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**THE DEVELOPMENT OF AN ELECTRONICALLY OPERATED
WATER CONTROL SYSTEM INCORPORATING A MAJOR THEME OF
INCLUSIVE DESIGN**

By

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ABSTRACT

This case study followed the development of an electronically operated water control system, using a structured product development process and incorporating a major theme of inclusive design. Three project objectives were identified for this project:

1. Use the Product Development Process to successfully develop an electronically operated water control system to a stage that is near ready for manufacture.
2. To understand and implement an inclusive design approach to the development of an electronically operated water control system to ensure that the product is usable by people regardless of age or ability.
3. To understand to what effect design decisions, related to the usability of a product, have upon the desirability of the product to all users.

The product development process used in the development of this product was successful. It resulted in an innovative new product idea that has associated intellectual property, currently under patent application. The product was identified as both usable to people with a wide range of impairments and desirable to a majority of all potential users.

The research methodology relating to inclusive design resulted in the finding that some design decisions relating to the usability of products do in fact affect the desirability of the product to other potential users, and hence could potentially affect the financial success of the product. A set of activities were identified from the process used in this case study and recommended for further product development projects, which will help to ensure that the product is made more usable while still retaining its desirability.

KEYWORDS

Product Development Process, New Products, Inclusive Design, Consumer Based Design, Successful Products, Elderly and Disabled

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CHAPTER 1

INTRODUCTION

In the developed world, we live in a society, which is reliant on products to perform the everyday tasks of living. We need cars and bikes and trains and buses to get to work in order to make money to buy food, which we purchase using eftpos and credit cards. We need stoves and microwaves to cook our food, and knives, forks and plates to eat it. Every single minute of every day involves an interaction in some way with a man made product. These products, which we are so reliant upon, include the physical objects and the human activities, which go with them. Furthermore, products include the knowledge about how they work, how to repair them, design them and make them. This package, which encompasses a product, is often termed technology or innovation.

How technology has influenced our society and similarly how society has influenced technology has been the topic of many literary debates. Theories such as 'technological determinism' claim that change in technology is the most important cause of change in society. There are two fundamentals to this line of argument. The first is that technology is separate from society, and the second is that technological change causes social change. Authors such as MacKenzie and Wajcman (1985) have argued against these fundamentals convincingly showing that indeed society does influence technology and not the other way around. MacKenzie and Wajcman (1985) provides a very accurate portrayal of the relationship between the two "A new device merely opens doors, it does not compel one to enter".

Societal influences on technology include demographics, culture, economics, and politics. These influences are both local and global and are forever changing the direction technology is following. A specific societal trend, which will be investigated as a major theme in this research, is "inclusive or universal design". Inclusive design

relates specifically to the development of products and processes to be usable by people with the widest range of abilities possible.

There is a second major influence on technology in our present day, which enables society to have such a major effect on the path, which technology follows. This second influence comes from the corporations and companies producing new technologies and their need for return on investment. A product, which does not meet the requirements or needs of society, will fail to achieve an acceptable level of profit for the organisation or company involved. The factors which influence a positive return on investment include the uniqueness of the product, the investment provided by the company, and the total size of the markets into which it is being sold. As far as companies are concerned "profitability is the key, and the contribution that product generated income makes to this will be seen as the most important factor in assessing the worth of the product to the company," (Wright 1990).

Product development is the process whereby societies needs can be accommodated by the development of new technologies or improvement of existing technologies. It is defined as 'a set of activities beginning with the perception of a market opportunity and ending in the production, sale and delivery of a product.' (Ulrich and Eppinger 1995). The product development process is a decision making process which allows product developers and product development teams to consider and compromise between any number of factors which may influence the product outcome. These factors include things such as: the natural environment, product environment, development cost, development time, usability, safety and many more. It is the developer or individuals within development teams, who choose which factors to consider in these decisions; and obviously, in order to develop a successful product, the developers need to consider the factors which best reflect societies needs.

1.1 PROJECT INTRODUCTION

At the end of 2003 a market opportunity was recognized for the replacement of taps with an electronic alternative. Existing taps and faucets offered problems to people with certain special needs; in particular people with neuromuscular impairments, people with skeletal impairments, and people with sensory impairments such as loss

of sight and touch sensation. The introduction of ceramic disk technology and new lever systems has made life easier but problems still exist with the use of these products. A number of electronic versions of tap and faucets are already available but they restrict the users ability to control such things as water temperature and flow. A review of available technologies, which may be used for the purpose of controlling water, led to the belief that a product could be developed, which would allow for the electronic control of both water temperature and flow. As a result the following product concept was outlined.

Product Concept: An electronically operated water control system, which allows users to control both temperature and flow from a user interface. The system and corresponding interface is intended to be used by users with a wide range of abilities and needs. The unit can be installed on any sink, bath or shower both as new or retro fit, and irrespective of the hot water system used feeding the facility.

An in depth market analysis was undertaken and showed interest from a number of areas. As well as the special needs groups who would directly benefit from such a product, facilities such as retirement homes, hospitals, schools and prisons all registered a high interest in the product. There was also a very high interest shown by the domestic market on the premise that the product would be offered in a competitive price range with conventional products. This research led to the design development and testing of an initial prototype. The results proved that the product was technically and financially feasible, meaning that the idea could work and it could be produced for an amount of money consumers were prepared to pay. The project was then taken over by an industry sponsor.

The industry sponsor was not interested in manufacturing and selling this product. They wished to develop the product further, in order to increase its worth to companies who may be potentially interested in manufacturing it.

The product incorporates two major systems, the user interface is the first and the valve system is the second. The initial prototype offered a very primitive form of both and the company realised that in order to increase the products worth both these systems would have to be developed in far greater depth. The development of the two systems involves very different activities. The interface development is very

consumer orientated where as the valve development was very technically orientated.

1.1.1 Inclusive Design

As previously stated Inclusive design is a major social trend, which has begun to influence technology. The following passage about inclusive design was taken from a website dedicated to universal design www.udeducation.org. The passage is typical of the literature relating to inclusive design. (Bamforth and Brookes 2002; Bleamish 2003; Include 2004; RSA 2004)

“Inclusive Design is not a fad or a trend but an enduring design approach that originates from the belief that the broad range of human ability is ordinary, not special. Inclusive design accommodates people with disabilities, older people, children, and others who are non-average in a way that is not stigmatising and benefits all users. After all, stereo equipment labels that can be read by someone with low vision are easier for everyone to read; public telephones in noisy locations that have volume controls are easier for everyone to hear; and building entrances without stairs assist equally someone who moves furniture, pushes a baby stroller, or uses a wheelchair. Designing for a broad range of users from the beginning of the process can increase usability of an environment or product without significantly increasing its cost. It results in easier use for everyone and it reduces the need for design modifications later when abilities or circumstances change.”

The passage represents the social influence that is being brought into this project; a product that is usable by everybody. However the second influence, profitability, does not result from a product that is **usable by everybody**, it results from a product that is **usable by everybody and is desirable by everybody**. In other terms it could be said that the product needs to be *usable* and *desirable*.

1.2 THESIS FOCUS

This thesis will focus on the development of an electronically operated water control system giving a description of the development process and outcomes as a case

study. The development will result in a prototype product, which can be used for both demonstration purposes to potential buyers, and further consumer testing.

A major theme of inclusive design will also be explored. The tools techniques and its association with the product development process will be demonstrated in the development of this product.

1.3 AIM

To use the Product Development (PD) Process to develop an electronically operated water control system that is commercially successful and meets the needs of users with the widest range of abilities as possible.

1.4 OBJECTIVES

4. Use the Product Development Process to successfully develop an electronically operated water control system to a stage that is near ready for manufacture.
5. To understand and implement an inclusive design approach to the development of an electronically operated water control system to ensure that the product is usable by people regardless of age or ability.
6. To understand to what effect design decisions, related to the usability of a product, have upon the desirability of the product to all users.

1.5 OUTCOMES

- A working prototype of an electronically operated water control system that is usable and desirable by people with the widest range of abilities as possible. The prototype should be in a form that can be used to demonstrate the product to potential customers and manufacturers.

- A case study of an electronically operated water control system following the New Product Development Process used.
- A demonstration of the inclusive design principles, and how they were put into practice within this project.
- An investigation into the effect decisions relating to usability, have upon the overall desirability of this product.

1.6 THESIS OUTLINE

Chapter two provides a context for the case study and research through a review of the literature. It looks at the product development process and its relevance to this case study. It also reviews the secondary theme of inclusive design looking at its application to the development process. Also reviewed is any literature relating to the development of the technical components of this case study, the interface and valve system.

Chapter three describes the product development process used in this case study and outlines the methodologies which were used in the research portion of this thesis. Product development and inclusive design tools and techniques, which will be used, will also be outlined in this chapter.

Chapters four, five, and six present the case study. Chapter four focuses on the initial stages of the interface development process. Chapter five focuses on design conflicts raised in chapter four between usability and desirability of the interface. Chapter six presents the development of the valve system.

Chapter seven presents the conclusions of the case study relating to the product development process used and inclusive design.