DESIGN IMPROVEMENT FOR POTATOES CULTERY TOOLS "POTTY" USING PRODUCT ARCHITECTURE ANALYSIS

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ABSTRACT

In every use of tools and product, the function of each component is crucial point to maximize product functionality. Considering each product design has deep implications for further product development, it is necessary to do cross-functional of product development.

Geometric and product design that are less precise, will lead to inaccuracy function for every component, thus reducing the reliability of the product. Therefore it is necessary to do assessment of geometry and product design with the aim of maximizing the function of each component.

The purpose of this research is to analyze the product existing product design of Potty using Product Architecture approach, and then made improvements to existing product design.

Keywords: Product Architecture, Product Design, Potatoes Cutlery Tools

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1. INTRODUCTION

1.1 Background

In industry that produces goods with aim to ease the use by consumers, it necessary to design a good product architecture.

This paper will discuss the design improvement for potatoes cutlery “Potty”. The Potty early product concept is already developed, but it is not included any analysis of product architecture. The product architecture will help the further refinement of this product design.

Less precise of geometry and product design will lead to maximum-less expected functions when designing product. At last, there will be quality downgrade. Therefore, it is necessary to do geometry and product design well in order to level-up the quality, competitiveness, and its functions. Therefore for a product development process, an analysis of product architecture is needed to make sure the product will be designed to serve the functions it intended.

1.2 Problem Formulations

Problem formulations in this research are:

1. How is the product architecture for ‘Potty’ design?
2. Based on the architecture scheme, what is the design improvement for the product?

1.3 Research Objective

The Objectives of this research are:

1. Establish the product architecture of ‘Potty’.
2. Propose an improvement of the product’s design.

2. THEORITICAL BACKGROUND

2.1 Product Description

Figure 1. “Potty” product

“Potty” has functions to improve time efficiency in cutting potatoes and decrease risk of injury due to the sharp edges of conventional knives. Wood is used as main material and there is a thin and sharp-knife inside the main part. Knife can be removed as in picture 1.

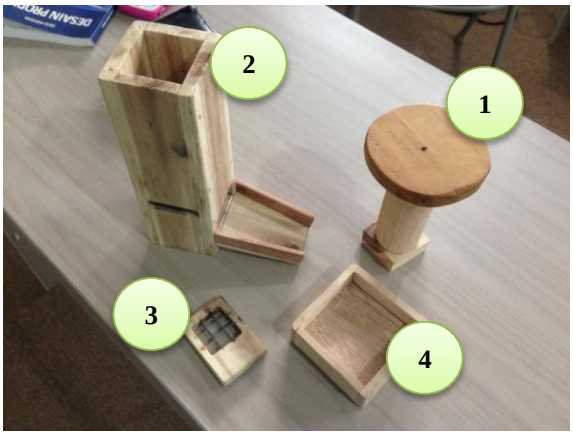


Figure 2. Product component of “Potty”

Figure 2 has showed that product has four components. They are:

1. The Potato Tray
2. The Cylinder that also consist of the place for potato slices
3. The Cutter
4. The Cantilever

The dimension of product are as stated in Table 1.

Table 1. Dimensions of "Potty"

Variable	Size (cm)
Length	6.5
Width	6.5
Height	22.5

2.2 Product Architecture

Product architecture is the assignment of functional elements on physical elements (building block) from product (Ulrich and Eppinger, 2012). Product architecture design essentially is the transformation of product function to the physical solution of the product (Stone, Wood, and Crawford). The goal is achieve define basic physical element from product that explains about what to do and what they look for entire product. Product architecture is scheme where functional elements of product divided to physical chunks and where chunk interact is. Product Architecture has implications for sustainable product development.

2.3 Product Development

Ulrich and Eppinger state that generic product development process can be done in stages as follows:

1. Planning.
2. Concept Development.
3. System Level Design.
4. Detal Design.
5. Testing and Refinement.
6. Production Ramp-Up.

The analysis of product architecture is established on early process i.e. start from the system level design.

3. RESEARCH METHODOLOGY

3.1. Conceptual Framework

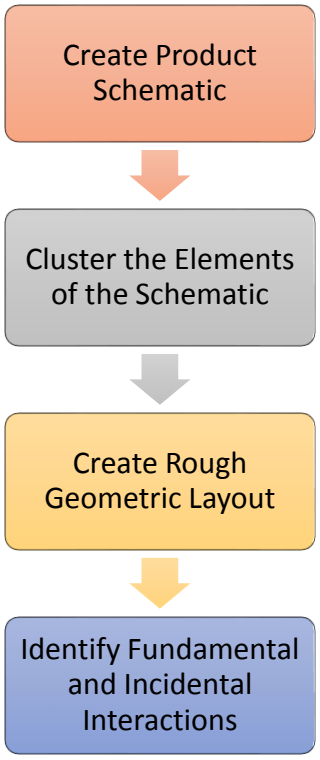


Figure 3. Conceptual Model

Ulrich and Eppinger (2012) offer four steps to establish a product architecture as shown in Figure 3. This approach will analyze the product based on its functional and physical elements.

3.2 Product Schematic

Schematic is a diagram that represent team's understanding of key elements of product. In late of developing concepts stage, some elements in scheme is physical concept. Some show critical component.

Elements are eliminated into physical concept and component typically become central of basic product concept which team has to generate and then select it. Elements that are not specifically be specified usually as an additional function. Product scheme should reflect the best team's understanding, but not include every detail from product's element. In preparing the scheme, it takes

maximum 30 elements or less in effort of manufacturing product architecture.

3.3 Clustering the Elements of the Schematic

There are factors that must be concerned in this stages (Ulrich and Eppinger):

1. The accuracy and integrity of geometry
2. Function classification
3. Vendor's ability.
4. Similarity of product's design and technology.
5. Localization of change.
6. Accommodate diversity.
7. Standardization Ability.
8. Portability of interfaces.

3.4 Geometric Layout

Geometric arrangement can be made by using 2D or 3D picture, computer modeling, and mock-up. Geometric arrangement makes researcher considering geometric interface possible to do and commercialize basic dimensional relationship between the numbers of 'chunk'.

3.5 Identification of Fundamental dan Incidental Interaction

Identification of fundamental interactions and incidental conducted to determine how the inter-chunk interact either by means of planned and unplanned. Fundamental interaction is a relationship between components or elements is an important relationship that the product can function correctly. Meanwhile, incidental interaction is the interaction or a matter arising from the physical implementation of the functional elements of a component that has been assembled to one another.

4. RESULTS AND DISCUSSION

4.1 Type of Architecture

Architecture product on product "Potty" is a modular architecture for each part in the "potty" allocated separately. In other words, chunks implemented in one or less of the overall functional elements. Interactions between chunks are well defined and is fundamental to the primary function of the product.

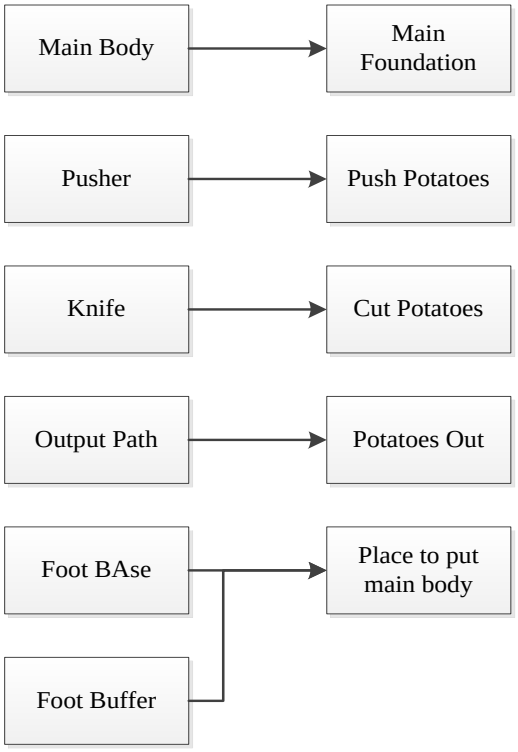


Figure 4. Modular Architecture of Existing "Potty" Product

4.2 Characteristics of Modular Architecture

Modularity on the product "Potty" is a type of slot modularity, because each chunk has a liaison between different types with each other. This causes each chunk cannot be exchanged.

4.3 Product schematic

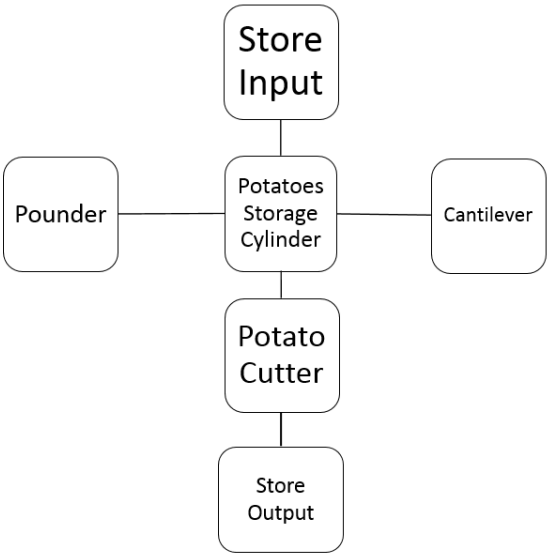


Figure 5. Product schematic 'Potty'

There are six chunks that explain the product function, they are Store Input, Potatoes Storage Cylinder, Cantilever, Pounder, Potato Cutter, and Storage Output.

4.4 Group of Product Scheme "Potty"

In this research, "Potty" is divided into several groups with a scheme based on several factors, including:

1. *Localization of Change*: potato cutter can be used as desired, resulting in several designs for cutting potatoes.
2. *Similarity Design*: Cylindrical storage potatoes with the support functions and manufacturing the same.
3. *Accommodate Diversity*: Potato cutter is designed to be modular to support the opportunity for the variation of cutting pattern.
4. *Portability of Interfaces:* At store input has the portability that is directly related to the user interface "Potty".

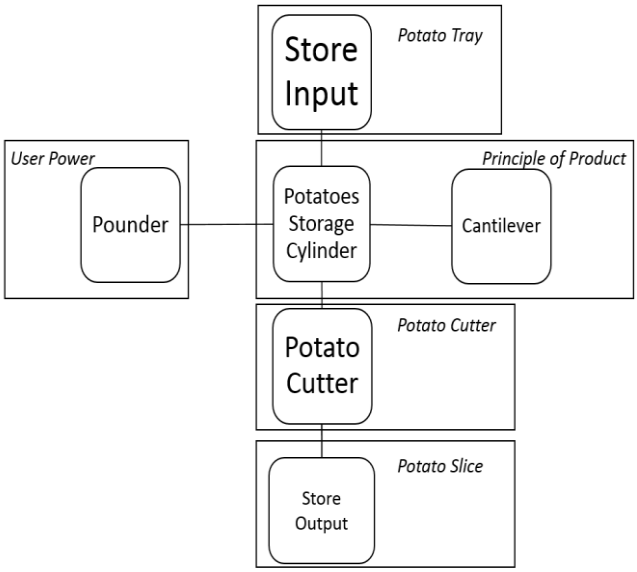
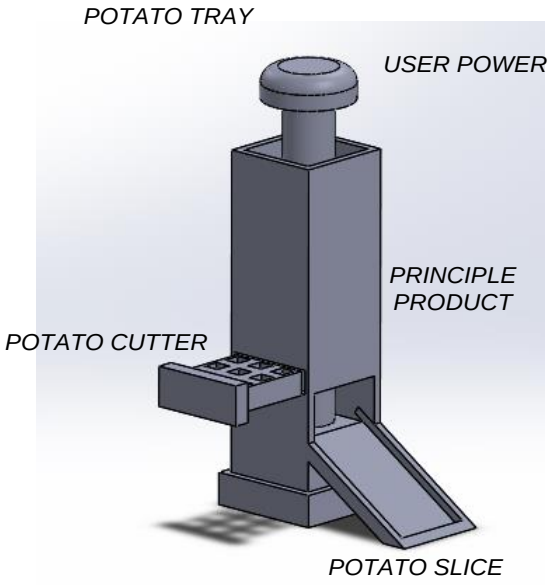


Figure 6. Group of Product Scheme "Potty"

4.5 *Geometric Layout*



Picture 7. Geometric Layout 'potty'

The product layout is arranged as in Picture 8.

4.6 Fundamental and incidental interactions

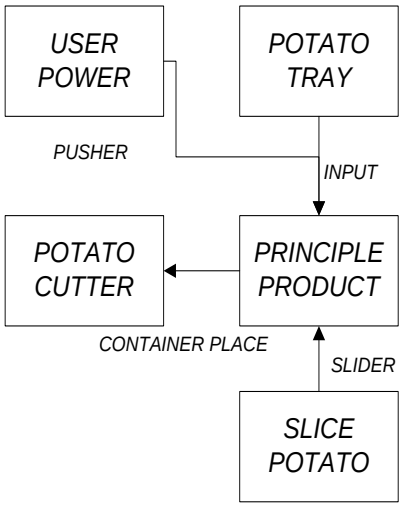


Figure 8. Fundamental and incidental interactions 'potty'

5. CONCLUSION

Process redesign is done in order to minimize the number of parts used without having to remove the function of the device is the main reference of the researchers. Cutlery potato "potty" is expected to be useful for daily lives.

Based on the result of architecture analysis, it is proposed to combine the cantilever and the principle product, so that it will become one chunk. The advantages and disadvantages of the re-design is as stated in table 2.

Table 2. Advantages and Disadvantages "Potty"

Advantages	Disadvantages
1. Minimize the number of parts to be used in the manufacture of these tools 2. Reduce the cost that will be incurred due to a reduction in parts or materials used in cutting tools 3. Improving the design tool Ptong be simpler and easier to use, especially in its use cutting tools to be lighter and easier to carry.	1. The joint of cantilever and principle product may use extra

The architecture of new design is more integral compared to previous design and the main advantage that can be obtained is the minimization of the part used.

6. REFERENCES

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