International Journal of Scientific Research & Engineering Trends
Volume 10, Issue 6, Nov-Dec-2024, ISSN (Online): 2395-566X

Industrial Production Productivity Analysis with Respect to Labors

Research Scholar Sachin Kachhi, Assistant Professor Ranjeet Singh Thakur
Department of Mechanical Engineering,
Infinity management and engineering college sagar, MP.

Abstract- Low productivity of workers is the most significant factor behind delivery slippages in manufacturing industries. As manufacturing is a laborer predominant industrial sector, this paper focuses on worker output and their efficiency in the manufacturing sector. It covers the definitions of productivity, efficiency of the workers, its perspectives and the factors influencing the productivity. Proposed ANOVA method optimize performance of productivity and worker production parameters. Also observed more sensible case to increase production productivity.

Index Terms- Productivity, Manufacturing.

I. INTRODUCTION

Manufacturing is the backbone of any industrialized nation. Manufacturing and technical staff in industry must know the various manufacturing processes, materials being processed, tools and equipments for manufacturing different components or products with optimal process plan using proper precautions and specified safety rules to avoid accidents. Beside above, all kinds of the future engineers must know the basic requirements of workshop activities in term of man, machine, material, methods, money and other infrastructure facilities needed to be positioned properly for optimal shop layouts or plant layout and other support services effectively adjusted or located in the industry or plant within a well planned manufacturing organization. The complete understanding of basic manufacturing processes and workshop technology is highly difficult for any one to claim expertise over it. The study deals with several aspects of workshops practices also for imparting the basic working knowledge of the different engineering materials, tools, equipments, manufacturing processes, basic concepts of electromechanical controls of machine tools, production criteria's, characteristics and uses of various testing instruments and measuring or inspecting devices for checking components or products manufactured in various manufacturing shops in an industrial environment. It also describes and demonstrates the use of different hand tools (measuring, marking, holding and supporting tools, cutting etc.), equipments, machinery and various methods of manufacturing that facilitate shaping or forming the different existing raw materials into suitable usable forms. It deals with the study of industrial environment which involves the practical knowledge in the area of ferrous and non ferrous materials, their properties and uses. It should provide the knowledge of basic workshop processes namely bench work and fitting, sheet metal, carpentry, pattern making, mould making, foundry, smithy, forging, metal working and heat treatment, welding, fastening, machine shop, surface finishing and coatings, assembling inspection and quality control. It emphasizes on basic knowledge regarding composition, properties and uses of different raw materials, various production processes, replacement of or improvement over a large number of old processes, new and compact designs, better accuracy in dimensions, quicker methods of production, better surface finishes, more alternatives to the existing materials and tooling systems, automatic and numerical control systems, higher mechanization and greater output.

Scope of Study

Today's competitive manufacturing era of high industrial development and research, is being called the age of mechanization, automation and computer integrated manufacturing. Due to new researches in the manufacturing field, the advancement has come to this extent that every different aspect of this technology has become a full-fledged fundamental and advanced study in itself. This has led to introduction of optimized design and manufacturing of new products. New developments in manufacturing areas are deciding to transfer more skill to the machines for considerably reduction of manual labor. The scope of the subject of workshop technology and manufacturing practices is a extremely wide as it specifies the need of greater care for man, machine, material and other equipments involving higher initial investment by using proper safety rule and precautions. The through and deep knowledge in the course of study of this important subject is therefore becoming essential for all kinds of engineers to have sound foundation in their profession. Therefore the course of study of this subject provides a good theoretical background and a sound practical knowledge to the engineering students and workshop staff.

One should also be aware of the following terms for better understanding of the scope of the study.

II. MANUFACTURING ENGINEERING

Manufacturing is derived from the Latin word manufactus, means made by hand. In modern context it involves making products from raw material by using various processes, by making use of hand tools, machinery or even computers. It is therefore a study of the processes required to make parts and to assemble them in machines. Process Engineering, in its application to engineering industries, shows how the different problems related to development of various machines may be solved by a study of physical, chemical and other laws governing the manufacturing process. The study of manufacturing reveals those parameters which can be most efficiently being influenced to increase production and raise its accuracy. Advance manufacturing engineering involves the following concepts— 1. Process planning. 2. Process sheets. 3. Route sheets. 4. Tooling. 5. Cutting tools, machine tools (traditional, numerical control (NC), and computerized numerical control (CNC). 6. Jigs and Fixtures. 7. Dies and Moulds. 8. Manufacturing Information Generation. 9. CNC part programs. 10. Robot programmers. 11. Flexible Manufacturing Systems (FMS), Group Technology (GT) and Computer integrated manufacturing (CIM).

Production Process
It is the process followed in a plant for converting semi-finished products or raw materials into finished products or raw materials into finished products. The art of converting raw material into finished goods with application of different types of tools, equipments, machine tools, manufacturing set ups and manufacturing processes, is known as production. Generally there are three basic types of production system that are given as under.

- Job production
- Batch production
- Mass production

Job production comprises of an operator or group of operators to work upon a single job and complete it before proceeding to the next similar or different job.

The production requirement in the job production system is extremely low. It requires fixed type of layout for developing same products. Manufacturing of products (less in number say 200 to 800) with variety of similar parts with very little variation in size and shape is called batch production. Whenever the production of batch is over, the same manufacturing facility is used for production of other batch product or items. The batch may be for once or of periodical type or of repeated kinds after some irregular interval. Such manufacturing concepts are leading to GT and FMS technology. Manufacturing of products in this case requires process or functional layout. Where as mass production involves production of large number of identical products (say more than 50000) that needs line layout type of plant layout which is highly rigid type and involves automation and huge amount of investment in special purpose machines to increase the production.

Process Planning
Process planning consists of selection of means of production (machine-tools, cutting tools, presses, jigs, fixtures, measuring tools etc.), establishing the efficient sequence of operation, determination of changes in form, dimension or finish of the machine tools in addition to the specification of the actions of the operator. It includes the calculation of the machining time, as well as the required skill of the operator. It also establishes an efficient sequence of manufacturing steps for minimizing material handling which ensures that the work will be done at the minimum cost and at maximum productivity. The basic concepts of process planning are generally concerned with the machining only. Although these concepts may also be extended to other processes such as casting, forging, sheet metal forming, assembling and heat treatment as well.

III. LITERATURE REVIEW

G.Rajendra Kannammal, Prediction of quality in production using optimized Hyper-parameter tuning based deep learning model: Large volumes of manufacturing data may now be collected because to the growing popularity of smart Industry 4.0. Product quality may be predicted from manufacturing data acquired during production using machine learning approaches such as classification. A supply chain can benefit from eliminating uncertainty by precise forecasting at any point in the process. As a result, knowing the quality of a product batch early on can save money on recalls, packaging, and shipping. Classification methods have been extensively studied for forecasting the quality of certain manufacturing processes, but the overall obedience of production batches has not been carefully studied. Classification methods based on deep learning (Convolutional Neural Network) and optimal hyper-parameter tuning are the focus of this article, which aims to evaluate the suggested appliance production process. Existing approaches for classifying unit batches are compared to the proposed classification model in terms of several quality parameters for compliance. As a result, a model for predicting compliance quality may be built using the new method. Features and dataset knowledge are also critical in training classification models, according to this study.

T. T. El-Midany, A Proposed Prediction Approach for Manufacturing Performance Processes using ANNs: This paper aims to provide an approach to predict the performance of the parts produced after multi-stages of manufacturing processes, as well as the assembly. Such approach aims to control and subsequently identify the relationship between the process inputs and outputs so that a process engineer can more accurately predict how the process output shall perform based on the system inputs. The approach is guided by a six-sigma methodology to obtain improved performance. In this paper a case study of the manufacture of a hermetic reciprocating compressor is presented. Each of manufacturing stages is separate and affects to the functionality of the end product. The application of Artificial Neural Networks (ANNs) technique is introduced to improve performance prediction within this manufacturing environment. The results demonstrate that the approach predicts accurately and effectively.

Cezarina Afteni and Gabriel Frumuşanu, A Review on Optimization of Manufacturing Process
Performance: In this study is present a systematic analysis of already published works on formulating and solving optimization problems concerning manufacturing process. Analysis it was performed on two levels, namely: planning and scheduling of manufacturing process. They were considered: type of optimization (mono-criterion or multi-criteria); objective function (the energy consumption, the manufacturing costs, the productivity, the manufactured surface roughness); methods of solve (Genetic Algorithms GA, Particle Swarm Optimization PSO technique, Artificial Neural Networks ANN). The main purpose of this study it is to substantiate a new approach to optimization problems. The proposed approach is of holistic type, based on integrated process planning and scheduling (IPPS) and defines new performance indicators, to be adapted to market current requirements. To cope with fierce competition exacerbated by globalization, companies seeking to improve their manufacturing processes, obtain higher quality products, manufactured at a competitive price, in increasingly restrictive terms of environmental impact, production costs, and specific consumption of materials. To reduce the manufacturing cost, to increase the productivity and to enhance the manufactured products quality, it is highly important to work in optimal conditions. In recent years, numerous studies on the issue of optimizing manufacturing processes have been developed.

Process planning for precision manufacturing, Mats Bagge: Process planning is a task comprising a broad range of activities to design and develop an appropriate manufacturing process for producing a part. Interpretation of the part design, selection of manufacturing processes, definition of operations, operation sequences, machining datums, geometrical dimensions and tolerances are some common activities associated with the task. Process planning is also “the link between product design and manufacturing” with the supplementary commission to support design of competitive products. Process planning is of a complex and dynamic nature, often managed by a skilled person with few, or no, explicit methods to solve the task.

The work is heuristic and the result is depending on personal experiences and decisions. Since decades, there have been plenty of attempts to develop systems for computer-aided process planning (CAPP). CAPP is still awaiting its breakthrough and one reason is the gap between the functionality of the CAPP systems and the industrial process planning practice. This thesis has an all-embracing aim of finding methods that cover essential activities for process planning, including abilities to predict the outcome of a proposed manufacturing process. This is realised by gathering supporting methods suitable to manage both qualitative and quantitative characterisation and analyses of a manufacturing process. The production research community has requested systematisation and deeper understanding of industrial process planning. This thesis contributes with a flow chart describing the process planning process (PPP), in consequence of the methodological studies. The flow chart includes process planning activities and information flows between these activities. The research has been performed in an industrial environment for high volume manufacturing of gear parts. Though gear manufacturing has many distinctive features, the methods and results presented in this thesis are generally applicable to precision manufacturing of many kinds of mechanical parts.

Pablo Bringas, Mechanical properties prediction in high-precision foundry production: Mechanical properties are the attributes of a metal to withstand several forces and tensions. Specifically, ultimate tensile strength is the force a material can resist until it breaks. The only way to examine this mechanical property is the employment of destructive inspections that renders the casting invalid with the subsequent cost increment. In a previous work we showed that modelling the foundry process as a probabilistic constellation of interrelated variables allows Bayesian networks to infer causal relationships. In other words, they may guess the value of a variable (for instance, the value of ultimate tensile strength). Against this background, we present here the firstultimate tensile strength prediction system that, upon the basis of a Bayesian network, is able to foresee the values of this property in order to correct it before the casting is made. Further, we have tested the accuracy and error rate of the system with data of a real foundry. Foundry is considered to be one of the main driving forces of modern economy. In this way, it supplies necessary pieces to automotive, naval, aeronautic or weapon industries, for instance. As one may think, high-precision is the key to develop smaller, better, and more precise parts of crucial pieces but such accuracy entails also other risks, since the tiniest error may become fatal. Think, for instance, that high-precision foundry casts components of car brakes, aero plane turbines or windmill propellers. Therefore, there are very strict quality standards to

assure the exclusion of faulty pieces. Unfortunately, these controls are all performed ex-post, when the production effort is already done. In this sense, error prediction, on the one hand, allows avoiding the production of defective items to fulfil quality standards, and on the other, it also helps not to squander resources on that activity (i.e. helps saving money).
Pablo Bringas, Machine-learning-based mechanical properties prediction in foundry production: Ultimate tensile strength (UTS) is the force a material can resist until it breaks. The only way to examinethis mechanical property is the employment of destructive inspections with the subsequent cost increment. Modelling thefoundry process as an expert knowledge cloud allows properly-trained machine-learning algorithms to foresee the valueof UTS. Extending previous research that presented outstanding results with a Bayesian-network-based approach, wehave adapted an ANN and K-nearest-neighbour algorithm for the same objective . We compare the obtained results andshow that artificial neural networks are more suitable than the rest of counterparts for the prediction of UTS.

Thorsten Wuest, Machine learning in manufacturing: advantages, challenges, and applications: The nature of manufacturing systems faces ever more complex, dynamic and at times even chaotic behaviors. In order to being able to satisfy the demand for high-quality products in an efficient manner, it is essential to utilize all means available. One area, which saw fast pace developments in terms of not only promising results but also usability, is machine learning. Promising an answer to many of the old and new challenges of manufacturing, machine learning is widely discussed by researchers and practitioners alike. However, the field is very broad and even confusing which presents a challenge and a barrier hindering wide application. Here, this paper contributes in presenting an overview of available machine learning techniques and structuring this rather complicated area. A special focus is laid on the potential benefit, and examples of successful applications in a manufacturing environment.

SaraNasiri, Machine learning in predicting mechanical behavior of additively manufactured parts: Although applications of additive manufacturing (AM) have been significantly increased in recent years, its broad application in several industries is still under progress. AM also known as three-dimensional (3D) printing is layer by layer manufacturing process which can be used for fabrication of geometrically complex customized functional end-use products. Since AM processing parameters have significant effects on the performance of the printed parts, it is necessary to tune these parameters which is a difficult task. Today, different artificial intelligence techniques have been utilized to optimize AM parameters and predict mechanical behavior of 3D-printed components. In the present study, applications of machine learning (ML) in prediction of structural performance and fracture of additively manufactured components has been presented. This study first outlines an overview of ML and then summarizes its applications in AM. The main part of this review, focuses on applications of ML in prediction of mechanical behavior and fracture of 3D-printed parts. To this aim, previous research works which investigated application of ML in characterization of polymeric and metallic 3D-printed parts have been reviewed and discussed. Moreover, the review and analysis indicate limitations, challenges, and perspectives for industrial applications of ML in the field of AM. Considering advantages of ML increase in applications of ML in optimization of 3D printing parameters, prediction of mechanical performance, and evaluation of 3D-printed products is expected.

ZiqiuKang, Machine learning applications in production lines: A systematic literature review: A production line is a set of sequential operations established in a factory where materials are put through a refining process to produce an end-product that is suitable for further usage. Monitoring production lines is essential to ensure that the targeted quality of the production process and the products are achieved. With the increased digitalization, lots of data can now be generated in the overall production line process. In parallel, the generated data sets are used by machine learning techniques for analytics of the production line to improve quality control, evaluate risks, and save cost.

This paper aims to identify, assess, and synthesize the reported studies related to the application of machine learning in production lines, to provide a systematic overview of the current state-of-the-art and, as such, paving the way for further research. To this end, we have performed a Systematic Literature Review (SLR) in which we retrieved 271 papers, of which 39 primary studies were selected for a detailed analysis. This SLR presents and categorizes the production line problems addressed by machine learning, identifies the targeted industrial domains, discusses which machine learning algorithms have been used, and explains the adopted independent and dependent variables of the models.

V. CONCLUSION

The manufacturing productivity strategy must be based on an effective supply chain management principle ensuring materials arrive on time, in full, at the correct production sites without halting any production. Any such delays will cause the workers to be inactive adding unnecessary costs, in addition to the company failing to fulfill orders on a specific time resulting in poor customer service. The concept of enhancing productivity by accurately planning procurement and production based on consumer demands can avoid excessive inventory or manufacturing over-runs reducing significant costs and at the same time improving customer service levels.

REFERENCES

1. Peter F Drucker, "The Practice of Management", Mc Graw Hill, New York..
2. Joseph Prokopenko, "Productivity Management – A practical Hand Book", International Labour Office Geneva.
3. Emmanuel Majekodunmi Ajala, "The influence of workplace environment on workers' welfare, performance and productivity", The African Symposium, Volume 12, No. 1, June 2012, pages 141-149.
4. R Meenakshi Sundaram, "Process Planning and Scheduling – A Method Integration for Productivity Improvement", Computers Engineering, Volume 15, Nos 1- 4, 1988, pages 293-301.
5. Dheeraj Nimawat and Ashish Shrivastava, "Increasing Productivity through Automation", European Journal of Advances in Engineering and Technology, 2016, 3(2): pages 45-47.
6. M.J. Antle (Eds.), Agricultural productivity. Measurement and explanation, Washington, DC: Resources for the Future, 17–95.
7. Anderson C.& Carl, P.Z. (1984). Stage of the product life cycle, business strategy and business performance. Acad Man J., 27, 5-24.
8. Antle, M.J. & Capalbo, S. (1988). An introduction to recent development in production theory and productivity measurement. In S. Capalbo &
9. Prokopenko, J.(1997). Productivity management: A practical handbook. Geneva: International Labour Organization.
10. Boltan, R.N. & James, H.D. (1991). A longitudinal analysis of the impact of service changes on customer attitude. J. Market, 55, 1-19.
11. Crosby, P.B. (2004). Quality is free: The art of making quality certain, NY, American Library
12. Tolentini, A. (2004). New concepts of productivity and its improvement. Paper presented at the European productivity network seminar,Budapest, 13–14 May.
13. Durdyev, S., Ismail, S. & Abu Bakar, N. (2012). Factors Causing Cost Overruns in Construction of Residential Projects; Case Study of Turkey.
14. International Journal of Science and Management, 1, 3-12.