Developing a Capability Maturity Model to Improve the Flexibility of Manufacturing Systems

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Abstract

Flexibility refers to the capability of manufacturing systems to cope with demand fluctuations in the market and internal disturbances within the factory. However, there is no capability maturity model developed specifically for the flexibility dimension of manufacturing systems. To address this gap in the literature, this research developed a capability maturity model specifically for evaluating the flexibility of a manufacturing system. This model will help in improving the capability of the Flexibility of Manufacturing Systems. Manufacturing Sector plays an important role in Bahrain's economy. Both theoretical and empirical techniques were used to develop and test the proposed model. The theoretical analysis indicates that manufacturing flexibility is a function of machine, process, product, routing, operational, volume, expansion and labour flexibilities.

These indicators that measure the capability of manufacturing flexibility were identified. The indicators were tested through analysis of primary data collected from 50 workers working in two manufacturing plants in Bahrain. The two plants considered were at different levels of flexibility and the various dimensions of flexibility in each plant were tested using the proposed model. This research identifies the key performance indicators of flexibility for monitoring the improvement of flexibility. Through this analysis, the key actions and indicators of flexibility for each level of each dimension considered in the capability maturity model were verified. The dimensions, levels and indicators for each level that lead to the formulation of flexibility capability maturity model for manufacturing were identified.

On the theoretical side, the mathematical formulae that can be used to quantitatively measure the achievement of a particular level of flexibility have been indicated. An assessment method has been provided to test any manufacturing system flexibility using the developed model. The weighted mean was introduced in the assessment of flexibility. This research also indicates methods of using the Capability Maturity Model (CMM) of manufacturing flexibility, that will enable manufacturers to identify which level of flexibility a particular dimension is at and how it can transit to the next level to improve flexibility.