



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

REDESIGN A BABY PUSHCHAIR THROUGH CONCURRENT ENGINEERING TOOLS

Thesis submitted in accordance with the requirements of the Universiti Teknikal
Malaysia Melaka for the Degree of Bachelor of Engineering (Honours)
Manufacturing (Design)

By

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APPROVAL

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ABSTRACT

Pushchair development was improved simultaneously by some of the company to produce a new design which fulfill customer requirement. Many techniques had been applied and one of the best techniques is Concurrent Engineering concept. A basic principle of Concurrent Engineering is that the design of the product must be integrated with the design of the processes. This paper described about redesign the pushchair by applied Concurrent Engineering method. Pushchair was selected as a case study for this project. This is because pushchair has a lot of part and it has potential to redesign using Concurrent Engineering method. The main objective of the project is to reduce the total number of pushchair parts by application of Concurrent Engineering methods. There are two (2) tools from Concurrent Engineering method that will be applied which is Quality Function Deployment (QFD) and Design for Assembly (DFA). The development process of this case study started with survey throughout distribution of questionnaires to get feedback from the respondent. Then, the QFD method will be applied based on the data from the survey. Next, the DFA process using the software called TeamSET will be applied to analyze which parts have to be eliminated. Finally, the final design will be shown through Solidwork simulation. The parts were recognized from the analysis and would be eliminated to reduce the total part and increased the design efficiency for the pushchair. Comparison result had developed between existing pushchair and redesign pushchair to determine the implementation of the Concurrent Engineering tools. Thus, the QFD used to analyse the customer requirement and DFA used to analyse and reduce the total part of pushchair. TeamSET software was used to application of the DFA. The design efficiency was increase for the redesign pushchair after done the DFA analysis.


ABSTRAK

Pembangunan kerusi tolak bayi dibangunkan secara berterusan oleh sesetengah syarikat dalam penghasilan rekabentuk produk baru yang memenuhi permintaan pelanggan. Pelbagai jenis teknik telah diadaptasikan dan salah satu teknik yg terbaik adalah melalui konsep Kejuruteraan Serentak (*Concurrent Engineering*). Prinsip asas Kejuruteraan Serentak adalah produk yg direkabentuk hendaklah bergabung dengan merekabentuk proses yang terlibat. Projek ini menyentuh tentang rekabentuk kerusi tolak bayi dengan menggunakan kaedah Kejuruteraan Serentak. Kerusi tolak bayi telah dipilih sebagai subjek utama dalam projek ini. Ini disebabkan produk ini mempunyai bahagian komponen yang banyak dan berpotensi untuk direkabentuk semula dengan menggunakan kaedah Kejuruteraan Serentak. Objektif utama projek ini adalah untuk mengurangkan jumlah komponen dengan menggunakan aplikasi *Concurrent Engineering*. Terdapat 2 (dua) teknik daripada kaedah Kejuruteraan Serentak yang digunakan iaitu *Quality Function Deployment (QFD)* dan *Design for Assembly (DFA)*. Proses membangunkan projek ini dimulakan dengan melakukan tinjauan yang disebarkan melalui soalan-soalan untuk mendapatkan maklum balas daripada responden. Seterusnya, kaedah *QFD* digunakan berdasarkan data daripada tinjauan yang dilakukan. Langkah seterusnya adalah melakukan proses *DFA* dengan menggunakan perisian yang dipanggil *TeamSET* untuk menganalisis bahagian komponen yang perlu disingkirkan. Akhirnya, rekabentuk akhir akan ditunjukkan melalui perisian *Solidwork*. Setiap komponen dikenalpasti melalui analisis yang dilakukan dan akan disingkirkan untuk mengurangkan jumlah komponen pada kerusi ini seterusnya akan meningkatkan *design efficiency* produk ini. Keputusan perbandingan akan dibuat di antara kerusi yang sedia ada dan yang telah direkabentuk semula untuk mengenalpasti hasil dari aplikasi Kejuruteraan Serentak. Oleh itu, *QFD* digunakan untuk menganalisa permintaan dari pengguna manakala *DFA* adalah untuk

menganalisa seterusnya mengurangkan jumlah komponen yang terdapat pada kerusi bayi ini. Perisian TeamSET digunakan dalam aplikasi DFA. *Design efficiency* bagi kerusi yang telah direkabentuk semula meningkat selepas analisis DFA dilakukan.

DECLARATION

Hereby, to declare the thesis entitled “Redesign A Baby Pushchair Through Concurrent Engineering” is the results of my own research except as cited in the reference.

Signature : 
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Date : 12 APRIL 2007

DEDICATION

Firstly thank to Allah S.W.T for the opportunity to finish this project. Special dedicated to my beloved family especially my father, En Hassan bin Ahmad and my mother Pn.

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TABLE OF CONTENTS

Abstract.....	i
Declaration.....	iv
Dedication.....	v
Acknowledgement.....	vi
Table of Contents.....	vii
List of Figures.....	x
List of Tables.....	xii
1.0 INTRODUCTION.....	1
1.1) Introduction.....	1
1.2) Problem Statement.....	2
1.3) Objective.....	2
1.4) Scope of study.....	3
2.0 LITERATURE REVIEW.....	4
2.1) Introduction.....	4
2.2) Pushchair Development.....	4
2.2.1 History of Pushchair.....	4
2.2.2 Existing Pushchair Design.....	5
2.3) Concurrent Engineering.....	8
2.3.1 Definition of Concurrent Engineering.....	8
2.3.2 Objective of Concurrent Engineering.....	9
2.3.3 Concurrent Engineering Fundamental.....	10
2.3.5 Concurrent Engineering Tools.....	11
2.3.5.1 Quality Function Deployment.....	11
2.3.5.2 Design for Assembly.....	13
2.3.5.1 TeamSET.....	20

3.0 METHODOLOGY.....	24
3.1) Method of study.....	24
4.0 SURVEY ANALYSIS AND QFD.....	27
4.1) Introduction.....	27
4.2) Survey.....	29
4.2.1) Pushchair Questionnaire.....	30
4.2.2) Questionnaire Result.....	30
4.3) Quality Function Deployment.....	34
4.3.1) Introduction.....	34
4.3.2) QFD Process.....	34
4.3.4) Final QFD Matrix.....	37
5.0 DESIGN FOR ASSEMBLY.....	40
5.1) Introduction.....	40
5.2) TeamSET Process Flow.....	41
5.3) Existing Product Analysis.....	47
i) Frame Component.....	48
ii) Holding Part Component.....	50
iii) Driving Part Component.....	52
iv) Supporting Part Component.....	54
5.4) Redesign Proposal and Analysis.....	56
i) Frame Subassembly.....	57
ii) Holding Subassembly.....	59
iii) Driving Subassembly.....	61
iv) Supporting Part.....	63

6.0 DISCUSSION.....	65
7.0 CONCLUSION.....	70
8.0 RECOMMENDATION.....	71
REFERENCES.....	73

APPENDICES

Appendix A

Appendix B

Appendix C

Appendix D

LIST OF FIGURE

FIGURE	SUBJECT	PAGE
1.0	: Wooden Pushchair c1880	5
2.0	: Twin Pushchair c1905	5
3.0	: All terrain	7
4.0	: Triple Pushchairs	8
5.0	: Pressed or molded parts (before and after)	15
6.0	: Building in self-fastening features	16
7.0	: Decrease ambiguity in part/subassembly orientation	16
8.0	: Graphical chart for DFA analysis	23
9.0	: Flow chart of Job Planning for the project	26
10.0	: The process flow of the QFD analysis	28
11.0	: Actual Pushchair	29
12.0	: Gender survey	31
13.0	: Difficulties when using pushchair	31
14.0	: Component of the QFD matrix	35
15.0	: Function of the QFD matrix	36
16.0	: The process flow to develop TeamSET database	41
17.0	: The actual existing pushchair	47
18.0	: Frame part component	48
19.0	: The Teamset analysis result for Frame subassembly	49
20.0	: Holding Part component	50
21.0	: Teamset analysis for holding subassembly	51
22.0	: Driving Part component	52
23.0	: Teamset analysis for driving subassembly	53
24.0	: Supporting Part component	54
25.0	: Teamset analysis for supporting subassembly	55
26.0	: Redesign proposal	56

27.0	:	Exploded drawing for frame	57
28.0	:	Component of frame part	57
29.0	:	Teamset analysis for frame subassembly	58
30.0	:	Exploded drawing for holding part	59
31.0	:	Component of holding part	59
32.0	:	Teamset analysis for holding subassembly	60
33.0	:	Exploded drawing for driving part	61
34.0	:	Component of driving part	61
35.0	:	Teamset analysis for driving subassembly	62
36.0	:	Exploded drawing for supporting part	63
37.0	:	Component of supporting part	63
38.0	:	Teamset analysis for supporting subassembly	64
39.0	:	The folding pushchair	68
40.0	:	Component for redesign pushchair	69
41.0	:	Recommendation for further study	71

LIST OF TABLE

TABLE	SUBJECT	PAGE
1.0	: Description of important scale	32
2.0	: Summary of Respondent requirement	33
3.0	: Simplified QFD	38
4.0	: The result of QFD analysis	39
5.0	: Summary analysis for Frame subassembly	49
6.0	: Summary analysis for holding subassembly	51
7.0	: Summary analysis for driving subassembly	53
8.0	: Summary analysis for supporting subassembly	55
9.0	: Summary analysis for frame subassembly	58
10.0	: Summary analysis for holding subassembly	60
11.0	: Summary analysis for driving subassembly	62
12.0	: Summary analysis for supporting subassembly	64
13.0	: Comparison of existing and redesign pushchair	67

CHAPTER 1

INTRODUCTION

1.1 Introduction

Nowadays the global marketplace is changing so rapidly that industrialist need to adopt new strategies to respond customer's requirement and to respond and satisfy market's needs more efficiently and quickly. Many companies especially in Japan, USA and Europe have already started to implement techniques and tools that would enable them to respond more quickly to consumer's demand in delivering high quality product at reasonable costs. The delay in time-to-market can be interpreted as a loss in profit [1].

Currently, the implementation of Concurrent Engineering (CE) tools are applied either manually or computer-aided. The objective of the project is to integrate some CE tools in analyzing a product to get the full benefit of the implementation. The advantages of the integration are to decrease the number of part design and indirectly to reduce cost and time. At the same time, it fulfills customer's requirement [2].

1.2 Problem Statement

In developing this project, there are several problems that need to be concerned and the most suitable method that can be used to solve the problems is by applying the CE tools.

In identifying of pushchair problems that arise in market nowadays, the most important aspects that needs to be concerned is the design of the wheelchair. Some of the pushchairs are being designed quite complicated with accessories and need to be eliminated, in the same time reduce the manufacturing cost and assembly time.

Beside that, there are several parts had been recognized that difficult to handle. The application of CE tools is highly expected in solving these problems to suit the customer requirements and convenient.

1.3 Objective

There are three (3) main objectives of the project: -

- i) To reduce the total number of pushchair parts.
- ii) To apply Concurrent Engineering tools such as: -
 - a) Quality Function Deployment
 - b) Design for Assembly.
- iii) To achieve the objective of Concurrent Engineering approach such as: -
 - a) To minimize the component of the product
 - b) To increase design efficiency

1.4 Scope of Study

1.4.1) Case study

A pushchair has been selected as a case study for this project. It is because the existing product has too many part and potential to redesign using the CE tools.

1.4.2) Design Tool

i) SolidWork

The tool selected for drawing the pushchair is SolidWork. In addition, in SolidWorks 3D models and 2D drawings communicate. Users can easily generate drawings from a model. And when a change in either a drawing or model occurs, all related drawings and models update automatically. Working in SolidWorks went very quickly and gave a lot of satisfaction. Photorealistic renderings and animations that allow communicating how future products will look and perform early in the development cycle

1.4.3) Quality Function Deployment (QFD)

QFD will be used to identify customer requirement. It will be done through a survey. The basic idea is to translate customer's requirement into the appropriate technical requirement for each stage of product development and production.

1.4.4) Design for Assembly (DFA) – TeamSET

DFA is a systematic methodology that reduces manufacturing costs by reducing the total number of individual parts in a product for ease of handling and insertion. For this project, the software called TeamSET is use to analyze the eliminating part.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

To develop this project, the product that had been selected is pushchair. The case study is to apply the Concurrent Engineering in pushchair development. There are several methods in Concurrent Engineering that are Quality Function Deployment (QFD) and Design for Assembly (DFA). The QFD is applied manually and the DFA application using software called TeamSET. This chapter described about the history of pushchair, the definition of concurrent engineering and the approach of QFD and DFA, including the application of the engineering software called TeamSET.

2.2 Pushchair Development

2.2.1 History of Pushchair

“Pushchair” was popular in UK between its invention and the early 1980’s, when a more compact design known as a ‘buggy’ became the trend, popularized

by the conveniently collapsible aluminium framed. Maclaren buggy designed and pattern by the British aeronautical designer Owen Maclaren in 1965. 'Buggy' is now the regular term used in the UK while in American English; 'buggy' more likely refers to a pram. Newer versions can be configured to carry in the forward-facing position. There are variety of twin pushchairs now manufactured, some designed for babies of a similar age (such as twins) and some for those with small age gap. Triple pushchairs are a fairly recent addition to the pushchairs has become a necessary. Most triple pushchair has a weight limit of 50kg and recommends use up to the age of 4 years [9].

2.2.2 Existing Pushchair Design

Several of existing pushchair model is used widely in the current market such as:-

a) Wooden Pushchair c1880

Pushchair in figure 1.0 came to market in a very poor state the upholstery had completely disintegrated, which made it difficult to reupholster. However despite the poor state of the wood then were amazed to find that it only needed a good clean with furniture restorer and very fine wire wool to lift the dirt off. It can be used in a sitting or lying position as the back drops down.



Figure 1.0: Wooden Pushchair c1880 [9]

b) Twin Pushchair c1905

Figure 2.0 shown the twin pushchair converts into a single by moving the backrest towards the handle end. It was restored before it came to market, unfortunately coloured varnish was used which is a shame.



Figure 2.0: Twin Pushchair c1905 [9]

c) All terrain

In figure 3.0, these are chunky looking pushchairs with large wheels that should cope with rough ground. Most are three-wheeled but there are four-wheelers too. Three-wheelers are popular with families who enjoy country walking or even jogging. They generally have a fully reclining seat so can be used from birth. There are a few double all terrain pushchairs and three-in-one and travel systems, with a lift-off carrycot or car seat. Most fold downwards and the wheels can be removed. Seat covers and a removable hood are included, sometimes with a rain cover.



Figure 3.0: All terrain [9]

d) Triple Pushchairs

Triple pushchairs as shown in figure 4.0 are a fairly recent addition to the pushchair family - but with the number of multiple births on the increase, triple pushchairs are a welcome addition to the range. Pushchairs for three children are available but brands are limited. All guidelines for standard

pushchairs apply but most triple buggies have a weight limit of 50kg and recommend use up to the age of 4 years.



Figure 4.0: Triple Pushchairs [9]

2.3 Concurrent Engineering

2.3.1 Definition of Concurrent Engineering

Concurrent engineering is a process in which appropriate disciplines are committed to work interactively to conceive, approve, develop, and implement product programs that meet pre-determined objectives.

This is the relatively recent term which is applied to the engineering design philosophy of cross-functional cooperation in order to create products which are better, cheaper and more quickly brought to market. This new trend reunites technical and non-technical disciplines such as engineering, marketing and accounting. Always focusing on satisfying the customer, these representatives work together in defining the product to be manufactured [3].

Concurrent engineering is the extent to which product and process designs are generated simultaneously in the stages of the product development process. Concurrent design reduces times and the use of cross-functional team can accelerate product development [10].

Many techniques involved in Concurrent Engineering such as Quality Function Deployment (QFD), Design for Assembly (DFA) and software known as TeamSET which is based on the customer requirement for product development.

2.3.2 Objective of Concurrent Engineering

The objective of Concurrent Engineering is to improve the interactive work of different disciplines affecting a product. The following are some of the objective:

a) Minimize the product life cycle

Eliminate the redesign procedure

b) Decrease production cost

Results from the minimization of the product life cycle

c) Maximize product quality

Spending more time and money initially in the design cycle and ensuring that optimize the concept selection. The company can increase the prospect of delivering a quality product to the customer.

d) Teamwork

Human Resources are working together for a common product