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Evaluation of Decision Making for Sustainable Manufacturing and Industrial Applications: Case Reviews & Propagations

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Abstract: Manufacturing is the broad term and is usually used to describe removal of material from a work piece. Manufacturing includes cutting, abrasive processes (grinding), advanced machining processes (electrical, chemical, thermal, hydrodynamic, lasers). Manufacturing is required to improve dimensional accuracy and to produce external and internal geometric features with forming or shaping. Manufacturing helps in obtaining final dimensions and surfaces with finishing operations. Additionally, manufacturing assists in obtaining special surface characteristics or textures. Today, it is required to attain the most economical means of producing a particular part. In present study, a decision making for sustainable manufacturing and industrial applications is reviewed and propagated to disclose utility and importance of manufacturing setting. Six case reviews are examined to identify the prominent manufacturing aspects. The study is presenting a knowledge based decision making reviews for evaluating manufacturing operations.

Keywords: Machining; Evaluation; Case Review; Optimization, Decision Making

1. INTRODUCTION:

It is indeed necessary that quality in the product should be maintained during manufacturing (Sahu et al., 2014; Sahu et al., 2015). The same is the major concern in manufacturing industries from consumers as well as producers point of view. Nowadays it is required to process smart alloys having high strength to satisfy the societal needs, where machining process evaluation is required for evaluating output parameters and alternatives (Guo et al., 2022; Sahu et al., 2022). The study highlighted the need of sustainable manufacturing practices, which can concentrate to improve the output characteristics with the intention to reduce energy consumption and environmental loads. The study emphasized that today the experiments conducted needs to be properly designed based on machine levels to acquire the effects of the main process parameters. Significant driving characteristics should be identified for extracting elevated outputs from group of inputs (Kang et al., 2022; Sahu et al., 2020). The same is required to help in the attainment of less consumption of resources and to analyze the information receiving from the customers and operators. There are numerous aspects in the product such as surface condition, height, weight, length, width etc., which may be consider for the measurement of the quality characteristics. Additionally, there are many input parameters like i.e. spindle speed, feed rate, cutting fluids and depth of cut , which are the process variables and the decision making under that field may be significant for attaining outputs. Thus, in present study, decision making for sustainable manufacturing and industrial applications is reviewed and propagated to disclose utility and importance of machining setting

2. MOTIVATIONS ABOUT STUDY:

Surface roughness, Metal Removal Rate (MRR), Machining Forces etc are found as few critical machining aspects that motivated the authors to conduct present research study. Numerous researchers have applied different approaches for their attainment in several years to get optimum results. Sustainability is found as major concerns, which motivated the authors about present study. Sustainability endeavors economical advantages and thus it is significant to investigate sustainable manufacturing initiatives (Wang et al., 2019; Sahu et al., 2019). The same is necessary for retaining green manufacturing and yielding elevated outputs. Sustainable manufacturing is the production of manufactured goods by the course of economically sound process with the aim to minimize the negative environmental impacts (He et al., 2021; Sahu et al., 2018b). Sustainability attempts to retrieve conservation of energy and natural resources. Sustainable manufacturing and consumption deal with doing more and better with less exploitation of natural resources. Energy consumption and environmental impact, while doing manufacturing is now been considering by the researchers as an important field of interest and thus researchers are now seeking performance drivers and optimized setting for the sustainable manufacturing.

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3. METHODOLOGY:

In present study, critical cases are reviewed to identify the crucial facts about machining. The papers are taken from literatures published by esteemed researchers. The main methodology taken in present study is to consolidate the significant aspects about machining based on review of articles. Six review cases are presented in this study. It has been found that the parameters setting are importance for giving right direction to the operator's. The machine possesses a bunch of process parameters, which needs to be synchronized for attaining appropriate setting.

3.1 Case review 1:

The case review 1 is emphasizes on the study presented by Manivel and Gandhinathan, 2016 and Ilo et al., 2012, where it can be identify that quality of the product is the major concern in manufacturing industries from customers as well as producers point of view. There are number of factors in the product, which should be considered for the measurement of the quality. The cost of the product and time of manufacturing is the primary concern in manufacturing industries even with utilizing the highly automated machines. It is necessary to have surfaced of the product fine enough, that the consumers further declare its performing abilities like functionality, reliability, durability and many more. It is found that Taguchi technique is an efficient optimization tool for product and process optimization. It is suggested to utilize Taguchi technique for designing the manufacturing system under high quality aspects.

3.2 Case review 2:

The case review 2 is emphasizes on the study presented by Lung et al., 2007 and Rowlands et al., 2000, where it can be identify that the optimization of response characteristics is required to be carried out using the intelligent approach. Operating the manufacturing process at optimum conditions helps in improving productivity. Taguchi technique can work to increase the surface quality parameters under the optimum cutting condition. The statistical techniques are needed for the experimental design to investigate the predictive model of response characteristics. Lung et al., 2007 and Rowlands et al., 2000 highlighted that that there is a vast variation in the response values, which varies from thousands to decimal. The empirical models and regression coefficients of the response characteristics are needed to be investigated by statistical analysis for attaining good results.

3.3 Case review 3:

The case review 3 is emphasizes on the study presented by Abbas et al., 2019 and Berkani et al., 2015, where it can be identify that strength always remains the prime requirement of any produced products, which normally explicate the capability of the products to sustain stress into it. In present scenario to survive in the global market, it is necessary to used advanced and modified optimization techniques. It is evident that manufacturing plays a very significant role in effectually satisfy dynamic needs of the customers. The manufacturing, machine tools and its related domain should be optimized for receiving elevated results. A statistical technique, which is practical for mathematical modeling and for examining the problems, where a response is surrounded by numerous variables, can be prominent to evaluate machining characteristics. The statistical techniques can be used to determine optimum value of each parameter. The implication of statistical tools, decision structures etc., can aid in loading a wide varieties of decision characteristics under derived statistical model. Development of multi objective optimization framework can aid in predicting optimize values of response parameters. Determination of optimum range of control parameters can lead in acquiring the elevated values of response parameters.

3.4 Case review 4:

The case review 4 is emphasizes on the study presented by Abbas et al., 2020 and Bouacha et al., 2010, where it can be identify that the ever increasing demands of quality products have propelled the engineers and managers to seek productivity with quality in manufacturing and thus there is an obligatory requirement of decision making tools, techniques and models, which can ease assist in this regard. Nowadays, manufacturing companies are chiefly concerning towards achieving quality along with quantity for grasping more profit by the manufactured products. The balance between the quality and quantity can be balanced by devising a range of soft computing techniques, which in advance assists in identifying the optimum levels of cutting parameters for executing machining operations with confidence. Taguchi technique is broadly accepted in manufacturing scenario from approximately three decades for robustly evaluating a product or process characteristics under single quality characteristics. Taguchi is affirmed as a time and cost competent technique that can be used under a wider range of manufacturing applications. The development of Taguchi based multi response optimization approaches is required as found that the preceding applications of the Taguchi technique have only underlined the single response tribulations.

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3.5 Case review 5:

The case review 5 is emphasizes on the study presented by Campatelli et al., 2014 and Jha et al., 2018, where it can be identify that machining processes are normally surrounded with multiple cutting parameters and responses, which therefore requires optimization tools under multiple aspects to lay down the synergy between multiple conflicting parameters and to efficiently transform the multi response optimization dilemma into the single objective optimization problem. Today it is required to fuse decision making techniques with Taguchi conception for defining the optimum values of cutting parameters under the combined effect of multiple output parameters. Today, there is a need to develop mathematical models for determining the optimal cutting conditions, which can accompanied multiple objectives into single integrated model [20]. It is found that the multiple objectives of the system is required to be obligatory considered into a single decision making process for yielding best manufacturing results.

3.6 Case review 6:

The case review 5 is emphasizes on the study presented by Korkut et al., 2004 and Caydaş and Hasçalık, 2008, where it can be identify that the machining today needs to be properly estimated from the insights of control variables and uncontrolled variables by generating a decision making model, which can precisely correlate the input parameters with the responses. It is profitable to appraise multiple outputs for assuming effectiveness and efficacy from implicated resources, additionally; it is fruitful to evaluate multiple outputs for assuming effectiveness and efficacy from implicated resources. Today, a decision making process is required, which possess series of steps to determine the best option or course of action to meet the needs of the society. The current social and industrial communities exceedingly demanded the materials that dealt with rich mechanical properties, i.e., the rich strength, hardness, reliability, high resistance against corrosion and oxidation, and high toughness. The optimization of the responses depends on the crucial evaluation and selection of inputs process parameters.

4. MANUFACTURING CONCERNS:

Today, it is necessary to develop decision making structure and techniques for accurate manufacturing and industrial applications (Sahu et al., 2017a; Sahu et al., 2017b). It is important to conclude the critical machining characteristics and optimum setting for extracting better outputs from collection of inputs (Chaturvedi et al., 2018; Sahu et al., 2018a). Today, hybrid metal alloys are the need of the society and that requires processing by the manufacturing resources under sustainable phases. These metal alloys and their processing are nowadays in the high interest of the researchers and industries. The same needs an application of producing near net shape metal components and precise manufacturing for assembly purpose. The smart hybrid materials have good properties like high thermal conductivity, superior wear resistance properties, high corrosion resistance etc., which makes them applicable in the industrial realm of aerospace, automotive, radiators, tool manufacture, robots design, hazardous works, radioactive means, biomedical industry etc., These material are nowadays needed to be machined with proper settings and attainment of process parameters to attain outputs parameters.

5. CONCLUSIONS:

In present study, the attempt has been made by the authors to review and propagate decision making scenario for highlighting the demand of sustainable manufacturing for industrial applications. The study highlighted importance of machining setting. The study highlighted that surface roughness, Metal Removal Rate (MRR), machining forces etc, are critical machining aspects that are evaluated by the researchers for optimized attainment of machine setting. Additionally, researchers have applied different approaches for their attainment in several years to get optimum results. The Design of experiment (DOE) has been used for the attainment of conducting appropriate experiments. The analysis is required to be done after DOE to determine effect of the quality characteristics on surface properties. It is found that the elevated levels of output can be attained by the final result of optimization of process parameters. The researchers have applied multi objective optimization techniques for their optimization. Many parameters i.e. spindle speed, feed rate and depth of cut are often taken by the researchers as process variables and the working ranges of these process variables are taken by them for conducting experiments based on Taguchi's Orthogonal Array (OA) design. Additionally, it is found that the significant process parameters are evaluated by them based on main effect plots for data means and for S/N ratio. It is also identify by the authors that the many researchers have utilized Minitab statistical software for the attainment of S/N ratio and main effects plots.

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