

Quantification of the Strategic Fit Between Process Choice Criteria and Production Systems

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Abstract

Manufacturing systems are the mode through which organizations can achieve competitive advantage by producing products with the desired wants. Hence, selecting a manufacturing system is one of the critical decisions in formulating a manufacturing strategy. Currently, there exist four traditional production systems (TPS) (i.e. job-shop, batch-shop, mass, and continuous) and additive manufacturing system (AMS), which appeared as the alternative for TPS during Industry 4.0 era. Different process choice criteria (PCC) need to be considered while determining a suitable system from five or a hybrid (AMS + TPS) configuration. This research has developed a framework comprising Delphi, voting analytical hierarchy process (VAHP), and machine learning (ML) based Bayesian network (BN) method techniques for selecting a suitable production system by quantifying the strategic fit between PCC and production systems. Initially, a pertinent body of knowledge is researched to identify the critical PCC and further validated by industry experts through Delphi. This results in retaining thirty-six PCC. The relative importance of an individual criterion concerning a particular production system is computed using VAHP in the second stage to understand the alignment of PCC in different production systems for exhibiting the congruence between PCC and manufacturing systems (TPS and AMS). Total 22 cases falling under different production systems are evaluated for strategic fit computation to understand the benchmarked values of PCC in each of the production system environments (TPS and AMS). Finally, a suitable production system is selected for a special case of hydraulic and pneumatic valve manufacture using a Bayesian network method. The findings offer critical insights into the different PCC and their *level-of-fit* in TMS and AMS, which can assist researchers and practitioners in evaluating a suitable manufacturing system for an organization using identified PCC.

Keywords

Manufacturing Strategy, Production systems, Process Choice Criteria, Strategic Fit, Delphi, VAHP, Bayesian Network.

Biography

Vishwas Dohale is a Doctoral Research Fellow at the National Institute of Industrial Engineering (NITIE), Mumbai, India, in the Operations and Supply Chain Management (O&SCM) domain. He is currently working as Business Analyst at the global renowned Goldratt Consulting, India. He completed his M.E. in CAD/CAM and Robotics from the University of Mumbai. His research interests include Manufacturing Strategy, Production System Management, Supply Chain Strategy and Risk Management, IEOR, IEOM, Optimizations, Simulations and Modelling, MCDM, and ML. He has published his research in refereed journals, namely International Journal of Production Economics, International Journal of Production Research, Computers & Industrial Engineering, Benchmarking, International Journal of Physical Distribution and Logistics Management, International Journal of Logistics Management, and reputed international conferences such as POMS, ISDSI, IAMOT, IEOM, and IEEM.

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