

Use of Analytic Hierarchy Process for Plant Site Selection

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Abstract : This paper presents the use of Analytic Hierarchy Process (AHP) in evaluating the site selection of a new plant by a corporation. Due to intense competition at a global level, multinational corporations are continuously striving to minimize production and shipping costs of their products. One key factor that plays significant role in cost minimization is where the production plant is located. In the U.S. for example, labor and land costs continue to be very high while they are much cheaper in countries such as India, China, Indonesia, etc. This is why many multinational U.S. corporations (e.g. General Electric, Caterpillar Inc., Ford, General Motors, etc.), have shifted their manufacturing plants outside. The continued expansion of the Internet and its availability along with technological advances in computer hardware and software all around the globe have facilitated U.S. corporations to expand abroad as they seek to reduce production cost. In particular, management of multinational corporations is constantly engaged in concentrating on countries at a broad level, or cities within specific countries where certain or all parts of their end products or the end products themselves can be manufactured cheaper than in the U.S. AHP is based on preference ratings of a specific decision maker who can be the Chief Operating Officer of a company or his/her designated data analytics engineer. It serves as a tool to first evaluate the plant site selection criteria and second, alternate plant sites themselves against these criteria in a systematic manner. Examples of site selection criteria are: Transportation Modes, Taxes, Energy Modes, Labor Force Availability, Labor Rates, Raw Material Availability, Political Stability, Land Costs, etc. As a necessary first step under AHP, evaluation criteria and alternate plant site countries are identified. Depending upon the fidelity of analysis, specific cities within a country can also be chosen as alternative facility locations. AHP experience in this type of analysis indicates that the initial analysis can be performed at the Country-level. Once a specific country is chosen via AHP, secondary analyses can be performed by selecting specific cities or counties within a country. AHP analysis is usually based on preferred ratings of a decision-maker (e.g., 1 to 5, 1 to 7, or 1 to 9, etc., where 1 means least preferred and a 5 means most preferred). The decision-maker assigns preferred ratings first, criterion vs. criterion and creates a Criteria Matrix. Next, he/she assigns preference ratings by alternative vs. alternative against each criterion. Once this data is collected, AHP is applied to first get the rank-ordering of criteria. Next, rank-ordering of alternatives is done against each criterion resulting in an Alternative Matrix. Finally, overall rank ordering of alternative facility locations is obtained by matrix multiplication of Alternative Matrix and Criteria Matrix. The most practical aspect of AHP is the 'what if' analysis that the decision-maker can conduct after the initial results to provide valuable sensitivity information of specific criteria to other criteria and alternatives.

Keywords : analytic hierarchy process, multinational corporations, plant site selection, preference ratings

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