ABSTRACT

During the past two decades, manufacturing industries have been facing intensified competition. In order to face this intensified competition, many modern manufacturing industries like those are involved in manufacturing mobile phones and computers have been adopting a paradigm that will enable the companies belonging to those industries to quickly respond against the dynamic demands of the customers. The researchers have been addressing this new paradigm under the title 'Agile Manufacturing' (AM). The capabilities of AM are regarded by the researchers as agility characteristics. Many modern manufacturing industries have imbibed agility characteristics. However, many traditional manufacturing industries are yet to imbibe agility characteristics. One among them is pump manufacturing industry.

The companies belonging to traditional pump manufacturing industry have been very slow in responding to the intensified competition. This situation indicates that it is high time that traditional pump manufacturing companies need to adopt agility characteristics. A careful study would indicate that modern industries have imbibed agility characteristics to a large extent by making use of digitization technologies. This development indicates that adoption of AM paradigm through the application of digitization technologies will enable the traditional pump manufacturing companies to imbibe agility characteristics for meeting the dynamic demands of the customers and delighting them with different varieties of pumps with innovative features. The doctoral work reported in this thesis was carried out with the objective of meeting this requirement.

In the beginning of this doctoral work, a detailed literature survey was carried out to study the history, origin and enablers of AM. Then the different agile characteristics that enable the products to become agile were prioritized by using fuzzy Analytic Hierarchy Process (AHP) technique. Then a model named Digitization enabled Aesthetics Functional and Ergonomic Agility (DAFEA) was designed to enable the pump manufacturing industry for imbibing agility characteristics through the adoption of digitization technologies. After designing DAFEA model, its implementation studies were carried out in three different pump manufacturing companies. During the conduct of these studies, DAFEA model was applied in the case of designing and developing shallow well jet pump, submersible pump and centrifugal monoblock pump. Finally, the practical feasibility of infusing agility by implementing the DAFEA model in the pump manufacturing industry was analyzed. Thus, the doctoral work reported in this thesis has resulted in the development of the DAFEA model that would guide the traditional pump manufacturing companies to acquire agility characteristics through the application of digitization technologies.