

Outsourcing of Machine Tools in Manufacturing Environment: A Review PaperNital Nirmal¹¹Assistant Professor, Production Engineering Department, Shantilal Shah Engineering College, Bhavnagar, Gujarat

Abstract — In return to new market requirement and competition in manufacturing industries and in order to provide high performance, cost effective products, there is a need of advance manufacturing machine tools. Selection process of machine tool has been very important issue for the companies for the years, because unsuitable selection of the machine tool might cause of many problems affecting precision, flexibility, negativity on productivity. Accordingly machine tool selection can be observed as a multiple-attribute decision making (MADM) problem. Generally, MADM methods deal with the process of selection of an alternative among number of different alternatives in the presence of usually conflict objectives and criteria. In the current research paper aims to provide the learning of the various multi attribute decision making techniques used for machine tool selection. Another Contribution is to transfer the complied information from research to their peer to support in designing or modeling the machine tool selection decision making system. This paper fulfills the demand of researchers in the field of machine tool selection.

Keywords- Multi Attribute Decision Making (MADM), Machine Tool Selection, Decision Support System (DSS), Outsourcing strategy, Selection Methodology

I. INTRODUCTION

A proper machine tool selection has been very important issue for manufacturing companies due to the fact that improperly selected machine tool can negatively affect the overall performance of a manufacturing system [1]. In the current scenario shows, demand from the Consumer increasing continuously and per requirement of product launching in the market increasing. To stay in the competitive world of market place, the industries have to make their product with high rate, as numbers of product coming in to the market; it makes customer bound to next product. So, product life cycle continuously decreases in nature. For making the product with right time, right place, right volume, right quality; selection of best Machine tools of machine tool play very important role in the purchasing as well smoothly running of supply chain management.

The paper contains the various methodologies carried out to select and ranking the machine tool. This paper contains various multi attribute decision making, artificial intelligence and hybrid techniques with relative work carried out by the different research work. Some Techniques gives the shortest distance from Positive Ideal Solution (PIS) which gives Lowest Cost of all alternatives and some Techniques farthest from Negative Ideal Solution (NIS) which bring towards lowest benefits and Highest cost. The related work also indicate the first time the cause and effect diagram for the Machine tool Selection which will helpful for the researcher. For the conclusion of the research work shows the factors affecting for the machine tool selection based on the given literature review.

II. PREVIOUS SERIOUS FINDING REGARDING MACHINE TOOL SELECTION

Literature survey divided in the two traditions. The originators of various MADM techniques and other are various MADM techniques used for machine tool selection.

2.1 Multi Attribute Decision Making Techniques (MADM)

Multi attribute decision making approach works for the numbers of alternatives and attributes (Criteria's). Where, some criteria having positive or beneficial criteria while other are non-beneficial criteria, some information in the input matrix in the form of qualitative and/or quantitative type. AHP (Analytical Hierarchy Programming) Introduced and investigation carried out by empirical effectiveness of these techniques 38 out of 75 articles applied AHP to select ranking technique investigated by [2]. PROMETHEE (Preference Ranking Organization Method of Enrichment for Enrichment) investigated by [3]. Artificial Neural Network (ANN) invented by [4]. DELPHI method found by [5]. Investigated Ant colony optimization theory investigated by [6]. Fuzzy AHP merged by [7]. Technique for Order Preference by Similarity to Ideal Solution investigated by [8]

2.2 Machine Tools Ranking and Selection with MADMs

the various serious finding regarding machine tool with various approaches of Multi attribute decision making techniques started with decision support system (DSS) Analytic Hierarchy Process (AHP) with nine attributes for machine tool selection using the weighted average approach and cost/ benefit analysis investigated [9]. Fuzzy Analytic Hierarchy Process (F-AHP) machine tool selection carried out by [10]. Machine tool selection in flexible manufacturing cell carried with F-AHP and Artificial Neural Network (ANN) to selection of most suitable CNC machine tool proved by [11]. Combined form of Fuzzy DELPHI method, AHP and PROMETHEE (Preference Ranking Organization Method of Enrichment for Enrichment) techniques applied for more efficient ranking solution investigated by [12]. Ant colony optimization approach to a fuzzy goal programming carried out by [13]. Computer Aided Tool Selection (CATS) methodology for machine tool selection developed by [14]. Computer Aided Machine Tool Selection by Fuzzy AHP approach [15]. Fuzzy AHP and VlseKriterijumska Optimizacija I Kompromisno Resenje (VIKOR) applied for machine tool selection and ranking by [16]. Genetic Algorithm machine tool selection problem developed by [17]. Fuzzy Technique for Order Preference by Similarity to Ideal Solution (F-TOPSIS) and Fuzzy AHP for machine tool selection carried out by [18]. Fuzzy AHP and Grey Relational Analysis (GRA) for ranking and selection developed and investigated by [19]. Fuzzy AHP and Preference Ranking Organization Method for Enrichment Evaluation (PROMETHEE) developed by [20].

III. RESULT & DISCUSSION

Cause and effect diagram for machine tool selection process and factors affecting machine tool selection: figure 1 shows the cause and effect diagram shows the different factors affecting for machine tool selection Process; here found that More than the evaluation method some interesting topic highly focus like Machine tool Selection for new product development, machine tool Selection including risk factors, order allocation with machine tool selection, machine tool Information and performance with incomplete and uncertain environment, machine tool evaluation audit comes for the future works.

The factors affecting the machine tool selection on the basis of innovativeness are varied depending upon the type of machine tool required, type of Industry, type of Product or Service needed & Time they spend to the industry. Hence the work carried out by various criteria (attributes) is come in the focus and subsequently new criteria also come in the focus for enhancement.

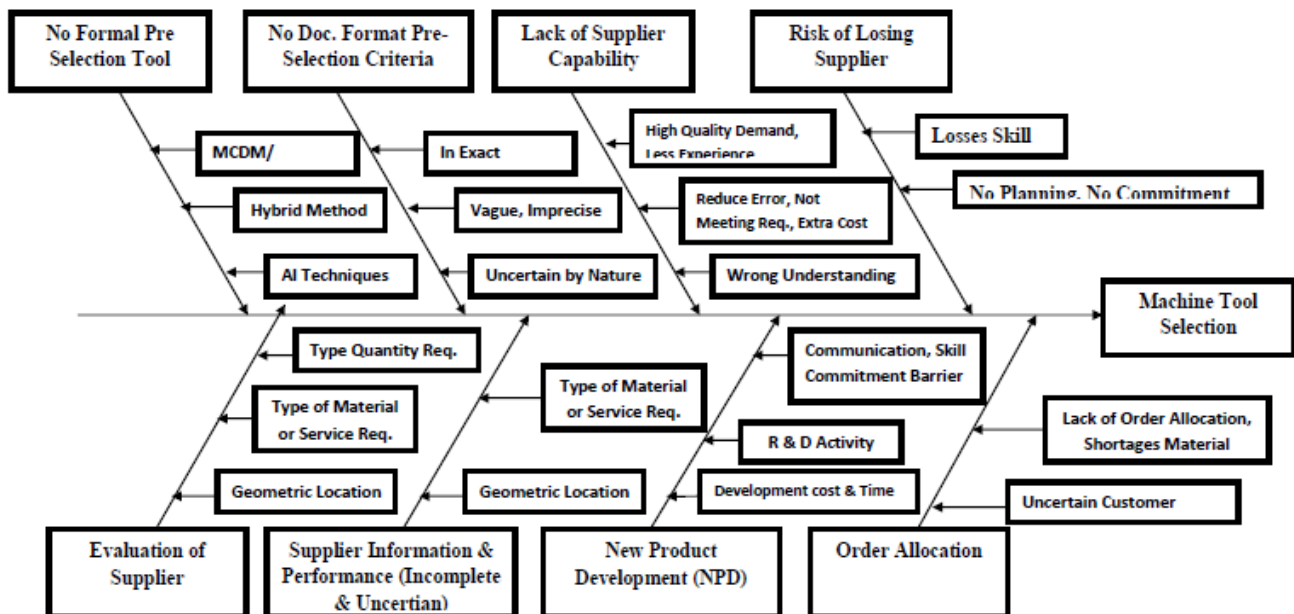


Figure 1: Cause and Effect Diagram for Machine tool Selection

IV. CONCLUSION

Machine tool selection here found that more than the evaluation method some interesting topic highly focus like Selection for various parts of machine tools, cutting tool selection, cutting fluid selection, various machine tool selection. Another

contribution is to transfer the complied information from research to their peer to support in designing or modeling the machine tool selection decision making system. This paper fulfills the demand of researchers in the field of machine tool selection.

REFERENCES

- [1] Z. Ayag, "A Hybrid Approach to Machine-Tool Selection through AHP and Simulation", *International Journal of Production Research*, Vol. 45, Issue No. 9, pp. 2029-2050, 2007.
- [2] R. W. Saaty, "The Analytic Hierarchy Process—What it is and How It is Used", *Mathematical Modeling*, Vol. 9, Issue No. 3, pp. 161-176, 1987.
- [3] J. P. Brans, P. Vincke and B. Mareschal, "How to Select and How to Rank Projects: The Promethee method", *European Journal of Operational Research*, Vol. 24, Issue No. 2, pp. 228-238, 1986.
- [4] J. C. Hoskins and D. M. Himmelblau, "Artificial Neural Network Models of Knowledge Representation in Chemical Engineering", *Computers & Chemical Engineering*, Vol. 12, Issue No. 9, pp. 881-890, 1988.
- [5] N. Dalkey and O. Helmer, "An Experimental Application of the DELPHI Method to the Use of Experts", *Management Science*, Vol. 9, Issue No. 3, , pp. 458-467, 1963
- [6] M. Dorigo and C. Blum, "Ant Colony Optimization Theory: A Survey", *Theoretical Computer Science*, Vol. 344, Issue No. 2, pp. 243-278, 2005.
- [7] D. Y. Chang, "Applications of the Extent Analysis Method on Fuzzy AHP", *European Journal of Operational Research*, Vol. 95, Issue No. 3, pp. 649-655, 1996
- [8] Y.-J. Lai, T.Y. Liu and C. L. Hwang, "TOPSIS for MODM", *European Journal of Operational Research*, Vol. 76, Issue No. 3, pp. 486-500, 1994
- [9] Z. Ayag and R. G. Ozdemir, "An Intelligent Approach to Machine Tool Selection through Fuzzy Analytic Network Process", *Journal of Intelligent Manufacturing*, Vol. 22, Issue No. 2, pp. 163-177, 2011
- [10] Z. Ayag and R. G. Ozdemir, "A Fuzzy AHP Approach to Evaluating Machine Tool Alternatives", *Journal of Intelligent Manufacturing*, Vol. 17, Issue No. 2, pp. 179-190, 2006
- [11] Z. Taha and S. Rostam, "A Fuzzy AHP-ANN-based Decision Support System for Machine Tool Selection in a Flexible Manufacturing Cell", *The International Journal of Advanced Manufacturing Technology*, Vol. 57, Issue No. 5, pp. 719, 2011
- [12] A. Özgen, G. Tuzkaya and U. R. Tuzkaya, "A Multi-Criteria Decision Making Approach for Machine Tool Selection Problem in a Fuzzy Environment", *International Journal of Computational Intelligence Systems*, Vol. 4, Issue No. 4, 2011, pp. 431-445.
- [13] F. T. S. Chan and R. Swarnkar, "Ant Colony Optimization Approach to a Fuzzy Goal Programming Model for a Machine Tool Selection and Operation Allocation Problem in an FMS", *Robotics and Computer-Integrated Manufacturing*, Vol. 22, Issue No. 4, pp. 353-362, 2006.
- [14] C. Chung and Q. Peng, "The Selection of Tools and Machines on Web-based Manufacturing Environments", *International Journal of Machine Tools and Manufacture*, Vol. 44, Issue No. 2-3, pp. 317-326, 2004.
- [15] O. Duran and J. Aguilo, "Computer-Aided Machine-Tool Selection based on a Fuzzy-AHP approach", *Expert Systems with Applications*, Vol. 34, Issue No. 3, pp. 1787-1794, 2008
- [16] M. Ilangkumaran, V. Sasirekha and L. Anojkumar , "Machine Tool Selection using AHP and VIKOR Methodologies under Fuzzy Environment", *International Journal of Modelling in Operations Management*, Vol. 2, Issue No. 4, pp. 409-436, 2012
- [17] K. W. Keung, W. H. Ip and T. C. Lee, "A Genetic Algorithm Approach to the Multiple Machine Tool Selection Problem", *Journal of Intelligent Manufacturing*, Vol. 12, Issue No. 4, pp. 331-342, 2001
- [18] S. Önüt, S. Soner Kara, T. Efendigil, "A Hybrid Fuzzy MCDM Approach to Machine Tool Selection", *Journal of Intelligent Manufacturing*, Vol. 19, Issue No. 4, , pp. 443-453, 2008
- [19] A. Samvedi, V. Jain and F. T. S. Chan, "An Integrated Approach for Machine Tool Selection using Fuzzy Analytical Hierarchy Process and Grey Relational Analysis", *International Journal of Production Research*, Vol. 50, Issue No. 12, pp. 3211-3222, 2012
- [20] Z. Taha and S. Rostam, "A Hybrid Fuzzy AHP-PROMETHEE Decision Support System for Machine Tool Selection in Flexible Manufacturing Cell", *Journal of Intelligent Manufacturing*, Vol. 23, Issue No. 6, , pp. 2137-2149, 2012