



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**THE DEVELOPMENT OF SLITTING SHEET METAL  
MACHINE FOR WIRE MESH USING TOTAL DESIGN  
APPROACH**

This document submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering (Design) (Hons.)

by

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**TAJUK: The development of slitting sheet metal machine for wire mesh using Total Design Approach**

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I hereby, declared this report entitled “The development of slitting sheet metal machine for wire mesh using Total Design Approach” is the results of my own research except as cited in references.

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## **APPROVAL**

This report is submitted to the Faculty of Manufacturing Engineering of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (Design) (Hons.). The member of the supervisory is as follow:

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## ABSTRAK

Menurut tajuk projek, objektif utama projek ini ialah bagaimana untuk melaksanakan keseluruhan pendekatan reka bentuk untuk menghasilkan produk. Selain itu, objektif juga menyatakan bahawa fabrikasi atau perkembangan mesin slit lembaran besi perlu dicapai menjelang akhir jadual projek. Dalam kajian ini, terdapat tiga pendekatan yang digunakan iaitu Pugh matriks, Kegagalan Mod Kesan Analisis (FMEA) dan Reka Bentuk untuk Perhimpunan Pembuatan (DFMA). Kaedah Pugh adalah satu proses reka bentuk untuk memilih konsep reka bentuk yang terbaik mengikut keperluan pelanggan. Di samping itu, proses reka bentuk mempunyai beberapa kaedah iaitu kaedah Pugh, Pahl dan model Beitz, Otto dan metodologi Wood, Ulrich dan Eppinger dan model Perancis. Analisis Unsur Terhingga (FEA) digunakan untuk mengumpul data hasil analisis. Data ini akan menunjukkan bahagian yang paling lemah yang perlu diperbaiki sama ada pada bahan atau reka bentuk. Bahan yang dipilih hendaklah memenuhi spesifikasi seperti daya tahan, menyerap getaran dan tekanan tinggi di bawah beban tekanan. Selepas itu, integrasi antara matriks Pugh dan Kegagalan Mod Kesan Analisis (FMEA) kaedah yang digunakan untuk meningkatkan reka bentuk pisau dan batang besi. Terdapat tiga reka bentuk konsep membincangkan dalam bahagian ini untuk pemilihan terakhir bilah pisau dan batang aci. Akhir sekali, pendekatan yang digunakan ialah reka bentuk bagi Perhimpunan Pembuatan. Dalam pendekatan ini, reka bentuk terkini daripada dua reka bentuk pendekatan yang merupakan kaedah matrik dan FMEA Pugh dianalisis dalam kaedah DFMA. Objektif menggunakan kaedah DFMA dalam kajian ini adalah untuk mengurangkan bahagian dan pembuatan kos. Keluaran projek itu dijangka akan diperlukan untuk memenuhi objektif yang ditetapkan. Hasilnya adalah fabrikasi penamat slit mesin lembaran logam untuk wire mesh. Selepas selesai proses fabrikasi, mesin itu dihantar ke TR Technology Sdn, Bhd bagi pekerja yang digunakan dalam talian produksi mereka. Di samping itu, hasil yang dijangka juga perlu memenuhi keperluan pelanggan dan mendapatkan kepuasan pelanggan. Ia akan menjadi jelas bahawa kaedah yang digunakan oleh penyelidik sesuai untuk menghasilkan produk.

## **ABSTRACT**

The main objective of this project is how to implement the total design approach to produce the product. Besides that, the objective also stated that the fabrication or developments of Slitting Sheet Metal Machine need to be achieved by the end of project schedule. In this study, there are three approaches used which is Pugh matrix, Failure Mode Effect Analysis (FMEA) and Design for Manufacturing Assembly (DFMA). Pugh method is a design process to select the best design concept according to customer requirement. In addition, the design process has several methods which is Pugh method, Pahl and Beitz' model, Otto and Wood methodology, Ulrich and Eppinger and French model. Finite Element Analysis (FEA) is used to collect the data of analysis result. This data will show the weakest part that needs to be improved either on the material or the design. Plus, the material chosen must consists of several specifications such as resistant to force, absorb the vibration and high pressure under stress load. After that, the integration between Pugh's matrix and Failure Mode Effect Analysis (FMEA) method is used to improve the designs of blade and shaft. There are three concept designs discussed in this section. The result from the approach is to select the best design of blade and shaft that is potential failure to the product. Lastly, the approach used is Design for Manufacturing Assembly. In this approach, the latest design from two designs approach which is Pugh's matrix and FMEA method is analyzed in DFMA method. The objective using DFMA method in this study is to reduce the part and manufacturing cost. The output of the project is expected to be required to meet the objectives set. The result is fabrication of slitting sheet metal machine for wire mesh and testing it to achieve the process of slits the wire mesh. After complete the fabrication process, the machine is sent to TR Technology Sdn, Bhd for the workers used in their productions line. In addition, the expected outcome should also meet the needs of customers and gain customer satisfaction. It will be evident that the methods used by researchers suitable for producing a product.

## **DEDICATION**

This report is dedicated to my parents, brothers and sisters for their endless love, support and encouragement. I also dedicate this work to my supervisor and friends who have supported me throughout the process. I will always appreciate all they have done. Thank you.

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I hope that this project report will fulfill the conditions as requested in Final Year Project in UTeM.

Thank You.



# TABLE OF CONTENTS

Abstrak	i
Abstract	ii
Dedication	iii
Acknowledgement	iv
Table of contents	v
List of Tables	xiii
List of Figures	xv
List of Abbreviations, Symbols and Nomenclatures	xviii

## CHAPTER 1: INTRODUCTION

1.1	Background of Project	1
1.2	Problem Statement	2
1.3	Objectives	3
1.4	Scope of project	3

## CHAPTER 2: LITERATURE REVIEW

2.1	Introduction	4
2.2	Design method	6
2.3	What is Total Design?	6
2.4	Advantage of apply Total Design	8
2.5	Type of Design Process	8
2.5.1	Pugh Matrix (PM)	9
2.5.1.1	Pugh's Model	9
2.5.2	Pahl and Beitz' model	11
2.5.3	Otto and Wood methodology	13
2.5.4	Ulrich and Eppinger Product Design Development	15
2.5.5	French's model	16

2.5.6	Comparison of Design method	18
2.6	Problem Solving Tool	19
2.8.1	Brainstorming	19
2.7	Finite Element Analysis (FEA)	19
2.7.1	Application of FEA and working principle	20
2.8	CES EduPack tools	20
2.9	Failure Mode and Effect Analysis (FMEA)	21
2.9.1	Type of FMEA	21
2.9.1.1	System FMEA	22
2.9.1.2	Design FMEA	22
2.9.1.3	Process FMEA	22
2.9.2	Element in FMEA	22
2.9.2.1	Severity (SEV)	22
2.9.2.2	Occurrence (OCC)	23
2.9.2.3	Detection (DET)	24
2.9.2.4	Risk Priority Number (RPN)	25
2.10	Designs for Manufacturing Assembly (DFMA)	25
2.10.1	Advantages of DFMA	26
2.10.2	Design for Manufacturing (DFM)	26
2.10.3	Design for Assembly (DFA)	26
2.10.4	Boothroyd-Dewhurst method	27
2.10.4.1	Guidelines for Manual Assembly	28
2.10.4.2	Part Handling	28
2.10.4.3	Insertion and Fastening	29
2.11	Slitting Machine	30
2.11.1	History of Slitting Machine	30
2.11.2	The function of Slitting Machine	31
2.12	Summary	32

## **CHAPTER 3: METHODOLOGY**

3.1	Introduction	33
3.2	Project planning	33
3.3	Project planning phase	35
3.3.1	Planning phase	35
3.3.1.1	Define the objective	35
3.3.1.2	Problem statement	35
3.3.1.3	Scope of project	36
3.3.1.4	Literature review	36
3.3.1.5	Methodology	36
3.4	Analysis Phase	36
3.3.2	Pugh's Method flow chart	36
3.3.2.1	Market identification	37
3.3.2.2	Product Design Specification (PDS)	37
3.3.2.3	Criteria selection	38
3.3.2.4	Concept selection	38
3.3.2.5	Select best conceptual design	39
3.3.2.5.1	3D modelling	39
3.3.2.5.2	Detail Design	39
3.3.2.5.3	Detail Drawing	39
3.3.2.5.4	Bill of Materials (BOM)	40
3.3.2.6	Analysis of product	40
3.3.2.7	Final Decision	40
3.3.3	Failure Mode Effect Analysis (FMEA) Flow Chart	41
3.3.3.1	Introduction to FMEA	41
3.3.3.1.1	Item Function	41
3.3.3.1.2	Potential Mode Failure	41
3.3.3.1.3	Potential Effect Failure	41
3.3.3.1.4	Potential Cause Failure	42
3.3.3.1.5	Recommended Action	42
3.3.3.1.6	Responsibility	42

3.3.3.1.7	Action Taken	42
3.3.3.2	Discussion on FMEA solution	42
3.3.3.3	How to apply FMEA method	43
3.3.3.4	FMEA result	43
3.3.4	Design For Manufacturing Assembly (DFMA) flow chart	43
3.3.4.1	Functional analysis	43
3.3.4.2	Manufacturing analysis	44
3.3.4.3	Handling analysis	44
3.3.4.4	Assembly Analysis	44
3.3.4.5	Optimized analysis	44
3.5	Result Phase	45
3.5.1	Results and Discussion	45
3.5.2	Fabrication of product	45
3.6	Preparation Report & Presentation	45
3.6.1	Preparation Report and Presentation Phase	45

## **CHAPTER 4: DEVELOPMENT OF SLITTING SHEET METAL MACHINE FOR WIRE MESH**

4.0	Introduction	46
4.1	Market identification	47
4.2	Conceptual design stage	47
4.3	Concept evaluation or integrated the method of process design	48
4.3.1	Pugh Matrix (Pugh's Method)	49
4.3.1.1	Proposed concept design of Slitting sheet metal machine	49
4.3.1.1.1	Datum Design	49
4.3.1.1.2	Product description of concept design A	50
4.3.1.1.3	Product description of concept design B	51
4.3.1.1.4	Product description of concept design C	52
4.3.1.2	Method of controlled convergence (Pugh's Method)	53
4.3.2	Integration of Pugh's Method and Failure Mode Effect and Analysis (FMEA)	56

4.3.2.1	Failure Mode Effect and Analysis (FMEA)	56
4.3.2.1.1	Suitability of design (Ergonomic Design)	57
4.3.2.1.2	Manufacturing consideration (Assembly operation)	57
4.3.2.2	Recommended Action and RPN	59
4.3.2.2.1	Risk Priority Numbers (RPN)	59
4.3.2.3	Product Design Specification (PDS) for FMEA designs	59
4.3.2.4	Improvement of part design	60
4.3.2.5	Determine new RPN value	61
4.3.3	Design for Manufacturing Assembly (DFMA)	63
4.3.3.1	Proposed original design of Slitting sheet metal machine	63
4.3.3.1.1	Product description for original design	63
4.3.3.1.2	Product structure and part quantity for original design	65
4.3.3.1.3	Bill of materials for original design	69
4.3.3.1.4	Part functions and critics for original design	70
4.3.3.1.5	Design for Manufacturing (DFM) analysis for original design	73
4.3.3.1.6	Design for Assembly (DFA) analysis for original design	75
4.3.3.2	Proposed redesign of Slitting sheet metal machine	76
4.3.3.2.1	Part eliminations from proposed design	76
4.3.3.2.2	Product description for proposed design	77
4.3.3.2.3	Product structure and part quantity for proposed design	79
4.3.3.2.4	Bill of materials for proposed design	84
4.3.3.2.5	Part functions and critic for proposed design	85
4.3.3.2.6	Design for Manufacturing (DFM) analysis for proposed design	88
4.3.3.2.7	Design for Assembly (DFA) Analysis for proposed design	89

4.4	Concept development	91
4.5	Final design	93
4.6	Fabrication process	94
	4.6.1 Flowchart of process fabrication	94
	4.6.2 Fabrication process for Slitting sheet metal machine	95
4.7	Summary	103

## **CHAPTER 5: RESULT AND DISCUSSION**

5.1	Introduction	104
5.2	Results	104
	5.2.1 Pugh's method result	104
	5.2.1.1 Analysis on design concept C (DC-C)	105
	5.2.1.2 Material selection for selection part	106
	5.2.1.3 Finite Element Analysis (FEA) by using SolidWorks Simulation	107
	5.2.1.3.1 Load and Fixtures	107
	5.2.1.3.2 Resultant Force	108
	5.2.1.3.3 Stress	108
	5.2.1.3.4 Resultant Displacement	109
	5.2.1.3.5 Strain	110
	5.2.1.4 Result of Pugh's selection method	111
	5.2.2 Failure Mode Effect Analysis (FMEA) Result	111
	5.2.2.1 Result of FMEA for blade and shaft	111
	5.2.2.2 Severity per Failure Mode (SEV)	112
	5.2.2.3 Occurrence per Failure Mode (OCC)	113
	5.2.2.4 Detection per Failure Mode (DET)	114
	5.2.2.5 Risk Priority Numbers (RPN)	114
	5.2.2.5.1 Reduction percentage	115
	5.2.3 Design for Manufacturing Assembly (DFMA) result	117
	5.2.3.1 Result for original design of Slitting sheet metal machine	117
	5.2.3.1.1 Suggestion for redesign of original design	117

5.2.3.2	Result for redesign of Slitting Sheet Metal Machine	120
5.2.3.3	Results comparison between original and redesigned	121
5.3	Discussion	122
5.3.1	The comparison between design concepts in Pugh's method Approach	123
5.3.2	Finite Element Analysis (FEA) for top layer (shaft and blade)	123
5.3.3	Failure Mode Effect Analysis (FMEA) design concept selection	124
5.3.4	Improvement of redesign concept in Design for Manufacturing Assembly (DFMA) method	124
5.3.5	The comparison between existing slitting machine and redesign slitting machine.	125

## **CHAPTER 6: CONCLUSION AND RECOMMENDATION**

6.1	Conclusion	126
6.2	Recommendation	127
6.2.1	Improvement on design concept	127
6.2.2	Potential on geometry interface part to be linked with the DFMA software	127
6.2.3	Potential improvement of the fabrication product	128

<b>REFERENCES</b>	129
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<b>APPENDIX A PSM 1 Gantt Chart</b>	134
<b>APPENDIX B PSM II Gantt Chart</b>	135
<b>APPENDIX C FMEA team TR Technology Sdn Bhd</b>	136
<b>APPENDIX D 2D drawing for design concept of slitting sheet metal machine</b>	137
<b>APPENDIX E Manual handling table</b>	150
<b>APPENDIX F Manual insertion table</b>	151

<b>APPENDIX G</b>	<b>Material and process selection table</b>	152
<b>APPENDIX H</b>	<b>DFMA software report for original concept design of Slitting sheet metal machine</b>	153
<b>APPENDIX I</b>	<b>DFMA software report for improved concept design of Slitting sheet metal machine</b>	168
<b>APPENDIX J</b>	<b>DFMA software report for comparison of original and improved design</b>	181
<b>APPENDIX L</b>	<b>Workstation at TR technology Sdn.Bhd</b>	186



## LIST OF TABLES

2.1	Comparison of Design Method	18
2.2	Scale of Severity for Design FMEA	23
2.3	Scale of Occurrence for Design FMEA	23
2.4	Scale of Detection for Design FMEA	24
4.1	Improved parts from concept design A	51
4.2	Improved parts from concept design B	52
4.3	Evaluation chart for conceptual slitting sheet metal machine for wire mesh	55
4.4	Result of selection design	56
4.5	Design FMEA for Slitting Sheet Metal Machine	58
4.6	Prediction of Product Design Specification for the design concept	61
4.7	Recalculate the RPN of Design FMEA for Slitting sheet metal machine	62
4.8	Bill of materials for the original design	69
4.9	Part functions and description of each part for original design	70
4.10	Materials and process of each part in original design	73
4.11	Assembly difficulties and suggestion of redesign part	76
4.12	Improved part from original design	76
4.13	Bill of materials for the improved design	84
4.14	Part functions and description of each part for improved design	85
4.15	Materials and process of each part in improve design	88
4.16	Assembly difficulties for redesign part	90
4.17	Flow of process fabrication	95
5.0	Results of selection design	104
5.1	Properties of Stainless Steel	106
5.2	Reaction forces	108

5.3	Reaction moments	108
5.4	Von mises stress	109
5.5	Resultant displacement	110
5.6	Maximum and minimum equivalent strain	110
5.7	Failure analysis result for shaft	112
5.8	Failure analysis result for blade	112
5.9	Reduction percentage RPN for shaft	116
5.10	Reduction percentage RPN for blade	116
5.11	Result from DFMA software for original design	117
5.12	Incorporate integral fastening elements into functional parts	118
5.13	Suggestion to combine or eliminated the components	118
5.14	Suggestion to add the assembly features	119
5.15	Suggestion to redesign the assembly parts to allow the adequate access	119
5.16	Suggestion to eliminate the need for grasping tools	120
5.17	Suggestion to eliminate or reduce handling difficulties	120
5.18	Ergonomic difficulties for the assembly workers	120
5.19	Result from DFMA software for redesign	121
5.20	Percentage improvement for result of DFMA	122
5.21	Comparisons between existing and redesign of slitting machine	125

## LIST OF FIGURES

1.1	Conventional cutting method	2
2.1	Comparisons of Perspectives of the Academic Communities in Marketing, Organizations, Engineering Design, and Operations Management	5
2.2	Product development general process	5
2.3	Design core	7
2.4	Pugh model of the design process	10
2.5	Pahl and Beitz's design model	12
2.6	Reverse engineering and redesign methodology	14
2.7	Ulrich and Eppinger's Design Methodology	15
2.8	Graphical representation of Product Design and Development	16
2.9	The design process of French model	17
2.10	Time to deliver comparison between DFMA+CE and the Traditional Methods	26
2.11	Geometrical features affect part handling	28
2.12	Features that affect part handling	29
2.13	Incorrect geometry allow part to jam	29
2.14	Provision of air-relief to improve insertion	29
2.15	The first paper slitting machine	30
2.16	Examples of slitting machine in manufacturing industry	31
3.1	Project Planning Phase	34
4.1	Datum design	49
4.2	Concept design A	50
4.3	Concept design B	52
4.4	Concept design C	53

4.5	Concept design 1 of assemble blade and shaft	60
4.6	Concept design 2 of assemble blade and shaft	60
4.7	Concept design 3 of assemble blade and shaft	61
4.8	Concept design of slitting sheet metal machine and view of subassembly	64
4.9	Exploded view of subassembly	64
4.10	Product structure of original design	66
4.11	Full assemble of concept design of slitting sheet metal machine	67
4.12	Framework of concept design of slitting sheet metal machine	67
4.13	Top layer of concept design of slitting sheet metal machine	67
4.14	Front Side of concept design of slitting sheet metal machine	68
4.15	Back Side of concept design of slitting sheet metal machine	68
4.16	Left Side of concept design of slitting sheet metal machine	68
4.17	Right Side of concept design of slitting sheet metal machine	69
4.18	Top Side of concept design of slitting sheet metal machine	69
4.19	Designs for manufacturing window of conceptual design	74
4.20	DFA Windows for original design of slitting sheet metal machine	74
4.21	DFA analysis on framework of original design	75
4.22	Improved design of slitting sheet metal machine and view of subassembly	78
4.23	Exploded view of subassembly	78
4.24	Product structure of improved design	80
4.25	Full assemble of new improved design of slitting sheet metal machine	81
4.26	Framework of new improved design of slitting sheet metal machine	81
4.27	Top layer of new improved design of slitting sheet metal machine	81
4.28	Front Side of concept design of slitting sheet metal machine	82
4.29	Back Side of concept design of slitting sheet metal machine	82
4.30	Left side of concept design of slitting sheet metal machine	82
4.31	Right Side of concept design of slitting sheet metal machine	83
4.32	Top Side of concept design of slitting sheet metal machine	83
4.33	Designs for manufacturing window of improved design	89
4.34	DFA windows for improve design of slitting sheet metal machine	89
4.35	DFA analysis on framework of improve design	90

4.36	Development of slitting sheet metal machine for wire mesh	92
4.37	Final design of slitting sheet metal machine for wire mesh	93
4.38	Process flow of fabrication process for slitting sheet metal machine	94
5.1	Evaluation of design concept C (shaft and blade)	105
5.2	Ashby's chart of Fracture toughness versus Yield strength	106
5.3	Fixture position for assemble part	107
5.4	Load applied at the assemble part	107
5.5	Von mises stress on shaft and blade	109
5.6	Resultant displacement on shaft and blade	109
5.7	Equivalent strain on shaft and blade	110
5.8	Result analysis of blade and shaft	111
5.9	Comparison of severity for shaft	112
5.10	Comparison of severity for blade	113
5.11	Comparison of occurrence for shaft	113
5.12	Comparison of occurrence for blade	113
5.13	Comparison of detection for shaft	114
5.14	Comparison of detection for shaft	114
5.15	Comparison of RPN for shaft	115
5.16	Comparison of RPN for blade	115
5.17	Equivalent problem having RPN = 360	116
5.18	Breakdown of cost product for improved design	121
5.19	Comparison chart of breakdown of cost per product	122

## LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

UTeM	=	Universiti Teknikal Malaysia Melaka
2D	=	Two Dimensional
3D	=	Three Dimensional
PDP	=	Product development process
PDS	=	Product Design Specification
PM	=	Pugh Matrix
CPS	=	Creative Problem Solving
FEA	=	Finite Element Analysis
CAD	=	Computer Aided Drawing Design
FEM	=	Finite Element Method
BOM	=	Bill of Materials
FMEA	=	Failure Mode Effect Analysis
SEV	=	Severity
OCC	=	Occurrence
DET	=	Detection
RPN	=	Risk Priority Number
DFMA	=	Design for Manufacture Assembly
DFM	=	Design for Manufacturing
DFA	=	Design for Assembly
CE	=	Concurrent Engineering
AEM	=	Assemblability Evaluation Method

# **CHAPTER 1**

## **INTRODUCTION**

This chapter discusses the background of the project, problem statement, objective and scope of the project.

### **1.1 Background of Project**

This project is industry project with concerned of collaboration between UTeM committee and TR Technology to solves a problem that occurs in a factory. TR Technology Sdn. Bhd. is located at Seksyen 16, Shah Alam, Selangor. This factory runs a business based on the process of stamping and cutting. Among the activities run in this factory is the process of cutting wire mesh sheet metal. According to their problem, they are still using old-fashioned scissors wire for cutting process of wire mesh. By using this conventional method, it has had wasted the time and cost, the workers' energy, productivity and the output of the product. To solve of the factory problems, the researcher used a framework of different approach which is Pugh matrix in Design Process method, Failure Mode Effect Analysis (FMEA) and Design for Manufacture Assembly (DFMA).

Using this approach, the design of slitting sheet metal machine for wire mesh will be through several steps before achieve the final design. In Pugh Matrix, there are three concept designs that used datum design as reference to select the best design. After that, FMEA is used to determine the potential failure of part in selected part of concept design. Lastly, DFMA approach is used to reduce the number of part, manufacturing cost and improve the design.

## 1.2 Problem Statement

TR Techonology Sdn. Bhd is the company of stamping machine industry, which also produces an automotive part. In industry we call as this factory as vendor company. This means that the vendor monitors the buyer's inventory and makes periodic resupply decisions regarding order quantities, shipping, and timing (Matt et al., 2001). At the TR Technology Sdn. Bhd, the wire mesh sheets metal cutting process is still done by using the conventional method which is using metal scissor cutter. After trough cutting process, this part will be process to produce a mold for filter casting in car engine. Figure 1.1 shows the worker at the company stills using metal scissor cutter to cut the wire mesh.



Figure 1.1: Conventional cutting method

To overcome the problem in TR Technology Sdn. Bhd. Their manager has asked UTeM committee to assist in development of slitting sheet metal machine for wire mesh. This product will reduce the lead time and increase the productivity. The problem is to design the slitting machine that has not yet available in industry. It also must meet with customer requirement. There also other problem occurs in this factory which is:-

- i. Ineffective cost production and strategies to increase the productivity.
- ii. Need to be competitive in market with further concerted effort.
- iii. The target level in their production did not achieve as production level.