

Material Handling Equipment Selection Using Fuzzy AHP Approach

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Abstract : This research paper is aimed at selecting appropriate material handling equipment among the given choices so that the automation level in material handling can be enhanced. This work is a practical case scenario of material handling systems in consumer electronic appliances manufacturing organization. The choices of material handling equipment among which the decision has to be made are Automated Guided Vehicle's (AGV), Autonomous Mobile Robots (AMR), Overhead Conveyer's (OC) and Battery Operated Trucks/Vehicle's (BOT). There is a need of attaining a certain level of automation in order to reduce human interventions in the organization. This requirement of achieving certain degree of automation can be attained by material handling equipment's mentioned above. The main motive for selecting above equipment's for study was solely based on corporate financial strategy of investment and return obtained through that investment made in stipulated time framework. Since the low cost automation with respect to material handling devices has to be achieved hence these equipment's were selected. Investment to be done on each unit of this equipment is less than 20 lakh rupees (INR) and the recovery period is less than that of five years. Fuzzy analytic hierarchic process (FAHP) is applied here for selecting equipment where the four choices are evaluated on basis of four major criteria's and 13 sub criteria's, and are prioritized on the basis of weight obtained. The FAHP used here make use of triangular fuzzy numbers (TFN). The inability of the traditional AHP in order to deal with the subjectiveness and impreciseness in the pair-wise comparison process has been improved in the FAHP. The range of values for general rating purposes for all decision making parameters is kept between 0 and 1 on the basis of expert opinions captured on shop floor. These experts were familiar with operating environment and shop floor activity control. Instead of generating exact value the FAHP generates the ranges of values to accommodate the uncertainty in decision-making process. The four major criteria's selected for the evaluation of choices of material handling equipment's available are materials, technical capabilities, cost and other features. The thirteen sub criteria's listed under these following four major criteria's are weighing capacity, load per hour, material compatibility, capital cost, operating cost and maintenance cost, speed, distance moved, space required, frequency of trips, control required, safety and reliability issues. The key finding shows that among the four major criteria selected, cost is emerged as the most important criteria and is one of the key decision making aspect on the basis of which material equipment selection is based on. While further evaluating the choices of equipment available for each sub criteria it is found that AGV scores the highest weight in most of the sub-criteria's. On carrying out complete analysis the research shows that AGV is the best material handling equipment suiting all decision criteria's selected in FAHP and therefore it is beneficial for the organization to carry out automated material handling in the facility using AGV's.

Keywords : fuzzy analytic hierarchy process (FAHP), material handling equipment, subjectiveness, triangular fuzzy number (TFN)

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