IMPROVING THE INVENTORY MANAGEMENT IN A SMALL AND MEDIUM ENTERPRISE (SME): A CASE STUDY IN A PRINTING FIRM IN MALAYSIA

By:

EUNICE WONG SIAW CHUI

(Matrix no: 120788)

Supervisor:

Dr. Amir Yazid Ali

June 2017

This final year project report is submitted to
Universiti Sains Malaysia
As partial fulfilment of the requirement to graduate with honors degrees in
BACHELOR OF ENGINEERING (MANUFACTURING ENGINEERING WITH MANAGEMENT)

School of Mechanical Engineering
Engineering Campus
Universiti Sains Malaysia

DECLARATION

This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.

Signed …… (EUNICE WONG SIAW CHUI)

Date ……

STATEMENT 1

This final year project report is the result of my own investigations, except where otherwise stated.
Other sources are acknowledged by giving explicit references.
Bibliography/references are appended.

Signed …… (EUNICE WONG SIAW CHUI)

Date ……

STATEMENT 2

I hereby give consent for my report, if accepted, to be available for photocopying and for interlibrary loan, and for the title and summary to be made available outside organizations.

Signed …… (EUNICE WONG SIAW CHUI)

Date ……

ACKNOWLEDGEMENT

First and foremost, I would like to extend my sincere appreciation to my supervisor, Dr. Amir Yazid Ali for his patience, guidance and the precious time he spared to supervise me until the completion of this report. His encouragement and feedback motivate me to keep on improving and making my project presentable. All his advice and suggestions are acknowledged with profound gratitude.

Besides, I would like to thank Dr. Ikhwan for coordinating mechanical final year students with passion and commitment. He always make sure that we, as final year students, understand the format on writing papers and journals, ensuring that we are able to complete our final year project before the deadline, according to the guidelines given.

It gives me an immense pleasure to be able to conduct my project in a printing company located in Miri, Sarawak. Without the help of the company's manager, employees working in office and operators working in production floor, I won't be able to collect all the data and information needed to complete my project successfully.

Lastly, I would like to extend my greatest gratitude to my course mates and friends for their tremendous support and willingness to share their ideas with me, leading me to complete this project on time. Moreover, they have been very helpful to me in the midst of doing this project.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABSTRAK

Kini, pengurusan aset yang berkesan memainkan peranan penting untuk memastikan kejayaan bagi organisasi-organisasi dalam persekitaran perniagaan baru. Oleh itu, pengurusan aset merupakan salah satu penentu yang penting untuk mencapai daya saing dan prestasi operasi bagi korporat atau perusahaan kecil dan medium. Kajian ini membantu untuk mengetahui cara-cara atau kaedah yang digunakan oleh satu korporat percetakan kecil yang bertempat di Miri, Sarawak untuk mengurus aset. Selain itu, kajian ini membuat analisis terhadap masalah yang dihadapi dalam pengurusan aset. Dengan ini, penyelesaian yang sesuai boleh dicadangkan bagi membantu mereka untuk mengetahui cara pengurusan aset dengan lebih baik.

Dari segi apa yang didapati, kajian ini mendedahkan korporat percetakan menghadapi masalah mempunyai stok lebihan dan kadang-kala stok tidak mencukupi. Oleh itu, satu pendekatan tradisi, iaitu analisis ABC adalah dicadang untuk mengelaskan aset-aset ke dalam kumpulan yang berbeza. Dengan ini, korporat akan dapat mengawal pelbagai aset yang berbeza dengan berkesan. Selepas itu, dasar pengawalan aset yang berlainan boleh diaplikasikan terhadap kumpulan masing-masing. Pengurusan visual di gudang dan system label juga boleh diwujudkan bagi setiap aset untuk menyelesaikan masalah stok lebihan atau stok tidak mencukupi.

Di samping itu, ketidak keberkesanan cara mengawal rekod aset dan pembelian aset di korporat percetakan X juga diperiksa. Berdasarkan apa yang didapati, kajian ini menyiasati faktor yang menyebabkan ketidakcekapan dalam pengurusan aset. Oleh yang demikian, satu sistem data aset telah diwujudkan untuk meningkatkan ketepatan rekod data dan kecekapan dalam organisasi. Akhir sekali, manfaat yang boleh dicapai dengan melaksanakan cadangan-cadangan yang diberi untuk korporat percetakan X turut dibincangkan dalam kajian ini.

Kata kunci: pengurusan aset, analisis ABC, pengurusan visual, kecekapan, sistem data aset

ABSTRACT

Today, effective inventory management plays an important role in the success of the organizations in new business environment. Inventory management can therefore be one of the crucial determinants of competitiveness as well as operational performance of small and medium enterprises (SMEs) in inventory intensive manufacturing industries. This study sought to determine the inventory management methods or practices used by a small and medium printing enterprise, located in Miri, Sarawak and to analyze the problems faced in managing inventory, thereby providing suitable recommendations to improve the current inventory management practices.

In terms of findings, the study revealed that the printing firm faces the problem of having stocks piling up and understock sometimes. Hence, a traditional approach used to classify inventory into different groups, which is the well-known ABC analysis is proposed to have an efficient control of a variety of inventory items in printing company X. Different inventory control policies can then be applied to different groups. Visual management in warehouse and coding label system are established for inventory items prior to the issue as well.

Besides, the inefficient methods to manage the inventory record and procurement of inventory in printing company X are examined. On the basis of the findings, this study investigated the cause of poor inventory management method in the printing firm, and thereby an inventory database system is established in order to improve inventory record accuracy and organization's efficiency within the firm. In addition, the benefits that will be brought by implementing the proposed solutions in the printing firm are discussed well in this study.

Keywords: inventory management, ABC analysis, visual management, efficiency, inventory database

CHAPTER 1

INTRODUCTION

1.1 Overview

Living in the age of informed consumer creating a business climate of increasing competition, gives an implication that all companies, including small and medium enterprises (SMEs) need to be as efficient as possible at every level, and this includes inventory management. For that reason, the key goal of inventory management is to have sufficient quantity of high quality inventory available to meet customer demands, while at the same time maintaining the cost of holding inventory at its minimum [1]. Inventory management is the activities to manage the quantity and quality of all stocks and that covers the quantity management of stocks, meeting the demands of customers, lead time of inventory replenishment, type of stocks, control of inventory cost, the length of plan and so on [2].

Inventory management has always been a prevalent topic as it is important in enhancing the proper operations of any industries. The excess or shortage of inventory in all levels of supply chain can affect the availability of products or services to customers. Effective management of inventory is essential in any business particularly for SMEs which have limited financial, informational and human resources. Furthermore, inventory forms a substantial part of SMEs current assets and often provide good quality products at lower prices [3]. On the other hand, ineffective management of inventory can lead to the dilemma of capacity underutilization and even profit loss.

It is prominent that the performance of SMEs based on the competition, productivity and efficiency will play a vital role in the development of any countries. On top of that, as perceived by other literatures, the use of formal inventory management practices is one of the ways to achieve competitiveness among other enterprises, by effectively controlling and minimizing inventory investment [4]. Even though it is known theoretically that the inventory management plays a critical responsibility for the survival of an enterprise, there are still SMEs which do not drive it into practice.

The dynamic role of small and medium enterprises (SMEs) in developing as well as developed countries have been identified as the means though which rapid industrialization and other development goals of these countries can be accomplished. Nevertheless, until now many SMEs are still facing failures or low profitability due to their poor management of inventory. For that reason, there is a need to conduct an investigation into the inventory management of SMEs, particularly a printing firm in this study in order to gain an insight into this state of affairs.

Each industry approach mass customization differently, where mass customization is used as a competitive advantage. In printing industry, it is about manufacturing products that meet the types, dimensions and colors of selected customer groups, by letting the customers to choose their design and pattern of their printing products. However, inventory management becomes difficult to handle when the industry employs make-to-order (MTO) production approach, in which the variety of products is large and all the products are highly customized.

Besides, modern inventory management software systems like MRP, ERP and SAP offer a complete inventory management to most of the industries, but despite the rapid development of these systems, little research can be found in evaluating the extent to which these systems can help SMEs to leap towards another level of inventory management effectiveness. For this reason, the choice of inventory management software application should be made according to the suitability and applicability of the organization.

The main objective of this study is to provide recommendations for better inventory management of a small and medium enterprise (SME) printing firm, located in Miri, Sarawak. This study intends to develop a set of guidelines that can guide the other small or medium printing industries to better manage their inventory through simple practices that are applicable, while still meeting customer service requirements.

1.2 Project Background

As a small and medium enterprise (SME), Company X is a printing company which produces paper-related products such as wedding cards, invitation cards, brochures, vouchers, menus, flyers, booklets, calendars and other products. Basically, the raw materials of Company X that falls under control and management include papers, cards, printing plates and printing inks.

It is a mass customized industry where all the paper products are highly customized in which the paper's materials, colors, sizes and designs are dependent on customers. In other words, customers want specialized and personalized products. The designers of Company X will have to design according to customer requirements. Otherwise, customers can design on their own and printing Company X will have to print the product according to the dimensions and colors as requested by customers. Other than that, Company X applies make-to-order (MTO) approach, where the production of an item begins only after a confirm customer order is received, as shown in Figure 1.1 below. Hence, there is no forecast on products which are made to an order from a customer. On top of that, the key performance measures for make-to-order (MTO) production are lead time, orders completion on time and final product's quality measures.

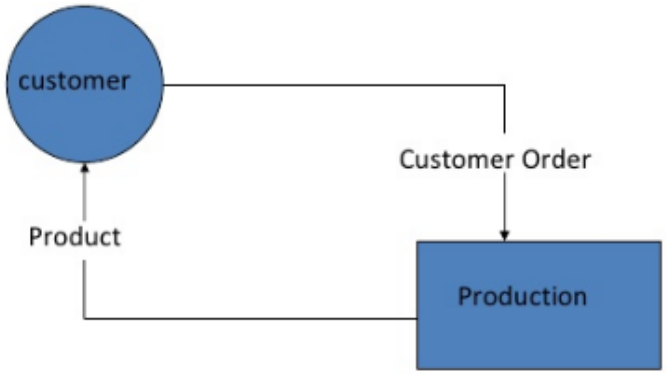


Figure 1.1 Make-to-order approach

The full process flow of a product produced in printing company X is illustrated in Figure 1.2 below. Printing company X collects printing order through face-to-face meeting up, phone calls or through emailing method. Once the printing order is logged, the design of the order will take place until the stage where the design is approved by customers. This

paper will focus on the inventory management that enables an organization to meet or exceed customers' expectations of product availability while maximizing net profits or minimizing costs.

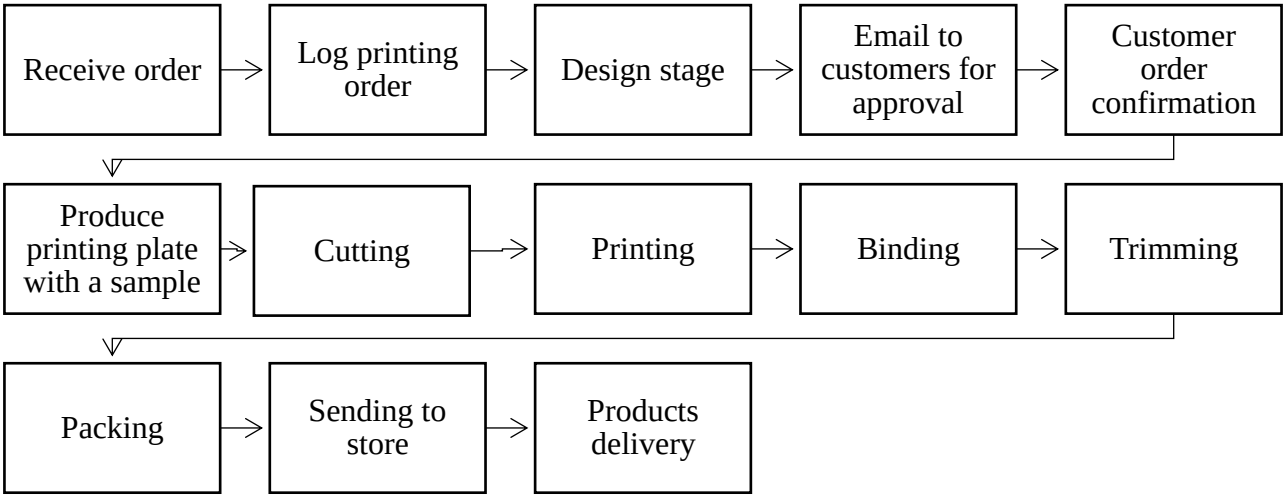


Figure 1.2 Printing production process flow

The customers come in and consult with company's person in charge of the printing order about the type of product they would like to print. The designers will design the layout of the product based on the customers' requirement, with the details about the type of paper or card to be used, quality of paper or card, size layout, color and some other printing details. Then the customer will be consulted and prices are decided based on the quantity ordered and quality desired. After the order is logged, the enterprise would check to see whether they have the ink, printing molds in some cases and paper type according to the requirements. If all the materials are readily available, the printing production will start to take place. Otherwise, the enterprise would contact their supplier and order the materials required. The suppliers would then send the raw materials which would arrive at the printing firm at different times. Often times, the order sizes are considerably small and scattered, hence the printing firm would have to pay premium costs to acquire them. When the materials arrive, printing process run, printing is done and delivered. Undoubtedly this process took a lot of time and money.

Small business like this printing enterprise could not afford to market their products through printed material. Eventually, printing company X successfully reduce costs by using a base set of product variety offerings using product variety management techniques. For instance, the business cards are offered on a controlled number of base substrate paper material types like gloss, premium gloss and matte. The raw material paper stock is maintained in their warehouse and the customers can choose only from these paper types. However, customers can customize the text, style and design on the card that they want to print.

Besides, they reduce inventory cost by ordering materials and stock up the materials on low unit cost due to bulk orders from suppliers. On the other hand, customers can still make their own product design and choices based on their preference. Printing company X will then produce these mass customized products of high variety and tolerable volume accordingly.

1.3 Problem Statement

Printing Company X is a printing paper products manufacturing company where the raw materials inventory management is purely manual. The current system operates manual inventory system, from stocks, products, ordering and purchasing, recorded in a book. This is faced with errors, incompleteness and insufficient data for analysis use. Information regarding stocks, products, sales and purchase are still in black and white, which is not properly organized and managed. From the wholesalers to retailer bills, vouchers, receipts of products are recorded in a book, but further operations are not being recorded and properly handled. As a consequence, it is difficult for company X in processing, updating and managing. Besides, the data are not properly updated at the end of each day's work, which means records on inventory flowing in and out are not maintained appropriately.

Moreover, the materials are ordered only when the operator in charge realized that the particular type of materials are running out soon. As a results, they face the problem of materials shortages some times. Particularly, company X stock their warehouse with

excessive inventory as they are fear of running out of raw materials before the replenishment cycle occurs. Most inventory control models deal with calculating and optimizing warehouse inventory. Even so, it is important to note that this does not apply for just any type of enterprises.

For a mass customized industry, inventory management becomes difficult as the demands of customers are unpredictable due to different taste and needs of different customer groups. The major problem is the unpredictable and unplanned orders flowing in daily. The lack of proper planning at each end is a major cause of concern for procuring and maintaining optimized inventory at printing manufacturing facility. It is extremely difficult to calculate and store the inventory to be maintained due to the fluctuating demand patterns which are hard to be forecasted accurately. This kind of unpredictability puts pressure on the printing firm, causing the need to build extra inventory of raw materials or to build extra production capacity in order to meet the rushing production deadlines.

The managers maintain stock levels in sufficient quantity to meet the demand from customers. Even though they go by past sales data and general industry trends, the dependency on their experience and feelings in taking major decisions like how much to order from the manufacturers of raw-materials is lacking boldness and confidence. This results in the piling-up of extra stocks and in some times very low-levels of stock which might cause situations where they could not produce the orders on time. Additionally, the current condition in warehouse, where the stocks are placed without proper labels, causes searching and transportation waste.

By verbal interactions with the workers, it is found that they find ways to solve urgent materials shortage by procuring from other firms that have ready materials. For non-urgent order, they just order materials using different method of delivery service as long as the materials can reach on time for them to complete the orders, or else they will need to negotiate with the particular customer to delay the deadline if it is possible. These form the base of the problem studied in this study. This study works on bridging the gap by analyzing the effectiveness of current on-floor inventory management and modify the existing inventory control methods in accordance with the constraints of the production settings of printing company X.

1.4 Objectives

Holistically, the study aims to examine the practices of inventory management of a small and medium printing enterprise located in Miri, Sarawak. There are several objectives of this study, which include:

I. To ascertain the current methods or practices that were used to manage inventory in printing company X.
II. To analyze the problems of managing inventory in printing company X.
III. To provide solutions for better inventory management in printing company X.

1.5 Scope of Work

This is an industrial-based case study where the main task of this project is to develop an inventory management method or provide solutions to improve the current managing inventory strategy for printing company X. The first stage of the study is to review the current method used by Company X to manage the raw materials. This enhances my understanding on the full process flow of the printing paper products from the control of raw materials until the full delivery of products. The variables that have to be taken into considerations in controlling the raw materials in company's storeroom are the demands of customers, paper and ink life cycles.

Next is to provide a suggestion improvement to manage the inventory in Company X to improve their inventory efficiency. The variables taken are based on the studies carried out during the visit and data collection. The way they manage raw materials currently plays a vital role in helping to generate a better inventory management method.

The design study adopted was a descriptive method due to the fact that this small scale study of short duration and it involves a systematic collection and clear picture of a particular situation. It was aimed at getting relevant information related to the practice of inventory management of this printing firm.

CHAPTER 2

METHODOLOGY

2.1 Overview

This chapter will cover the explanation of methodology that is being used in detail in order to achieve the aim of the study. This study aims to examine the inventory management in a small and medium printing enterprise and suggest solutions method to improve its current inventory management method. A systematic methodology has been outlined in order to ensure that the progress of the project will be able to run smoothly and can be completed on time. The methodology of this project is described as in Figure below:

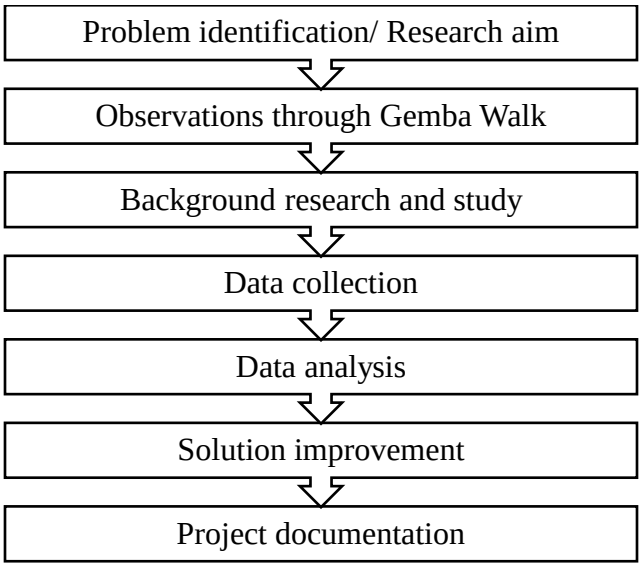


Figure 2.1 Flow chart of project methodology

2.2 Problem Identification

Problem identification is the first and foremost step at the early stage of the study. Regarding the project title, all the relevant problems must be clearly determined and properly stated during this stage. This planning section enables the objectives and appropriate scope of project work to be figured out accordingly in order to solve the current existing problems. The major research area of the study is the inventory management in a small and medium printing enterprise, particularly in the section on how the firm manage the procurement of raw materials and inventory flow in warehouse.

2.3 Background Study

Background study plays a crucial role in the early stage of the project as well. In general, background study helps to provide a better and deeper understandings on the topic of the project given through journals, articles, books and research papers. The big picture regarding the project area of research can be discovered with clarity. Following background study, literature review related to the inventory management method for small and medium printing enterprise where make-to-order (MTO) production approach is used to produce and deliver end products to customers is conducted. By having a glimpse and view on how different small printing firms manage their inventory in their own ways, ideas can be referred for this study according to its appropriateness and applicability.

2.4 Observation through Gemba Walk

For any kind of problems encountered, Gemba walk is the most critical strategy because value-added location is the place that matters most – a place where time, productivity and space are vital and not to be wasted. This is the section where time is spent on the most. It is about observing where the real work is being done. During Gemba walk, key issues such as the materials procurement method and inventory flow in warehouse and production are observed. Monitoring the way employees manage and control the inventory flow is the main scope of the project. During this stage, interactions and communications is extremely significant as operators are those who do their job every day and they are the one who understand their own job scopes the most.

2.5 Data Collection

Data collection is an important aspect of any type of research study. It helps to collect the information needed to answer the research problem. In this research, data collection refers to the whole process of preparing and collecting topic related to inventory management in a small and medium sized enterprise in order to serve as a basis of analysis for later use. The type of data for the research is primary data as the data are collected as fresh and for

the first time. Reliability and validity are two fundamental measurements for this data collection stage.

Interview, observations, records are instrument tools that are being used to collect data on inventory management. Unstructured interview is conducted as it is more conversational and can be conducted in a usual situation where the operators are in the midst of doing their tasks. Besides, the depth of response can be assured as unstructured interview questions can be conducted according to its degree of objectivity and researcher's flexibility.

For qualitative research, observation is the most commonly used tools. A structured observation is carried out by the preparation of record-keeping forms prior to some knowledge about the inventory management area of interest. Through observation in the office, where procurement of materials and customer orders are logged, observation in production area and warehouse, processes involved and different work streams are eventually familiarized. Hence, an overview of both production floor, inventory and warehouse management practices are well mastered. Record is another useful tool that is being employed in this study. A record refers to all the numbers and statistics that the printing organization keep as a record of their activities. It would be beneficial as it covers a period of time and that its content is unbiased.

As for secondary data, information collected from any sources have already been published. In this study, secondary data such as books, journals and contents of website are used as information about inventory management topic can be easily accessed. Furthermore, other sources used were the internal information system provided by the company, which comprise of reports, statistics, and company's newsletters.

2.6 Data Analysis

After necessary data has been collected from both primary and secondary sources, the next step is to process and analyze data. Data analysis is the collecting and organizing of data to come out with a conclusion after that. Analysis of data is used to discover useful information, thereby suggesting improvement methods in order to support decision-making.

With problems identified at the beginning of the study, data regarding the inventory procurement and management method is analyzed after data collection stage.

The main objective of this study is to understand the current inventory management methods employed by printing company X, analyze the problems faced regarding the management of inventory, and thereby provide solutions to improve the current inventory management.

Quantitative data analysis is applied in this study. Data analysis for quantitative studies involves critical analysis and interpretation of figures and numbers, and attempts to find rationale behind the emergence of main findings. Past year data on the inventory annual demand with unit value in printing company X is analyzed using ABC inventory classification method. Comparisons of primary research findings to the findings of the literature review are critically important for quantitative analysis.

2.7 Solution Improvement

After the whole picture of the current condition is grasped and problems of the inventory management practices in printing company X are analyzed, some relevant solutions are proposed in order to improve the inventory management efficiency. The proposed solutions can be used as a guideline for implementing effective inventory management practices.

2.8 Project Documentation

After all, project documentation is the last step of the project, which is the report writing for this study. The report consists of introduction, methodology, proposed solution and conclusion. All the pertinent diagrams and data obtained in this study will be included in the report writing in order to ease the understanding of the reader.

CHAPTER 3

RECOMMENDATIONS

3.1 Overview

This chapter covers the body of the report writing, which explain the proposal to help printing company X to have a better inventory management. This chapter consists of four sections, which are Access inventory database system, ABC inventory classification, coding label system for inventory items in warehouse and visual management of inventory items in warehouse. Each section will be explained in details in this chapter.

3.2 Access Inventory Database System

A database is a collection of data that is related to a particular purpose, which is to monitor the inventory in this research study. Microsoft Access is easy to use, effective and save a lot of time and repetitive effort as it allows to keep track of various types of information. It is a relational database tool where all data is organized into related tables. The key is to help printing company X in structuring data into simple, non-redundant tables that can be linked together. In other words, this database system helps the company to achieve information management of inventory, such as inventory item information management, inventory-checking management, inventory replenishment alert management, decision-making according to statistics report and so on.

Broadly, Microsoft Access provides a platform for printing company X to create multiple relational tables. With the help of the software, bank of data can be easily integrated into useful information. Tools such as tables, queries, forms, and reports provided in Access, are able to be generated with a click of a button, with zero data errors as this program practice high integrity constraints that help in ensuring the quality of the information.

The biggest benefits of creating an inventory database for printing company X is that it helps to track inventory items efficiently. Furthermore, it can help printing company X to store and remember data so that data can be easily retrieved for future use. Most importantly, Access makes complex data operations effortless. Considering the fact that the case study is conducted in a small and medium printing firm, it would not be effective for them to apply the use of advance inventory software such as SAP or ERP software

system as implemented by some large-scale printing enterprises. Moreover, SAP or ERP system would not be affordable by small and medium-sized enterprises.

Instead of having the need to train the employees to use advance software which they might not be able to catch up and being familiarize with, a simple database system like Access is much more applicable and suitable for employees working in printing company X. Apart from that, database is more formal and has rules of structure, in which errors are less likely to occur and it is easier to extract data and obtain reports with a properly designed database. Most of all, it is relatively time consuming to record all the details manually whenever a material is triggered to be procured. On that account, Access inventory database could help the workers to be alarmed on when and what type of inventory items need to be re-ordered when the quantity on-hand falls below the re-order quantity, without extra effort and a waste of time.

There are some convincing reasons of establishing an inventory database for the printing company X:

I. The inventory information which includes customer details, supplier details, material details and purchase order details is a large details content that would become unmanageable in either manual recording or the spreadsheet form.
II. The inventory details record has to be maintained for ongoing use.
III. The information is subject to many changes (change of supplier address, change of pricing, change of supplier lead time, etc.)
IV. Reports based on the information can be generated for the owner's use.

In order to design an inventory database for printing company X, a good representation of how they manage their organization's inventory data is figured out and presented. On account of that, a list of data object is constructed, as displayed in Figure 3.1 below.

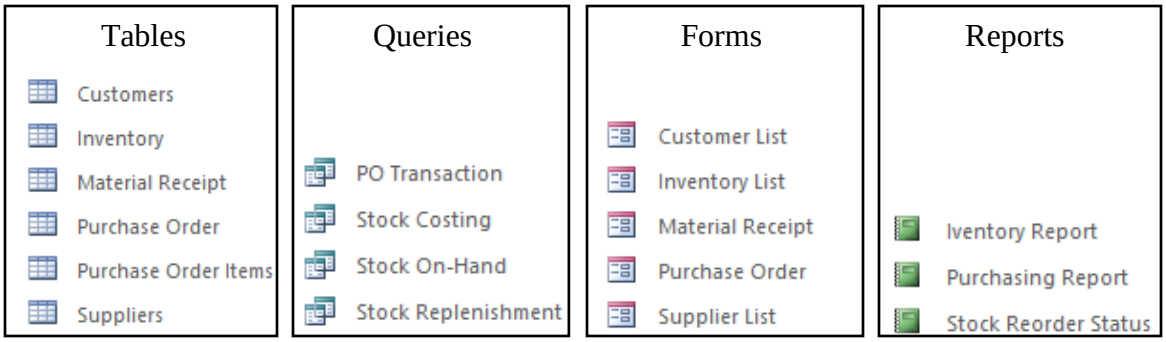


Figure 3.1 List of data object used in the construction of inventory database

3.2.1 Tables

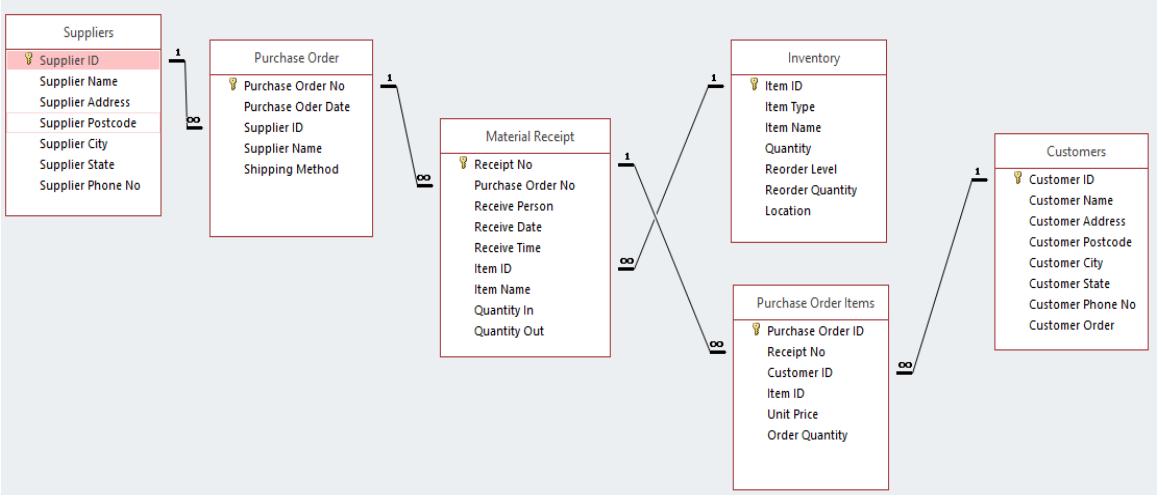


Figure 3.2 Relationships diagram of all the tables in inventory database

Raw data are stored in tables, in which a subject-based lists that contain all the data are arranged and viewed in records. Inventory database is established by developing relationships among the six normalized tables (Suppliers, Purchase Order, Material Receipt, Inventory, Purchase Order Item and Customers), as shown in Figure 3.2 above. By defining the primary key for each tables, which uniquely describes each records, the records contained in the respective tables can be traced easily.

3.2.2 Queries

Queries are used to extrude data from tables. It is widely used in database management as it can answer simple questions, perform calculations, combine data from different tables, or even to add, modify or delete table data. Detailed inventory transaction such as purchase order date, receiving date and shipping method, costs of stock purchased as well as the quantity of on-hand stock in warehouse can be tracked easily using query function, as displayed in Figure 3.3, Figure 3.4 and Figure 3.5 below.

Stock replenishment query, as shown in Figure 3.6 below enables the procurement officer to always know the quantity to order for all inventory items when the quantity on-hand in warehouse falls below the reorder quantity. Location of each inventory items is stated clearly in this query as well, which could help the operator to find the required items in warehouse in a shorter time.

Purchase Oder Date	Item Name	Unit Price	Order Quantity	Price	Receive Date	Shipping Method
07-Nov-16	NINGBO STAR C2S 230g 635x940mm	RM73.00	35	RM2,555.00	12-Nov-16	Cargo
10-Oct-16	MRIO 220g Green Manila Card 30" x 25"	RM58.50	70	RM4,095.00	14-Oct-16	Cargo
02-Dec-16	OJI Pheonix NCR Paper - Top White	RM116.00	28	RM3,248.00	03-Dec-16	Truck
11-Oct-16	GHS-BB Impression Plus NCR - Bottom Pink	RM56.00	52	RM2,912.00	14-Oct-16	Truck
03-Nov-16	White Paper 25" x 35.5" 50gsm	RM114.00	30	RM3,420.00	07-Nov-16	Truck

Figure 3.3 Purchase Order (PO) transaction query

Item ID	Item Name	Unit Price	Order Quantity	Price
01-A3-M2-WH	NINGBO STAR C2S 230g 635x940mm	RM114.00	30	RM5,928.00
01-A4-M2-WH	OJI Pheonix NCR Paper - Top White	RM73.00	35	RM1,314.00
01-A4-S1-WH	White Paper 25" x 35.5" 50gsm	RM116.00	28	RM5,220.00
02-A1-L1-PK	GHS-BB Impression Plus NCR - Bottom Pink	RM56.00	52	RM2,240.00
02-A1-M2-GN	MRIO 220g Green Manila Card 30" x 25"	RM58.50	70	RM2,047.50

Figure 3.4 Stock costing query

Item ID	Item Name	Location	Quantity	Quantity In	Quantity Out	On-Hand Quantity
01-A3-M2-WH	NINGBO STAR C2S 230g 635x940mm	R1L2	52	35	10	77
02-A1-M2-GN	MRIO 220g Green Manila Card 30" x 25"	R1L1	35	50	22	63
01-A4-M2-WH	OJI Pheonix NCR Paper - Top White	R3L2	18	28	18	28
02-A1-L1-PK	GHS-BB Impression Plus NCR - Bottom Pink	R4L1	40	30	21	49
01-A4-S1-WH	White Paper 25" x 35.5" 50gsm	R2L3	45	52	30	67

Figure 3.5 Stock on-hand query

Item ID	Item Type	Item Name	Quantity	Reorder Quantity	Location
01-A3-M2-WH	Paper	NINGBO STAR C2S 230g 635x940mm	52	20	R1L2
01-A4-M2-WH	Paper	OJI Pheonix NCR Paper - Top White	18	20	R3L2
01-A4-S1-WH	Paper	White Paper 25" x 35.5" 50gsm	45	50	R2L3
02-A1-L1-PK	Card	GHS-BB Impression Plus NCR - Bottom Pink	40	20	R4L1
02-A1-M2-GN	Card	MRIO 220g Green Manila Card 30" x 25"	35	20	R1L1

Figure 3.6 Stock replenishment query

3.2.3 Forms

For each table, a basic form can be created to manage data, as displayed in Figure 3.7, Figure 3.8, Figure 3.9, Figure 3.10 and Figure 3.11 below. Once forms have been created, users will have a more user-friendly way of entering and managing data in the inventory database (datasheet view is not considered user-friendly). This allows the user to add, remove, update or edit the information. For instance, Customers' information can always be added or modified using the form created, as in Figure 3.7 below. If specific customer's details is needed, person in charge will just need to click on the "Find customer" icon and type in the name of the customer.

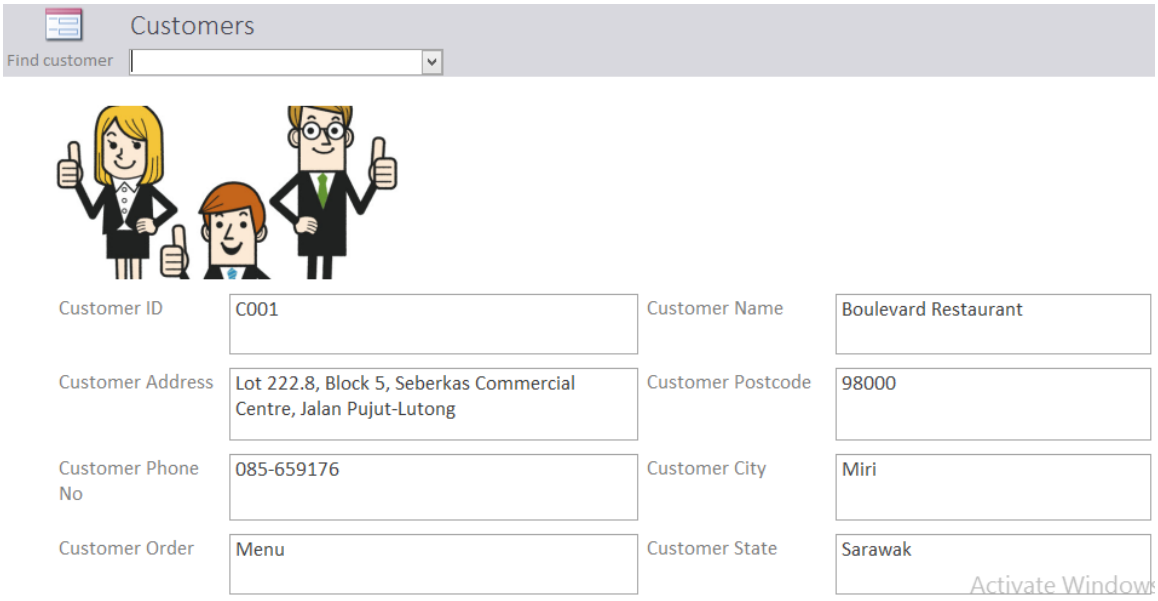


Figure 3.7: Customer information form

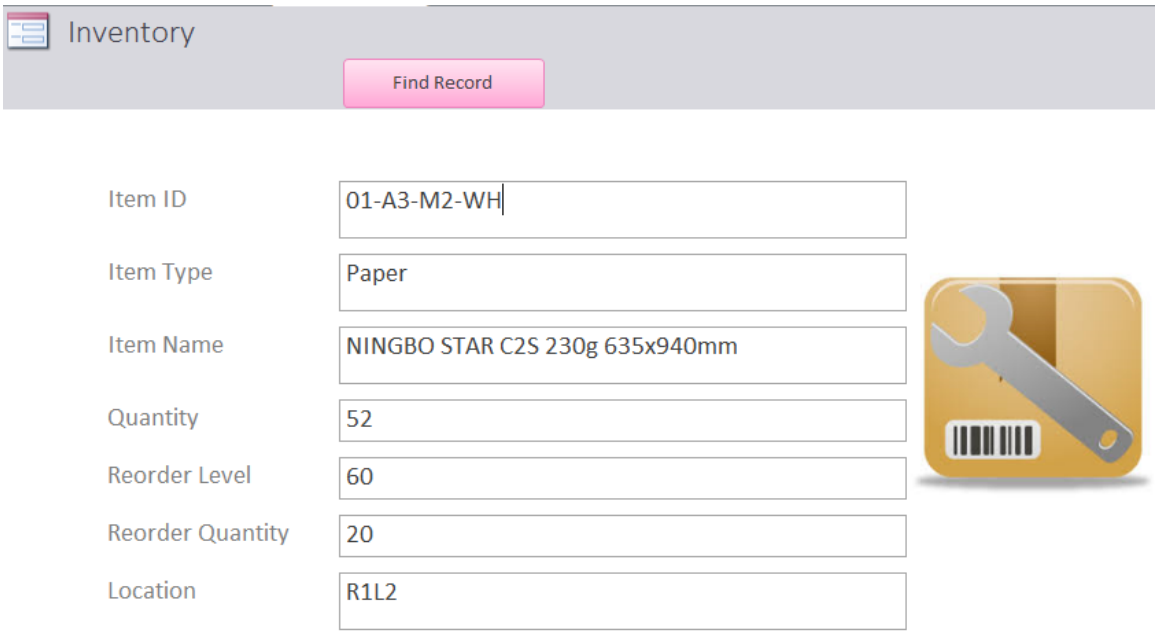


Figure 3.8: Inventory details form

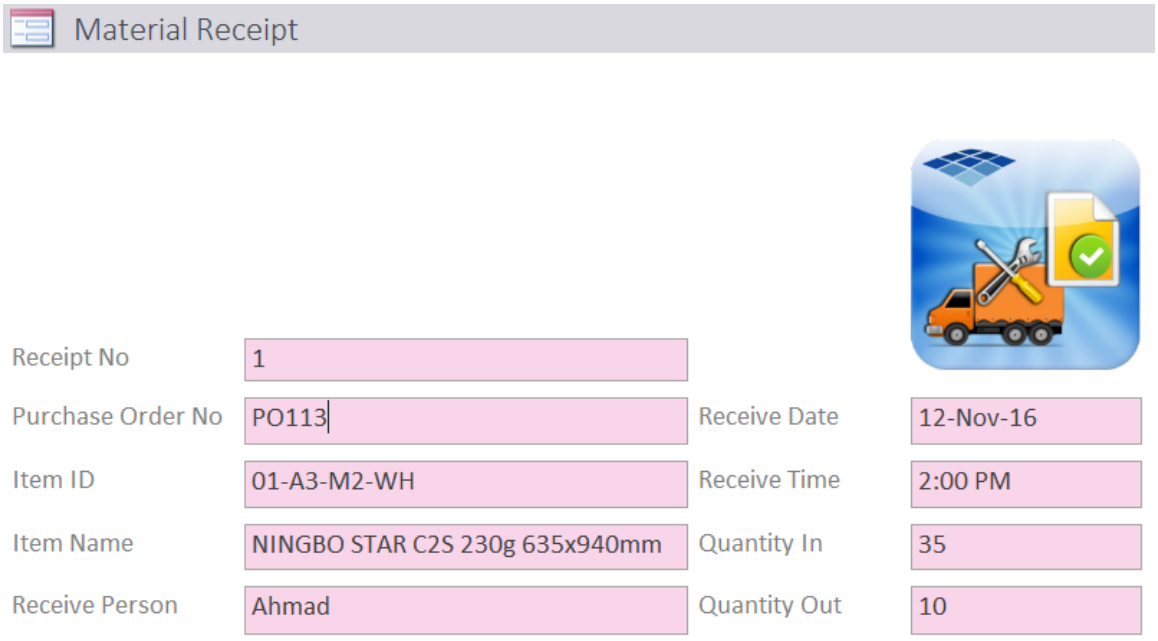


Figure 3.9: Material receipt form

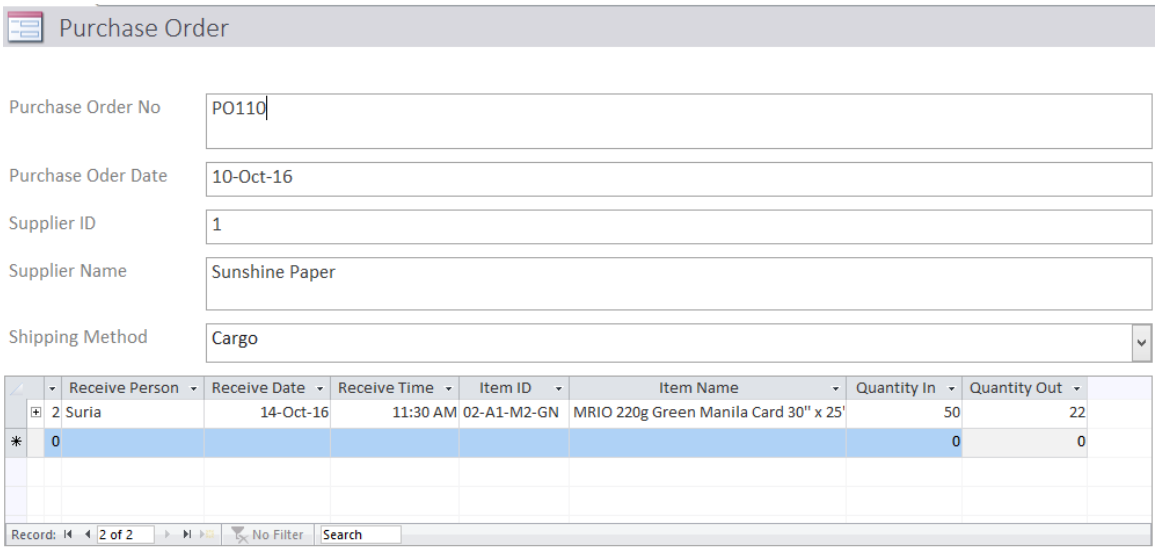


Figure 3.10: Purchase Order Form

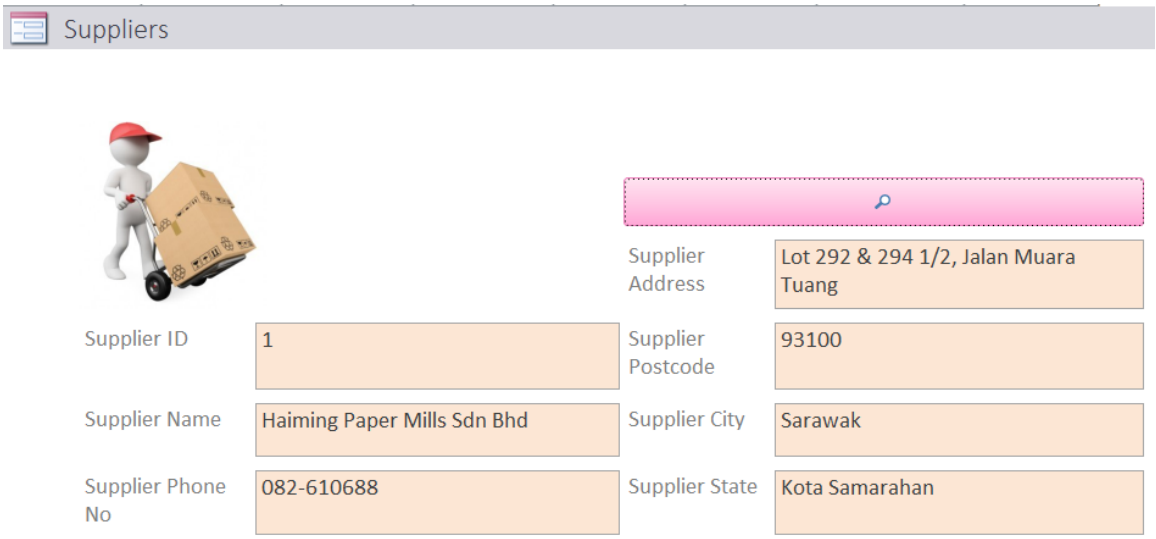
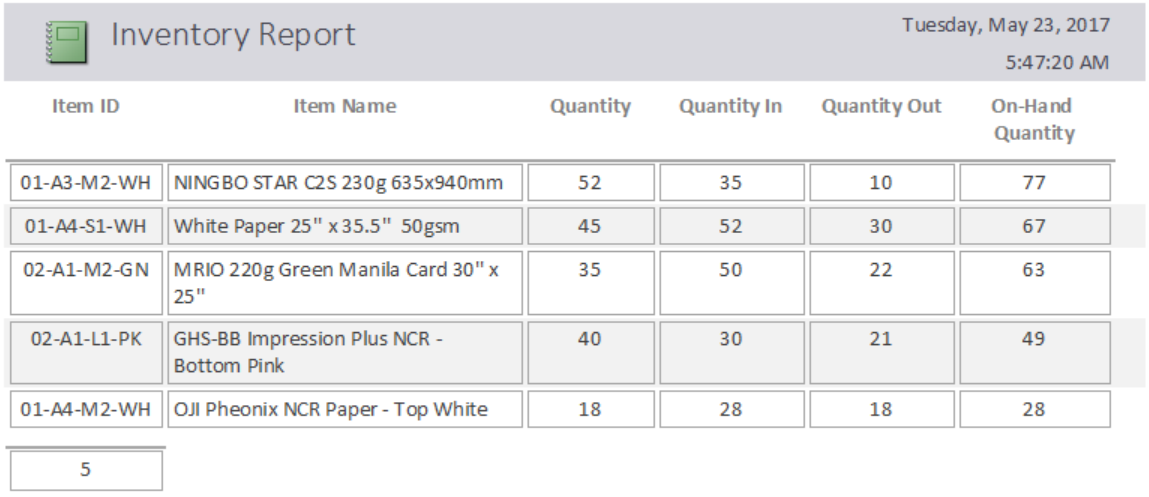


Figure 3.11: Supplier information form

3.2.4 Reports

A database report is the formatted result of database queries and contains useful data for decision-making and analysis. It is used to display and summarize data. In this inventory database, reports allow the user to have a glance on the summary of inventory, purchasing and stock replenishment at the end of each month, or at any time as needed. Manager can always know the on-hand quantity of all inventory items, by viewing the inventory report, as shown in Figure 3.12. Likewise, manager can always know how much he spent on buying inventory for each month by having a glance on the purchasing report, as denoted in Figure 3.13.

Items which are highlighted in red shows that the quantity of hand of those items are under the reorder quantity. Referring to Figure 3.14, 5s visual metric helps the procurement officer to know what type of items need to be reordered at reorder quantity. Item columns highlighted in red indicate that the particular item need to be triggered for purchase order. Eventually, this will help to avoid materials shortage when it is needed.



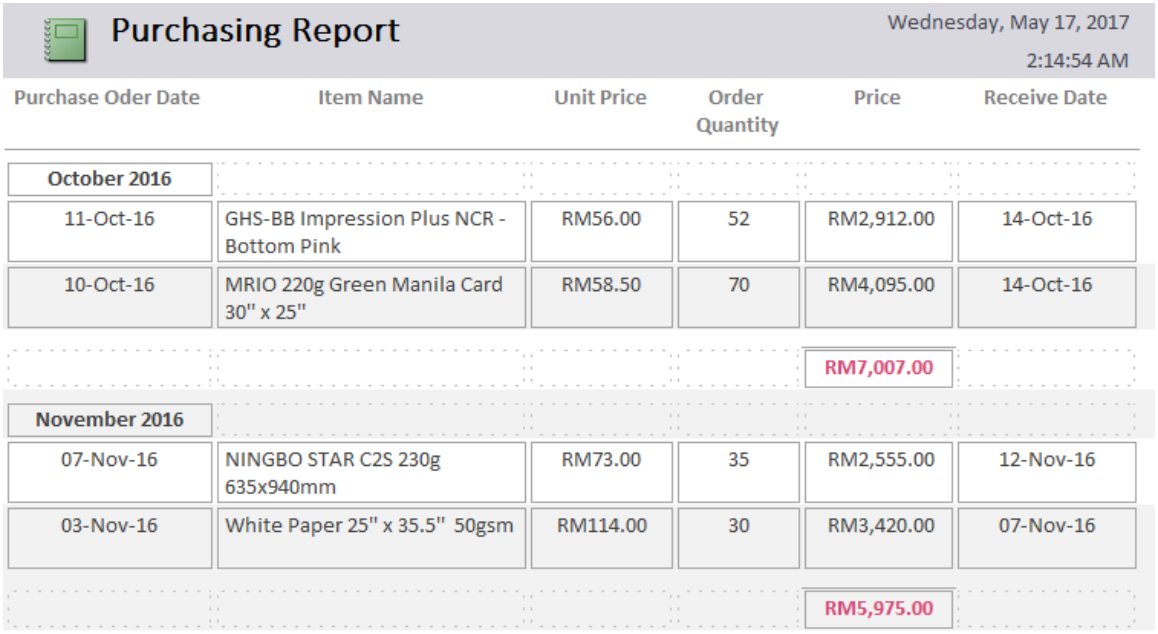
Inventory Report

Tuesday, May 23, 2017
5:47:20 AM

Item ID	Item Name	Quantity	Quantity In	Quantity Out	On-Hand Quantity
01-A3-M2-WH	NINGBO STAR C2S 230g 635x940mm	52	35	10	77
01-A4-S1-WH	White Paper 25" x 35.5" 50gsm	45	52	30	67
02-A1-M2-GN	MRIO 220g Green Manila Card 30" x 25"	35	50	22	63
02-A1-L1-PK	GHS-BB Impression Plus NCR - Bottom Pink	40	30	21	49
01-A4-M2-WH	OJI Pheonix NCR Paper - Top White	18	28	18	28

5

Figure 3.12: Inventory report

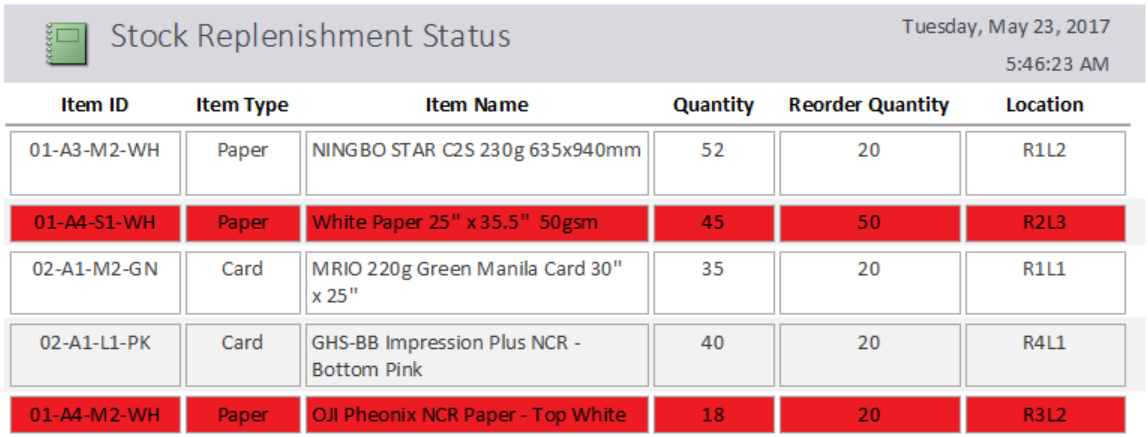


Purchasing Report

Wednesday, May 17, 2017
2:14:54 AM

Purchase Oder Date	Item Name	Unit Price	Order Quantity	Price	Receive Date
October 2016					
11-Oct-16	GHS-BB Impression Plus NCR - Bottom Pink	RM56.00	52	RM2,912.00	14-Oct-16
10-Oct-16	MRIO 220g Green Manila Card 30" x 25"	RM58.50	70	RM4,095.00	14-Oct-16
				RM7,007.00	
November 2016					
07-Nov-16	NINGBO STAR C2S 230g 635x940mm	RM73.00	35	RM2,555.00	12-Nov-16
03-Nov-16	White Paper 25" x 35.5" 50gsm	RM114.00	30	RM3,420.00	07-Nov-16
				RM5,975.00	

Figure 3.13: Purchasing report



Stock Replenishment Status

Tuesday, May 23, 2017
5:46:23 AM

Item ID	Item Type	Item Name	Quantity	Reorder Quantity	Location
01-A3-M2-WH	Paper	NINGBO STAR C2S 230g 635x940mm	52	20	R1L2
01-A4-S1-WH	Paper	White Paper 25" x 35.5" 50gsm	45	50	R2L3
02-A1-M2-GN	Card	MRIO 220g Green Manila Card 30" x 25"	35	20	R1L1
02-A1-L1-PK	Card	GHS-BB Impression Plus NCR - Bottom Pink	40	20	R4L1
01-A4-M2-WH	Paper	OJI Pheonix NCR Paper - Top White	18	20	R3L2

Figure 3.14: Stock replenishment report

3.3 ABC Inventory Classification

ABC analysis is a material management tool used to categorize inventory items. Since inventory items in printing company X are of different types with vastly different attributes, ABC analysis is helpful in classifying different inventory items into different categories as not all the items require the same management efforts and control. In other words, it helps to target the grouping of inventory items in order to facilitate appropriate control, effective processes and management. This proposed method of classifying inventory items can provide a guideline for printing company X for streamlining the materials management processes, whereby in future, workers are able to focus their time and effort on items that need it most.

In ABC analysis the items are classified into A, B & C classes based on the total cost usage. ABC analysis is a mechanism to identify different categories of stock that requires different management and control, thus placing significant impact on overall inventory management cost [5]. A company which implement ABC inventory strategy is proved to have 33% less inventory than a company which uses the approach of maintaining the same inventory level for all inventory items [6].

The outcome of ABC inventory categorization is that inventory of differing attributes are classified into 3 groups. Eventually, this will help printing company X to configure the processes and workflow around these groups, which include cycle count processes,

procurement processes as well as materials handling processes. In addition, it is expected that the inventory accuracy will be increased significantly if printing company X implement this inventory classification method in future, thereby leading to reduced inventory levels and improved on-time delivery to customers. All the inventory items are ranked according to their respective annual usage, as displayed in Table 3.1 below.

ABC model calculations:

Annual usage = Unit cost * Annual Demand

Cumulative annual usage

C1 = A1, C2 = A2 + A1, C3 = A3 + A2 etc.

No	Item	Unit Cost (RM)	Annual Demand	Annual Usage (RM)	Rank
1	plain white paper	56.00	6105	341,880.00	4
2	art paper	82.00	3216	263,712.00	6
3	carbonate paper	90.00	4853	436,770.00	3
4	pearl white shimmer	98.00	920	90,160.00	12
5	laid card	64.00	3150	201,600.00	9
6	kraft paper	78.00	1008	78,624.00	13
7	cream paper	72.00	2753	198,216.00	10
8	woodfree uncoated paper	61.00	1002	61,122.00	14
9	signature matte	114.00	2009	229,026.00	7
10	copy paper	53.00	3274	173,522.00	11
11	premium double thick matte	195.00	1091	212,745.00	8
12	silk paper	120.00	2767	332,040.00	5
13	gloss paper	137.00	3820	523,340.00	1
14	matte paper	155.00	3100	480,500.00	2

Table 3.1: Inventory items with respective unit cost and annual demand

No	Cumulative of items (%)	Item	Unit Cost (RM)	Annual Demand	Annual Usage (RM)	Cumulative Annual Usage (RM)	Annual Usage (%)	Category
13	7	gloss paper	137.00	6630	908,310.00	908,310.00	20.24%	A
14	14	matte paper	155.00	5782	896,210.00	1,804,520.00	40.22%	A
3	21	carbonate paper	90.00	6809	612,810.00	2,417,330.00	53.88%	A
1	29	plain white paper	56.00	6203	347,368.00	2,764,698.00	61.62%	B
12	36	silk paper	120.00	2305	276,600.00	3,041,298.00	67.79%	B
2	43	art paper	82.00	3216	263,712.00	3,305,010.00	73.66%	B
9	50	signature matte	114.00	2009	229,026.00	3,534,036.00	78.77%	B
11	57	premium double thick matte	195.00	1091	212,745.00	3,746,781.00	83.51%	C
5	64	laid card	64.00	3050	195,200.00	3,941,981.00	87.86%	C
7	71	cream paper	72.00	2175	156,600.00	4,098,581.00	91.35%	C
10	79	copy paper	53.00	3274	173,522.00	4,272,103.00	95.22%	C
4	86	pearl white shimmer	98.00	920	90,160.00	4,362,263.00	97.23%	C
6	93	kraft paper	78.00	1008	78,624.00	4,440,887.00	98.98%	C
8	100	woodfree uncoated paper	61.00	750	45,750.00	4,486,637.00	100.00%	C
		Total Usage			4,486,637.00			

Table 3.2: Categorization of inventory items

Using Table 3.3 below as a guideline to classify the inventory items in printing company X into 'A', 'B' and 'C' category, the items are categorized according to their percentage of cumulative annual usage. The results are displayed in Table 3.2 above.

Category	Annual Consumption	Number of items	
A	60 - 70%	10 - 20%	Daily control
B	15 -25%	30%	Regular review
C	10 - 15%	50%	Infrequent review

Table 3.3: Guideline for inventory items according to ABC analysis

In order to illustrate the percentage of annual usage of each inventory items in a clearer way, a pie chat is constructed, as shown in Figure 3.15 below. From the pie chart, it is clearly seen that 3 items are classified under A category, 4 items under B category and 7 items under C category.

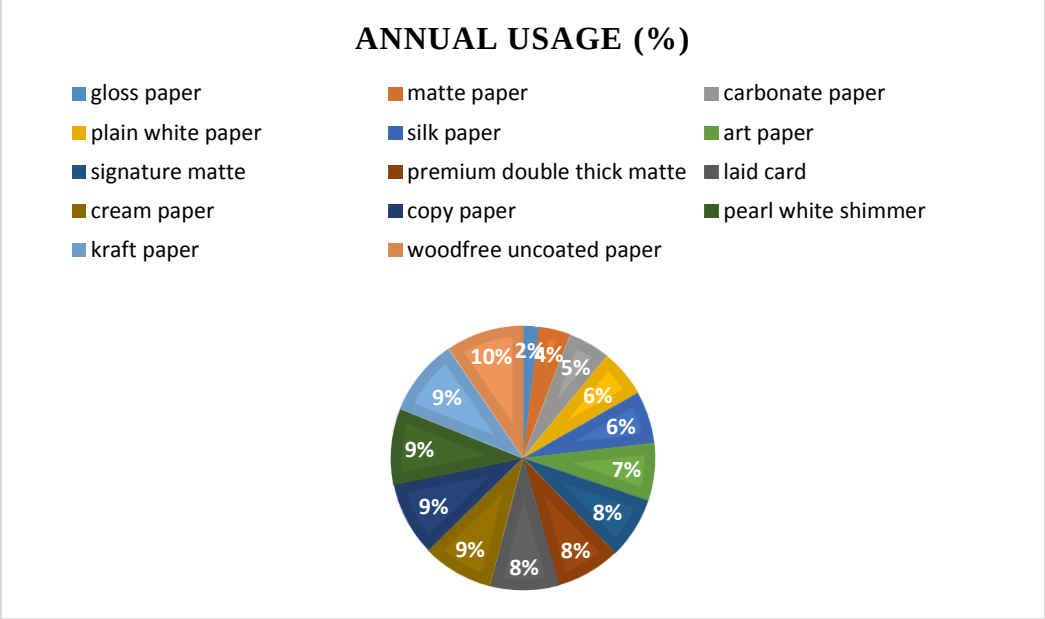


Figure 3.15: Pie chart for inventory items according to respective annual usage