The Viability of Digital and Rapid Prototyping in Enhancing Ceramics Product Development

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ABSTRACT

This research practically investigates on how to reduce development time, development cost and also improve prototype quality in ceramic production. The researcher used an experimental approach, by first investigating and analysing the conventional method used by ceramics manufacturers in product development. This was achieved with several visits to three ceramic factories in Kelantan, Malaysia. After which a digital method was developed by introducing computer-aided design (CAD) into three stages in development process. In order to test the viability of the CAD introduced, the digital method was used to develop prototypes of ceramic products selected from the three ceramic factories. Finally, a comparison was done between conventional and digital method based on development time, development cost and prototype quality. This reveals that digital method can successfully reduce development time and improve prototype quality in ceramic product development process. However, the comparison also reveals that digital method is more expensive than the conventional method used by the factories in ceramic product development.

Keywords: Ceramics, Computer-Aided Design (CAD), Digital Prototyping, Prototype, Prototyping, Rapid Product Development

INTRODUCTION

According to 3D Vision Technologies (2008), physical prototyping can be a major bottleneck, slowing down the product development process and seriously constraining the number of design alternatives that can be examined. Gary Hawley, a designer in Denby Pottery Company said, “Despite the prodigious skills of the company’s carvers, some having more than 25 years experience; the process of physical prototyping was time consuming and never produced 100 percent accurate models”. As a result, it was hard for the clients to fully understand the concepts being proposed. Also, the fact that their prototypes take as long as four weeks to be created made them too careful about introducing new products (Gary, 2012).

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Many manufacturers easily accept that eliminating physical prototypes equates to shorter or shortened product development cycle time and also a competitive strategies for reducing development cycles and getting products to market faster. However, the reality is that many product development teams are still forced to include physical prototyping in the design loop to verify proper functionality, ease of assembly and also use it to create mould. Therefore, some manufacturers feel there are still valid reasons to keep physical prototypes in the design loops. So, while the use of physical prototypes is still a necessity for many product developers, replacing more and more physical prototyping and testing with digital methods and better coordination of physical test and measurement with digital modelling and simulation is seen as an approach that can save development costs while slashing months off product development schedules (3D Vision Technology, 2008).

Research from the Aberdeen Group shows that manufacturers that use Digital Prototyping build half of the number of physical prototypes as the average manufacturer, get to market 58 days faster than average, and experience 48 percent lower prototyping cost (Aberdeen Group, 2006). Instead of needing to build multiple physical prototypes and then testing them to see if they’ll work, companies can conduct testing digitally throughout the process by using Digital Prototyping to catch design problems up front, therefore manufacturers often can reduce the number of physical prototypes they need to create before a product can be manufactured, reducing the cost and time needed for physical prototyping (Aberdeen Group, 2006).

Therefore, this research practically investigates on how to reduce development time, development cost and also improve prototype quality in ceramic production. The researcher used an experimental approach, by first investigating and analysing the conventional method used by ceramics manufacturers in product development. This was achieved with several visits to three ceramic factories in Kelantan, Malaysia. After which a digital method was developed by introducing computer-aided design (CAD) into three stages in development process. In order to test the viability of the CAD introduced, the digital method was used to develop prototypes of ceramic products selected from the three ceramic factories. Finally, a comparison was done between conventional and digital method based on development time, development cost and prototype quality. This reveals that digital method can successfully reduce development time and improve prototype quality in ceramic product development process. However, the comparison also reveals that digital method is more expensive than the conventional method used by the factories in ceramic product development.

**PROTOTYPING**

Prototyping is a fundamental design initiation which involves the construction of working models of conceived products for mass production (Adelabu & Kashim, 2010). A prototype is the first or original example of product that has been or will be copied or developed; it is a model or preliminary version (Chua & Leong, 2003). According to Soegaard (2010), a prototype is often used as part of product design process to allow engineers and designers the ability to explore design alternatives, test theories and confirm performances prior to starting production of a new product. For example, some prototypes are used to confirm and verify consumer interest in a proposed design whereas other prototypes will attempt to verify the performance or suitability of a specific design. Prototypes are also used to revise design for the purpose of reducing cost through optimizations and refinement.

There are two main modes of prototyping; Visual/Virtual Prototyping and Physical Prototyping. Visual Prototyping is the process of simulating the appearance, colour, size or shape of the intended design visually while physical prototyping is the building of a real model. The application of CAD tools in the two modes of prototyping has results in digital and rapid prototyping. Digital prototyping helps
Transforming Culture to Stimulate Economic Development: Lessons from Singapore
www.igi-global.com/article/transforming-culture-to-stimulate-economic-development/163118?camid=4v1a

The Nodal Closet
www.igi-global.com/article/nodal-closet/60662?camid=4v1a