LOCATION SLECTION BY AHP FOR SPECIAL ECONOMIC ZONE

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Abstract: Location selection by converting the qualitative factors into quantitative based on a fundamental scale makes it effective to make decision. The aim of the research is to select the best suited location for Special Economic Zone (SEZ) in Sylhet and to characterize the relative importance of the selected factors. In this study six significant factors were identified and used to compare four alternative locations. Each factor was further divided into several sub-factors. The selected factors were quantified in a logical manner using Analytical Hierarchy Process (AHP) through survey based questionnaire. The collected data were used to obtain pair wise comparison matrix both among the criteria and the alternative locations. Consistencies of all matrices were checked. The analysis revealed that the factor "Fund Availability" has the highest relative weight-age among all the selected factors and the location Paraichok (South Surma) is the best suited location for SEZ in Sylhet.
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1. Introduction

A Special Economic Zone (SEZ) is a geographical region that has economic and other laws that are more open-market-oriented than a country's typical or national laws. "Nationwide" laws may be suspended inside a Special Economic Zone (http://en.wikipedia.org). Usually the goal

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of such a structure is to increase foreign direct investment by foreign investors, typically an international business or a Multinational Corporation (MNC).

The impact of location on the firm performance has been the subject for research and special economic zones, as a specialized location, have provided ease to use business location along with advance infrastructure and other facilities to enhance competitiveness at the country level (http://www.iitk.ac.in). SEZ have emerged as a popular strategy adopted by various countries, particularly the developing countries, to increase their trade competitiveness.

SCCI (Sylhet Chamber of Commerce and Industries) along with the Board of Investment [BOI] and Ministry of Finance proposed the Government of Bangladesh to establish an SEZ in Sylhet region. Initial assessment of the government and the other organizations like SCCI, Asia Foundation etc suggest several locations for the SEZ as shown in Figure no. 1.
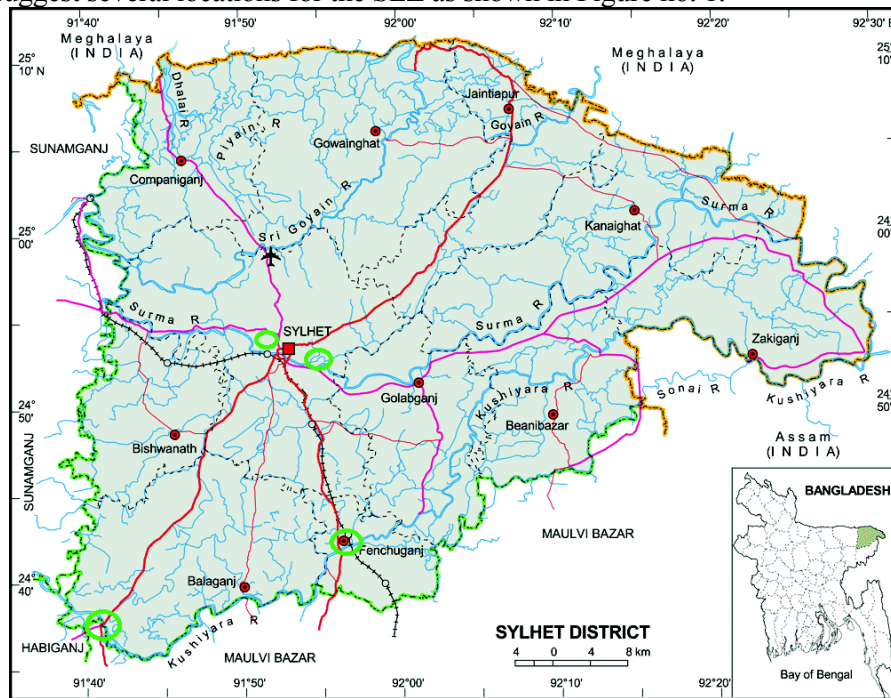

Figure no.1. Proposed locations for SEZ (Green Circles)

In this research the best suited location for SEZ was chosen based on six selected significant criteria. The criteria were identified based on previous literature and expert opinion. The selected criteria are Land, Transportation, Labour, Facility, Fund availability, Quality-of-Life. The experts were chosen in such a way that they must have enough knowledge on the required fields for this study like SEZ, Facility location and knowledge about the alternative locations.

In this study, AHP (Analytical Hierarchy process) has been applied to identify the best suited location for the proposed SEZ in Sylhet region. AHP is a prominent tool for dealing with decisions under certainty, where the subjective judgment is quantified in a logical manner and then used as a basis for reaching a decision (Taha, H.A., 2001, pp. 489-497).

2. State of the art

Dhingra et. al. (http://www.iitk.ac.in) of Motilal Nehru National Institute of Technology performed a research related with Competitiveness, Location strategy and Special economic zones. The study proposed a generic theoretical framework which identifies various variables subsequently leading to superior firm performance.

Viswanadham et. al. (2007) developed a generic framework that can aid the decision maker in identifying and grouping the M attributes into a hierarchy for location selection in global supply chains. A hierarchical structuring was proposed with four fundamental criteria: product/process value chain, economic and political integration, resources and management, and connecting technologies.

Javaheri et. al. (2006, pp. 177-184)performed a study that involves a kind of multi-criteria evaluation method under the name of weighted linear combination by using geographical information technology as a practical instrument to evaluate the suitability of the vicinity of Giroft city in Kerman province of Iran for landfill using AHP. Water permeability, slope, distance from rivers, depth of underground water table, distance from residential areas, distance from generation centers, general environmental criterion and distance from roads are the criteria which have been taken into consideration in the process of analyzing.

Jesuk (2005) used an integrated decision model for determining the location of distribution facilities. Analytical hierarchy process and decision factor analysis were proposed to enhance the decision making process about distribution location.

The location selection for an SEZ is a long term strategic issue. So, using AHP rather than typical strategies like desk review or personal suggestion would result a more enhanced decision which is mathematically approved.

3. Location selection criteria

According to Fulton (1971, pp. 166-168) there are some selected factors and many sub factors related to the selection of facility location. AHP hierarchy can be multi-level hierarchy. But in the present work three level hierarchies (Goal-Criteria-Alternatives) has been chosen to avoid redundancy of marix. Six major factors were considered based on the previous work and expert opinion to fulfil the targeted goal. Under those major factors probable sub factors were included in questionnaire so that all the factors could be considered by the experts while judging the rank.The six major factors and sub factors those were considered in this research are:

i) Land
  - variability and cost
  - setup cost and
  - ease of acquisition
ii) Transportation
  - viable ways like Roads, Railway, water, air -distance from port, nearest city, capital and -transportation cost
iii) Labour
  - availability and skill
  - employment rate
  - wage rate, and
  - labour force competitors
iv) Facility
  - viability and cost of energy like gas, electricity
  - Telecommunication cost
  - water availability
  - Waste disposal facility
  - Proximity to raw materials
  - ease of expansion
v) Fund Availibility
  - interest of local entrepreneurs
  - interest of foreign investors
  - interest of Non- Resident Bangladeshis
  (NRB)

vi) Quality of life

It is defined as "a feeling of well-being, fulfillment, or satisfaction resulting from factors in the external environment.

4. Data and analysis

As AHP converts some qualitative terms into quantitative, it is highly dependent on expert judgment (Hafeez, K., Zhang, Y.B. & Malak, N., 2002, pp. 67-76). Experts are asked to compare criteria and alternatives based on a fundamental scale known as satty rating scale (Saaty, T.L., 1980). According to the purpose of this study the experts who has familiarity with relevent sector were chosen. According to the requirements some entrepreneur from Sylhet, some Faculties from Shahjalal University of Science and Technology and some government employees related to SEZ in Sylhet were selected as interviewee.

4.1. AHP

AHP calculation is based on modelling the problem as a hierarchy containing the decision goal, the alternatives for reaching it, and the criteria for evaluating the alternatives as shown in Figure no. 2.
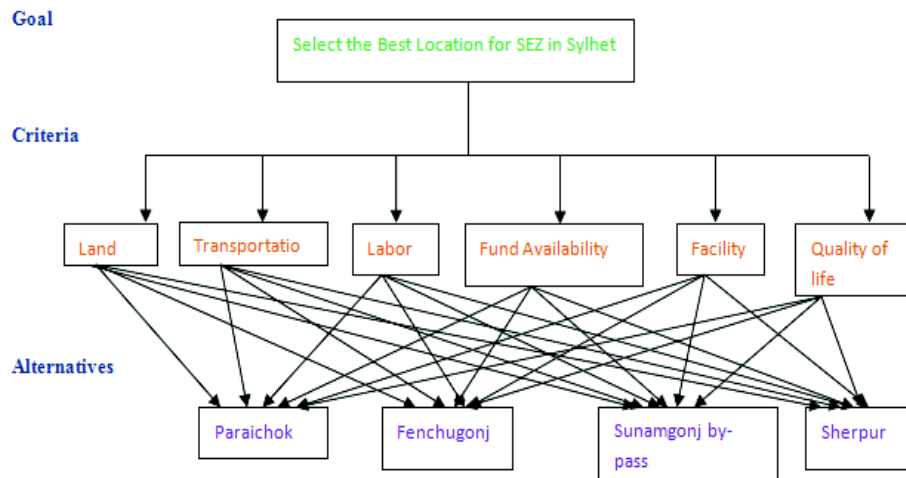

Figure no.2: Hierarchy of AHP for the present study

For developing comparison matrices at first a survey questionnaire was prepared to collect the data. The questionnaire contains two sections. First section is comparison among criteria and second section is comparison among alternatives according to criteria. After collecting data from thirty experts those data were sorted and arranged and required matrices were found.

Comparison matrix for criteria is shown in Table no. 1. It was found by taking geometric mean (Escobar, M.T., Aguaron, J. & Jimenez, J. M, 2004, pp. 318–322) of all 30 experts' data.

Table no.1. Comparison Matrix for Criteria

	Land	Transportation	Labour	Fund Availability	Facility	Quality of life
Land	1	0.329929263	1.49275813	0.54501224	1.23894285	2.426532813
Transportation	3.029578365	1	2.80059541	0.49247186	1.77237175	2.69110498
Labour	0.669646265	0.356976444	1	0.68509366	1.70859524	1.708595245
Fund Availability	1.834221637	2.029638591	1.45911909	1	1.90320731	2.564921247
Facility	0.806929806	0.563944827	1.32565593	0.52532372	1	1.698830028
Quality of life	0.411997964	0.385315953	0.58480698	0.38956821	0.63314712	1
Column sum	7.752374037	4.665805078	8.66293553	3.63746969	8.25626427	12.08998431
		CI=0.0882104	RI= 1.24	CR=0.071		

Geometric mean was used because all values are nonzero value. The consistencies of the matrices were also checked and it was found that the level of inconsistency is acceptable (Taha, H.A., 2001, pp. 489-497). Comparison matrix for criteria was the first section. On the other hand comparison among alternative locations according to criteria was the second section. According to the criteria "Land" comparison matrix among alternative locations is given in Table no. 2.

After obtaining the weight-age the final composite weight-age of locations were calculated and it was found that the location "Paraichok (South Surma)" has the highest relative weight.

Like the criteria "land" the comparison matrix for other criteria was calculated and final weight-age of all locations was found. The summary is highlighted in the Figure no. 3.

Table no. 2. Comparison Matrix According to the Factor "Land"

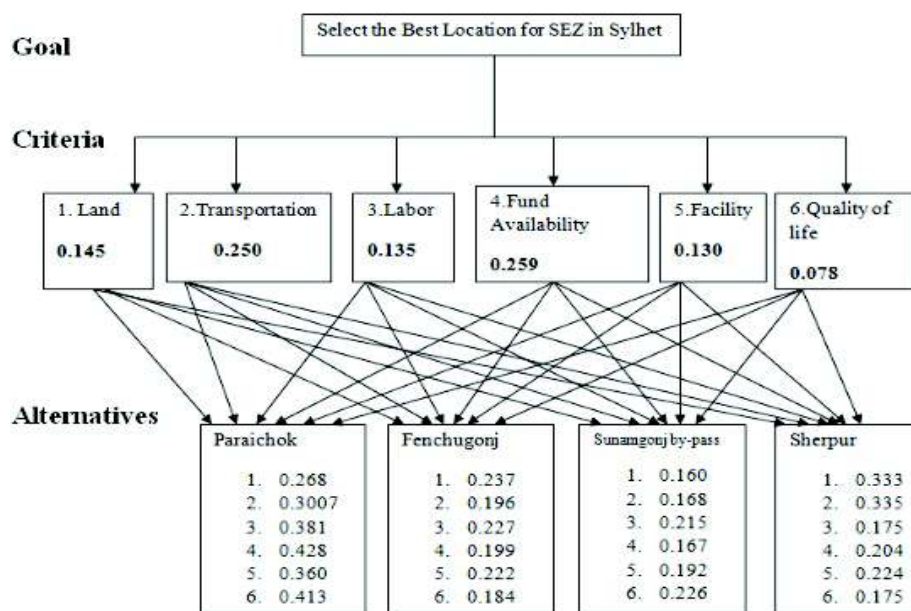|	Paraichok	Fenjugonj	Sunamgonj by pass	Sherpur
Paraichok	1	1.238610865	1.371377461	0.918546071
Fenjugonj	0.806984608	1	1.855134524	0.629373281
Sunamgonj by pass	0.728804863	0.538666276	1	0.498195704
Sherpur	1.191013594	1.588310059	2.006507138	1
Column sum	3.726803064	4.3655872	6.233019123	3.046115057
	CI=0.01813	RI= 0.9	CR=0.02	

Figure no.3. Weight-age of alternative locations according to the criteria

The final weight of the four locations are-

Final weight =

$$\sum (\text{Factor's weight} * \text{alternative's weight according to that factor})$$

Paraichok = (0.145436702×0.268403222) + (0.2501754×0.30074498) + (0.1358224×0.38188971) + (0.2596037×0.04287078) + (0.130673×0.36026878) + (0.07828886×0.413548058) = 0.3568915

Sherpur = 0.252479

Fenjugonj = 0.209637
Sunamgonj by pass = 0.1810403863

5. Discussions

At first, the target was to find the alternative locations those were proposed by relevant authority. The district commissioner office along with BOI proposed three locations. They were Paraichok (South Surma), Fenchugonj and Sunamgonj by-pass for SEZ in Sylhet. According to declaration of the Finance Minister of Bangladesh in October, 2011 Sherpur was considered as the 4th alternative location for SEZ. So, this research was performed to find out which location is best suited among all the four alternatives for SEZ.

The next step was to find the criteria for the comparison of alternative locations. There are many factors related to the selection of facility location according to several authors. But in this study six criteria like Land, Transportation, Labour, Facility, Fund availability and Quality of life were chosen. Some other factors like Community attitude, political stability; raw materials availability etc. had been considered as sub criteria for the simplicity of the analysis.

Then the challenge was to identify the experts for interview. The experts were chosen based on the requirements like they must have enough knowledge on SEZ in Sylhet Division, its alternative locations and facility location.

Then the target was to implement AHP after collecting data from 30 experts through the survey questionnaire. The analysis by AHP using "Microsoft Excel" was done. At first the comparison matrix was found based on the fundamental Scale of comparison. After obtaining comparison matrices normalized matrix of those matrices were calculated. Thus the relative weightage of alternative locations and factors were found. It was found that the location "Paraichok (South Surma)" is the best suited location for SEZ in Sylhet and the factor "Fund Availability" has the highest relative importance.

6. Conclusions

Sylhet region enjoys enormous prospects considering several important elements like abundance of idle funds, agricultural resources,

minerals, forest resources and also the abundance of land. As a result, it was decided to set a special economic zone in this region.

Several studies were performed to analyze the feasibility of SEZ in Sylhet. The studies were based on survey. No study has been performed using a scientific tool like AHP. Location selection based on AHP will help decision makers to look at this problem from a different angle. It will aid the decision making process for best suited location for SEZ in Sylhet.

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