

Distribution Facility Location in Humanitarian Logistics

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Summary: By using analytical hierarchy process, this research develops a decision making framework that assists in evaluation of different locations for stockpiling in humanitarian logistics. This developed tool enables the comparison of multiple locations and provides significant insights when it comes to choosing the most suitable location for the intended purpose.



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Key Insights

- The proposed facility location decision making model can be effectively utilized to determine the most suitable location for pre-positioning of relief items in humanitarian logistics.
- This study provides the first of its kind AHP framework unique to the problem of facility location in humanitarian logistics. It takes into consideration the human judgment and opinion to allow and choose an ideal location.
- Consideration of political factors is vital in the decision making process. However, on an operational level, experts believe that local regulations (custom procedures, etc.) can be most

time and effort consuming and can make the relief operations inefficient.

INTRODUCTION

Disasters know no boundaries. Objective of any immediate humanitarian response is to provide immediate assistance to the affected population with necessary relief (food, shelter, medicine, etc.). The increasing trend in the number and severity of disasters calls for better preparedness by governments and humanitarian organizations to enable them respond to these disasters effectively.

Humanitarian organisations engage in necessary pre disaster planning and preparatory exercises that increase their logistical capabilities required to respond to any disaster. Strategically placed inventory in depots can improve the response time and

increase the efficiency of response of relief effort. Dependence on post disaster procurement will reduce which will enable organisations to manage their costs better. It also provides relief organisations a property base from where they can manage their operations and manage incoming supplies more effectively.

Once in the process of deciding a location for pre-positioning of supplies, one is always faced with the dilemma of evaluating various factors simultaneously. Some of the factors can be quantified and compared easily whereas others will be qualitative in nature but equally important.

To help our decision makers, analytical hierarchy process has been used in this thesis to give differentiating importance to various identified factors when evaluating different locations for stockpiling. This will help decision makers to compare multiple locations and choose the most suitable for the intended purpose.

METHODOLOGY DISCUSSION

Facility location is and has been a well-established research area within operations research. In specific, models devised for particular application in the area of public and emergency services hinge on user accessibility and response time. The major constraint in using such models is that given the remoteness of the location that might be ideal according to the model, the practicality of using that location may be lost in terms of budgetary and logistics resource constraints

that will be accompanied with such a location.

Analytical Hierarchy Process (AHP) allows us to structure the problem systematically and comprehensively, and helps in identifying the parts that influence the outcome the most. It is a psychophysical way to make decisions. Some of the objectives that this thesis aims to achieve by using analytical hierarchy process are 1) Practical way to deal with complex network of factors related to the objective. 2) A tool for integrating forward and backward in an interactive manner that reflects the judgment of all relevant managerial personnel.

The aim of forming a hierarchical structure is to identify the grass root factors that need to be considered for making an informed decision. This helps us to develop logical thinking towards our goal. Using AHP in our thesis, it gives us the advantage of incorporating view of various people involved and resolve conflicts between their opinions. By using AHP, it will also help us to make trade-offs between different factors that are considered in facility location.

Involved people can pin down their responses to compare between two or more criteria and how strongly one is dominant over the others.

Intention is to develop pair wise comparison matrices between various identified important factors that will decide the ideal location for a distribution facility in the chain of humanitarian logistics.

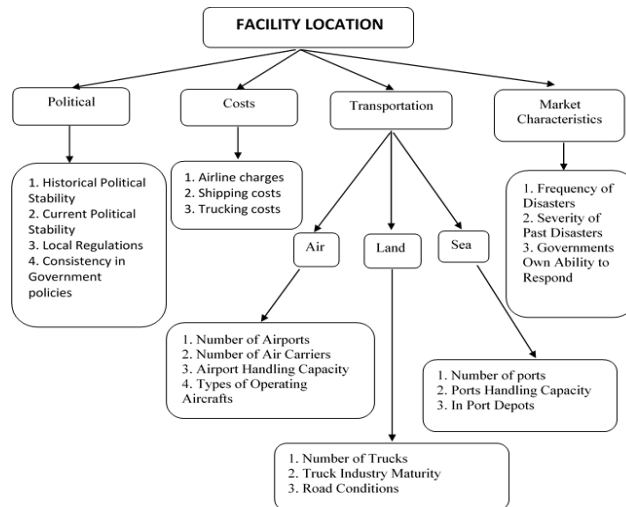


Figure 1: Hierarchy model for Facility Location

RESEARCH

A simple survey was conducted with a sample size of 10 to understand the most important factors according to the experts. For the purpose of this study, experts with familiarity with the humanitarian operations were chosen. In all, top 20 factors out of listed 52 were chosen to build our hierarchical model as seen in figure above.

Experts were then asked to compare each of the above listed factors on a fundamental rating scale known as Satty rating scale. Survey questionnaire was prepared to collect data in two sections. In the first section the four criteria as per the hierarchical model were compared against each other and then in the second section their subsequent factors were compared within each of the criteria.

Arithmetic mean was used to derive at a common conclusion from all the responses. Out of 15 responses collected, nine were found to be within the acceptable consistency limit of 10%.

CONCLUSION

Findings of this research indicates the significance of different location selection factors with varying hierarchy levels with reference to the humanitarian sector industry.

- High priority was given to transportation infrastructure as humanitarian relief operations are highly dependent on logistics for their efficiency and effectiveness. They collectively govern one-third of the final decision with 33% of numerical weight in the final decision.
- Political factors and market characteristics govern a priority of 23% and 27% respectively.
- The least importance has been given to associated cost factors with a weightage of only 17% in the final decision.
- The lower weightage to costs when compared to factor of costs in commercial supply location decision, can be explained by the fact that humanitarian organisations are largely dependent on government financial aid and support to establish their presence in any location.