A Conceptual Framework to Agile Product Development for Sustainable Garment Product

Suhartini, Mokh Suef, Udisubakti Ciptomulyono, and Erwin Widodo

Abstract
The company develops new products to improve performance. The company develops new products according to consumer wishes. Consumers buy products considering the quality, price, and product availability. The company responds to consumer desires quickly. Research on agile concepts is used in garment product development. Companies that implement garment product development with an agile concept aim to respond to consumer desires. The research aims to develop a conceptual framework for the agile garment product development process. To achieve this goal, this research analyzes the literature study. The result of the conceptual framework is the conceptual framework proposed by the researcher. Researchers will conduct a validation test on the proposed conceptual framework.

1 Introduction
According to [1], product development has several stages: planning, design, manufacturing, and launching. The planning stage is the main stage in carrying out business activities. Several studies discuss the planning process of product development. This shows that planning is an essential step in the product development process [2]. According to [3], planning is carried out on supply chain management, information systems, risk, and iteration in product development. Planning can be done with business collaboration [4].

Planning begins with determining the idea to make a product in the product development process. Planning determines the product's success because the initial information is contained in the product development process. New product development is carried out by companies to improve performance [5]. New product development must match consumer demand. Consumers consider products based on quality, price, and availability time [6].

The company has a strategy to plan new product development. The research uses a product development strategy with an agile concept. Product development with an agile concept is made in the form of a framework. This study aims to develop a conceptual framework to measure a company's ability to apply agile concepts. Companies know the value of profits by looking at the number of product ideas resulting from product development.

The preparation of this paper is as follows, in the second part presents a literature review on the development of garment products. The third part describes the research problem. The fourth section is an explanation of the methods used in the research. The fifth part is to create an analysis framework, and the following discussion, the sixth part is to make conclusions and provide suggestions for future research.

2 Literature Reviews
The product development process by [7] discusses sustainable product performance. This study states that product development has no significant relationship to product innovation with sustainable product performance. According to [8], the sustainable product development process includes economic, social, and environmental aspects that can improve company performance. The company has a product development strategy to improve performance [9].

Product development is the process of converting customer requirements into economical products. The application of the agile concept aims to deal with intensive global competition, increased operational costs, and the pace of technological innovation [10]. New product development can be applied to agile concepts. Previously, new product development used a conventional product development process. The stages of the conventional product development process can be seen in Figure 1.

Agile hardware product development aims to improve product quality [11]. Large companies and Small and Medium Enterprises can apply the agile concept. This shows that the agile concept is easy to implement in large companies and small and medium
enterprises. The product development process with an agile concept consists of requirements, design process, design, production process, and product. The process design consists of concept and detailed design; the agile concept in the product development process can be seen in Figure 2. Research [12] states that the process of developing agile concept products involves many stakeholders, the complexity of the process is very low, and the scope of the process has iterations. According to [13], decision-makers with the agile concept experience change quickly because they consider several options and experience changes over time. Working on an agile product development process has a fast timeframe [14].

3 Problem Statement

This study aims to create a framework for the product development process. Researchers discuss the development of agile garment products. Consumers want a fast response to the availability of garment products. The garment product development process, seen from product availability, can be divided into fast and slow fashion [15]. In fast fashion, companies produce with large capacity and low prices, resulting in a lot of waste. Whereas in the slow fashion process, the company will produce in a small capacity but at a high price, resulting in little waste. Consumers have fast-changing desires, so companies must respond quickly to consumer needs. In addition to rapidly changing desires, consumers want sustainable products. Sustainable products have high prices because there are additional costs in the production process. The following in Figure 3 shows the problem of the garment product development process.

4 Proposed Approach

The approach taken by researchers to create a framework is to conduct a literature review of Scopus data. The topic of the literature review is the garment product development process.

The following are the steps in conducting a literature review:

1. Researchers use articles from Data Scopus from 2012 – 2021 about developing sustainable products. The sustainable products used are garment products. The first stage uses the keywords "process, development, product" to get 341 papers. The second stage used the keywords "development, product, garment" to get 78 papers. The third stage uses the keywords "development, product, garment, sustainable" to get 34 papers.

2. Researchers used 34 papers to be identified based on the following:
   a. The stages of the product development process are design, planning, manufacturing, and launching.
   b. The sustainable aspect is the economy, Environmental and social.
   c. The use of variables, namely the dependent variable and independent variable.
   d. The use of data, namely quantitative data and qualitative data.
   e. The types of research objects are garments and fashion.
   f. Data sources are companies, SMEs, articles, and suppliers.
   g. Research findings from each article.
   h. Limitations of research determined by researchers.
   i. Future research proposed by researchers for further research.

3. The identification results show that there are nine articles discussing the stages of planning with three sustainable aspects. Determine research positions based on nine articles to create a sustainable product development framework. Figure 4 shows the approach researchers took to design a conceptual research framework.

The steps in creating a conceptual framework are based on literature studies. The conceptual framework design uses a literature study on garment product development. The framework design is based on the stages of the product development process and is sustainable. The stages of the product development process consist of planning, design, manufacturing, and launching. Meanwhile, the sustainable aspect uses economic, environmental, and social aspects.
Researchers create a matrix between the stages of garment product development and sustainable aspects. The results of the matrix become the topic of this research. Researchers identify the characteristics of product development between traditional and agile. The conceptual framework design uses the characteristics of agile concept product development in figure 4 Proposed approach.

![Fig. 4. Proposed approach](image)

5 Result

After the literature review process, the researcher has nine articles to support the research. The article discusses issues regarding Supply Chain Management, Business Strategies, and Challenges and opportunities. The researcher determines the research position based on the topic. The research position is used as the basis for creating a research framework. Figure 5 shows the research position based on nine articles.

The agile product development process is different from the conventional product development process. Based on previous research, several characteristics distinguish the development process between agile and conventional. This study uses the dependent variable and independent variable. The results of identifying the characteristics of agile product development as the dependent variable. At the same time, the number of product ideas is an independent variable. In determining the characteristics of conventional and agile product development processes, the advantages and disadvantages of implementing the product development process can be seen. The agile product development process has advantages over conventional product development processes. Table 1 shows the differences and advantages of conventional and agile product development processes.

According to [16], traditional product development is a stage carried out sequentially and results in a long product development time. Therefore, product life cycles are becoming increasingly shorter, and many manufacturers, especially design manufacturers, have tried to shorten the lengthy product development time to improve competitiveness. Meanwhile, concurrent product development emphasizes that the upstream working group must work with the downstream working group to consider all the desired product development characteristics at the downstream stage to produce the selected designs earlier and shorten product development time. Apart from traditional and concurrent product development, there is also agile product development. In this research, the product development process with the agile concept uses the method according to [17], which states that the agile methods often used by companies are Kanban, Scrum, Scrum/XP, Scrum/XP/Lean, Waterfall/Scrum, and XP.

![Fig. 5. Position of the proposed research topic](image)

**Table 1. Differences Between Conventional and Agile Characteristics**

<table>
<thead>
<tr>
<th>No</th>
<th>Characteristics</th>
<th>Difference</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Planning</td>
<td>Predictive</td>
<td>Tacit Knowledge</td>
</tr>
<tr>
<td>2</td>
<td>Stakeholders</td>
<td>Low engagement rate</td>
<td>High engagement rate</td>
</tr>
<tr>
<td>3</td>
<td>Process</td>
<td>Tall</td>
<td>Low</td>
</tr>
<tr>
<td>4</td>
<td>Process scope</td>
<td>No iteration</td>
<td>There are iterations</td>
</tr>
<tr>
<td>5</td>
<td>Decision making</td>
<td>Faster because it is taken at the beginning of planning</td>
<td>Slower due to exploiting options that can appear at any time</td>
</tr>
<tr>
<td>6</td>
<td>Working timeframe</td>
<td>Slower</td>
<td>Faster</td>
</tr>
<tr>
<td>7</td>
<td>Communication</td>
<td>Diamond Communications</td>
<td>Spider Communications</td>
</tr>
<tr>
<td>8</td>
<td>Product condition</td>
<td>The market needs that are well-known to customers</td>
<td>Market development is speedy and constantly changing</td>
</tr>
<tr>
<td>9</td>
<td>Consumer needs</td>
<td>Needs are stable and change over time</td>
<td>Needs can change quickly</td>
</tr>
<tr>
<td>10</td>
<td>Design</td>
<td>Changing the features that consumers want</td>
<td>develop rapidly to meet changing consumer needs</td>
</tr>
<tr>
<td>11</td>
<td>Product specifications</td>
<td>Determination in detail at an early stage based on consumer needs</td>
<td>The general setting is at an early stage but can be updated as feedback according to customer needs</td>
</tr>
</tbody>
</table>
6 Discussion

The conceptual model in the product development process is based on research by [1] and [10]. In the model by [1], a matrix is made between the product development and sustainability stages. Meanwhile, the model by [10] models the conventional and agile product development process. Based on research conducted by [1] and [2], researchers will create a conceptual model for planning an agile sustainable product development process. While the characteristics of the agile concept are obtained from [18], [12], [13], [14], [20], [21], [22], and [23]. The results of the identification of characteristics used in agile product development planning can be seen in Figure 6. Agile garment product development has 18 characteristics. The characteristics of the product development are used as the dependent variable. Meanwhile, the independent variable is the number of product ideas. Consumers want fast product availability. Consumers want the accuracy of the model or garment design. Thus, this study aims to create a conceptual framework for agile garment product development. The proposed conceptual framework regarding agile product development can be seen in Figure 7.

![Fig. 6. Characteristics of product development with the Agile concept](image)

**Fig. 6. Characteristics of product development with the Agile concept**

The proposed conceptual framework comprises several steps for the agile garment product development process. This research uses garment products and determines the stages of product development. Product development stages consist of planning, design, manufacturing, and launching. Researchers identified the characteristics of traditional and agile garment product development. The results of the identification of characteristics are used as research attributes. Researchers determine the independent variable and the dependent variable. The dependent variable is characteristic of agile product development. At the same time, the independent variable is the number of garment product ideas in the agile development process. The study conducted a validation test using a mathematical model.

The mathematical model used the basic model for calculating profits, namely total revenue minus total cost. The mathematical model consists of several scenarios and chooses the best scenario. Selection of the best scenario shows that the profit and the number of ideas for garment products produce optimal value.

7 Conclusion

Research on the product development process has been carried out by many researchers before. This study aims to create a conceptual framework for agile garment product development. The development of agile garment products considers economic, environmental, and social sustainability. Product development stages consist of planning, design, manufacturing, and launching. This research focuses on the planning stages in garment product development. Researchers have identified several characteristics of agile garment product development. The characteristics of agile garment product development are 18 characteristics, namely tacit knowledge planning, very high level of stakeholder involvement, low process complexity, clear process scope because there are iterations, faster decision-making methods, faster processing timeframes, spider communication, Product conditions often change, Changes in consumer needs, Design develops fast, Product specifications are flexible according to needs, Final design parameters are at 40-70% conditions, Technology changes quickly, Documentation is informal, Management is leadership...
and collaboration. Organizational structure is small in number, Quality is by the initial plan, Quality Control is carried out continuously. The study conducted a validation test using a mathematical model. The proposed conceptual framework is used to research agile garment product development planning. The results of this study are expected to determine the company’s ability to apply agile concepts to garment product development.

References


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