

# Chapter 7 Conclusion

This chapter is a summary of the whole research and consists of three sections: 1) research contributions, 2) research limitations, and 3) suggestions for further research.

## 7.1 Contributions of the Research

This research has two key contributions:

1. It proposes a new conceptual model of Smart Clothing development process, which can be used as a basis to generate a computer software to plan, manage and control product development teams and activities at the front-end of the NPD process. This new conceptual model has several advantages, which other models cannot provide:
  - It enhances the performance of collaborative product development by combining a conceptual model of the NPD process with that of collaboration management. In this way, it is easier for the participants to understand how to co-ordinate their expertise and contributions within the NPD process.
  - It assists the management of the NPD process by presenting a conceptual model in the new way, which explains the relationships of all tasks as well as roles and responsibilities of all participants explicitly. Since the linear order and rigid structure were broken down, the new conceptual model is very dynamic. Furthermore, detailed information is easy to access and alter.
  - It improves the understanding of the Smart Clothing development process, as the conceptual model was developed specifically for this field, and based on the requirements of both existing and potential developers. Because unique

contexts of Smart Clothing are incorporated into this model, it requires less effort to adapt to a specific project than those of generic models, which are far simpler and contain no element that relates to Smart Clothing development.

2. It offers new design directions for Smart Clothing applications within the potential market. Certain suggestions are practical solutions. For instance, there are opportunities for '*practical*' applications in the areas of personal healthcare and sportswear. If a product focuses on '*practical functions*', it should adopt a design approach and strategy of functional clothes, such as uniforms and protective garments. Some recommendations are at strategic level, for example, functions and styles should be able to be personalised.
3. It provides a means to investigate and develop a conceptual model of the NPD process specifically for a particular field. The means comprises of eight steps:
  - Find out the main problems, challenges and requirements of a particular field
  - Investigate which problems and challenges are caused by the NPD process
  - Examine NPD processes, working procedures, expertise, and contributions of all the participants involved in the development process
  - Identify the key factors influencing the success of the NPD process in that area
  - Discover which differences in terms of requirements, working procedures, and cultures, can be compromised and reconciled
  - Find out which factors in the conceptual models of the NPD process that prevent development teams from achieving their goals
  - Employ creative techniques, that specialise in divergent thinking, challenging the established approaches and exploring the radical outcomes, to create a new conceptual model that solves existing problems and offers new advantages

- Refine the model by testing the ideas with the major influences in the area

## 7.2 Limitations of the research

There are several limitations of this research as summarised below:

1. Many experts in Smart Clothing field refused to cooperate. Since their research and developments involved a large scale of investment; therefore, information, especially the NPD processes and future design directions, was treated as highly confidential and not always disclosed.
2. Due to the nature of the Smart Clothing project, participants involved in the collaboration continued to change. In most cases, by the time the research and developments were published, the collaborative teams had already separated and were working on other projects. Hence, it was difficult to find the interviewees and examine their NPD processes.
3. There was no academic journal that was dedicated to this area. Most academic papers concentrated on the technical side of Smart Clothing development, such as the system specification of a washable circuit board. As a result, the research that focuses on the management side of Smart Clothing development, such as team management and design strategy that is truly based on user or market research, is not common.
4. As the management side of Smart Clothing development was still underdeveloped, there were not many experts that were able to evaluate the conceptual model proposed.
5. Since Smart Clothing developments often stop at the prototype stage, there was insufficient data from the later stages, e.g. mass production and commercialisation, for the research.

## 7.3 Suggestions for Further Research

Due to the limitations, there are certain parts of this research that require further study.

1. The conceptual model can be strengthened and improved by incorporating later stages of the NPD process, such as production and commercialisation. In this way, the model can assist development team throughout the whole process. Observation, work placement or practical research with Smart Clothing development teams is recommended.
2. As Smart Clothing development continues to change and its development teams become larger and more complex, the conceptual model suggested, as well as the new design directions, should be replaced or updated in the next few years.
3. In order to improve the outcome of Smart Clothing development, this conceptual model of the NPD process should be employed in conjunction with other design tools and techniques designed specifically for Smart Clothing field. There are requirements for specific tools and techniques in every stage of Smart Clothing development. For example, team management, idea communication, and progress monitoring.