Table of Contents

Acknowledgement..... ii

Abstract..... iii

Table of Contents..... v

Table of Figures..... viii

Introduction..... 1

1.0 The Manufacturing Sector..... 1

1.1 Overview of Manufacturing Production Process..... 2

1.2 Motivation..... 5

1.3 Problem Statement..... 6

1.4 Research Objectives..... 7

1.5 Summary of Proposal..... 9

1.6 General Strategy of Research..... 10

1.7 Outcome..... 12

1.8 Methodology of Research..... 12

1.9 Chapters Organisation..... 13

Literature Review..... 14

2.0 Production Planning Methods..... 14

2.1 The Manufacturing Process..... 15

2.1.1 Components in Manufacturing..... 16

2.1.2 Manufacturing Resource Planning MRP II..... 17

2.1.3 Production Planning Domain..... 22

2.2 Research Survey and Analysis..... 24

2.2.1 Motorola Incorporated and Motorola, Kuala Lumpur (KLM)..... 24

2.2.1.1 KLM Setup of Functions..... 26

2.2.1.2 Background to Research Survey..... 26

2.2.1.3 Survey Approach..... 27

2.2.1.4 Survey Results and Analysis..... 30

2.2.1.5 Conclusion..... 36

2.2.2 Research Analysis on Semiconductor Product Plant (Siemens/Infineon). 37
2.2.2.1 Company's Background..... 38
2.2.2.2 Operating Procedure..... 39
2.2.3 A Comparison of Workflows..... 40
2.2.4 Conclusion of Initial Research Activities..... 45
2.3 Existing Research Prototypes and Techniques..... 46
2.3.1 Reuse Techniques for Customisation..... 51
System Architectural View and Analysis..... 53
3.0 Architectural View..... 53
3.1 Object-Oriented (OO) Software Engineering Process..... 54
3.2 Object-Oriented Development Life Cycle..... 55
3.3 System Development Activities..... 57
3.4 Requirements Model Through Use Case Model..... 59
3.5 Analysis Model..... 63
3.5.1 Plan Production Use Case..... 65
3.5.2 Customisation Through Variation Points..... 66
3.5.3 Check Capacity Use Case..... 69
3.5.4 Schedule Production Use Case..... 70
Architectural and Detail Design..... 72
4.0 Design Model..... 72
4.1 System Architecture..... 72
4.1.1 Production Planning Application System..... 76
4.1.2 Capacity Planning Application System..... 79
4.1.3 Production Scheduling Application System..... 81
4.1.4 Sequence Diagrams..... 82
4.1.5 Customisable Components..... 88
4.2 Storage Management for Production Planning..... 91
4.2.1 Entity-Relationship Diagram..... 92
4.2.2 Storage Management Structure..... 94
4.2.3 Security Access Login..... 94
4.3 Summary..... 95

Implementation..... 97
5.0 Implementation Model..... 97
5.1 Application and Component Systems 97
5.2 Customisation..... 99
5.2.1 Production Environment..... 100
5.2.2 Inventory and Forecast..... 101
5.3 Data Storage Implementation..... 104
5.3.1 Login Access..... 105
5.4 Test Procedures..... 108
Evaluation and Conclusion..... 111
6.0 Evaluation..... 111
6.1 Strength of Research..... 113
6.2 Limitations..... 114
6.3 Future Enhancements..... 115
6.4 Concluding Remarks..... 116
References..... 118

Appendix A : Survey Questionnaire conducted at Motorola SemiConductor Products, Petaling Jaya..... i

Appendix B : Main Interface of Customised Production Planning Tool..... ii

Appendix C : The Contents of the Readme.txt file..... iii

Appendix D : The Contents of the Production Planning Help file / Guidelines..... iv

Table of Figures

Figure 1.1 : An overview of manufacturing planning / MRP II of a plant..... 4

Figure 2.1 : The Manufacturing Resource Planning - MRP II..... 19

Figure 2.2 : Categories of Motorola Semiconductor staff involved in the survey..... 28

Figure 2.3 : Graph showing number of users (from 40 samples) using the respective systems in production..... 29

Figure 2.4 : Graph showing percentage of staff using the respective systems in production..... 30

Figure 2.5 : Pie chart showing suggestions to overcome delayed orders..... 32

Figure 2.6 : Rating of current planning system..... 34

Figure 2.7 : Production Planning and Control for Infineon Technologies..... 41

Figure 2.8 : Production Planning and Control for Motorola KLM..... 43

Figure 3.1 : A Layered Architecture of Application and Component Systems..... 54

Figure 3.2 : Overview of the Production Planning Development Cycle [OMG. 1992a]. 57

Figure 3.3 : Summary of the Development Activities..... 58

Figure 3.4 : Use Case Diagram for Production Planning Tool..... 60

Figure 3.5 : Components of a Production Plan..... 62

Figure 3.6 : Three different kinds of analysis types (BCE)..... 64

Figure 3.7 : A collaboration diagram to trace the Plan Production Use Case Model.... 66

Figure 3.8 : A collaboration diagram to trace the Plan Production Environment Use Case Model..... 67

Figure 3.9 : A collaboration diagram to trace the Plan Production Use Case Model with Variation Points..... 68

Figure 3.10 : A collaboration diagram to trace the Check Capacity use case model..... 69

Figure 3.11 : A collaboration diagram to trace the Schedule Production use case model.. 71

Figure 4.1 : Layered Architecture of the Customisable Production Planning System.... 73

Figure 4.2 : Layered Architecture of the Capacity Planning System..... 76

Figure 4.3 : Component Systems of the Production Planning Application System..... 77

Figure 4.4 : BCE diagram for Demand, Product, Delivery and Plan Detail Management Component Systems..... 78

Figure 4.5 : Component Systems of the Capacity Planning Application System..... 79

Figure 4.6 : BCE diagram for Resource, Check Capacity and Year-To-Date (YTD) Management Component Systems..... 80

Figure 4.7 : Component Systems of the Production Scheduling Application System... 81

Figure 4.8 : BCE diagram for Product and Production Week Management Component Systems..... 82

Figure 4.9 : A sequence diagram describes how the objects perform the plan production use case..... 84

Figure 4.10 : A sequence diagram describes how the objects perform the capacity planning use case..... 86

Figure 4.11 : A sequence diagram describes how the objects perform the schedule production use case..... 88

Figure 4.12 : Customised Component System for Production Environment..... 89

Figure 4.13 : Customised Component System for Inventory and Forecast..... 90

Figure 4.12 : The E-R Diagram for Production Planning..... 93

Figure 5.1 : Main Screen of the Customisable Production Planning Tool..... 99

Figure 5.2 : Customisable Production Environment..... 101

Figure 5.3 : Customisation of Inventory..... 102

Figure 5.4 : Customisation of Forecast..... 103

Figure 5.5 : The Total Year-To-Date Production Values..... 104

Figure 5.6 : Login Window..... 105

Figure 5.7 : Permission for Use to Different Users..... 108