CHAPTER 9

CONCLUSION

9.1 INTRODUCTION

Due to the intensification of the competition, manufacturing companies are required to design, develop, produce and sell the products with innovative features that would delight the customers. A delighted customer is self-motivated to buy a new product with advanced features to replace the existing product. For example, a customer possessing an android based mobile phone is eager to replace the same with ios based iphone. The manufacturing industries which are able to supply quickly this kind of products infused with high innovations are able to win the competitive race. The companies which are not acquiring those capabilities are failing to win the competitive race.

A careful study conducted during the doctoral work reported in this thesis revealed that industries like those involved in manufacturing products like mobile phones and laptops have been able to be agile by contributing quickly the products with innovative features. Further study also revealed that these agile industries have been adopting digitization technologies and effecting the convolution of technologies to produce products that would delight the modern customers. For example, a mobile phone is incorporated with the cameras. This is an example for the convolution of mobile phone technology and the field of photography. Further a mobile
phone is incorporated with the provision for using internet. This is an example for utilizing the digitization technologies. Furthermore, the CAD models of mobile phones are explored and analyzed to bring out new designs of the mobile phones with innovative features. These developments indicate that the conventional industries like those manufacturing pumps are also required to convolute the technologies, digitization and CAD technologies. In order to enable the pump industry to progress in this direction, the DAFEA model was developed by conducting the doctoral work reported in this thesis.

The DAFEA model was developed by extracting information and knowledge by applying Fuzzy AHP approach. After designing DAFEA model, its implementation aspects were investigated in the manufacturing of three types of pumps in three different companies. The experiences of conducting these investigations revealed that DAFEA model will be powerful enough to bring about agile products in pumps manufacturing companies. The contributions, limitations and the scope for pursuing further work in direction of the doctoral work reported in this thesis are presented in this chapter.

9.2 CONTRIBUTIONS OF THE WORK

The contributions of the doctoral work reported in this thesis are enumerated below:

- The history, origin and enablers of agile manufacturing paradigm were studied by conducting a detailed literature survey.

- The researches on agile manufacturing reported in literatures arena were identified and the ways of imparting agility characteristics in traditional pump manufacturing industry were studied.
• The agility characteristics that are required to infuse agility in traditional pump products were prioritized.

• A conceptual model named DAFEA was developed for infusing agile manufacturing concepts in pump manufacturing industry by adopting digitization technologies.

• Studies were conducted in three traditional pump manufacturing companies to investigate the infusing of agility characteristics through the implementation of the steps of DAFEA model.

• The practical feasibility of infusing agile manufacturing characteristics in traditional pump manufacturing industry through the implementation of DAFEA model was investigated.

Altogether, the doctoral work reported in this thesis has resulted in the development of DAFEA model which would guide the practitioners to infuse agility characteristics in pump industry.

9.3 LIMITATIONS OF THE WORK

While carrying out the implementation studies on DAFEA model in the three pump manufacturing companies, the management of these three companies was sceptical about the implementation of agile manufacturing principles in designing and manufacturing of pumps. Also, the digitization of the products could not be carried out effectively due to the non-availability of two dimensional part drawings in Askhar Pumps and Jay Pumps. This aspect resulted in developing three dimensional models by manually referring to the actual components. Additionally, the lack of availability of software like LMS Virtual Lab to analyze the newly designed models of pumps was found to be a limitation while conducting the implementation studies.
9.4 SCOPE FOR FUTURE WORK

At the end of carrying out the implementation studies, it was learned that, DAFEA model could be practically implemented with some limitations. In the future work, efforts should be made to overcome these limitations and carry out the hindrance free implementation of DAFEA model not only in traditional pump manufacturing companies but also in other traditional manufacturing industries.

9.5 CONCLUSION

During the past one decade, the growth of the pump industry has been plummeted. This is a surprising situation as the pump is the product which is used in wide variety of applications like pumping water in domestic and industrial situations, pumping fluids in hydraulic circuits and pumping fuel in internal combustion engines. Another interesting observation is that numerous varieties of pumps have emerged in the world over the past several centuries. This is due to the reason that, pump industry is one of the oldest industries. The reason for the pump industry failing to flourish in the last one decade is due to the sluggish infusing of agility in this industry. In the background of this situation, the activities to be carried out for endeavouring to achieve agility in pump manufacturing industry were identified. In order to make those activities practically feasible endeavours, the DAFEA model has been contributed by carrying out the doctoral work reported in this thesis.

The applicability of the DAFEA model was investigated in the manufacturing of three different types of pumps in three different companies. The outcomes of these investigations indicated that DAFEA model is so powerful that it would enable the infusing of agility in designing the pumps through the adoption of advanced digitization technologies. Yet, the agility
infused design of pumps could not be manufactured in the three companies in which the investigations were carried out. This is due to the reason that the management of these three pump manufacturing companies has been keen focussing to meet the production schedule against the orders placed by the customers. Hence, it is required to conduct several exposure programmes like seminars and workshops to expose about the benefits of infusing agility in pump manufacturing companies through the implementation of DAFEA model.

Once the commitment and support of the contemporary manufacturers are obtained then the practicality of DAFEA model can be further investigated. The results of those researches may be utilised to modify and define (if found necessary to make DAFEA model practically feasible). Till this level of improvement is achieved, the researchers may apply DAFEA model on the models of pumps other than those investigated in the doctoral work reported in this thesis and expose the agile pump models to the manufacturers. When pump manufacturers manufacture those agility infused pumps, the pump industry will prosper like the way mobile phone and laptop industries have been prospering in today’s high intensive competitive world.