

Simulation Trends in Modern Manufacturing Industry: A Discussion

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Abstract—Modern day of manufacturing industry now involves complexities and dynamic environment. Various techniques like six sigma, lean manufacturing, ERP, JIT etc are evolving to provide better control and increase the effectiveness of the processes. In this kind of scenario it becomes essential, to have proper planning and monitoring of activities at the levels. Various simulation and modeling tools are adopted by researchers and practitioners to attain this target. This paper discusses role of simulation in modern industry to cope up with dynamics involved in them.

Keywords: Simulation, productivity improvement, manufacturing

1. INTRODUCTION

Modern manufacturing industries these days are facing competitive challenges to improve productivity or production and achieve profit. Currently, the companies are oriented on meeting the clients' requirements which calls for using many tools and methods necessarily utilized in production planning. Computer simulations, in this scenario, prove to be efficient tools for implementation of various planning tools like MRP, ERP etc. Further it can be used for in developing and verifying the production plans.

Simulation has wide range of application in various fields like manufacturing, services, defence, healthcare etc. Pannirselvam et al (1997) recognized simulation as second most popular modeling tool in operations management. Various illustrations in literature can be found which depicts its wide range of its application- manufacturing (Farzi et al (2019); Reinhardt et al (2019)), health care (Latimer et al (2019), defence (Shi et al (2018)). The purpose of this paper is to put light on some of the facts related to simulation in industry fields and present extensive picture of simulation in manufacturing and business.

2. SIMULATION

Simulation is the imitation of the system and its dynamic processes included in the model able to simulate the experiments in order to acquire knowledge applicable in real. The act of simulating something first requires that a model be developed; this model represents the key characteristics or behaviors of the selected physical or abstract system or

process. Simulation is now considered an indispensable tool to study the system behavior as it gives valuable understanding of system under dynamic conditions. Various researchers have found simulation as useful and powerful tool for system analysis and evaluation. They found that very important information can be generated from simulation runs that may be difficult to acquire from other analytical tools. In spite of the fact that generating a solution about a system in simulation technique may not give optimum result, it is more convenient in modeling complex system than analytical technique. The complexity of complex networks can be overcome by using simulation. Flexibility of simulation models allows studying the behavior of network model which is very similar to the real system. Simulation also provides the ability to simulate the effect of particular events on system performance and experimenting with different scenarios without huge investments (time and money) and process disruption.

3. SIMULATION ROLE IN INDUSTRY

As discussed in previous section, simulation plays vital role in improving the productivity of any industry and wide range of application are complied by various researchers. In this section some of the vital applications of simulation are discussed.

Effective risk management is important procedure to counter balance the critical effects along supply chain. Various optimization techniques can be observed to properly manage the risk along supply chains and have proper decision making. Oliverai et al (2018) studies application of simulation for supply chain risk management approach to study the complex and dynamic environment of supply chains. They proposed hybrid and simulation based model for real time model and found that efficient decision making can be done in the competitive environment.

Garg et al (2001) studies the concept of technological flexibility to investigate its requirement in JIT environment. The choice of extent of flexibility is supposed to be market driven and are dependent on various economic factors. Wide range of scenarios are discussed and the result found by simulation experiments were found to be vital.

Subhash Wadhwa et al. (2010) have addressed the issue of Part mixing and Routing Flexibility with different control rules namely, dispatching rules and sequencing rules in FMA. ARENA is used to analyze the system with unbalanced load condition. Simulation results, show the effect of part mix and routing flexibility on the overall performance of Flexible manufacturing system. In the proposed simulation model, it has been clearly shown that part mix and routing flexibility together can improve the make – span performance of an FMS.

Table 1 represents application of simulation in various fields and clearly indicates the wide usage of simulation tools in manufacturing and business.

Table 1: Application of simulation in various fields

Simulation Application	References	Description
System design and facility design/layout	Masoud et al (2019), Papakostas et al (2018)	The issues related to design of system and facility layout considering the constraints imposed by the system
Material handling system design	Negahban and Smith (2014), Smith (2003)	The study related to optimize the material movement and handling of material.
Performance analysis	(Smith, 2003), Sharma and Garg (2012),	The performance in terms of efficiency, productivity is studied and optimum conditions are found.
Supply chain management	Oliveira et al (2019), Hidayatno et al (2019)	Various issues of SCM like risk management, supply chain integration etc can be closely evaluated by simulation techniques.
Inventory management	Akhtari et al (2019), Tsai and Chen (2017)	This application studies the different aspects related to stock management and spares parts.
Knowledge management	Jahangirian et al., (2010), Edwards et al (2004)	The application regards knowledge dissemination through the organization
Health care	Carlson and Gagnon (2016), Rius et al (2019)	Issues like improved customer services, greater collaborations within Health System, judicious use of IT etc can be easily addressed by simulating techniques.
Financial Services	Schwab et al (2019), Trigos et al (2019)	

4. RESULTS AND CONCLUSION

Application of simulation in area of business and manufacturing has wide range of successful implementation in various areas of production, planning and control viz inventory management, maintenance management etc. Wide range of simulation tools and packages are available in market to perform the analysis. An attempt is made in this research to report its application in various fields of manufacturing, business and services. It can be concluded that with application of simulation technique provides high level production planning support simulation modeling helps to acquire the results for real time applications. It can also be found from this study that simulation helps to solve complications of any type before it actually takes place and has high potential to get the appropriate action well on time. This study, thus, provides platform for researchers and practitioners to effectively apply the simulation tool in wide areas of business- both manufacturing and services.

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