# LOW VOLUME HIGH MIX MANUFACTURING SCHEDULING SYSYTEM WITH ODOO ERP OPEN SOFTWARE

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# Low Volume High Mix Manufacturing Scheduling System with Odoo ERP Open Software

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**Bachelor of Manufacturing Engineering Technology with Honours**

**2021**

# LOW VOLUME HIGH MIX MANUFACTURING SCHEDULING SYSTEM WITH ODOO ERP OPEN SOFTWARE

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**A thesis submitted**
**in fulfilment of the requirements for the degree of**
**Bachelor of Manufacturing Engineering Technology with Honours**

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**2021**

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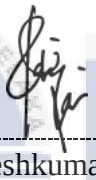
| Signature | : |  |
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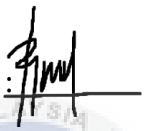
Signature : 

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**DEDICATION**

**For my beloved parents:**

Aplasamy/L Nokal

Lalitha A/P Subrayan

**For my respected PSM supervisor**

Ts. Dr. Rohana Binti Abdullah

**For my project advisor**

Dr. Bong Cheng Siong, Micro Nano Precision Sdn Bhd

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**And my treasured friends**

Project team members

UTeM's students

## ABSTRACT

This report addresses the issue of low volume high mix manufacturing scheduling faced by many production companies. Many businesses are attempting to increase profits by using competitive advantages such as cost reduction, speedy delivery, and distinctive high-quality items. Many companies utilise effective production-scheduling procedures to achieve these competitive advantages. Because the qualities of both parts and processes are continually changing, implementing scheduling strategies in high-mix low-volume (HMLV) manufacturing businesses, especially in Industry 4.0 environments, remains a challenge. Therefore, this project was carried out in Micro-Nano Precision Sdn. Bhd (MNPSB), a HMLV precision tool manufacturing company located at Ayer Keroh, Melaka. The company's issue is the production scheduling interruptions due to priorities changes, customer new requests, due date changes and equipment breakdowns causing the company to miss the committed customer delivery dates. The objectives were set to study the open-source software available in the market for the high mix low volume manufacturing scheduling in order to develop a suitable scheduling system the identified open-source software and test this software using the company's data. The Odoo open-source ERP software was chosen to aid MNPSB in boosting their business processes and technology. After studying the business process and obtaining the to-be business process, According to the conclusions of the study, the Odoo ERP system is appropriate for manufacturing industry business processes. Odoo is a versatile ERP software for business management for industry revolution 4.0.



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## ABSTRAK

Laporan ini menangani isu penjadualan pembuatan campuran tinggi volum rendah yang dihadapi oleh banyak syarikat pengeluaran. Banyak perniagaan cuba meningkatkan keuntungan dengan menggunakan kelebihan daya saing seperti pengurangan kos, penghantaran cepat dan item berkualiti tinggi yang tersendiri. Banyak syarikat menggunakan prosedur penjadualan pengeluaran yang berkesan untuk mencapai kelebihan daya saing ini. Oleh kerana kualiti kedua-dua bahagian dan proses sentiasa berubah, melaksanakan strategi penjadualan dalam perniagaan pembuatan campuran tinggi volum rendah (HMLV), terutamanya dalam persekitaran Industri 4.0, kekal sebagai cabaran. Oleh itu, projek ini telah dijalankan di Micro-Nano Precision Sdn. Bhd (MNPSB), sebuah syarikat pembuatan alat ketepatan HMLV yang terletak di Ayer Keroh, Melaka. Isu syarikat ialah gangguan penjadualan pengeluaran akibat perubahan keutamaan, permintaan baharu pelanggan, perubahan tarikh tamat dan kerosakan peralatan menyebabkan syarikat terlepas tarikh penghantaran pelanggan yang komited. Objektif ditetapkan untuk mengkaji perisian sumber terbuka yang tersedia di pasaran untuk penjadualan pembuatan volum rendah campuran tinggi untuk membangunkan sistem penjadualan yang sesuai perisian sumber terbuka yang dikenal pasti dan menguji perisian ini menggunakan data syarikat. Perisian ERP sumber terbuka Odoo telah dipilih untuk membantu MNPSB dalam meningkatkan proses dan teknologi perniagaan mereka. Selepas mengkaji proses perniagaan dan mendapatkan proses perniagaan yang akan datang, Menurut kesimpulan kajian, sistem ERP Odoo sesuai untuk proses perniagaan industri pembuatan. Odoo ialah perisian ERP serba boleh untuk pengurusan perniagaan untuk revolusi industri 4.0.

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Finally, I hope this report will benefit the readers.

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## LIST OF SYMBOLS AND ABBREVIATIONS

| | | |
|---|---|---|
| HMLV | - | High-Mix Low-Volume |
| ERP | - | Enterprise Resource Planning |
| CAPS | - | Cloud-Based Advanced Planning And Scheduling |
| MNPSB | - | Micro-Nano Precision Sdn. Bhd |
| QC | - | Quality Control |
| CNC | - | Computer Numerical Control |
| Odoo | - | On Demand Open Object |
| FYP | - | Final Year Project |
| MRP | - | Material Requirement Planning |
| CPS | - | Cyber-Physical System |
| MPC | - | Manufacturing Planning And Control |
| IIoT | - | Industrial Internet Of Things |
| SMEs | - | Small And Medium-Sized Manufacturing Enterprises |
| APS | - | Advanced Planning And Scheduling |
| SAP | - | Systems Applications And Products |
| OSI | - | Open -source Initiative |
| OSS | - | Open -source Software |
| FSF | - | Free Software Foundation |
| CSS | - | Cascading Style Sheets |
| POS | - | Invoicing, Point Of Sale |
| SDLC | - | Software Development Life Cycle |
| CRM | - | Customer Relationship Management |
| MTTR | - | Mean Time To Repair |
| MTBF | - | Mean Time Between Failure |
| MO | - | Manufacturing Order |
| MPS | - | Master Poroduction Schedule |
| OEE | - | Overall Equipment Effectiveness |

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# CHAPTER 1

# INTRODUCTION

## 1.1 Background

The manufacturing industry has recently been under a lot of stress as a result of the COVID-19 pandemic. To contain the infection, numerous factories were shut down on a large scale, and transportation links were disrupted. On the positive side, the pandemic has re-ignited interest in the advantages of Industry 4.0 and cloud manufacturing. Specifically, companies with a high mix, low volume demand that requires solution that allows demands, in different quantities, in response to orders placed at irregular intervals and in variable amounts each time.

Many high-mix low-volume (HMLV) firms are attempting to increase profits by using competitive advantages such as cost reduction, speedy delivery, and distinctive high-quality items. These companies utilise effective production-scheduling procedures to achieve these competitive advantages. Because the qualities of both components and processes are continually changing, implementing scheduling strategies in HMLV manufacturing businesses, especially in Industry 4.0 contexts, remains a difficulty. A new sophisticated and effective real-time production-scheduling decision-support system model was created in response to these issues in HMLV Industry 4.0 manufacturing (Kocsi et al., 2020).

The practise of allocating manufacturing resources over time to the set of manufacturing operations in the process plan is known as production scheduling. It calculates the best time to perform each operation, taking into consideration the temporal linkages between production processes as well as the capacity constraints of shared production resources. The assignments also have an impact on the optimality of a schedule in terms of cost, tardiness, and throughput (Svancara & Kralova, 2012).

In the revolution industry 4.0, cloud manufacturing is a new idea that refers to running manufacturing-related software in cloud infrastructure, or virtual factories in a larger sense. In this digital manufacturing environment, a cloud-based production scheduling system is introduced, which integrates inventory, sales, procurement, and shop-floor management into one programme. Enterprise resource planning (ERP) systems are commonly utilised nowadays to construct a cloud-based advanced planning and scheduling (CAPS) system (Liu et al., 2019).

ERP solutions boost efficiency and production. Because an ERP system connects data and operations across many departments and locations, it enables a firm to move items faster, process orders faster, maintain complete cost control, and have complete visibility (Arsovski et al., 2009). In making improvement by ERP solution, there was may open source software that will make perfect solution in production scheduling problem nowadays.

In a summary, under the umbrella of Industry 4.0 technologies, Digital Manufacturing is responsible for integrating technologies and information across the product life cycle. The upgrade of industry standard, the use software to make changes in collect scheduling data to improve the production in high mix low volume manufacturing industry.

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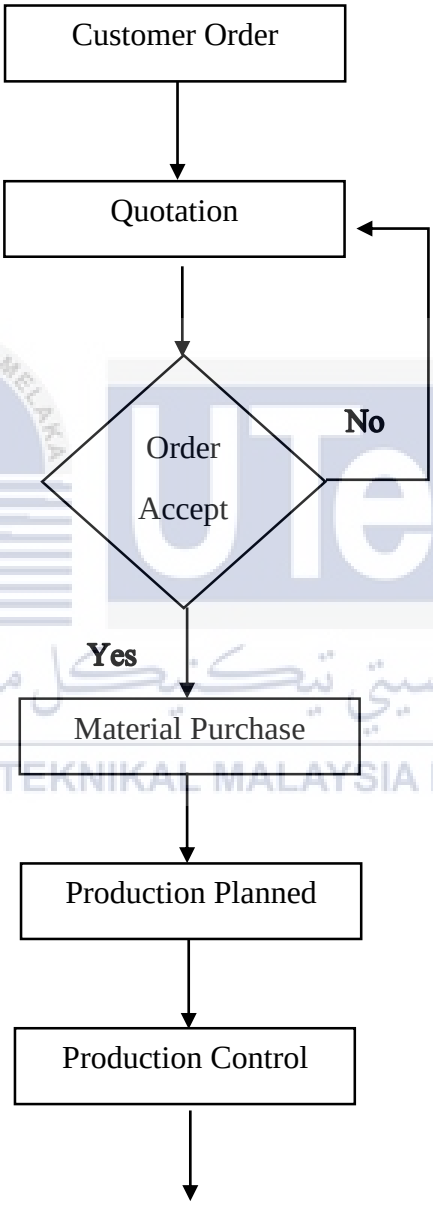
## 1.2 Problem Statement

This project is carried out in Micro-Nano Precision Sdn. Bhd (MNPSB), a tool fabrication company at Ayer Keroh, Melaka. MNPSB fabricates products designed by the customers. The company manufacturing equipment include the trimming and moulding, cavities bar, precision punching and devices, decommissioning tools, die sets, plastics industry core, automotive components and machining items, cavity injection moulding, jigs, and fixtures. All the fabricated products with the design from customers have different processes. Figure 1.1 shows the production flow which begins with the product drawing by customer and receipt through e-mail. The materials procurement and distribution criteria are based on the process required and will determine the price quote for the final product. The decision making focused on the ability of the machine system and the company's supply capacities. The purchasing of materials as approved and the product begins to be fabricated through its own process requirement. During manufacture, the product quality is monitored internally after each process. The responsible person must monitor the product in time

and in good quality for the product to be completed. Then, the completed product must proceed through the QC department and the defected part has to be reprocessed or disposed of depending on the product condition. The final and good quality products are properly labelled and packed before being sent to customers.

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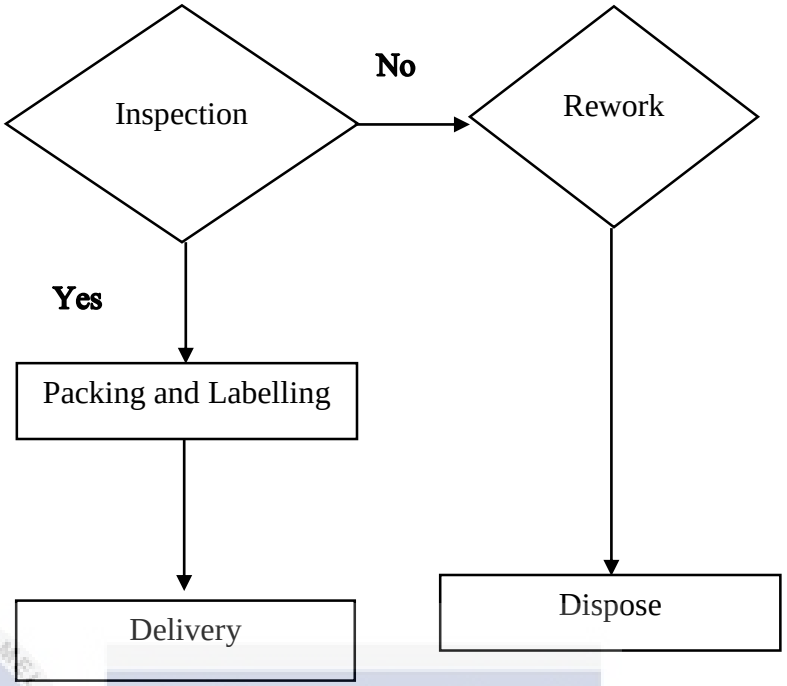


**Figure 1.1 General Production Flow**

Each drawing has varying quantities of tools and each of the products to be manufactured and generated by different processes in conventional machines or automated machines for each consumer. The machines used in the manufacturing of instruments such as wire cut, electrical discharge machining, CNC milling, turn milling, CNC grinding, jig grind, super drill and CNC grinding.

Based on the observation and discussion with MNPSB's management, MNPSB has an issue with the production delivery to the customer. The problems were identified due to the inability to decide when and how often capacity changes and to communicate with the key centre of work and every single resources. In addition, the processing of customer order sequence or the priority rules in the production line is not properly organized by the managers and responsible personnel. By not properly following the priority rule of the products often leads to the not being able to meet the customer due dates for some products. For example, the reworking of rejected products and reprioritizing highly urgent orders also interrupted the current order processing.

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Besides that, two kinds of MNPSB inspections are internal inspections of procedures and QC inspections. The rejection of machine problem and human error operating the machine have different rates for each process. The program rejection takes place when programmer writes a faulty programme, leading to a defect on the product on the automated machine. The rejection at the assembly process occurred with an improper equipment set-up causing scratches on the product.

Quality management and inspection is also a concern found in MNPSB when inspection fails to comply with criteria, fitness of purpose, degree of preference, measure of promise requirement and degree of excellence, and all these items are regulated to meet specifications and expectations. The quality issue occurs due to the inspection is not in line with the specifications, fitness of intent, degree of preference, measure of promise requirement and degree of excellence including control of all of these items to meet the requirement and standards. This issue escalated especially when there are a surge in customer demand and also because of the lack of inspection tool at QC. Thus, plenty of the rejected product requires reworks causing high manufacturing time lost, which resulted in the company failing to meet customer due dates.

In summary, the major issue with the company is the order processing and prioritising. Therefore, the study aims to investigate a suitable open-source scheduling system to help the company with the order processing issue and improve the customer delivery time.

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## 1.3 Project Objectives

The objectives of this study is set as the following:

a) Study the existing open source software in high mix low volume manufacturing.
b) Develop a scheduling system for MNPSB using the suitable open-source scheduling software.
c) Validate the scheduling software using the high mix low volume manufacturing data.

## 1.4 Scope of Work

This research is carried out in Micro-Nano Precision Sdn. Bhd (MNPSB). This focuses mainly on studying the open-source scheduling software in HMLV manufacturing system. The software selected to be used in this study is the Odoo ERP open-source software. The evaluation criteria used were the number of orders, warehouse analysis report, stock on hand, average completion time, cost analysis report, and master production Schedule (MPS), work centre panning Ghats chart and overall equipment effectiveness (OEE). The study and analysis were conducted on the current target company production to determine a suitable scheduling technique to solve meeting the customer dateline issue. The suggestion to improve the production scheduling were also provided in this study. The conclusion and recommendation were discussed in the last chapter.

## 1.5 Final Year Report Framework

This final year project has been split into two parts; Final Year Project (FYP) 1 and 2. The five main chapters of this report is structured as follows. Chapter 1 describes the overall conduct of the study such as the project background, problem statement, objectives, and scope of work, final year report framework and the summary of this project. This chapter also includes the background of the company where the case study was conducted and the problem of company were investigated to define the aims of the final year project.

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Chapter 2 includes the literature reviews to gain better knowledge on the HMLV manufacturing system, the scheduling concepts and the various open-source scheduling tools available in the market. Thus, this section covers the basic concepts of production planning, the definition of scheduling, and several methods of advanced planning and scheduling, the open-source software. Several case studies done using the open-source scheduling system were also summarized in this chapter. These information were important because these studies from the previous researchers can be used as a reference to guide the implementation of a similar open-source scheduling tool in this study.