# Production process flow optimisation at Euro-Plastifoam (Pty) Ltd

by

Ignatius Zietsman 26038562

Final Project Report Submitted in Partial Fulfillment of the Requirements for the Degree

of

#### **BACHELORS IN INDUSTRIAL ENGINEERING**

in the

FACULTY OF ENGINEERING, BUILT ENVIRONMENT AND INFORMATION TECHNOLOGY

**UNIVERSITY OF PRETORIA** 

October 2011

#### **Executive Summary**

Euro-Plastifoam is one of the companies working on the T6 Project for the 2011 model Ford Ranger truck. The company was chosen to be the national supplier of over fifty different plastic injection moulded trim components for the Ford Ranger, including components for the instrument panel, turret console and door panel. The projected demand is about five hundred of each component daily, resulting in the normal daily production demand of the injection moulding facility being tripled.

To facilitate such a large increase in total production, it is of utmost importance to ensure all waste in the production system is eliminated, and the production process flow is improved to an optimum level.

Various methods, tools and techniques will be identified and applied in order to improve, and ultimately optimise, the production process flow at Euro-Plastifoam. Work measurement will be performed, followed by value stream analysis as well as the application of problem identification methods. This again, will be followed by layout analysis and improvement. Other proposed solutions include the introduction of a Kanban system, 5S Housekeeping and Single Minute Exchange of Dies (SMED).

### **Table of Contents**

	Page
Chapter 1: Introduction	1
1.1 Company Background	1
1.2 Problem Definition	2
1.3 Project Aim	2
1.4 Project Scope	2
1.5 Project Objectives and Deliverables	3
1.6 Project Overview	3
Chapter 2: Literature Review	4
2.1 Lean Manufacturing	4
2.2 Value Stream Mapping	5
2.3 Just-In-Time (JIT)	9
2.4 Single Minute Exchange of Die (SMED)	9
2.5 The Concept of Kanban	10
2.6 5S House Keeping	10
2.7 Supply Chain Management	12
2.8 Facilities Planning	12
2.9 Discrete Event Simulation	13
2.10 Work Measurement	14
2.11 Problem Identification Methods	15
2.11.1 Fishbone Diagram	15
2.11.2 Critical Analysis Technique	15
2.11.3 Pareto Chart	16
2.12 Layout Analysis Techniques	17

2.12.1	Flow Diagram	17
2.12.2	Travel Chart	17
2.12.3	Flow Process Chart	18
2.12.4	Spaghetti Diagram	18
Chapter 3:	Selection of Appropriate Methods, Tools and Techniques	20
3.1 Selec	eted methods, tools and techniques	20
3.2 Metho	odology	21
Chapter 4:	Development of Supplementary Methods, Tools and Techniques	22
•	Data Collection	25
	mining the production process flow	25
5.2 Work	Measurement	31
5.3 Efficie	ency measurement in the injection moulding plant	34
Chapter 6:	Data Analysis	35
6.1 Analy	rsis of the plant layout and process flow	35
6.1.1	Receiving of raw material	35
6.1.2		27
	Moving of delivered material to raw material store	37
6.1.3	Moving of delivered material to raw material store	37
6.1.4	Before production begins	37

6.2 Analy	sis of the injection moulding efficiency data	44
6.2.1	Pareto Analysis	45
6.2.2	Bar Graph and Pie Chart	45
6.2.3	Fishbone Diagram	46
Chapter 7:	Design and Problem Solving	48
7.1 Solut	ion Identification	48
7.1.1	Ordering of Raw Material	48
7.1.2	Layout Improvements	49
7.1.3	Improvement of the process flow	51
7.1.4	Training and Appointment of new personnel	51
7.1.5	Material Handling Equipment	52
7.1.6	Introduction of a Kanban System	52
7.1.7	Introduction of SMED	52
7.1.8	Introduction of 5S House keeping	53
7.2 Sele	ction of the best solutions	54
7.3 Solu	tion Implementation	56
7.4 Solu	tion Validation	56
Chapter 8:	Recommendations	64
Conclusion	n	65
References	5	66

Appendices		69
Appendix A:	Process Efficiency Data capturing spread she	69

## **List of Figures**

		Page
List of Figu	ures	9-
Figure 1:	Standard Value Stream Mapping notation	8
Figure 2:	Example of a 5S Scoring Results Radar Chart	11
Figure 3:	Example of a 5S Scoring Results Bar Chart	12
Figure 4:	Example of a From-To Chart	18
Figure 5:	Methodology	21
Figure 6:	Efficiency Recording Sheet	24
Figure 7:	Plant Layout	27
Figure 8:	Process Flow Chart – Top Finisher Manual LHD 2x4	28
Figure 9:	Current State Value Stream Map	33
Figure 10:	Satellite View	36
Figure 11:	Flow Diagram	38
Figure 12:	From-To Chart	39
Figure 13:	Relationship Diagram	40
Figure 14:	Spaghetti Diagram	41
Figure 15:	Flow Process Chart	43
Figure 16:	Pareto Analysis	45
Figure 17:	Bar Graph	46
Figure 18:	Pie Chart	46
Figure 19:	Fishbone Diagram	47
Figure 20:	Satellite photo depicting the proposed layout improvements	49
Figure 21:	Proposed Plant Layout	50
Figure 22:	Future State Value Stream Map	58
Figure 23:	Future State From-To Chart	59

Figure 24:	Future State Flow Diagram	61
Figure 25:	Future State Spaghetti Diagram	62
Figure 26:	Injection Moulding Efficiency spread sheet – 1 April 2011	69

#### **List of Tables**

		Page
List of Tabl	es	
Table 1:	Critical Analysis Technique	16
Table 2:	Definition of possible areas of waste	22
Table 3:	Production information for Top Finisher Manual LHD 2x4	26
Table 4:	Process Description	29
Table 5:	Current State Information	32
Table 6:	Summarised results from injection moulding efficiency study	44
Table 7:	Critical Analysis Technique	55
Table 8:	Future State Information	57
Table 9:	Summarised results from injection moulding efficiency study	63