that questionnaire was too long as it contained 101 questions and took between 20-30 minutes to complete the survey. As a result some of the potential respondents promised to provide feedback but never did.
Two completed questionnaires were incomplete and were discarded. Most of the responses received were consistent. However, due to large numbers of questions, some questions were left unanswered due to possibly "reply fatigue."

4.4 Analysis

Individual survey responses were tabulated in two groups and analyzed formulating government decision makers (GDM) and private sector freight forwarder (PSFF) models. A third model was created combining (COMB) both of the above groups. Table 3 shows the derived weights of five evaluation criteria and table 4 shows derived weight of sub-criteria. The consistency ratio (CR) is also shown in the table 3 and 4 which in all case is less than 0.1 indicating consistency of the pair-wise comparison and weight derivation.

### TABLE 3 Derived Weights of Evaluation Criteria

<table>
<thead>
<tr>
<th>Goal</th>
<th>Criteria</th>
<th>GDM (C.R=0.01)</th>
<th>PSFF (C.R=0.08)</th>
<th>COMB (C.R=0.08)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prioritize location of logistics center</td>
<td>Development and operation costs (C1)</td>
<td>0.240</td>
<td>0.142</td>
<td>0.220</td>
</tr>
<tr>
<td>Time (C2)</td>
<td>0.129</td>
<td>0.131</td>
<td>0.215</td>
<td></td>
</tr>
<tr>
<td>Intermodal transport connectivity (C3)</td>
<td>0.230</td>
<td>0.150</td>
<td>0.199</td>
<td></td>
</tr>
<tr>
<td>Environmental impacts (C4)</td>
<td>0.170</td>
<td>0.312</td>
<td>0.176</td>
<td></td>
</tr>
<tr>
<td>Regional economic development (C5)</td>
<td>0.231</td>
<td>0.265</td>
<td>0.190</td>
<td></td>
</tr>
</tbody>
</table>

The above results show that GDM assign high priority to cost and regional economic development, interestingly PSFF assign priority to environmental impacts and regional economic developed while COMB indicates high priority to time and costs.

### TABLE 4 Derived Weights of Sub-criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Sub-criteria</th>
<th>GDM</th>
<th>PSFF</th>
<th>COMB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development and operation costs (C1)</td>
<td>Land acquisition costs (C11)</td>
<td>0.280</td>
<td>0.266</td>
<td>0.276</td>
</tr>
<tr>
<td>Construction costs (C12)</td>
<td>0.353</td>
<td>0.169</td>
<td>0.282</td>
<td></td>
</tr>
<tr>
<td>Transportation costs (C13)</td>
<td>0.367</td>
<td>0.566</td>
<td>0.442</td>
<td></td>
</tr>
<tr>
<td>(C.R=0.02)</td>
<td>(C.R=0.01)</td>
<td>(C.R=0.01)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time (C2)</td>
<td>Total transport time from seaport (C21)</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Intermodal transport connectivity (C3)</td>
<td>Highways (C31)</td>
<td>0.423</td>
<td>0.281</td>
<td>0.356</td>
</tr>
<tr>
<td>Railways (C32)</td>
<td>0.338</td>
<td>0.358</td>
<td>0.355</td>
<td></td>
</tr>
<tr>
<td>C33 Inland waterways</td>
<td>0.149</td>
<td>0.208</td>
<td>0.172</td>
<td></td>
</tr>
<tr>
<td>Seaports (C34)</td>
<td>0.090</td>
<td>0.153</td>
<td>0.117</td>
<td></td>
</tr>
<tr>
<td>(C.R=0.01)</td>
<td>(C.R=0.08)</td>
<td>(C.R=0.02)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental impacts (C4)</td>
<td>Impacts from construction (C41)</td>
<td>0.545</td>
<td>0.583</td>
<td>0.524</td>
</tr>
<tr>
<td>Impacts from transport operation (C42)</td>
<td>0.455</td>
<td>0.417</td>
<td>0.476</td>
<td></td>
</tr>
<tr>
<td>(C.R=0.0)</td>
<td>(C.R=0.0)</td>
<td>(C.R=0.0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regional economic development (C5)</td>
<td>Proximity to market, production centers and consumers (C51)</td>
<td>0.425</td>
<td>0.222</td>
<td>0.340</td>
</tr>
<tr>
<td>Government polices to develop special economic zone or free trade area nearby (C52)</td>
<td>0.386</td>
<td>0.505</td>
<td>0.438</td>
<td></td>
</tr>
</tbody>
</table>
Construction cost (C12), transportation time (C21), proximity to market and production centers (C51) and freight demand (C53) are tangible criteria which can be measured. For land acquisition cost (C11) comparison of land cost at different location is used. Sub-criteria transportation cost (C13) is also measurable but due to sensitivity of the transportation price among freight forwarders and transport operators it could not be collected and the rating provided by the respondents was instead. The data for these criteria and sub-criteria was collected during the survey and secondary sources. The table 5 shows the tangible data collected and their normalized values which were used for analysis. Except for ‘freight demand’ higher the value of element lower the priority. For example, higher construction cost of an alternative would encourage decision makers to consider other alternative locations having lower construction costs.

**TABLE 5 Estimated Values of Tangible Criteria and Sub-criteria**

<table>
<thead>
<tr>
<th>Alternatives</th>
<th>Land acqu. Cost (C11)</th>
<th>Construction cost (C12)</th>
<th>Transport time (C13)</th>
<th>Proximity to market (C51)</th>
<th>Freight demand (C53)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>1</td>
<td>0.192</td>
<td>32</td>
<td>0.053</td>
<td>9</td>
</tr>
<tr>
<td>A2</td>
<td>0.65</td>
<td>0.295</td>
<td>3.7</td>
<td>0.459</td>
<td>9</td>
</tr>
<tr>
<td>A3</td>
<td>0.8</td>
<td>0.240</td>
<td>4.56</td>
<td>0.373</td>
<td>9</td>
</tr>
<tr>
<td>A4</td>
<td>0.7</td>
<td>0.274</td>
<td>14.77</td>
<td>0.115</td>
<td>7</td>
</tr>
</tbody>
</table>

The analysis was done using distributive mode and overall CR of the GDM model is 0.02, PSFF model 0.05 and that of COMB model is 0.04. This indicates overall consistency of data and analysis and reliability of the outcome.

Figure 4 shows final derived weight of four alternative locations using three different AHP models. Detail weight derivation and ranking for three different AHP models is shown in table 6. The results and outputs of three location models ranked Thanalaeng logistic center as the highest priority location followed by Savannakhet and Pakse. This result output is in line with the view of policy makers and freight forwarders. The result highlights the importance of Thanalaeng because its railway connectivity, proximity to Vientiane capital and expected freight volume. Thakhek scored lowest rank in all three models even though it is a shortest route to connect Vietnam. It could be because the bridge over Mekong River connecting Laos and Thailand at Thakhek is still under construction and is planned to be opened on 11 November 2011.
4.5 Results and Discussion

The results further reinforce the priority for Thanalaeng even if there is some dilemma among some policy makers on priority because of the existing policy to promote SSFEZ and Savannakhet logistics center. This argument is further strengthened by the same outcome from GDM and PSFF model. There are some views that Savannakhet is more important for international trade as this is located along GMS East-West Corridor.

Only logistics infrastructure is not enough to facilitate trade and movement of goods. Its efficient operation and management is the key to support international trade and transport. Development of logistics centers should be driven from real economic potential, implementation of facilitation measures and improvement of road infrastructure. Initiating policy or system for single handling of cargoes using ASYCUDA for customs clearance, reducing numbers of documents required for imports and exports, expanding use of single window system, using information and communication technology for cargo/container tracking, initiating freight train services between Bangkok and Vientiane and enhancing use of the Mekong river are some of the measures that would promote freight transport in Laos and contribute towards turning it into a “land-linked” country.

5. CONCLUSIONS

The location of proposed logistics centers was analyzed using AHP. The analysis showed that Thanalaeng, which is close to Vientiane, ranked high priority followed by Savannakhet, Pakse and Thakhek. These results are consistent with the view of the freight forwarders and government officials. However, some difference in weights of each criteria and sub-criteria were noted among government decision makers and private sector freight forwarders.

The development of logistics infrastructure is not sufficient in itself it will require more efforts to operate these facilities. More importantly reduction of documents to be handled in...
dealing with export and import, implementation single window system this eliminating double
inspection of cargoes at the border as well and at the logistics centers are some of the policy and
system issues that need to considered. There is no “one fits for all policies” these should be
implemented by taking a step by step approach. As the railway connectivity to Thailand has now
been completed starting regular freight train between Thailand and Laos would help to improve
international freight transport and to reduce environmental burden to some extent. By effectively
using these logistics facilities as consolidation and distribution centers number of less-than-truck
trips could be reduced. These facilities would also help to improve transit transport through Laos
and transforming is as a “land-linked” country in South-East Asia.
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ACKNOWLEDGEMENT

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