

# ONLINE INVENTORY MANAGEMENT SOFTWARE SYSTEM FOR LTK INTERTRADING COMPANY LIMITED



Natnicha Phimpama  
Supasit Chivapong

Bachelor of Science in  
Engineering and Technology Management  
Faculty of Engineering  
King Mongkut's Institute of Technology Ladkrabang  
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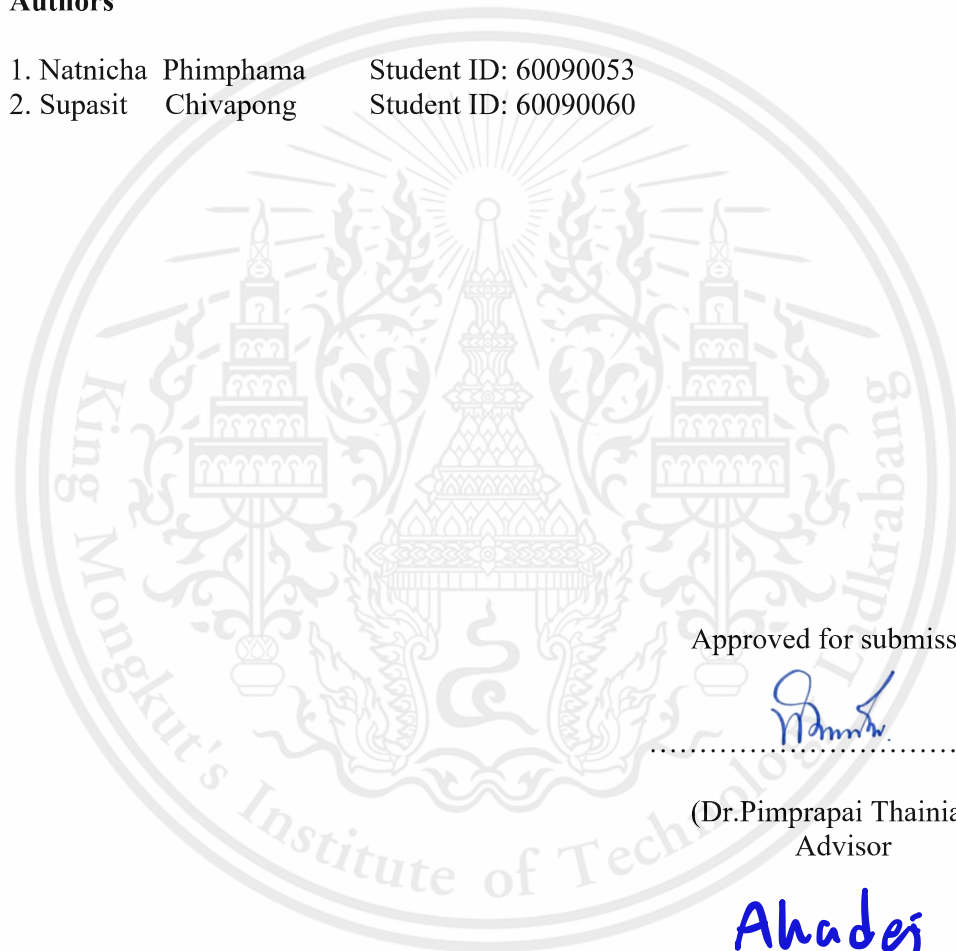
**Thesis – Academic Year 2020**

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Company Limited

**Authors**

- |                       |                      |
|-----------------------|----------------------|
| 1. Natnicha Phimphama | Student ID: 60090053 |
| 2. Supasit Chivapong  | Student ID: 60090060 |



Approved for submission

A handwritten signature in blue ink, appearing to read 'Pimprapai', is written over a horizontal dotted line.

(Dr.Pimprapai Thainiam)  
Advisor

A handwritten signature in blue ink, appearing to read 'Akadej', is written over a horizontal dotted line.

(Dr.Akadej Udomchaiporn)  
Co-Advisor

Date **1** / **6** / **2021**

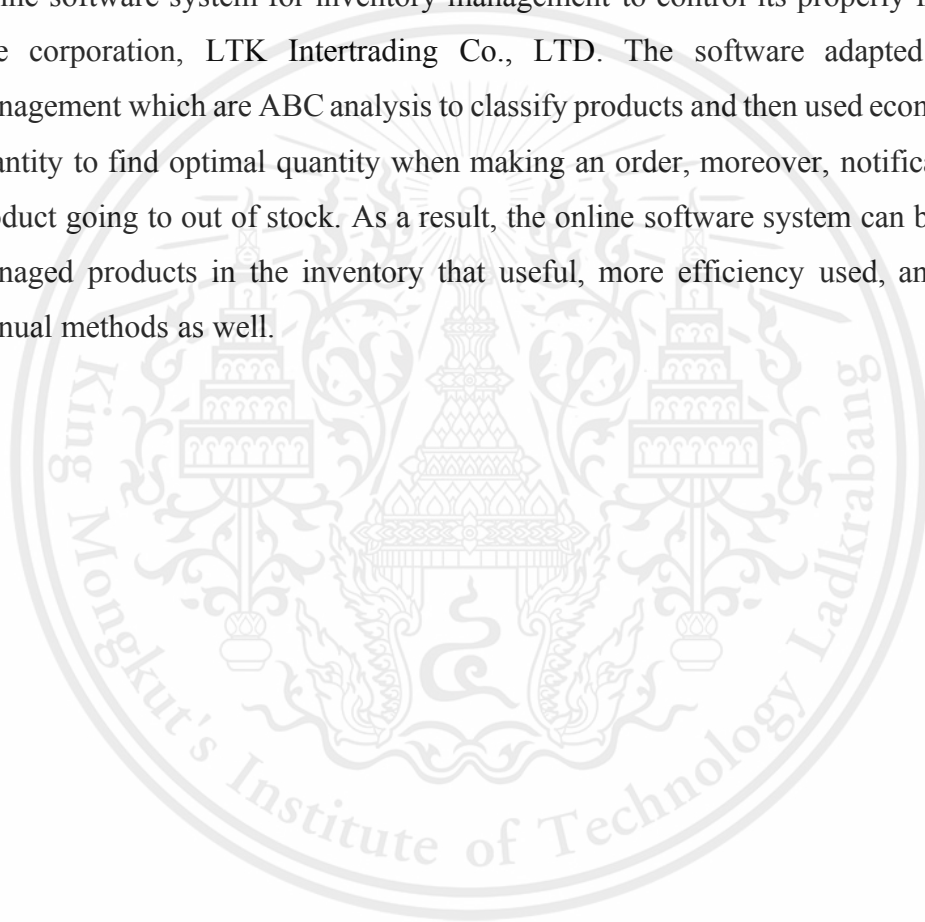
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## **Abstract**

This thesis presents the design and development of Online Inventory Management Software System for LTK Intertrading Co., LTD. It focuses on improving ability of the online software system for inventory management to control its properly for medium size corporation, LTK Intertrading Co., LTD. The software adapted inventory management which are ABC analysis to classify products and then used economic order quantity to find optimal quantity when making an order, moreover, notification when product going to out of stock. As a result, the online software system can be used and managed products in the inventory that useful, more efficiency used, and replaced manual methods as well.



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# Chapter 1

## Introduction

### 1.1 Motivation

LTK Intertrading Co., LTD is a distributor for sanitary products such as toilet paper, industrial cleaner, cleaner equipment under first-class brand as Kimberly-Clark, Ecolab, 3M, Karcher, and Marvel. Products also include paper water cups, automatic hand dryer, washing machine, high pressure washer, automatic faucet, automatic soap dispenser, water dispenser, and Double A paper.

LTK Intertrading has been operated over 30 years and started managing product inventory by manual system. The company is growing up of the number of the customers and orders. When an order comes, the company do not have enough of some products that might lost selling opportunities. The manual system of the company has to pass through many processes, and it takes time for inventory management. The manual system nowadays is not functional as well as it could be in term of updated data inventory. Moreover, reordering for each time takes time to consider how much it should be ordered because they usually order product quantity based on their experiences. It takes so much time for making the order.

To make the product inventory data keep update real time, inventory software system could support and help to manage inventory. Inventory management software system could resolve the problem of product lacking and reduce unnecessary processes of inventory management and also help to consider which is the optimum number of product to make an order to supplier.

In this project, we want to implement the inventory software system that they could check product amount of each product when the products are sell and arrived after ordering from supplier, suggestion number to make an order with minimum cost. Moreover, the system could notice to make an order when the products are shortage. The inventory software system could reduce process times and steps, and more convenient and easier of managing product inventory of LTK Intertrading company limited.

## **1.2 Objectives**

- To implement and design computer inventory software system instead of using manual method
- To control product inventory properly

## **1.3 Scope of Work**

- Total products used are 118 from 1000 units due to the data privacy of the company
- All given data from the company is from January to December of 2020
- To use web base for LTK Company Limited Company Limited
- Suppose demand is constant (Not much changed) for every year.

## **1.4 Thesis Structure**

This thesis consists of five chapters which are arranged as follows:

- Chapter 1 Introduction - refers to the bemotionation, objectives, scope of work, and thesis structure of this thesis.
- Chapter 2 Literature Review – proposes the Literature survey that are relevant to this project, and theories
- Chapter 3 Research Methodology – explains the methods that we use to conduct our research and software program.

- Chapter 4 Results and Discussion – shows the results obtained from our research and also discusses those results.
- Chapter 5 Conclusion and Recommendations – concludes what we have done and what you have found, and also gives some recommendations for related to the use of our research result.



# Chapter 2

## Literature Review

This chapter is divided into 3 parts which are;

**Part1:** Background of LTK Intertrading Company Limited.

**Part2:** Inventory management theory describes about inventory management such as retail inventory management, types of inventory, and inventory management formula.

**Part3:** Several existing software that acting a similar role as the proposed project on the market. The evaluation and primary benefit among software related to inventory management software system, which are Zoho inventory, Sellbrite, TradeGecko and inflow Inventory

### 2.1 Background of LTK Intertrading Company Limited

LTK Intertrading Co., LTD is a retail and wholesale distributor for sanitary products such as toilet paper, industrial cleaner, cleaner equipment under first-class brand as Kimberly-Clark, Ecolab, 3M, Karcher, and Marvel. Products also include paper water cups, automatic hand dryer, washing machine, high pressure washer, automatic faucet, automatic soap dispenser, water dispenser, and Double A paper.

LTK Intertrading Co., LTD started from kitchenware business at Talat Wat Klang, Chonburi under the name “Lim Tek Ki” and then run the business under “LTK Intertrading” since August 29, 2003. It has been more than 30 years of providing the best service to customers with high experienced and performance employees. [1]

**Partnership:** Ecolab, 3M, Karcher, Kimberly-Clark, Rubbermaid, Unger, Marvel, Champion, Fest, Taski, Paramat, Patra, Double A, King’s stella, Hotel marts group and Victor

**Groups of customers:** Industry plant, hotel, resort, golf course, hospital, clinic, university, college, bank, restaurant, and café.

**Service areas:** Chonburi, Rayong, Pattaya, Chachoengsao, and east region

## **2.2 Inventory management theory**

### **2.2.1 Inventory management**

Inventory management is a component of supply chain management that supervises the flow of goods from manufacturer to warehouses and from these facilities to point of sale. A key function is to keep a detail record of each product as it enters or leaves a warehouse or point of sale [2]. Stevenson defined as a framework employed in firms in controlling its interest in inventory. It includes the recording and observing of stock level, estimating future request, and settling on when and how to arrange [3]. On the other hand, Deveshwar and Dhawal proposed that inventory management is a method that companies use to organize, store, and replace inventory, to keep an adequate supply of goods at the same time minimizing cost [4]. There are so many techniques of inventory management and using the suitable one can leads to better efficiency product amounts, place, and time. Inventory management could help to run the business smoothly. Knowing when to restock inventory, what amounts to purchase, or what price to sell, these can easily become complex decision. Small businesses will often keep track of stock manually and determine the reorder points and quantities using Excel formula. Larger businesses will use specialized enterprise resource planning (ERP) software. The largest corporations use highly customized software as a service (SaaS) applications [5]

#### **2.2.1.1 Retail Inventory Management**

Retail inventory management is a term to business-to-consumer (B2C). It is the process of ensuring to carry merchandise that shopper want, with neither too little nor too much on hand. By managing inventory, retailers meet customer demand without running out of stock or carrying excess supply [6].

There are essentially two types of retail separated by how and where a sale takes place.

1. Online retail (e-Commerce) where the purchase takes place digitally.

Offline retail where the purchase is physical through a brick-and-mortar storefront or a salesperson.

### **2.2.1.2 Wholesale Inventory Management**

Wholesale inventory management refers to business-to-business (B2B) selling. Wholesalers are marketing intermediaries who buy in large quantity and sell to other intermediaries, who buy for resale or for industrial use. Wholesalers perform a variety of functions essential to the marketing process; and frequency able to perform these functions more effectively and at lower cost than are other members of the distribution channel. Wholesalers provide a warehousing or storage function that benefit both manufacturers and retailers. Manufacturers benefits because the warehousing done by the wholesale reduces manufacturers cost on physical distribution and the capital needed to store larger inventories; The retailer benefits because the similar inventory that can carried result in higher turnover and less inventory investment [7]

### **2.2.2 ABC Analysis**

ABC Analysis also referred to as ABC Classification, is an integral part of material management. It is an inventory categorization method, which classifies the inventory primarily into three distinct categories based on the revenue generation. ABC inventory helps business entrepreneurs and stock owners identify the essential products in the stock and prioritize their management based on the value. The inventory analysis is based on the Pareto Principle.

The Pareto Principle is a popular economic theory, discovered by renowned Italian economist Vilfredo Pareto. Pareto believed that optimum economic growth occurs only due to a small part of the economy. It means that the relation between the input and output is always unequal.

Pareto Principle states that 80% of the sales volume gets generated from the top 20% of the items. It says that in any group, there are significant few and insignificant many. It is also known as the 80/20 rule [8].

### Category of ABC analysis

- Item “A” - Items that register the highest value in terms of annual consumption. It is interesting to note that the top 70 – 80 percent of the yearly consumption value of the company comes from only about 10 – 20 percent of the total inventory items. Hence, it is crucial to prioritize these items.
- Item “B” – These are items that have a medium consumption value. These amount to about 30 percent of the total inventory in a company which accounts for about 15 – 20 percent of annual consumption value.
- Item “C” - The items placed in this category have the lowest consumption value and account for less than 5 percent of the annual consumption value that comes from about 50 percent of the total inventory items.

### ABC Analysis Calculation

- 1) Determine inventory value by multiplying the price of an item by the consumption volume of that item in a year per period. Simply put,

$$\text{Item cost} * \text{Annual consumption} = \text{Inventory value}$$

- 2) Repeat step 1 for all items to calculate total inventory value
- 3) Sort your parts from highest inventory value to lowest
- 4) Calculate each item’s percentage of total inventory value. Percentage of total inventory value calculates as

$$\text{Item’s inventory value} / \text{sum of all inventory value}$$

Group the parts that account for the highest 70% - 80% of your total inventory and allocate them as ‘A’ items. Group the parts that account for the next 15% - 20% and allocate them as ‘B’ items. Group all remaining items as ‘C’ [9]

### Policies Governing the ABC Method of Inventory Management

#### **Item “A”**

- These are subjected to strict inventory control and are given highly secured areas in terms of storage
- Have a better forecast for sales

- Kept as priority item and efforts are made to avoid unavailability or stock-out of these items

**Item “B”**

- These items are not as important as item section A or as trivial as items categorized under C
- They are monitored for potential inclusion towards category A or in a contrary situation towards category C

**Item “C”**

- These items are manufactured less often and follow the policy of having only one of its item on hand or in some cases they are reordered when a purchase is actually made
- Since these are low demand goods with a comparatively higher risk of cost in terms of excessive inventory, it is an ideal situation for these items to stock-out after each purchase
- The questions managers find themselves dealing with when it comes to items in category C is not how many units to keep in stock but rather whether it is even needed to have to these items in store at all.

For all categories of ABC analysis, it could highlight and summarize the pivot features as the image below

Category A	Category B	Category C
It involves Precise and Exact Estimation of Inventory Value.	It involves an approximate estimation of inventory value.	It requires minimal or no estimation of inventory value.
The senior managers and professionals are involved in managing the inventory.	Mid-level professionals and managers are assigned to manage this category of inventory.	This category is usually managed by the junior staff as it does not require much experience.
It requires very strict degree of control.	It requires moderate degree of control.	It requires minimal or limited degree of control.

*Figure 2.1 ABC Analysis*

There are many researches about using ABC classification;

Partovi and Anandarajan [10] presented artificial neural network (ANN) for ABC classification of SKUs in a pharmaceutical company. The learning methods of ANN were back propagation and genetic algorithms.

Mohamadghasemi and Hadi-Vencheh [11] proposed an integrated fuzzy analytic hierarchy process-data envelopment analysis (FAHP-DEA) for multiple criteria ABC inventory classification. The proposed FAHP-DEA methodology uses the FAHP to determine weights of criteria.

Ng [12] proposed a simple model for multiple criteria inventory classification. The model converts all criteria measures of an inventory item into a scalar score. The classification based on the calculated scores using ABC principle is then applied.

### **2.2.3 Inventory Management Formulas**

#### **2.2.3.1 Economic order quantity: EOQ**

Economic order quantity (EOQ) is the ideal order quantity a company should purchase to minimize inventory costs such as holding costs, shortage costs, and order costs. This production-scheduling model was developed in 1913 by Ford W. Harris and has been refined over time. The formula assumes that demand, ordering, and holding costs all remain constant. The EOQ model seeks to ensure that the right amount of inventory is ordered per batch so a company does not have to make orders too frequently and there is not an excess of inventory sitting on hand. It assumes that there is a trade-off between inventory holding costs and inventory setup costs, and total inventory costs are minimized when both setup costs and holding costs are minimized. [13]

#### **Here are some literature reviews of using EOQ technique**

Shubham et al [14] examined inventory situation at organization's central storeroom. The main objective of this study is to investigate whether any of two selected methods could reduce inventory related costs at organization's central storeroom. The ABC analysis technique for the inventory control system is first used to identify the most important multiple items and then the economic order quantity (EOQ) of each items is

developed to find their inventory model equation individually. The use of this model Wild and Axsater [15] used inventory technique methods in solving real inventory issues for business in a variety of industries from aerospace to retail consumables and from automotive to process chemicals. They noted that appropriate database was prerequisite for the application of the techniques. This implies the manufacturing entities need to have a well identifiable database for the application of more sophisticated inventory model.

Nanaware et al, 2017 [1] discussed ABC and EOQ Analysis of Construction Company and finally concluding section, project provides detail of financial analysis of effective utilization of inventory models in material management for cost reduction. The implementation of ABC analysis gives the distribution of A, B, C type materials. This distribution of materials gives the economic importance of materials. EOQ gives the results of right quantity of orders at right time. It avoids the delays in material supply and also avoids wastage of materials. Inventory control system minimizes the wastage of materials which ultimately saves the cost of a project.

#### **The formula for (EOQ) Economic Order Quantity (EOQ)**

$$EOQ = \sqrt{\frac{2RcD}{Hc}}$$

Where:

$R_c$  = Reordering cost

$D$  = Annual demand

$H_c$  = Holding cost (per unit, per year)

#### **2.2.3.2 Reorder point (ROP)**

The reorder point (ROP) is the minimum inventory or stock level for a specific product that triggers the reordering of more inventory when reached. When calculating the reorder points for different SKUs, the lead time it will take to replenish inventory is factored in to ensure inventory levels don't reach zero. Setting accurate reorder points allows businesses to avoid having products out of stock while waiting for new inventory.

## **The important of reorder point**

1. Minimize costs – Storing more inventory than what can be sold in a timely fashion is not a productive use of capital. Reorder points provide businesses with greater financial flexibility by allowing them to keep minimum amount of inventory on hand without running out of products.

2. Minimize stockout – Too much inventory is expensive, but too little inventory can result in stockouts, which are harmful for your business: Orders are delayed or cancelled, your business loses customers, and your reputation can suffer. Reorder points help prevent stockouts in the first place.

3. Better forecasting – Calculating reorder points goes hand in hand with having a clear idea of purchasing trends over a given time period. The more you calculate ROP for each product, the more accurately you can forecast demand in the future and ensure you use the reorder quantity formula correctly [16].

### **Reorder point formula**

$$ROP = d * L$$

Where:

d = Average demand

L = lead time

### **2.2.3.3 Minimum total cost**

Summing the two costs together to find the optimal quantity that minimizes this cost, the annual total cost is differentiated with respect to Q. It is shown as follows:

$$TC = (D/Q * R_c) + (Q/2 * H_c)$$

Where:

D = Annual demand

Q = Order quantity

R<sub>c</sub> = Reordering cost

H<sub>c</sub> = Holding cost (per unit, per year)

## 2.3 Software part

### 2.3.1 Diagram for Software Development

#### 2.3.1.1 Unified Modeling Language – UML

An Unified Modeling Language (UML) is a general- purpose, developmental, modeling language in the field of software engineering that is intended to provide a standard way to visualize the design of a system. In 2005, UML was also published by the International Organization for Standardization (ISO) as an approved ISO standard. Since then the standard has been periodically revised to cover the latest revision of UML [17].

#### 2.3.1.2 ER Diagram – Crows Foot Model

An entity–relationship diagram describes interrelated things of interest in a specific domain of knowledge. A basic ER model is composed of entity types, which classify the things of interest and specifies relationships that can exist between entities. In software engineering, an ER Diagram is commonly formed to represent things a business needs to remember in order to perform business processes. Consequently, the ER Diagram becomes an abstract data model, that defines a data or information structure which can be implemented in a database, typically a relational database. Entity–relationship modeling was first developed for database and design by Peter Chen and published in a 1976 paper [18], with variants of the idea existing previously [19]. Some ER models show super and subtype entities connected by generalization-specialization relationships, and an ER model can be used also in the specification of domain-specific ontologies.

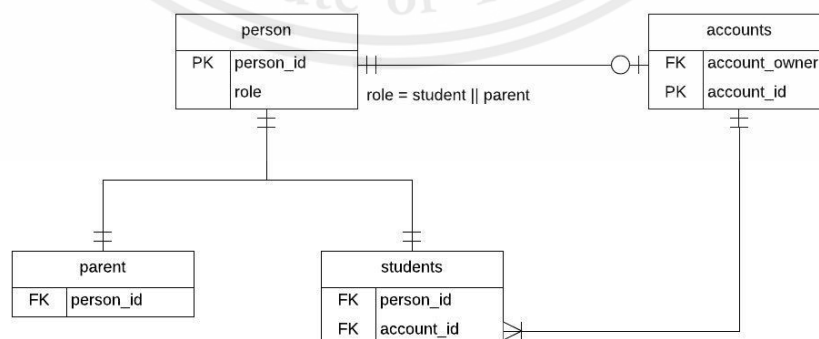


Figure 2.2 Example of diagram using Crows Foot's notation.

### 2.3.1.3 Activities Diagram

Activity diagrams are graphical representations of workflows of stepwise activities and actions with support for choice, iteration and concurrency. In the Unified Modeling Language, activity diagrams are intended to model both computational and organizational processes, as well as the data flows intersecting with the related activities. Although activity diagrams primarily show the overall flow of control, they can also include elements showing the flow of data between activities through one or more data stores.

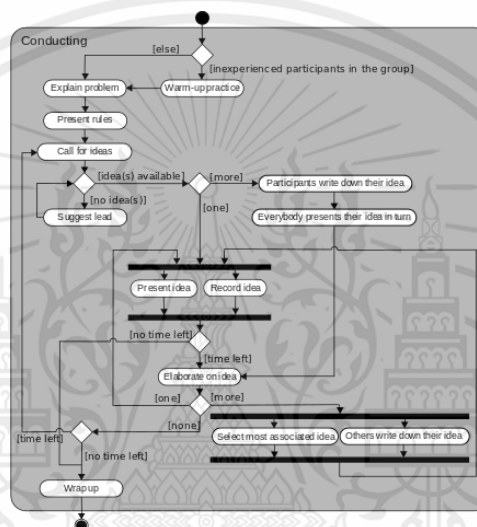


Figure 2.3 Example of Activities Diagram

### 2.3.1.4 Data Flow Diagram

A data-flow diagram is a way of representing a flow of data through a process or a system for information. The DFD also provides information about the outputs and inputs of each entity and the process itself. A data-flow diagram has no control flow, there are no decision rules and no loops. Specific operations based on the data can be represented by a flowchart [20]. The data-flow diagram is part of the structured-analysis modeling tools. When using UML, the activity diagram typically takes over the role of the data-flow diagram. A special form of data-flow plan is a site-oriented data-flow plan. DFD consists of processes, flows, warehouses, and terminators. There are several ways to view these DFD components.

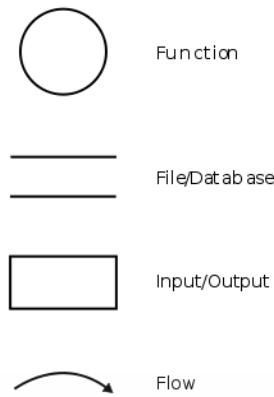


Figure 2.4 Example of Data Flow Diagram notations

To make the DFD more transparent, multi-level DFDs can be created. DFDs that are at a higher level are less detailed. The contextual DFD is the highest in the hierarchy called zero level is followed by DFD 0, starting with process numbering (e.g., process 1, process 2). In the next, the so-called first level – DFD 1 – the numbering continues. E.g. process 1 is divided into the first three levels of the DFD, which are numbered 1.1, 1.2 and 1.3. Similarly, processes in the second level (DFD 2) are numbered eg 2.1.1, 2.1.2, 2.1.3 and 2.1.4. The number of levels depends on the size of the model system. DFD 0 processes may not have the same number of decomposition levels. DFD 0 contains the most important system functions. The lowest level should include processes that make it possible to create a process specification for roughly view. If the mini-specification should be longer, it is appropriate to create an additional level for the process where it will be decomposed into multiple processes. For a clear overview of the entire DFD hierarchy, a vertical diagram can be created. The warehouse is displayed at the highest level where it is first used and at every lower level as well.

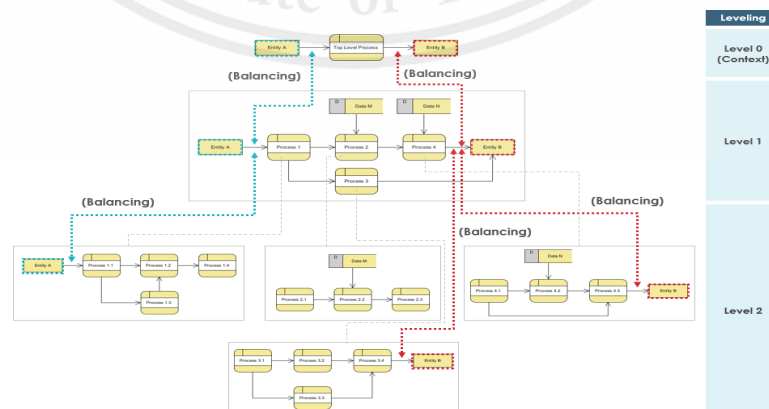


Figure 2.5 Example of Data Flow Diagram in different level

### 2.3.1.5 System Context Diagram

A system context diagram (SCD) in software engineering is a diagram that defines the boundary between the system, or part of a system, and its environment, showing the entities that interact with it [21]. This diagram is a high level view of a system. It is similar to a block diagram and Data Flow Diagram in Level 0

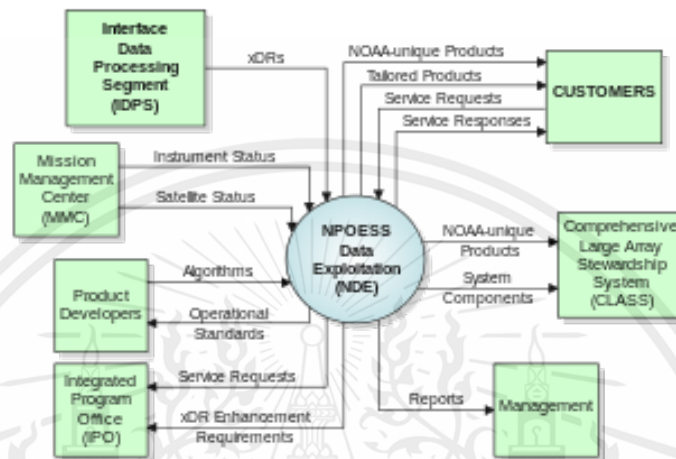


Figure 2.6 Example of a system context diagram

### 2.3.1.6 Use Case Diagram

A use case diagram at its simplest is a representation of a user's interaction with the system that shows the relationship between the user and the different use cases in which the user is involved. A use case diagram can identify the different types of users of a system and the different use cases and will often be accompanied by other types of diagrams as well. The use cases are represented by either circles or ellipses. Due to their simplistic nature, use case diagrams can be a good communication tool for stakeholders. The drawings attempt to mimic the real world and provide a view for the stakeholder to understand how the system is going to be designed. Siau and Lee conducted research to determine if there was a valid situation for use case diagrams at all or if they were unnecessary.

## 2.3.2 Software Development Tools

### 2.3.2.1 HTML 5

Hypertext Markup Language (HTML) is the standard markup language for documents designed to be displayed in a web browser. It can be assisted by technologies such as Cascading Style Sheets (CSS) and scripting languages such as JavaScript. Web

browsers receive HTML documents from a web server or from local storage and render the documents into multimedia web pages. HTML describes the structure of a web page semantically and originally included cues for the appearance of the document. HTML elements are the building blocks of HTML pages. With HTML constructs, images and other objects such as interactive forms may be embedded into the rendered page. HTML provides a means to create structured documents by denoting structural semantics for text such as headings, paragraphs, lists, links, quotes and other items. HTML elements are delineated by tags, written using angle brackets. HTML can embed programs written in a scripting language such as JavaScript, which affects the behavior and content of web pages. Inclusion of CSS defines the look and layout of content. The World Wide Web Consortium (W3C), former maintainer of the HTML and current maintainer of the CSS standards, has encouraged the use of CSS over explicit presentational HTML since 1997.

#### **2.3.2.2 CSS 2.1**

Cascading Style Sheets (CSS) is a style sheet language used for describing the presentation of a document written in a markup language such as HTML [22]. CSS is a cornerstone technology of the World Wide Web, alongside HTML and JavaScript. CSS is designed to enable the separation of presentation and content, including layout, colors, and fonts. This separation can improve content accessibility, provide more flexibility and control in the specification of presentation characteristics, enable multiple web pages to share formatting by specifying the relevant CSS in a separate .css file which reduces complexity and repetition in the structural content as well as enabling the .css file to be cached to improve the page load speed between the pages that share the file and its formatting.

#### **2.3.2.3 PHP 7**

PHP is a general-purpose scripting language especially suited to web development. PHP code is usually processed on a web server by a PHP interpreter implemented as a module, a daemon or as a Common Gateway Interface (CGI) executable. On a web server, the result of the interpreted and executed PHP code, which may be any type of data, such as generated HTML or binary image data would form the whole or part of an HTTP response.

#### **2.3.2.4 MySQL**

MySQL is an open-source relational database management system (RDBMS). Its name is a combination of "My", the name of co-founder Michael Widenius's daughter [23], and "SQL", the abbreviation for Structured Query Language. A relational database organizes data into one or more data tables in which data types may be related to each other; these relations help structure the data. SQL is a language programmers use to create, modify and extract data from the relational database, as well as control user access to the database. In addition to relational databases and SQL, an RDBMS like MySQL works with an operating system to implement a relational database in a computer's storage system, manages users, allows

#### **2.3.2.5 Bootstrap**

Bootstrap is a HTML, CSS & JS Library that focuses on simplifying the development of informative web pages. The primary purpose of adding it to a web project is to apply Bootstrap's choices of color, size, font and layout to that project. As such, the primary factor is whether the developers in charge find those choices to their liking. Once added to a project, Bootstrap provides basic style definitions for all HTML elements. The result is a uniform appearance for prose, tables and form elements across web browsers. In addition, developers can take advantage of CSS classes defined in Bootstrap to further customize the appearance of their contents. For example, Bootstrap has provisioned for light- and dark-colored tables, page headings, more prominent pull quotes, and text with a highlight.

#### **2.3.2.6 Visual Studio Code Application**

Visual Studio Code is a free source-code editor made by Microsoft for Windows, Linux and macOS. Features include support for debugging, syntax highlighting, intelligent code completion, snippets, code refactoring, and embedded Git. Users can change the theme, keyboard shortcuts, preferences, and install extensions that add additional functionality.

#### **2.3.2.7 GIT**

Git is a software for tracking changes in any set of files, usually used for coordinating work among programmers collaboratively developing source code during software development. Its goals include speed, data integrity, and support for linear workflows.

### 2.3.2.8 MAMP Application

The name MAMP is an acronym that stems from the names of the components of the system: macOS, Apache, MySQL or MariaDB and PHP, PHPMyAdmin or Python. The name is derived from LAMP, a similar stack of all open-source software widely used for web sites, but substituting the proprietary macOS for the open-source Linux OS.

### 2.3.2.9 MySQL Workbench

MySQL Workbench is a visual database design tool that integrates SQL development, administration, database design, creation and maintenance into a single integrated development environment for the MySQL database system. It is the successor to DBDesigner 4 from fabFORCE.net, and replaces the previous package of software, MySQL GUI Tools Bundle.

## 2.3.3 Existing Software in Worldwide Market

### 2.3.3.1 ZOHO Inventory

Zoho Inventory is cloud-based inventory management software that helps company create and manage both sales and purchase orders, and track inventory. A company can integrate it with online sales channels like Amazon, eBay, and Etsy, as well as shopping carts like Shopify and many more. Zoho Inventory, additionally helps in managing sales over digital marketing platforms like Amazon, eBay, Etsy, or Shopify. Sales team can now efficiently manage offline and online orders with this integrated order management system. Zoho Inventory is equipped with an end-to-end tracking system that helps in tracking the movement of each item from warehouse to salespoint.

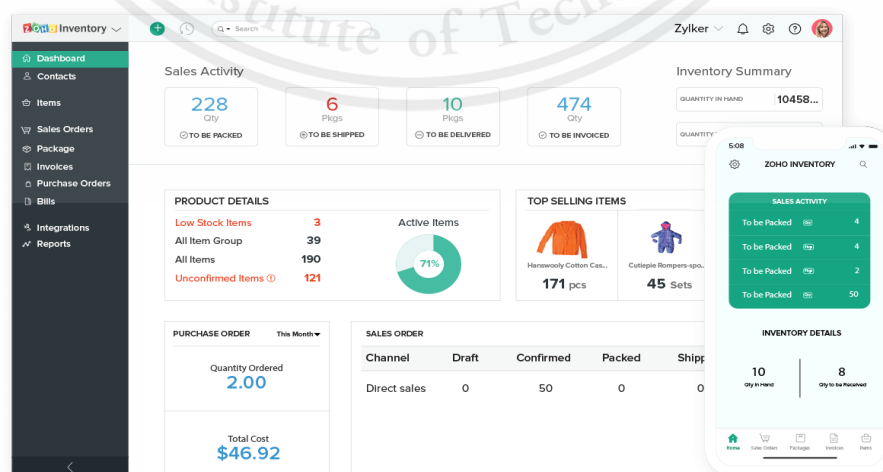


Figure 2.7 Screenshot of ZOHO Inventory webpage

### 2.3.3.2 Sellbrite

Sellbrite is one of the best small business inventory software that provides user-friendly advanced features to save you from overstocking. Its multi-channel inventory control feature assists the business in tracking inventory, automate orders routing between various warehouses and provide complete warehouse control. This inventory and order management software is a unique platform with great UI. Sellbrite is one of the most sorted business inventory software. This user-friendly platform offers enterprise-level inventory management features and helps the business in establishing a balance between stock, sales, and purchase orders.

### 2.3.3.3 inFlow Inventory

inFlow is an inventory management software designed for item-based businesses to track merchandise, manage orders, generate invoices, curate reports and handle other trade and transaction operations, the software hosts product lists, tracks the transit status of stocks, and organizes the inventory using DYMO printer generated barcodes. These barcodes also aid in product identification and order distribution.

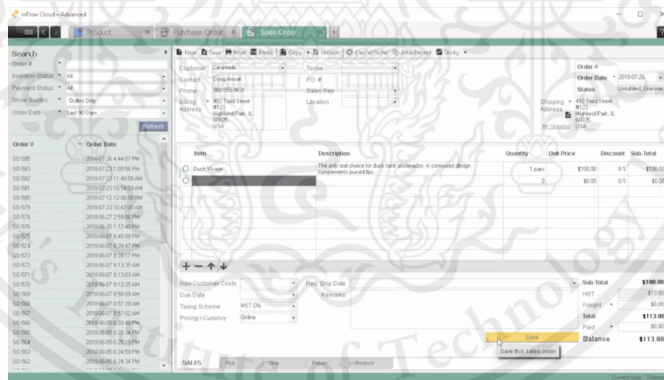


Figure 2.8 Screenshot of inFlow Inventory program

# Chapter 3

## Methodology

For this chapter, we describe about the processes of how we do this project from the beginning until it is done. Some steps might contain calculation part or theory part that we already mentioned in chapter 2.

### 3.1 Gathering the data

The first step is going to the site to see the business process as shown as figure below. The purpose of this time was to address the business problem of inventory management and collect the data as much as possible. The business we went to is LTK Intertrading company limited, it is located at Chonburi, Thailand.



*Figure 3.1: On-site at LTK Intertrading Co., ltd*

The data in this project we used is secondary data of year 2020. And according to policy, the firm can provide us the data of 119 products. The data includes as followed.

1. Annual order quantity of total 119 product
2. Lead time of suppliers
3. Product cost
4. Cost of ordering and carrying the products

### **3.2 Research tool: ABC classification system**

We classify groups of products by using ABA classification system. We calculate and find inventory for each product and then rank from maximum to minimum value.

#### **ABC classification**

1. Find inventory value by multiplying the price of an item by the annual volume of that item.
2. Calculate each item's percentage of total inventory value
3. Sort item's percentage of each inventory value from maximum to minimum
4. Group the products into 3 groups
  - Group A: This group has 70%– 80% of total inventory value
  - Group B: This group has 15%– 20% of total inventory value
  - Group C: This group is all remaining inventory value

### **3.3 Define problem solution**

#### **3.3.1 Economic order quantity: EOQ**

We use EOQ to find optimum amount to make an order and increase efficiency of inventory management. The data that used to find EOQ are annual amount of product, reordering cost, and holding cost. EOQ formula is shown as below

$$EOQ = \sqrt{\frac{2RcD}{Hc}}$$

Where:

$R_c$  = Reordering cost

$D$  = Annual demand

$H_c$  = Holding cost (per unit, per year)

### 3.3.2 Reorder point (ROP)

After we know EOQ, then we find reorder point to know when the right time is to make an order again. Reorder point can calculate by this formula

$$ROP = d * L$$

Where:

d = Average demand

L = lead time

### 3.3.3 Compare total cost between original and EOQ method

This step we make a comparison of cost between original method and EOQ to see how cost decrease by using EOQ instead. Total cost and find by this formula below

$$TC = (D/Q * R_c) + (Q/2 * H_c)$$

Where:

D = Annual demand

Q = Order quantity

R<sub>c</sub> = Reordering cost

H<sub>c</sub> = Holding cost (per unit, per year)

### 3.4 Software section

In this section we used Agile Development Process to design, develop and maintain online inventory management software.

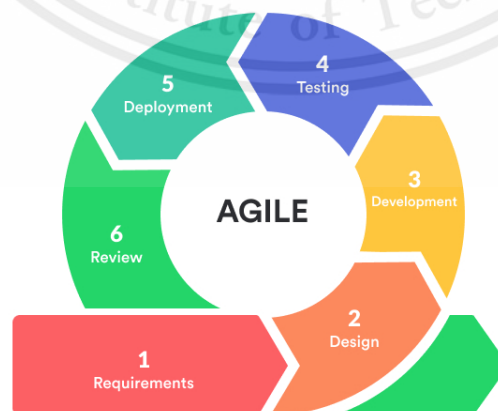


Figure 3.2: Agile Development Processes

Agile Development Process, as can see from the figure sprint from sprint more function will be added to the project. As the system adds more function to it and keep repeating the sprint, it is an incremental and iterative development process. For this system, we skip the real situation of deployment under limitations of cost and actual flexible business processes.

### **3.4.1 Step 1 Requirement**

This step involved collecting information from the company and employees who involve in purchasing order department. Then provide listing and a basic diagram (Context Diagram) for collected requirements.

### **3.4.2 Step 2 Design**

This step involved using the analytical result and report to design the inventory management software. This step is also requiring layout design and database design. We use papers for a concept and drafts of all pages in the website layout. The layout design is too flexible. So, the layout design can be added and edited in development process. We also use MySQLWorkbench to draft basic database architecture for the system. MySQLWorkbench projects all records' relationship among the tables in the database. Moreover, MySQLWorkbench can construct ideal SQL code for creating the database in PHPMyAdmin.

### **3.4.3 Step 3 Development**

#### **3.4.3.1 Development tools**

##### **3.4.3.1.1 Operating System**

- macOS 11.4
- macOS 10.13.6
- iPadOS 14.6
- iOS 14.6

##### **3.4.3.1.2 Web Browser**

- Safari 14.1.1
- Safari 13.1.2

##### **3.4.3.1.3 Programming Language**

- HTML
- CSS
- PHP

- Javascript
- SQL

#### 3.4.3.1.4 Frameworks

- Bootstrap

#### 3.4.3.1.5 IDE

- Microsoft Visual Studio Code 1.56.2

#### 3.4.3.1.6 Database Management System

- PHPMyAdmin (with MAMP)
- MySQLWorkbench

#### 3.4.3.1.7 Utility Software

- Adobe illustrator CC2021
- Adobe photoshop CC2021
- Microsoft Office Excel 365
- RapidMiner Studio

#### 3.4.3.2 Development techniques

Functional Programming is a programming concept such as, pure function, query data function and filter-reduce-add-update data function.

#### 3.4.3.3 Requirements Analysis

The requirement analysis provides further details on the project requirements along with Use Case Diagram, Activities diagram, Context Diagram, Data Flow Diagram level 1 and ER Diagram – Crows Foot Model. The requirements are represented in a form that identify functional requirements of the system.

#### 3.4.3.3.1 Use Case Diagram

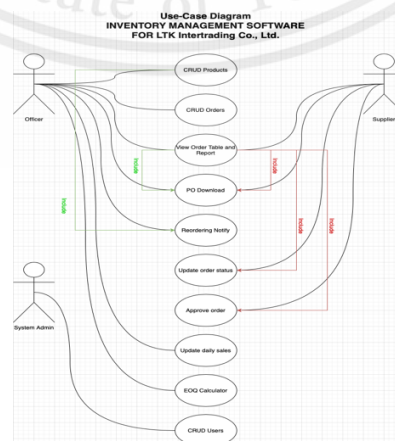


Figure 3.3: Use-case diagram of software

### 3.4.3.3.2 Activities Diagram

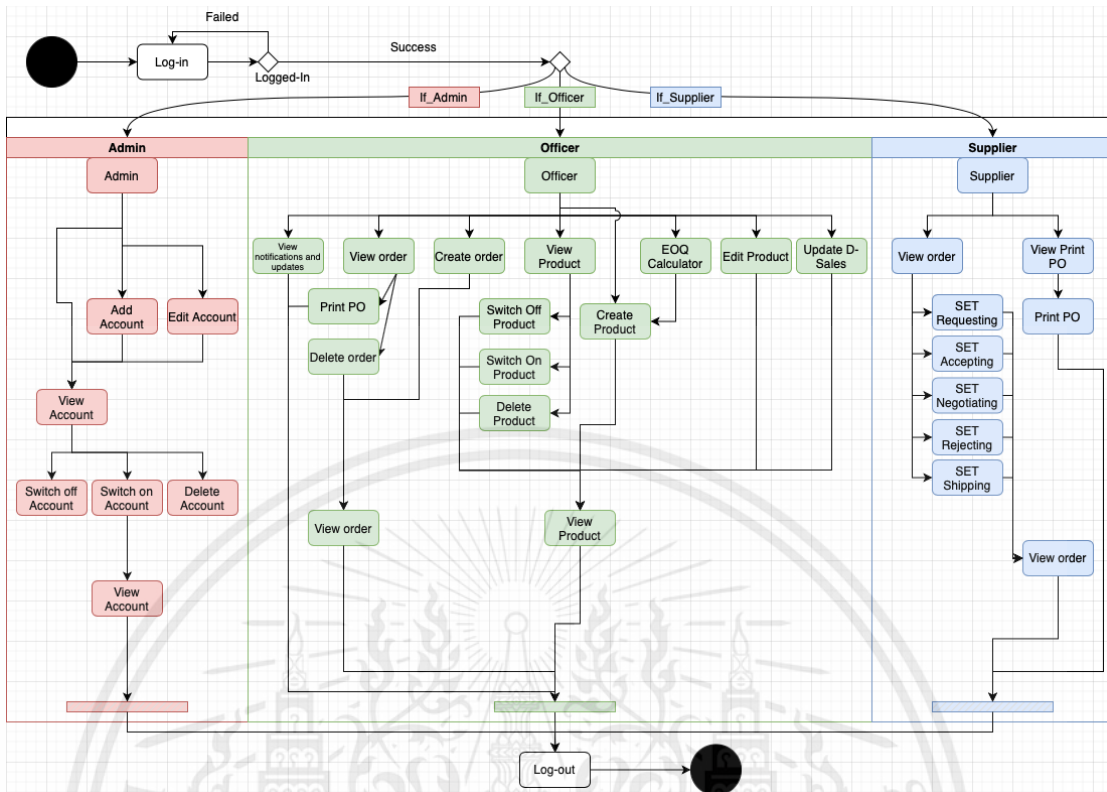


Figure 3.4: Activities diagram of software

### 3.4.3.3.3 Context Diagram

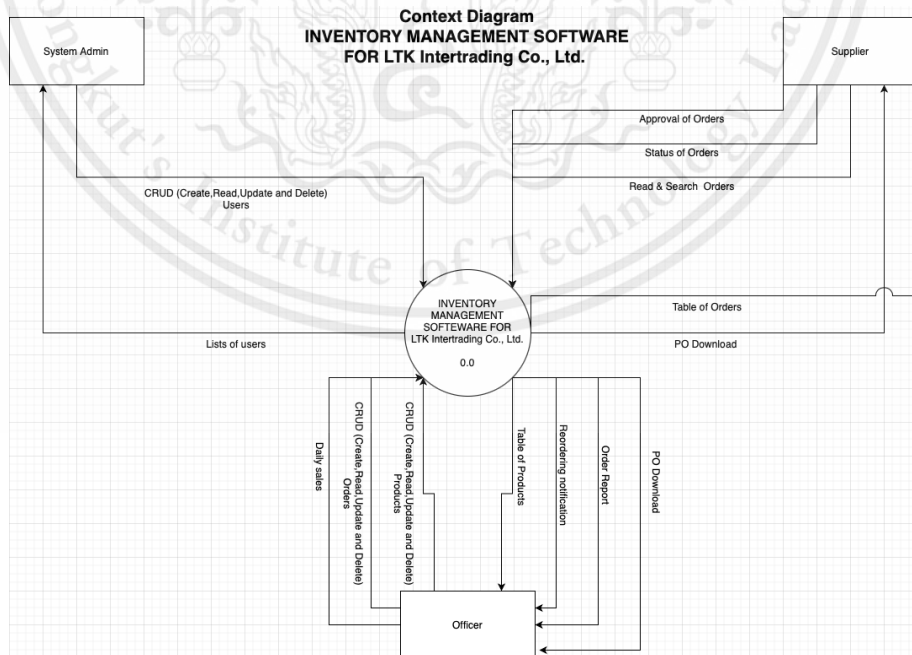


Figure 3.5: Context diagram of software

### 3.4.3.3.4 Data Flow Diagram level 1

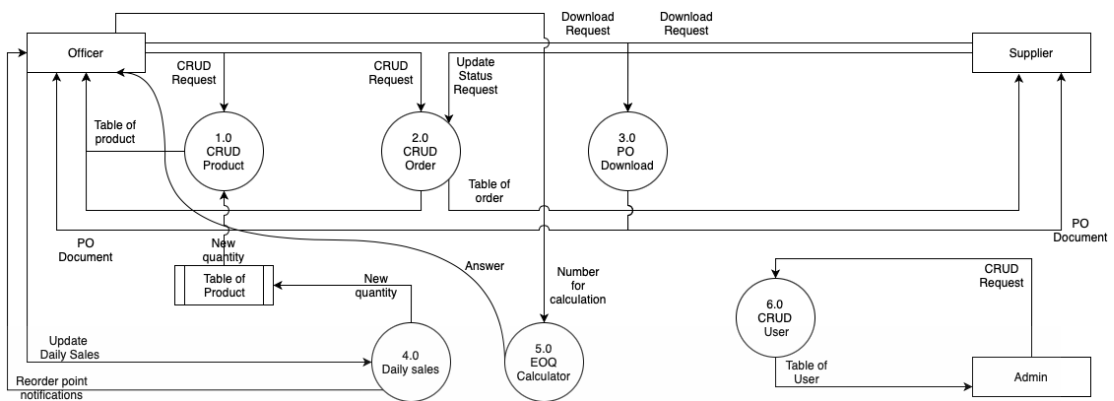


Figure 3.6: Data flow diagram level1

### 3.4.3.3.5 ER Diagram – Crows Foot Model

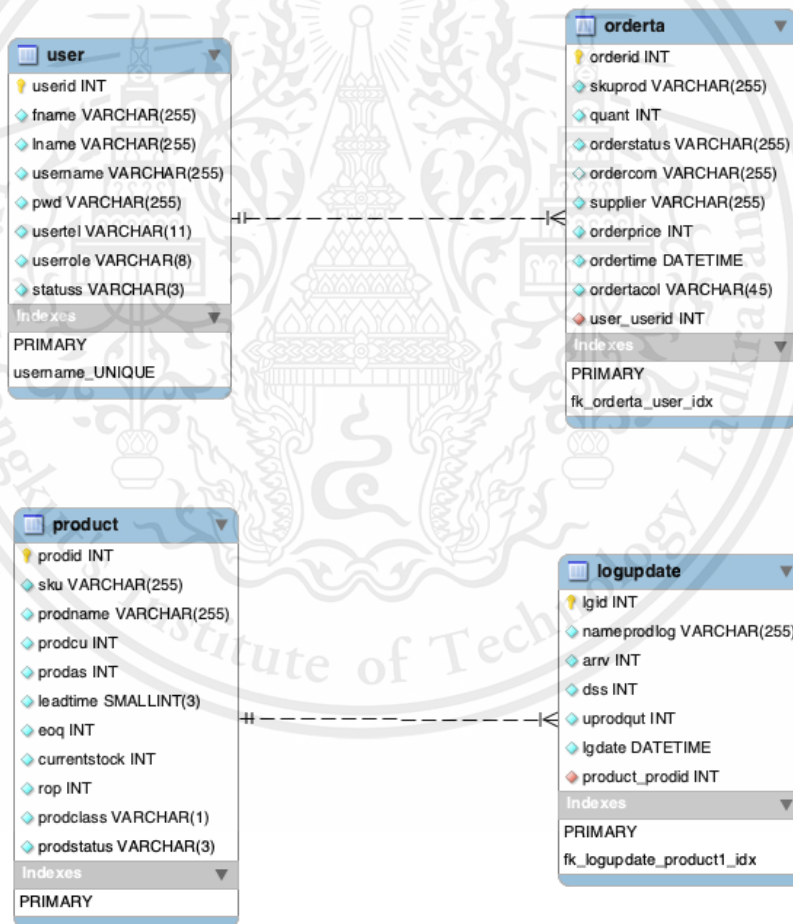


Figure 3.7: ER Diagram of software

#### **3.4.4 Step 4 Testing**

The software that indicate its usability are its capacity to adapt, user's interaction , and the interaction between the system and users. This step is tested by 10 employees in the firm to determine how its performance and suit in term of practical used.

#### **3.4.5 Step 5 Deploy**

For this system, we do not publicly deploy this system yet. Because of operation cost.

#### **3.4.6 Step 6 Review**

This step, we distributed the feedback form to 10 employees in the firm. Then collect all of feedback for initiate new requirements again and preparing for a new sprint of Agile Development Process.



# Chapter 4

## Result

In this chapter mentions the process from the first step until it is finished as an inventory software of LKT Intertrading company limited. This chapter shows how the given data had been analyze in term of inventory management and then apply it through software to show and manage the data of inventory more efficiently.

### 4.1 Gathering the data

Firstly, we analyze the problem of inventory to find which method could solve it. Then we gather inventory data from procurement department. Gathered products are 119 from the total, due to data privacy of the business. The table 4.1 is shown the data of 119 products, each product consists of cost per unit, and annual demand volume to classify product group next step.

### 4.2 Product inventory classification

According to the inventory data total 119 products, we classify group of products by applying ABC classification system to consider and control in appropriate way. We group products in to three groups which are group A, B, and C. Calculation of ABC classification is shown as table 4.2

Table 4.1: 119 Products data from procurement department

<b>Product</b>	<b>Unit cost</b>	<b>Annual volume</b>	<b>Inventory value</b>
22 multi-quat sanitizer 2 l	1,200	1,200	1,440,000
3M disinfectant deodorizer	120	8,200	984,000
3M disinfectant toilet cleaner floral 3.8 l	194	7,500	1,455,000
3M floor cleaner 3.8l (romantic rose)	140	5,100	714,000
3M fresh scent deodorizer	45	9,200	414,000
3M glass cleaner 3.8 l	170	3,500	595,000
3M Grease cutter	270	1,524	411,480
3M hand soap 3.8 l	140	35,600	4,984,000
3M multi-purpose cleaning powder 25 kg	700	4,320	3,024,000
3M toilet sanitizer 3.8 l (Pruksa)	180	5,500	990,000
A4 quality yellow 70 gram	70	31,000	2,170,000
Air neutralizer: morning air	900	6,720	6,048,000
All-purpose cleaner	195	18,000	3,510,000
Aquarius bath tissue jumbo roll dispenser 70270	560	5,400	3,024,000
Aquarius jumbo roll toilet tissue	300	7,200	2,160,000
Auto alcohol spray	1,200	1,800	2,160,000
Auto foam dispenser	2,400	1,440	3,456,000
Auto hand dryer (MH-112)	2,550	600	1,530,000
Auto soap dispenser (drop)	450	3,240	1,458,000
Auto soap dispenser (foam)	450	3,600	1,620,000
Auto tissue dispenser	650	1,500	975,000
Automatic air spray dispenser	670	1,320	884,400
Automatic hand dryer (MH-104)	6,500	480	3,120,000
Automatic perfume dispenser	1,400	560	784,000
Carpet cleaner	510	2,080	1,060,800
Cleaning sanitizer Rivonit ds	200	200	168,000
Cold-hot water dispenser (Blue)	2,800	420	1,176,000
Cold-hot water dispenser (Green)	2,900	300	870,000

<b>Product</b>	<b>Unit cost</b>	<b>Annual volume</b>	<b>Inventory value</b>
Cold-hot water dispenser (Red)	2,900	240	696,000
Cold-hot water dispenser (VT-279K)	4,000	304	1,216,000
Cold-hot water dispenser (VT-28D/S1)	2,300	300	690,000
Dish soap (Super trump)	220	6,720	1,478,400
Double A A4 paper	550	327,000	179,850,000
Double A A4 report book	1,200	146,900	176,280,000
Double A A5 notebook professional (ring binder) 70 gram	1,320	82,600	109,032,000
Double A A5 notebook professional 70 gram	890	19,600	17,444,000
Double A A6 notebook professional 70 gram	1,100	58,400	64,240,000
Double A B5 notebook professional 70 gram	1,270	96,000	121,920,000
Double A planner 80 gram	1,300	6,600	8,580,000
Ecolab Hand soap AB clean & smooth	260	11,760	3,057,600
Evostar floor cleaner 3.8 l	80	4,500	360,000
Evostar paper water cone cup (4000 cups)	580	21,000	12,180,000
Evostar paper water cone cup (4500 cups)	550	86,000	47,300,000
Evostar paper water cone cup (5000 cups)	600	18,000	10,800,000
Fest bio spoon	780	9,600	7,488,000
Fest bio square box 1,000 ml	980	38,200	37,436,000
Fest bowl 850 ml	630	9,000	5,670,000
Fest bowl 850 ml (Chicken)	630	9,600	6,048,000
Fest foam box 1300 ml	650	19,200	12,480,000
Fest foam box 500 ml	700	15,240	10,668,000
Fest foam box 600 ml	680	91,000	61,880,000
Fest hybrid choice box 650 ml	770	13,000	10,010,000
Fest paper cup 8 oz	1,350	7,560	10,206,000
Fest paper plate 7 inches	600	20,600	12,360,000

<b>Product</b>	<b>Unit cost</b>	<b>Annual volume</b>	<b>Inventory value</b>
Fest paper plate 9 inches	950	10,800	10,260,000
Floor cleaner Future DC 3.8l	200	2,400	480,000
Garbage bags 18 x 20	30	9,000	270,000
Glass cleaner 3.8 l	110	4,200	462,000
Grease trouble shooter	180	740	133,200
Hair dryer 1200W. 0601-020	1,000	1,100	1,100,000
Hair dryer 1200W. 0601-029	1,000	520	520,000
Kimsoff 6 rolls 2 ply	480	9,600	4,608,000
Kimsoft 1 roll 2ply	400	8,160	3,264,000
Kimsoft 24 rolls 2-ply	420	217,400	91,308,000
Kimsoft jumbo roll 1ply	1,200	2,400	2,880,000
Kimsoft jumbo roll tissue 2 ply	1,200	2,040	2,448,000
Kimsoft jumbo roll tissue compact 1-ply	600	256,000	153,600,000
Kimsoft jumbo roll tissue compact 2-ply	600	12,000	7,200,000
King's stella toilet seat sanitizer	570	4,920	2,804,400
Kingstella fresh gel air	450	6,720	3,024,000
Kleenex facial tissue 100's	600	7,200	4,320,000
Kleenex facial tissue 150's	650	10,800	7,020,000
Kleenex facial tissue 170's	680	285,200	193,936,000
Kleenex roll towel	700	10,440	7,308,000
Marvel auto faucet (MF-102)	2,600	1,800	4,680,000
Marvel auto faucet (MF-103)	2,400	2,280	5,472,000
Marvel auto faucet (MF-104)	2,600	2,400	6,240,000
Marvel auto faucet (MF-113)	3,200	2,500	8,000,000
Marvel auto faucet (MF-1502)	3,300	1,800	5,940,000
Marvel auto faucet (MF-1503-M)	3,500	1,680	5,880,000
Marvel auto faucet (MF-1503-S)	3,300	2,760	9,108,000
Marvel auto faucet (MF-1503-T)	3,850	2,400	9,240,000
Marvel stainless paper dispenser (MS304_18)	850	7,920	6,732,000

<b>Product</b>	<b>Unit cost</b>	<b>Annual volume</b>	<b>Inventory value</b>
Marvel walls mount stainless auto faucet (MF-1501)	3,500	1,320	4,620,000
Marvel walls mount stainless towel dispenser	3,500	2,220	7,770,000
Nilon broom with lid	250	250	150,000
Nitri blue gloves	380	7,200	2,736,000
Nitri orange gloves	200	16,200	3,240,000
Nitri purple glove	400	9,000	3,600,000
Nitri white gloves	380	9,800	3,724,000
Plastic paper cup dispenser	300	12,000	3,600,000
Scott 1 roll 2 ply	450	10,800	4,860,000
Scott 24 rolls 2-ply	500	264,500	132,250,000
Scott alcohol antibacterial wipe 4100	80	30,000	2,400,000
Scott facial tissue 60's cubic	440	19,200	8,448,000
Scott facial tissue 60's long	420	10,320	4,334,400
Scott facial tissue 60's short	400	12,000	4,800,000
Scott HBT 1 ply 300'S	600	9,100	5,460,000
Scott HBT 2 ply 150's	500	6,600	3,300,000
Scott interfold hand towel	1,050	248,000	260,400,000
Scott jumbo roll tissue 1 ply	1,000	4,080	4,080,000
Scott jumbo roll tissue 2 ply	1,000	2,400	2,400,000
Scott pop-up (200's x 60)	270	15,600	4,212,000
Scott standard compact towels	1,000	142,400	142,400,000
Single mop wringer	800	420	336,000
Spray buff	410	2,160	885,600
Stainless jumbo roll dispenser	800	3,600	2,880,000
Stainless paper cup dispenser	220	15,240	3,352,800
Stainless water dispenser, 4 taps	10,000	470	4,700,000
Stainless water dispenser, 6 taps	13,000	480	6,240,000
Stainless water dispenser: 1tap	2,700	600	1,620,000

Product	Unit cost	Annual volume	Inventory value
Sterilization spray	530	760	402,800
Stretch film 15 micron	80	36,000	2,880,000
Sunlight dish soap 3.6 l	140	6,000	840,000
Wall hair dryer 1200W. 0601-029	1,100	700	770,000
Wall mounted hair dryer 1200W.0601-030	1,000	1,300	1,300,000
Wall mounted stainless tissue dispenser (double horizontal)	600	3,600	2,160,000
Wall mounted stainless tissue dispenser (double vertical)	600	4,260	2,556,000
Wypall jumbo tissue *20 perforated	860	8,160	7,017,600

Table 4.2: ABC classification calculation

Product list	Unit cost	Annual volume	Inventory value	Inventory value (%)	Group
Scott interfold hand towel	1,050	248,000	260,400,000	11.9148	<b>A (71.42%)</b>
Kleenex facial tissue 170's	680	285,200	193,936,000	8.8737	
Double A A4 paper	550	327,000	179,850,000	8.2292	
Double A A4 report book	1,200	146,900	176,280,000	8.0658	
Kimsoft jumbo roll tissue compact 1-ply	600	256,000	153,600,000	7.0281	
Scott standard compact towels	1,000	142,400	142,400,000	6.5156	
Scott 24 rolls 2-ply	500	264,500	132,250,000	6.0512	
Double A B5 notebook professional 70 gram	1,270	96,000	121,920,000	5.5785	
Double A A5 notebook professional (ring binder) 70 gram	1,320	82,600	109,032,000	4.9888	
Kimsoft 24 rolls 2-ply	420	217,400	91,308,000	4.1779	

Product list	Unit cost	Annual volume	Inventory value	Inventory value (%)	Group
Double A A6 notebook professional 70 gram	1,100	58,400	64,240,000	2.9393	<b>B (22.76%)</b>
Fest foam box 600 ml	680	91,000	61,880,000	2.8314	
Evostar paper water cone cup (4500 cups)	550	86,000	47,300,000	2.1642	
Fest bio square box 1,000 ml	980	38,200	37,436,000	1.7129	
Double A A5 notebook professional 70 gram	890	19,600	17,444,000	0.7982	
Fest foam box 1300 ml	650	19,200	12,480,000	0.571	
Fest paper plate 7 inches	600	20,600	12,360,000	0.5655	
Evostar paper water cone cup (4000 cups)	580	21,000	12,180,000	0.5573	
Evostar paper water cone cup (5000 cups)	600	18,000	10,800,000	0.4942	
Fest foam box 500 ml	700	15,240	10,668,000	0.4881	
Fest paper plate 9 inches	950	10,800	10,260,000	0.4695	
Fest paper cup 8 oz	1,350	7,560	10,206,000	0.467	
Fest hybrid choice box 650 ml	770	13,000	10,010,000	0.458	
Marvel auto faucet (MF-1503-T)	3,850	2,400	9,240,000	0.4228	
Marvel auto faucet (MF-1503-S)	3,300	2,760	9,108,000	0.4167	
Double A planner 80 gram	1,300	6,600	8,580,000	0.3926	
Scott facial tissue 60's cubic	440	19,200	8,448,000	0.3865	
Marvel auto faucet (MF-113)	3,200	2,500	8,000,000	0.366	

Product list	Unit cost	Annual volume	Inventory value	Inventory value (%)	Group
Marvel walls mount stainless towel dispenser	3,500	2,220	7,770,000	0.3555	<b>B (22.76%)</b>
Fest bio spoon	780	9,600	7,488,000	0.3426	
Kleenex roll towel	700	10,440	7,308,000	0.3344	
Kimsoft jumbo roll tissue compact 2-ply	600	12,000	7,200,000	0.3294	
Kleenex facial tissue 150's	650	10,800	7,020,000	0.3212	
Wypall jumbo tissue *20 perforated	860	8,160	7,017,600	0.3211	
Marvel stainless paper dispenser (MS304_18)	850	7,920	6,732,000	0.308	
Marvel auto faucet (MF-104)	2,600	2,400	6,240,000	0.2855	
Stainless water dispenser, 6 taps	13,000	480	6,240,000	0.2855	
Fest bowl 850 ml (Chicken)	630	9,600	6,048,000	0.2767	
Air neutralizer: morning air	900	6,720	6,048,000	0.2767	
Marvel auto faucet (MF-1502)	3,300	1,800	5,940,000	0.2718	
Marvel auto faucet (MF-1503-M)	3,500	1,680	5,880,000	0.2690	
Fest bowl 850 ml	630	9,000	5,670,000	0.2594	
Marvel auto faucet (MF-103)	2,400	2,280	5,472,000	0.2504	
Scott HBT 1 ply 300'S	600	9,100	5,460,000	0.2498	
3M hand soap 3.8 l	140	35,600	4,984,000	0.2280	
Scott 1 roll 2 ply	450	10,800	4,860,000	0.2224	
Scott facial tissue 60's short	400	12,000	4,800,000	0.2196	

Product list	Unit cost	Annual volume	Inventory value	Inventory value (%)	Group
Stainless water dispenser, 4 taps	10,000	470	4,700,000	0.2151	<b>B (22.76%)</b>
Marvel auto faucet (MF-102)	2,600	1,800	4680,000	0.2141	
Marvel walls mount stainless auto faucet (MF-1501)	3,500	1,320	4,620,000	0.2114	
Kimsoff 6 rolls 2 ply	480	9,600	4,608,000	0.2108	
Scott facial tissue 60's long	420	10,320	4,334,400	0.00198	<b>C (5.82%)</b>
Kleenex facial tissue 100's	600	7,200	4,320,000	0.00197665	
Scott pop-up (200's x 60)	270	15,600	4,212,000	0.00192723	
Scott jumbo roll tissue 1 ply	1,000	4,080	4,080,000	0.00186683	
Nitri white gloves	380	9,800	3,724,000	0.00170394	
Plastic paper cup dispenser	300	12,000	3,600,000	0.00164721	
Nitri purple glove	400	9,000	3,600,000	0.00164721	
All-purpose cleaner	195	18,000	3,510,000	0.00160603	
Auto foam dispenser	2,400	1,440	3,456,000	0.00158132	
Stainless paper cup dispenser	220	15,240	3,352,800	0.00153410	
Scott HBT 2 ply 150's	500	6,600	3,300,000	0.00150994	
Kimsoft 1 roll 2ply	400	8,160	3,264,000	0.00149347	
Nitri orange gloves	200	16,200	3,240,000	0.00148249	
Automatic hand dryer (MH-104)	6,500	480	3,120,000	0.00142758	
Ecolab Hand soap AB clean & smooth	260	11,760	3,057,600	0.00139903	
Kingstella fresh gel air	450	6,720	3,024,000	0.00138365	
Aquarius bath tissue jumbo roll dispenser 70270	560	5,400	3,024,000	0.00138365	

Product list	Unit cost	Annual volume	Inventory value	Inventory value (%)	Group
3M multi-purpose cleaning powder 25 kg	700	4,320	3,024,000	0.00138365	<b>C (5.82%)</b>
Stretch film 15 micron	80	36,000	2,880,000	0.00131777	
Stainless jumbo roll dispenser	800	3,600	2,880,000	0.00131777	
Kimsoft jumbo roll 1ply	1,200	2,400	2,880,000	0.00131777	
King's stella toilet seat sanitizer	570	4,920	2,804,400	0.00128317	
Nitri blue gloves	380	7,200	2,736,000	0.00125188	
Wall mounted stainless tissue dispenser (double vertical)	600	4,260	2,556,000	0.00116952	
Kimsoft jumbo roll tissue 2 ply	1,200	2,040	2,448,000	0.00112010	
Scott alcohol antibacterial wipe 4100	80	30,000	2,400,000	0.00109814	
Scott jumbo roll tissue 2 ply	1,000	2,400	2,400,000	0.00109814	
A4 quality yellow 70 gram	70	31,000	2,170,000	0.00099290	
Aquarius jumbo roll toilet tissue	300	7,200	2,160,000	0.00098832	
Wall mounted stainless tissue dispenser (double horizontal)	600	3,600	2,160,000	0.00098832	
Auto alcohol spray	1,200	1,800	2,160,000	0.00098832	
Auto soap dispenser (foam)	450	3,600	1,620,000	0.00074124	
Stainless water dispenser: 1tap	2,700	600	1,620,000	0.00074124	
Auto hand dryer (MH-112)	2,550	600	1,530,000	0.00070006	
Dish soap (Super trump)	220	6,720	1,478,400	0.00067645	

<b>Product list</b>	<b>Unit cost</b>	<b>Annual volume</b>	<b>Inventory value</b>	<b>Inventory value (%)</b>	<b>Group</b>
Auto soap dispenser (drop)	450	3,240	1,458,000	0.00066712	<b>C (5.82%)</b>
3M disinfectant toilet cleaner floral 3.8 l	194	7,500	1,455,000	0.00066575	
22 multi-quat sanitizer 2 l	1,200	1,200	1,440,000	0.00065888	
Wall mounted hair dryer 1200W.0601-030	1,000	1,300	1,300,000	0.00059482	
Cold-hot water dispenser (VT-279K)	4,000	304	1,216,000	0.00055639	
Cold-hot water dispenser (Blue)	2,800	420	1,176,000	0.00053809	
Hair dryer 1200W. 0601-020	1,000	1,100	1,100,000	0.00050331	
Carpet cleaner	510	2,080	1,060,800	0.00048538	
3M toilet sanitizer 3.8 l (Pruksa)	180	5,500	990,000	0.00045298	
3M disinfectant deodorizer	120	8,200	984,000	0.00045024	
Auto tissue dispenser	650	1,500	975,000	0.00044612	
Spray buff	410	2,160	885,600	0.00040521	
Automatic air spray dispenser	670	1,320	884,400	0.00040466	
Cold-hot water dispenser (Green)	2,900	300	870,000	0.00039807	
Sunlight dish soap 3.6 l	140	6,000	840,000	0.00038435	
Automatic perfume dispenser	1,400	560	784,000	0.00035872	
Wall hair dryer 1200W. 0601-029	1,100	700	770,000	0.00035232	
3M floor cleaner 3.8l (romantic rose)	140	5,100	714,000	0.0003267	

Product list	Unit cost	Annual volume	Inventory value	Inventory value (%)	Group
Cold-hot water dispenser (Red)	2,900	240	696,000	0.00031846	<b>C (5.82%)</b>
Cold-hot water dispenser (VT-28D/S1)	2,300	300	690,000	0.00031571	
3M glass cleaner 3.8 l	170	3,500	595,000	0.00027225	
Hair dryer 1200W. 0601-029	1,000	520	520,000	0.00023793	
Floor cleaner Future DC 3.8l	200	2,400	480,000	0.00021963	
Glass cleaner 3.8 l	110	4,200	462,000	0.00021139	
3M fresh scent deodorizer	45	9,200	414,000	0.00018943	
3M Grease cutter	270	1,524	411,480	0.000188276	
Sterilization spray	530	760	402,800	0.000184304	
Evostar floor cleaner 3.8 l	80	4,500	360,000	0.00016472	
Single mop wringer	800	420	336,000	0.000153739	
Garbage bags 18 x 20	30	9,000	270,000	0.00012354	
Cleaning sanitizer Rivonit ds	200	200	168,000	7.68696E-05	
Nilon broom with lid	250	250	150,000	6.86336E-05	
Grease trouble shooter	180	740	133,200	6.09466E-05	

### 4.3 Economic Order Quantity analysis (EOQ)

To find an optimum quantity to make an order, we decide to use economic order quantity. We consider economic order quantity by considering the calculation of ordering cost and carrying cost.

#### 4.3.1 Ordering cost

##### 4.3.1.1 Procurement cost

cost of procurement department process. It includes data planning, asking information from suppliers and related departments, and through doing purchasing order. The procurement processes have total 4 employees that show the calculation cost that calculate from labor hours and salary as followed.

Table 4.3: Procurement cost calculation

Employee No.	Activities	Times per day	Monthly wage	Annual wage calculation	Annual wage calculation
1	Plan and approve purchasing requisition (PR)	0.5 hour	70,000	$70000 \times 12 \times 0.5/8$	52,500
2-3	Plan and coordinate to suppliers and others dep.	3 hours	37,000	$37000 \times 12 \times 3/8 \times 2$	333,000
4-5	Issue purchasing order (PO) and coordinate to supplier	3 hours	20,000	$20000 \times 12 \times 3/8 \times 2$	180,000
6	Collect PR and PO to send to Accounting department	1 hour	12,000	$12000 \times 12 \times 1/8$	18,000
<b>Total</b>					<b>583,500</b>

#### 4.3.1.2 Warehouse and quality labor cost

cost of the process from receiving the products, prepare storage spaces, loading, managing, and also included checking product quality, return its back when occur the issue pass inspection. The costs shown as table below

Table 4.4: Warehouse and quality labor costs calculation

Employee No.	Activities	Times per day	Monthly wage	Annual wage calculation	Annual wage calculation
1-4	Report pick up lists to prepare the storage spaces and loading the products	3 hours	15,000	$15000 \times 12 \times 3/8 \times 4$	270,000
5-6	Report and check daily pick-up list data to QC department and record to ERP system	3 hours	25,000	$25000 \times 12 \times 3/8 \times 2$	225,000
7-8	Goods receipt and issue pass inspection list for defected products and monitor at the inspection areas to check the product quality	3 hours	37,000	$37000 \times 12 \times 3/8 \times 2$	333,000
9-10	Check pick-up list daily and keep certificate of product quality	2 hours	25,000	$25000 \times 12 \times 2/8 \times 2$	150,000
<b>Total</b>					<b>978,000</b>

#### 4.3.1.3 Accounting cost

cost of accounting department when products arrive. The cost occurs for billing, make a payment, or any related financial processes. And also follow up financial statements. All accounting cost shown as table 4.3

Table 4.5: Accounting cost

Employee No.	Activities	Times per day	Monthly wage	Annual wage calculation	Annual wage calculation
1-2	Do the accounting when received products	3 hours	18,000	$18000 * 3/8 * 12 * 2$	162,000
3-4	Billing and make a payment	2 hours	25,000	$18000 * 2/8 * 12 * 2$	108,000
5	Checking tax allowance and tax ordinary filling.	2 hours	50,000	$50000 * 2/8 * 12$	150,000
Total					420,000

#### 4.3.1.4 Internet and telephone cost

The charge to communicate between buyer and seller as showed as table below

Table 4.6: Internet and telephone cost

Activities	Times Per day	Charge	Annual rate calculation	Annual wage calculation
Telephone charge (24 days / month)	1 hour	3 Baht / minute	$60 * 3 * 24 * 12$	51,840
Internet charge	All day	6000 / month	$6000 * 12$	72,000
Total				123,840

#### 4.3.1.5 Stationery and office equipment

Stationery and office equipment such as paper, pencil, pen, eraser, ruler, notebook, etc. The calculation is shown as table

Table 4.7: Stationery and office equipment cost

Activities	cost	Annual rate calculation	Annual wage calculation
Paper (PR, PO, Inspection list) - Average = 6 papers per order - 2,150 orders per year	0.176 Baht / paper	$6 \times 0.176 \times 2150$	2,270.4
Ink (Black-white)	0.25 Baht / paper	$6 \times 0.25 \times 2150$	3,225
Pen, pencil, ruler, eraser, marker, etc - 20 employees	50 Baht/person/year	$50 \times 20$	1,000
Total			6495.4

According to all calculation cost above, we sum up each activity cost and then divide by total number of purchasing orders. It is equal 1,064.58 Baht per order that shown as table below.

Table 4.8: Ordering cost calculation

list	Cost
Procurement cost	583,500
Warehouse and quality control cost	978,000
Accounting cost	420,000
Internet and telephone cost	123,840
Stationery and office equipment	6,495.4
Total cost	2,111,835.4
Total number of purchasing order (PO)	2150
Ordering cost	982.25

### 4.3.2. Carrying cost

In order to calculate inventory carrying cost, we estimate under assumption as 23 percent, over 65 percent of all companies do not compute inventory carrying cost, but use rough estimates instead. The rule of thumb for inventory cost is 25 percent of inventory value on hand [25]. The inventory carrying cost can be broken down as table below

Table 4.9: Estimated carrying cost

Lists	Percent
Cost of money	0.06
Tax	0.02
Insurance	0.01
Rental warehouse	0
Physical handling	0.02
Clerical and inventory control	0.03
Obsolescence	0.06
Deterioration and pilferage	0.03
Total	0.23

To find an optimal order quantity can calculate by using formula as below

$$EOQ = \sqrt{\frac{2RcD}{Hc}}$$

Where:

$R_c$  = Reordering cost

$D$  = Annual demand

$H_c$  = Holding cost (per unit, per year)

- Scott interfold hand towel

$$EOQ = \sqrt{\frac{2 * 982.25 * 248000}{0.23 * 1050}}$$

$$= 1,420$$

$$\text{Frequency} = \frac{D}{Q} = 175 \text{ per year}$$

- Kleenex facial tissue 170's

$$\text{EOQ} = \sqrt{\frac{2 * 982.25 * 285200}{0.23 * 680}}$$

$$= 1,893$$

$$\text{Frequency} = \frac{D}{Q} = 151 \text{ per year}$$

- Double A A4 paper

$$\text{EOQ} = \sqrt{\frac{2 * 982.25 * 327000}{0.23 * 550}}$$

$$= 2,253$$

$$\text{Frequency} = \frac{D}{Q} = 145 \text{ per year}$$

- Grease trouble shooter

$$\text{EOQ} = \sqrt{\frac{2 * 982.25 * 740}{0.23 * 180}}$$

$$= 187$$

$$\text{Frequency} = \frac{D}{Q} = 4 \text{ per year}$$

#### 4.4 Reordering point

Time is a matter for the company, and they could have left stock to make sure they have enough products to sell to the customer. Reordering point is a point that can notify when the company should make an order to supplier. After we know the EOQ then we continue find ROP from formula as below

$$\text{ROP} = d * L$$

Where:

d = Average demand

L = lead time

Average working days of the company is 315 days

- Scott interfold hand towel

$$\begin{aligned}\text{ROP} &= 248000/315 * 1 \\ &= 787 \text{ units}\end{aligned}$$

- Kleenex facial tissue 170's

$$\begin{aligned}\text{ROP} &= 285200/315 * 1 \\ &= 905 \text{ units}\end{aligned}$$

- Double A A4 paper

$$\begin{aligned}\text{ROP} &= 327000/315 * 3 \\ &= 3114 \text{ units}\end{aligned}$$

- Grease trouble shooter

$$\begin{aligned}\text{ROP} &= 740/315 * 3 \\ &= 7 \text{ units}\end{aligned}$$

## 4.5 Total cost

$$TC = (D/Q * R_c) + (Q/2 * H_c)$$

Where:

D = Annual demand

Q = Order quantity

R<sub>c</sub> = Reordering cost

H<sub>c</sub> = Holding cost (per unit, per year)

- The comparison of cost between EOQ method and original method of group A shown as table 4.10 and 4.11 respectively.

Table 4.10: Total cost of using EOQ method of group A

Name	Cost/unit	Annual sale	Q	Frequency	Annual ordering cost	Average Inventory	Average inventory value	Holding cost per unit (23%)	Total cost
Scott interfold hand towel	1050	248000	1420	175	171,506.35	710.1712355	745679.7973	171,506.35	343,012.7
Kleenex facial tissue 170's	680	285200	1893	151	148,009.28	946.350882	643518.5997	148,009.28	296,018.6
Double A A4 paper	550	327000	2253	145	142,532.84	1126.741832	619708.0077	142,532.84	285,065.7
Double A A4 report book	1200	146900	1023	144	141,111.12	511.2721798	613526.6158	141,111.12	282,222.2
Kimsoft jumbo roll tissue compact 1-ply	600	256000	1909	134	131,721.09	954.5006851	572700.411	131,721.09	263,442.2
Scott standard compact towels	1000	142400	1103	129	126,827.88	551.4255457	551425.5457	126,827.88	253,655.8
Scott 24 rolls 2-ply	500	264500	2126	124	122,224.30	1062.820011	531410.0057	122,224.30	244,448.6
Double A B5 notebook professional 70 gram	1270	96000	804	119	117,353.81	401.7590265	510233.9636	117,353.81	234,707.6
Double A A5 notebook professional (ring binder) 70 gram	1320	82600	731	113	110,977.95	365.5400316	482512.8417	110,977.95	221,955.9
Kimsoft 24 rolls 2-ply	420	217400	2103	103	101,558.00	1051.325048	441556.5201	101,558.00	203,116.0
									<b>2,627,645.3</b>

Table 4.11: Total cost of using original method of group A

Name	Cost/unit	Annual sale	Q	Frequency	Annual ordering cost	Average Inventory	Average inventory value	Holding cost per unit (23%)	Total cost
Scott interfold hand towel	1050	248000	1240	200	196,449.80	620	651000	149,730.00	346,179.80
Kleenex facial tissue 170's	680	285200	1994	143	140,461.61	997.2027972	678097.9021	155,962.52	296,424.13
Double A A4 paper	550	327000	2422	135	132,603.62	1211.111111	666111.1111	153,205.56	285,809.17
Double A A4 report book	1200	146900	1191	123	121,108.47	595.7154704	714858.5645	164,417.47	285,525.94
Kimsoft jumbo roll tissue compact 1-ply	600	256000	1662	154	151,266.35	831.1688312	498701.2987	114,701.30	265,967.65
Scott standard compact towels	1000	142400	1158	123	120,816.63	578.8617886	578861.7886	133,138.21	253,954.84
Scott 24 rolls 2-ply	500	264500	2619	101	99,207.15	1309.405941	654702.9703	150,581.68	249,788.83
Double A B5 notebook professional 70 gram	1270	96000	1067	90	88,402.41	533.3333333	677333.3333	155,786.67	244,189.08
Double A A5 notebook professional (ring binder) 70 gram	1320	82600	635	130	127,692.37	317.6923077	419353.8462	96,451.38	224,143.76
Kimsoft 24 rolls 2-ply	420	217400	2576	84	82,883.83	1288.19419	541041.5597	124,439.56	207,323.39
									<b>2,659,306.60</b>

- The comparison of cost between EOQ method and original method of group B shown as table 4.12 and 4.13 respectively.
- The comparison of cost between EOQ method and original method of group A shown as table 4.14 and 4.15 respectively.
  - The total of using original method of total three group is 7,327,760.51 Baht
  - The total of using EOQ method of total three group is 7,244,593.73 Baht
  - In conclusion, The cost of economic order quantity compares with the original is cheaper **83,166.78** Baht.

Table 4.12: Total cost of using EOQ method of group B

Name	Cost/unit	Annual sale	Q	Frequency	Annual ordering cost	Average Inventory	Average inventory value	Holding cost per unit (23%)	Total cost
Double A A6 notebook professional 70 gram	1100	58400	673	87	85,184.87	336,699,096	370369.0206	85,184.87	170,369.75
Fest foam box 600 ml	680	91000	1069	85	83,605.51	534,562,0537	363502.1965	83,605.51	167,211.01
Evostar paper water cone cup (4500 cups)	550	86000	1156	74	73,095.44	577,829,5767	317806.2672	73,095.44	146,190.88
Fest bio square box 1,000 ml	980	38200	577	66	65,028.61	288,503,1309	282733.0683	65,028.61	130,057.21
Double A A5 notebook professional 70 gram	890	19600	434	45	44,389.76	216,852,7427	192998.941	44,389.76	88,779.51
Fest foam box 1300 ml	650	19200	502	38	37,546.29	251,145,7441	163244.7337	37,546.29	75,092.58
Fest paper plate 7 inches	600	20600	542	38	37,365.34	270,763,3458	162458.0075	37,365.34	74,730.68
Evostar paper water cone cup (4000 cups)	580	21000	556	38	37,092.27	278,052,9695	161270.7223	37,092.27	74,184.53
Evostar paper water cone cup (5000 cups)	600	18000	506	36	34,927.83	253,100,2151	151860.1291	34,927.83	69,855.66
Fest foam box 500 ml	700	15240	431	35	34,713.73	215,613,2026	150929.2418	34,713.73	69,427.45
Fest paper plate 9 inches	950	10800	312	35	34,043.44	155,805,205	148014.9447	34,043.44	68,086.87
Fest paper cup 8 oz	1350	7560	219	35	33,953.73	109,351,791	147624.9179	33,953.73	67,907.46
Fest hybrid choice box 650 ml	770	13000	380	34	33,626.12	189,870,8089	146200.5228	33,626.12	67,252.24
Marvel auto faucet (MF-1503-T)	3850	2400	73	33	32,306.93	36,484,3945	140464.9188	32,306.93	64,613.86
Marvel auto faucet (MF-1503-S)	3300	2760	85	33	32,075.34	42,259,99663	139457.9889	32,075.34	64,150.67
Double A planner 80 gram	1300	6600	208	32	31,131.74	104,119,5251	135355.3826	31,131.74	62,263.48
Scott facial tissue 60's cubic	440	19200	611	31	30,891.33	305,250,3447	134310.1517	30,891.33	61,782.67
Marvel auto faucet (MF-1113)	3200	2500	82	31	30,061.09	40,843,87159	130700.3891	30,061.09	60,122.18
Marvel walls mount stainless towel dispenser	3500	2220	74	30	29,625.81	36,802,24838	128807.8693	29,625.81	59,251.62
Fest bio spoon	780	9600	324	30	29,083.23	162,113,8807	126448.827	29,083.23	58,166.46
Kleenex roll towel	700	10440	357	29	28,731.55	178,456,8062	124919.7644	28,731.55	57,463.09
Kimsoft jumbo roll tissue compact 2-ply	600	12000	413	29	28,518.45	206,655,4603	123993.2762	28,518.45	57,036.91
Kleenex facial tissue 150's	650	10800	377	29	28,159.72	188,359,3081	122433.5502	28,159.72	56,319.43
Wypall jumbo tissue *20 perforated	860	8160	285	29	28,154.90	142,340,2554	122412.6196	28,154.90	56,309.81
Marvel stainless paper dispenser (MS304 18)	850	7920	282	28	27,576.03	141,053,8729	119895.7919	27,576.03	55,152.06
Marvel auto faucet (MF-104)	2600	2400	89	27	26,549.24	44,396,71468	115431.4582	26,549.24	53,098.47
Stainless water dispenser, 6 taps	13000	480	18	27	26,549.24	8,879,342,935	115431.4582	26,549.24	53,098.47
Fest bowl 850 ml (Chicken)	630	9600	361	27	26,137.59	180,383,6742	113641.7148	26,137.59	52,275.19
Air neutralizer: morning air	900	6720	253	27	26,137.59	126,268,5719	113641.7148	26,137.59	52,275.19
Marvel auto faucet (MF-1502)	3300	1800	68	26	25,903.17	34,128,02,605	112622.486	25,903.17	51,806.34
Marvel auto faucet (MF-1503-M)	3500	1680	64	26	25,772.02	32,014,92,625	112052.2419	25,772.02	51,544.03
Fest bowl 850 ml	630	9000	349	26	25,307.62	174,655,7415	110033.1172	25,307.62	50,615.23
Marvel auto faucet (MF-103)	2400	2280	90	25	24,861.81	45,039,51,338	108094.8321	24,861.81	49,723.62
Scott HBT 1 ply 300'S	600	9100	360	25	24,834.54	179,960,4034	107976.242	24,834.54	49,669.07
3M hand soap 3.8 l	140	35600	1474	24	23,727.32	736,873,3808	103162.2733	23,727.32	47,454.65
Scott 1 roll 2 ply	450	10800	453	24	23,430.30	226,379,7145	101870.8715	23,430.30	46,860.60
Scott facial tissue 60's short	400	12000	506	24	23,285.22	253,100,2151	101240.0861	23,285.22	46,570.44
Stainless water dispenser, 4 taps	10000	470	20	23	23,041.39	10,017,99,512	99966.57516	23,041.39	46,082.78
Marvel auto faucet (MF-102)	2600	1800	77	23	22,992.31	38,448,68,275	99966.57516	22,992.31	45,984.62
Marvel walls mount stainless auto faucet (MF-1501)	3500	1320	57	23	22,844.45	28,378,19,904	99323.69663	22,844.45	45,688.90
Kimsoft 6 rolls 2 ply	480	9600	413	23	22,814.76	206,655,4603	99194,62,094	22,814.76	45,629.53
									<b>2,770,155.23</b>

Table 4.13: Total cost of using original method of group B

Name	Cost/unit	Annual sale	Q	Frequency	Annual ordering cost	Average Inventory	Average inventory value	Holding cost per unit (23%)	Total cost
Double A A6 notebook professional 70 gram	1100	58400	730	80	78,579.92	365.000000	401500.000	92,345.00	170,924.92
Fest foam box 600 ml	680	91000	1096	83	81,526.67	548.192771	372771.084	85,737.35	167,264.02
Evostar paper water cone cup (4500 cups)	550	86000	1194	72	70,721.93	597.222222	328472.222	75,548.61	146,270.54
Fest bio square box 1,000 ml	980	38200	597	64	62,863.94	298.437500	292468.750	67,267.81	130,131.75
Double A A5 notebook professional 70 gram	890	19600	456	43	42,236.71	227.906977	202837.209	46,652.56	88,889.27
Fest foam box 1300 ml	650	19200	549	35	34,378.72	274.285714	178285.714	41,005.71	75,384.43
Fest paper plate 7 inches	600	20600	515	40	39,289.96	257.500000	154500.000	35,535.00	74,824.96
Evostar paper water cone cup (4000 cups)	580	21000	512	41	40,272.21	256.097561	148536.585	34,163.41	74,435.62
Evostar paper water cone cup (5000 cups)	600	18000	545	33	32,414.22	272.727273	163636.364	37,636.36	70,050.58
Fest foam box 500 ml	700	15240	476	32	31,431.97	238.125000	166687.500	38,338.13	69,770.09
Fest paper plate 9 inches	950	10800	360	30	29,467.47	180.000000	171000.000	39,330.00	68,797.47
Fest paper cup 8 oz	1350	7560	244	31	30,449.72	121.935484	164612.903	37,860.97	68,310.69
Fest hybrid choice box 650 ml	770	13000	380	34	33,626.12	189.870809	146200.523	33,626.12	67,252.24
Marvel auto faucet (MF-1503-T)	3850	2400	69	35	34,378.72	34.285714	132000.000	30,360.00	64,738.72
Marvel auto faucet (MF-1503-S)	3300	2760	89	31	30,449.72	44.516129	146903.226	33,787.74	64,237.46
Double A planner 80 gram	1300	6600	189	25	34,378.72	94.285714	122571.429	28,191.43	62,570.14
Scott facial tissue 60's cubic	440	19200	768	35	24,556.23	384.000000	168960.000	38,860.80	63,417.03
Marvel auto faucet (MF-113)	3200	2500	93	27	26,520.72	46.296296	148148.148	34,074.07	60,594.80
Marvel walls mount stainless towel dispenser	3500	2220	74	30	29,625.81	36.802248	128807.869	29,625.81	59,251.62
Fest bio spoon	780	9600	356	27	26,520.72	177.777778	138666.667	31,893.33	58,414.06
Kleenex roll towel	700	10440	402	26	25,538.47	200.769231	140538.462	32,323.85	57,862.32
Kimsoft jumbo roll tissue compact 2-ply	600	12000	500	24	23,573.98	250.000000	150000.000	34,500.00	58,073.98
Kleenex facial tissue 150's	650	10800	491	22	21,609.48	245.454545	159545.455	36,695.45	58,304.93
Wypall jumbo tissue *20 perforated	860	8160	272	30	29,467.47	136.000000	116960.000	26,900.80	56,368.27
Marvel stainless paper dispenser (MS304_18)	850	7920	273	29	28,485.22	136.551724	116068.966	26,695.86	55,181.08
Marvel auto faucet (MF-104)	2600	2400	100	24	23,573.98	50.000000	130000.000	29,900.00	53,473.98
Stainless water dispenser, 6 taps	13000	480	21	23	22,591.73	10.434783	135652.174	31,200.00	53,791.73
Fest bowl 850 ml (Chicken)	630	9600	369	26	25,538.47	184.615385	116307.692	26,750.77	52,289.24
Air neutralizer: morning air	900	6720	280	24	23,573.98	140.000000	126000.000	28,980.00	52,553.98
Marvel auto faucet (MF-1502)	3300	1800	67	27	26,520.72	33.333333	110000.000	25,300.00	51,820.72
Marvel auto faucet (MF-1503-M)	3500	1680	65	26	25,538.47	32.307692	113076.923	26,007.69	51,546.17
Fest bowl 850 ml	630	9000	429	21	20,627.23	214.285714	135000.000	31,050.00	51,677.23
Marvel auto faucet (MF-103)	2400	2280	120	19	18,662.73	60.000000	144000.000	33,120.00	51,782.73
Scott HBT 1 ply 300'S	600	9100	350	26	25,538.47	175.000000	105000.000	24,150.00	49,688.47
3M hand soap 3.8 l	140	35600	1618	22	21,609.48	809.090909	113272.727	26,052.73	47,662.21
Scott 1 roll 2 ply	450	10800	470	23	22,591.73	234.782609	105652.174	24,300.00	46,891.73
Scott facial tissue 60's short	400	12000	571	21	20,627.23	285.714286	114285.714	26,285.71	46,912.94
Stainless water dispenser, 4 taps	10000	470	29	16	15,715.98	14.687500	146875.000	33,781.25	49,497.23
Marvel auto faucet (MF-102)	2600	1800	106	17	16,698.23	52.941176	137647.059	31,658.82	48,357.06
Marvel walls mount stainless auto faucet (MF-1501)	3500	1320	63	21	20,627.23	31.428571	110000.000	25,300.00	45,927.23
Kimsoff 6 rolls 2 ply	480	9600	505	19	18,662.73	252.631579	121263.158	27,890.53	46,553.26
									<b>2,791,746.90</b>

Table 4.14: Total cost of using EOQ method of group C

Name	Cost/unit	Annual sale	Q	Frequency	Annual ordering cost	Average Inventory	Average inventory value	Holding cost per unit (23%)	Total cost
Scott facial tissue 60's long	420	10320	458	23	22,127.09	229,0588576	96204.7202	22127.08564	44,254.17
Kleenex facial tissue 100's	600	7200	320	22	21,810.42	160,0746312	96044.77874	22090.29911	44,180.60
Scott pop-up (200's x 60)	270	15600	702	22	21,812.42	351,2467416	94836.62022	21812.42265	43,624.85
Scott jumbo roll tissue 1 ply	1000	4080	187	22	21,467.91	93,33874743	21467.91191	42,935.82	42,935.82
Nitri white gloves	380	9800	469	21	20,509.95	234,6675972	89173.68693	20509.94799	41,019.90
Plastic paper cup dispenser	300	12000	585	21	20,165.59	292,2495447	87676.48641	20165.59187	40,331.18
Nitri purple glove	400	9000	438	21	20,165.59	219,191216	86573.59362	20165.59187	40,331.18
All-purpose cleaner	195	18000	888	20	19,911.93	443,9671468	85905.06166	19911.92653	39,823.85
Auto foam dispenser	2400	1440	72	20	19,758.16	35,79377569	19758.16418	39,516.33	39,516.33
Stainless paper cup dispenser	220	15240	769	20	19,460.93	384,6033211	19460.92805	19460.92805	38,921.86
Scott HBT 2 ply 150's	500	6600	336	20	19,307.08	167,8876896	83943.84448	19307.08443	38,614.17
Kimsoft 1 roll 2ply	400	8160	417	20	19,201.48	208,7117842	83484.71367	19201.48414	38,402.97
Nitri orange gloves	200	16200	832	19	19,130.76	415,8860914	83177.21829	19130.76021	38,261.52
Automatic hand dryer (MH-104)	6500	480	25	19	18,773.14	12,5572872	18773.14437	18773.14437	37,546.29
Ecobab Hand soap AB clean & smooth	260	11760	622	19	18,584.46	310,7770027	80802.02071	18584.46476	37,168.93
Kingstella fresh gel air	450	6720	357	19	18,482.07	178,5707269	80356.82713	18482.07024	36,964.14
Aquarius bath tissue jumbo roll dispenser 70270	560	5400	287	19	18,482.07	143,4943342	80356.82713	18482.07024	36,964.14
3M multi-purpose cleaning powder 25 kg	700	4320	230	19	18,482.07	114,7954673	80356.82713	18482.07024	36,964.14
Stretch film 15 micron	80	36000	1961	18	18,036.65	980,2529182	78420.23346	18036.65369	36,073.31
Stainless jumbo roll dispenser	800	3600	196	18	18,036.65	98,02529182	78420.23346	18036.65369	36,073.31
Kimsoft jumbo roll 1ply	1200	2400	131	18	18,036.65	65,35019455	78420.23346	18036.65369	36,073.31
King's stella toilet seat sanitizer	570	4920	272	18	17,798.35	135,7616197	77384.1232	17798.34834	35,596.70
Nitri blue gloves	380	7200	402	18	17,579.96	201,1436547	76434.5888	17579.95542	35,159.91
Wall mounted stainless tissue dispenser (double vertical)	600	4260	246	17	16,991.83	123,129201	73877.52061	16991.82974	33,983.66
Kimsoft jumbo roll tissue 2 ply	1200	2040	120	17	16,628.97	60,24900259	72299.88287	16628.97306	33,257.95
Scott alcohol antibacterial wipe 4100	80	30000	1790	17	16,465.14	894,8443923	71587.55138	16465.13682	32,930.27
Scott jumbo roll tissue 2 ply	1000	2400	143	17	16,465.14	71,58755138	71587.55138	16465.13682	32,930.27
A4 quality yellow 70 gram	70	31000	1945	16	15,656.32	972,4420135	68070.94094	15656.31642	31,312.63
Aquarius jumbo roll toilet tissue	300	7200	453	16	15,620.20	226,3797145	67913.91434	15620.2003	31,240.40
Wall mounted stainless tissue dispenser (double horizontal)	600	3600	226	16	15,620.20	113,1898572	67913.91434	15620.2003	31,240.40
Auto alcohol spray	1200	1800	113	16	15,620.20	56,59492862	67913.91434	15620.2003	31,240.40
Auto soap dispenser (foam)	4500	3600	261	14	13,527.49	130,70033891	58815.17509	13527.49027	27,054.98
Stainless water dispenser: Itap	2700	600	44	14	13,527.49	21,78339818	58815.17509	13527.49027	27,054.98
Auto hand dryer (MH-112)	2550	600	45	13	13,146.36	22,41493181	57158.07611	13146.3575	26,292.72
Dish soap (Super trump)	220	6720	511	13	12,922.77	255,3907615	56185.96753	12922.77253	25,845.55
Auto soap dispenser (drop)	450	3240	248	13	12,833.30	123,9932762	55796.97428	12833.30408	25,666.61
3M disinfectant toilet cleaner floral 3.8 l	194	7500	575	13	12,820.09	287,3172187	55739.54043	12820.09443	25,660.19
22 multi-quat sanitizer 2 l	1,200	1200	92	13	12,753.84	46,20956572	54541.47886	12753.84014	25,507.68
Wall mounted hair dryer 1200W,0601-030	1000	1300	105	12	12,118.01	52,68701123	52687.01123	12118.01258	24,236.03
Cold-hot water dispenser (VT-279K)	4000	304	25	12	11,719.97	12,73909813	50956.39253	11719.97028	23,439.94
Cold-hot water dispenser (Blue)	2800	420	36	12	11,525.60	17,89688785	50111.28597	11525.59577	23,051.19
Hair dryer 1200W, 0601-020	1000	1100	97	11	11,146.95	48,46500139	48465.00139	11146.95032	22,293.90
Carpet cleaner	510	2080	187	11	10,946.53	93,32080285	47593.60945	10946.53017	21,893.06
3M toilet sanitizer 3.8 l (Pruksa)	180	5500	511	11	10,574.93	285,4329853	45977.93736	10574.92559	21,149.85
3M disinfectant deodorizer	120	8200	764	11	10,542.83	381,9866545	45838.39853	10542.83166	21,085.66
Auto tissue dispenser	650	1500	140	11	10,494.51	70,1973695	45628.29018	10494.50674	20,989.01
Spray buff	410	2160	212	10	10,001.81	106,0637149	43486.1231	10001.80831	20,003.62
Automatic air spray dispenser	670	1320	130	10	9,995.03	64,86067309	43456.65097	9995.029723	19,990.06
Cold-hot water dispenser (Green)	2900	300	30	10	9,913.33	14,86255639	43101.41353	9913.325112	19,826.65
Sunlight dish soap 3.6 l	140	6000	605	10	9,740.91	302,5126182	42351.76654	9740.906305	19,481.81
Automatic perfume dispenser	580	700	58	10	9,410.61	29,22549547	40915.69366	9410.609541	18,821.22
Wall hair dryer 1200W, 0601-029	1100	600	74	9	9,326.21	36,86248123	40548.72935	9326.207751	18,652.42
3M floor cleaner 3.8l (romantic rose)	140	558	58	9	8,980.67	278,9028532	39054.30945	8980.671874	17,961.34
Cold-hot water dispenser (Red)	2900	240	27	9	8,866.75	13,29347456	38551.07623	8866.747533	17,733.50
Cold-hot water dispenser (VT-28D/S1)	2300	300	33	9	8,828.45	16,68893397	38384.54813	8828.446069	17,656.89
3M glass cleaner 3.8 l	170	3500	419	8	8,198.19	209,6724879	35644.32295	8198.194278	16,396.39
Hair dryer 1200W, 0601-029	1000	520	67	8	7,664.10	33,32219172	32014.92625	7664.104096	15,328.21
Floor cleaner Future DC 3.8l	200	2400	320	7	7,363.43	160,0746312	32014.92625	7363.433037	14,726.87
Glass cleaner 3.8 l	110	4200	571	7	7,224.05	285,5355518	31408.91017	7224.04946	14,448.10
3M fresh scent deodorizer	45	9200	1321	7	6,838.48	660,72431806	29732.54313	6838.48492	13,676.97
3M Grease cutter	270	1524	220	7	6,817.64	109,7848691	29641.91466	6817.640371	13,635.28
Sterilization spray	530	760	111	7	6,745.35	55,33510627	29327.60632	6745.349454	13,490.70
Evostar floor cleaner 3.8 l	80	4500	693	6	6,376.92	346,5717429	27725.73943	6376.920069	12,753.84
Single mop wringer	800	420	67	6	6,160.69	33,4820113	26785.60904	6160.69008	12,321.38
Garbage bags 18 x 20	30	9000	1601	6	5,522.57	800,3731561	24011.99468	5522.574777	11,045.15
Cleaning sanitizer Rivonit ds	200	840	189	4	4,356.27	94,70142896	18940.28579	4356.265752	8,712.53
Nilon broom with lid	250	600	143	4	4,116.28	71,58755138	17896.88785	4116.284204	8,232.57
Grease trouble shooter	180	740	187	4	3,878.93	93,69393829	16864.90889	3878.929045	7,757.86

1,846,793.24

Table 4.15: Total cost of using original method of group C

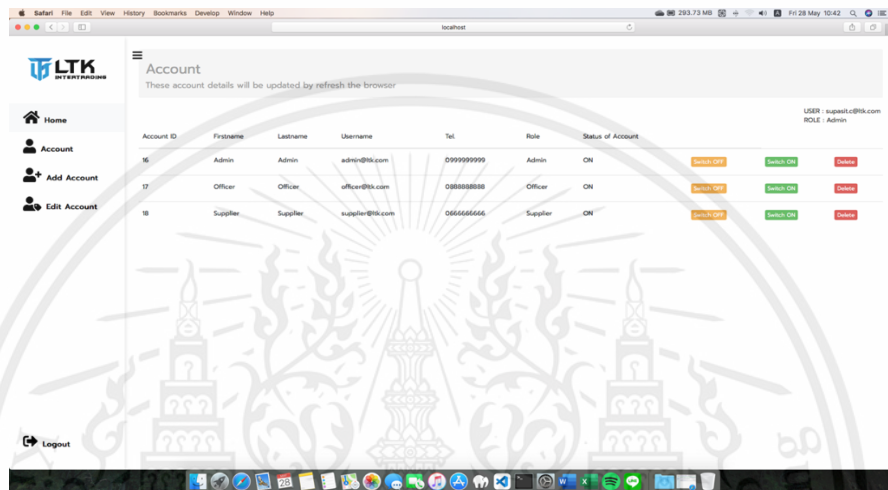
Name	Cost/unit	Annual sale	Q	Frequency	Annual ordering cost	Inventory	Average inventory value	Holding cost per unit (23%)	Total cost
Scott facial tissue 60's long	420	10320	516	20	19,644.98	258	108360	24922.8	44,567.78
Kleenex facial tissue 100's	600	7200	400	18	17,680.48	200	120000	27600	45,280.48
Scott pop-up (200's x 60)	270	15600	821	19	18,662.73	410	5263158	25493.68421	44,156.42
Scott jumbo roll tissue 1 ply	1000	4080	163	25	24,556.23	81.6	81600	18768	43,324.23
Nitri white gloves	380	9800	490	20	19,644.98	245	93100	21413	41,057.98
Plastic paper cup dispenser	300	12000	706	17	16,698.23	352	9411765	24352.94118	41,051.17
Nitri purple glove	400	9000	500	18	17,680.48	250	100000	23000	40,680.48
All-purpose cleaner	195	18000	947	19	18,662.73	473	6842105	21244.73684	39,907.47
Auto foam dispenser	2400	1440	60	24	23,573.98	30	72000	16560	40,133.98
Stainless paper cup dispenser	220	15240	693	22	21,609.48	346	3636364	17526	39,135.48
Scott HBT 2 ply 150's	500	6000	314	21	20,627.23	157	1428571	18071.42857	38,698.66
Kimsoft 1 roll 2ply	400	8160	453	18	17,680.48	226	6666667	20853.33333	38,533.82
Nitri orange gloves	2000	16200	771	21	20,627.23	385	7142857	17742.85714	38,370.09
Automatic hand dryer (MH-104)	6500	480	27	18	17,680.48	13	333333333	19933.33333	37,613.82
Ecolab Hand soap AB clean & smooth	260	11760	784	15	14,733.74	392	101920	23441.6	38,175.34
Kingstella fresh gel air	450	6720	292	23	22,591.73	146	869565	15120	37,171.73
Aquarius bath tissue jumbo roll dispenser 70270	560	5400	257	21	20,627.23	128	5714286	16560	37,187.23
3M multi-purpose cleaning powder 25 kg	700	4320	216	20	19,644.98	108	75600	17388	37,032.98
Stretch film 15 micron	80	36000	2250	16	15,715.98	1125	90000	20700	36,415.98
Stainless jumbo roll dispenser	800	3600	200	18	17,680.48	100	80000	18400	36,080.48
Kimsoft jumbo roll 1ply	1200	2400	104	23	22,591.73	52	17391304	14400	36,991.73
King's stella toilet seat sanitizer	570	4920	234	21	20,627.23	117	1428571	15357.42857	35,984.66
Nitri blue gloves	380	7200	480	15	14,733.74	240	91200	20976	35,709.74
Wall mounted stainless tissue dispenser (double vertical)	600	4260	224	19	18,662.73	112	1052632	15470.52632	34,133.26
Kimsoft jumbo roll tissue 2 ply	1200	2040	113	18	17,680.48	56	66666667	15640	33,320.48
Scott alcohol antibacterial wipe 4100	80	30000	2000	15	14,733.74	1000	80000	18400	33,133.74
Scott jumbo roll tissue 2 ply	1000	2400	171	14	13,751.49	85	71428571	19714.28571	33,465.77
A4 quality yellow 70 gram	70	31000	2214	14	13,751.49	1107	142857	17825	31,576.49
Aquarius jumbo roll toilet tissue	300	7200	554	13	12,769.24	276	9230769	83076.92308	31,876.93
Wall mounted stainless tissue dispenser (double horizontal)	600	3600	240	15	14,733.74	120	72000	16560	31,293.74
Auto alcohol spray	1200	1800	129	14	13,751.49	64	28571429	17742.85714	31,494.34
Auto soap dispenser (foam)	450	3600	225	16	15,715.98	112.5	50625	11643.75	27,359.73
Stainless water dispenser: 1up	2700	600	38	16	13,751.98	18.75	50625	11643.75	27,359.73
Auto hand dryer (MH-112)	2550	600	43	14	13,751.49	21	42857143	12567.85714	26,319.34
Dish soap (Super trump)	220	6720	395	17	16,698.23	197	6470588	43482.35294	26,699.17
Auto soap dispenser (drop)	450	3240	295	11	10,804.74	147	2727273	15242.72727	26,047.47
3M disinfectant toilet cleaner floral 3.8 l	194	7500	625	12	11,786.99	312.5	60625	13943.75	25,519.32
22 multi-quat sanitizer 2 l	1,200	1200	90	13	13,145.08	44	83421207	53801.05449	25,059.73
Wall mounted hair dryer 1200W,0601-030	1000	1300	81	16	15,715.98	40	625	9343.75	25,059.73
Cold-hot water dispenser (VT-279K)	4000	304	28	11	10,804.74	13	81818182	12712.72727	23,517.47
Cold-hot water dispenser (Blue)	2800	420	42	10	9,822.49	21	58800	13524	23,346.49
Hair dryer 1200W, 0601-020	1000	1100	122	9	8,840.24	61	111111111	14055.55556	22,895.80
Carpet cleaner	510	2080	160	13	12,769.24	80	40800	9384	22,153.24
3M toilet sanitizer 3.8 l (Pruksa)	180	8200	500	11	10,804.74	250	45000	10350	21,154.74
3M disinfectant deodorizer	1200	8200	631	13	12,769.24	315	3846154	8704.615385	21,473.85
Auto tissue dispenser	650	1500	125	12	11,786.99	62.5	40625	9343.75	21,130.74
Spray buff	410	2160	309	7	6,875.74	154	2857143	14549.14286	21,424.89
Automatic air spray dispenser	670	1320	165	8	7,857.99	82.5	55275	12713.25	20,571.24
Automatic water dispenser (Green)	2900	300	25	10	10,039.72	12.5	36250	8337.5	20,124.49
Sunlight dish soap 3.6 l	140	6000	587	12	11,786.99	293	5088151	41091.23411	19,490.71
Automatic perfume dispenser	1100	560	112	5	4,911.25	56	78400	18032	22,943.25
Wall hair dryer 1200W, 0601-029	1400	700	78	9	8,840.24	38	88888889	9838.888889	18,679.13
3M floor cleaner 3.8l (romantic rose)	2900	5100	638	8	7,857.99	318.75	44625	10263.75	18,121.74
Cold-hot water dispenser (Red)	4000	2400	20	12	11,786.99	10	29000	6670	18,456.99
Cold-hot water dispenser (VT-28D/S1)	2300	300	27	11	10,804.74	13	63636364	7213.636364	18,018.38
3M glass cleaner 3.8 l	170	3500	350	10	9,822.49	175	29750	6842.5	16,664.99
Hair dryer 1200W, 0601-029	1000	520	104	5	4,911.25	52	52000	11960	16,871.25
Floor cleaner Future DC 3.8l	200	2400	343	7	6,875.74	171	4285714	7885.714286	14,761.46
Glass cleaner 3.8 l	110	4200	600	7	6,875.74	300	33000	7590	14,465.74
3M fresh scent deodorizer	45	9200	1840	5	4,911.25	920	41400	7590	14,465.74
3M Grease cutter	270	1524	562	6	5,893.49	127	34290	7886.7	13,780.19
Sterilization spray	530	760	190	4	3,929.00	95	50350	11580.5	15,509.50
Evostar floor cleaner 3.8 l	80	4500	750	6	5,893.49	375	30000	6900	12,793.49
Single mop wringer	800	420	84	5	4,911.25	42	33600	7728	12,639.25
Garbage bags 18 x 20	30	9000	1800	5	4,911.25	900	27000	6210	11,121.25
Cleaning sanitizer Rivotit ds	200	840	120	7	6,875.74	60	2760	2760	9,635.74
Nylon broom with lid	250	600	120	5	4,911.25	60	15000	3450	8,361.25
Grease trouble shooter	180	740	148	5	4,911.25	74	13320	3063.6	7,974.85
									<b>1,876,707.01</b>

## 4.6 Software System iteration

### 4.6.1 Administration Section

#### 4.6.1.1 Account Table

This accounting page shows all account that stored in the database. This page provides “Switch On” for validate an account, “Switch Off” for disable an account and “Delete” for delete account from the database.

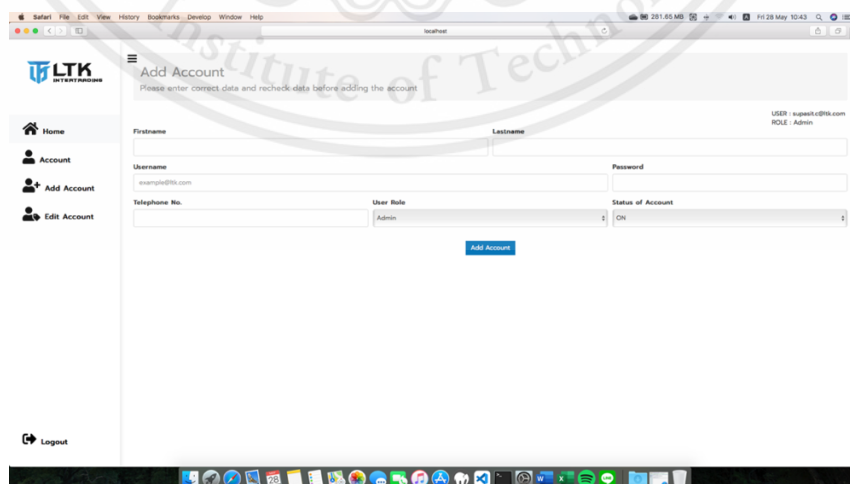


Account ID	Firstname	Lastname	Username	Tel	Role	Status of Account			
16	Admin	Admin	admin@ltk.com	0999999999	Admin	ON	Switch Off	Switch On	Delete
17	Officer	Officer	officer@ltk.com	0888888888	Officer	ON	Switch Off	Switch On	Delete
18	Supplier	Supplier	supplier@ltk.com	0666666666	Supplier	ON	Switch Off	Switch On	Delete

Figure 4.1: Account Table

#### 4.6.1.2 Account Adding Form

This account adding page provides features for an administrator to add newcomer account into the database.



Firstname: \_\_\_\_\_ Lastname: \_\_\_\_\_

Username:  Password:

Telephone No.: \_\_\_\_\_ User Role:  Status of Account:

Figure 4.2: Account Adding Form

#### 4.6.1.2 Account Editing Page and Form

This account editing page provides features for an administrator to update existing account details into the database.

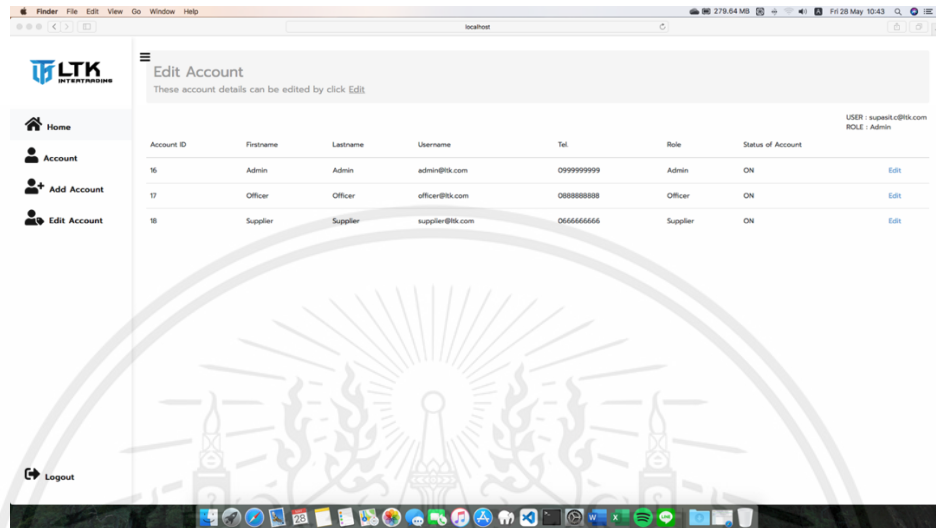


Figure 4.3: Account Editing Page

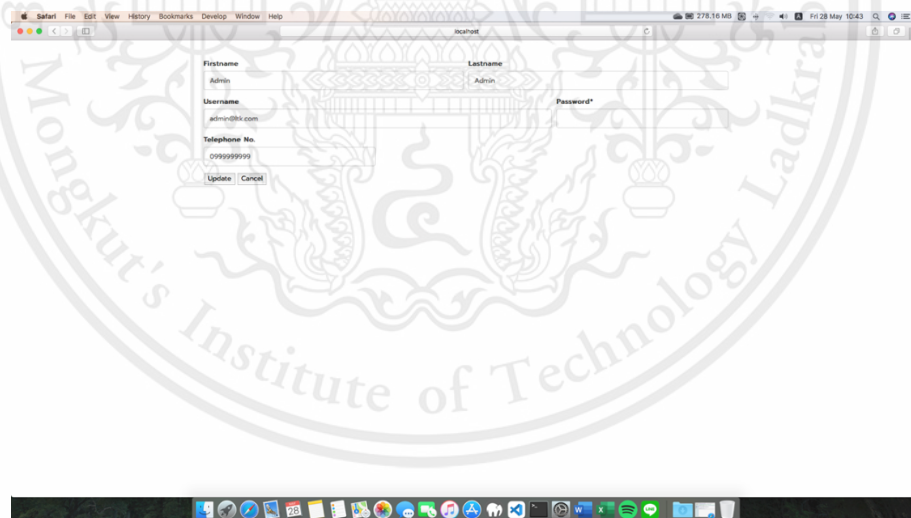
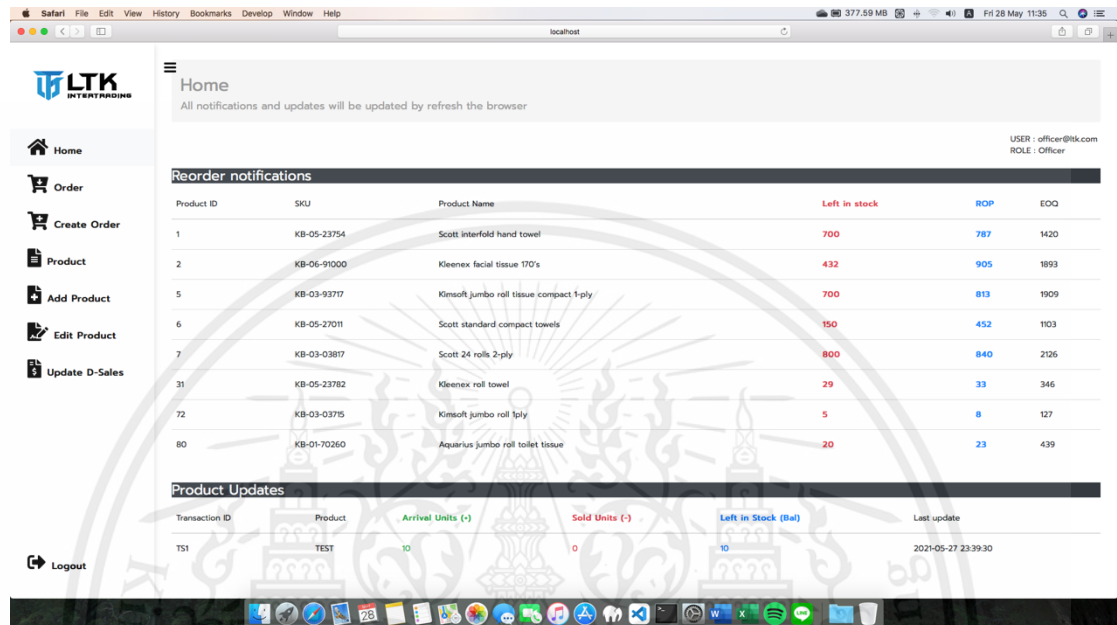


Figure 4.4: Account Editing Form

## 4.6.2 Officer Section

### 4.6.2.1 Reorder Point Notifications and Product Updates

This home page for an officer provides inadequate of “Left in stock” number for particular product. Also, the page provides product updates transaction.



The screenshot shows the LTK system home page for an officer. The page features a navigation sidebar on the left with options: Home, Order, Create Order, Product, Add Product, Edit Product, Update D-Sales, and Logout. The main content area is titled "Home" and includes a message: "All notifications and updates will be updated by refresh the browser". Below this, there are two tables: "Reorder notifications" and "Product Updates".

Product ID	SKU	Product Name	Left in stock	ROP	EOQ
1	KB-05-23754	Scott interfold hand towel	700	787	1420
2	KB-06-91000	Kleenex facial tissue 170's	432	905	1893
5	KB-03-93717	Kimsoft jumbo roll tissue compact 1-ply	700	813	1909
6	KB-05-27011	Scott standard compact towels	150	452	1103
7	KB-03-03817	Scott 24 rolls 2-ply	800	840	2106
31	KB-05-23782	Kleenex roll towel	29	33	346
72	KB-03-03715	Kimsoft jumbo roll 1ply	5	8	127
80	KB-01-70260	Aquarius jumbo roll toilet tissue	20	23	439

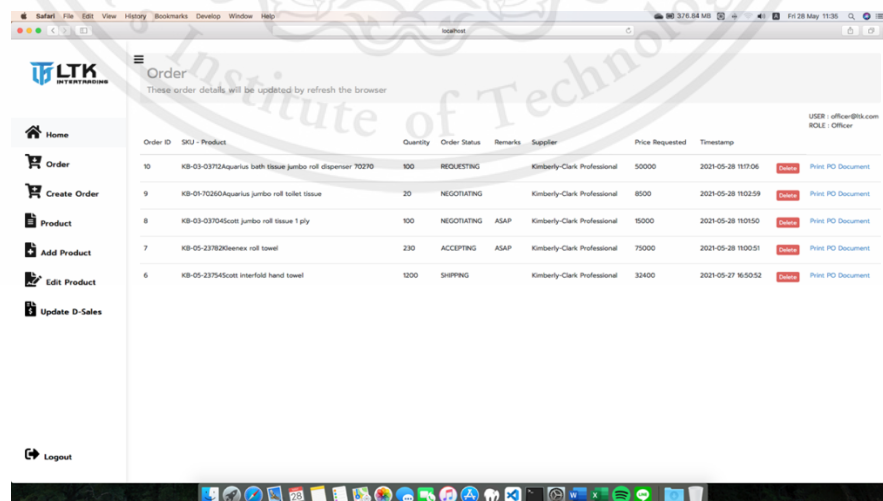
  

Transaction ID	Product	Arrival Units (+)	Sold Units (-)	Left in Stock (Bal)	Last update
TS1	TEST	10	0	10	2021-05-27 23:39:30

Figure 4.5: Reorder Point Notification and Product Updates

### 4.6.2.2 Order Table

This order page shows all order that stored in the database. This page provides “Delete” for delete account from the database and print a purchasing order document.



The screenshot shows the LTK system order table. The page features a navigation sidebar on the left with options: Home, Order, Create Order, Product, Add Product, Edit Product, Update D-Sales, and Logout. The main content area is titled "Order" and includes a message: "These order details will be updated by refresh the browser". Below this, there is a table listing orders with columns: Order ID, SKU - Product, Quantity, Order Status, Remarks, Supplier, Price Requested, and Timestamp. Each row also includes "Delete" and "Print PO Document" buttons.

Order ID	SKU - Product	Quantity	Order Status	Remarks	Supplier	Price Requested	Timestamp	Delete	Print PO Document
10	KB-03-03710Aquarius bath tissue jumbo roll dispenser 70270	100	REQUESTING		Kimberly-Clark Professional	50000	2021-05-28 11:07:06	Delete	Print PO Document
9	KB-05-70260Aquarius jumbo roll toilet tissue	30	NEGOTIATING		Kimberly-Clark Professional	8500	2021-05-28 11:02:59	Delete	Print PO Document
8	KB-03-03745Scott jumbo roll tissue 1 ply	100	NEGOTIATING	ASAP	Kimberly-Clark Professional	15000	2021-05-28 11:01:50	Delete	Print PO Document
7	KB-05-23782Kleenex roll towel	230	ACCEPTING	ASAP	Kimberly-Clark Professional	75000	2021-05-28 11:00:51	Delete	Print PO Document
6	KB-05-23754Scott interfold hand towel	1000	SHIPPING		Kimberly-Clark Professional	32400	2021-05-27 16:50:52	Delete	Print PO Document

Figure 4.6: Order Table

### 4.6.2.3 Creating Order Form

This order page shows all order that stored in the database. This page provides “Delete” for delete account from the database and print a purchasing order document.

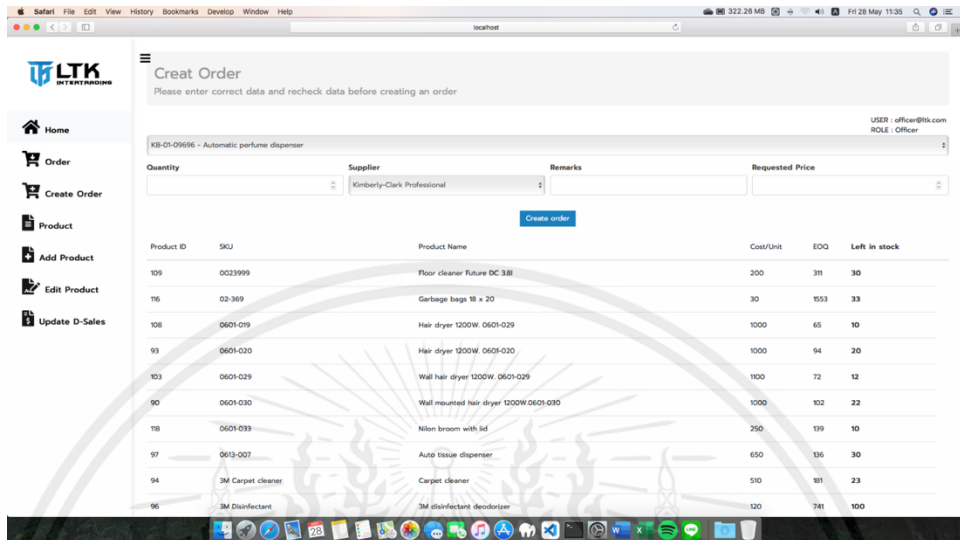


Figure 4.7: Creation Order Form

### 4.6.2.4 Product Table

This product page shows all products that stored in the database. This page provides “Switch On” for validate a product, “Switch Off” for disable a product and “Delete” for delete a product from the database.

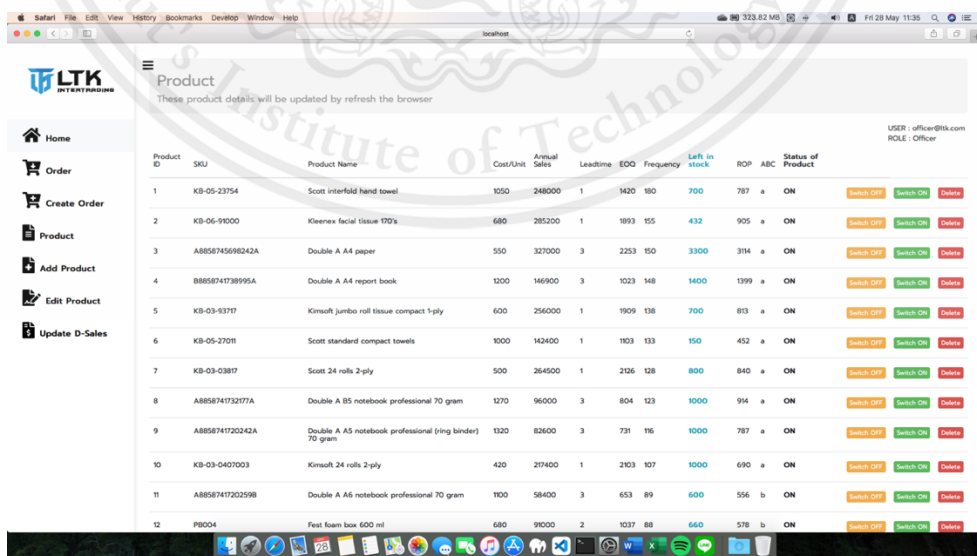


Figure 4.8: Product Table

#### 4.6.2.5 Product Adding Form

This product adding page provides features for an officer to add new product into the database.

The screenshot shows the 'Add Product' form in a web browser. The form is titled 'Add Product' and includes a sub-header 'Please enter correct data and recheck data before adding the product'. The form fields are: SKU, Product Name, Cost/Unit, Annual Sales, Leadtime, EOQ, Frequency, Reordering Point, ABC Analysis, and Status of Product. There is an 'Add a new Product' button. Below the form is an 'EQO Calculator' section with 'Demand' and 'Cost/Unit' input fields and a 'Calculate' button. The user is identified as 'officer@ltk.com' with the role of 'Officer'.

Figure 4.9: Product Adding Form

#### 4.6.2.6 Product Editing Page and Form

This product editing page provides features for an officer to update existing product details into the database.

The screenshot shows the 'Edit Product' page in a web browser. The page is titled 'Edit Product' and includes a sub-header 'These product details can be edited by click Edit'. The page displays a table of existing products with columns for Product ID, SKU, Product Name, Cost/Unit, Annual Sales, Leadtime, EOQ, Frequency, ROP, ABC, and Status of Product. Each row has an 'Edit' link. The user is identified as 'officer@ltk.com' with the role of 'Officer'.

Product ID	SKU	Product Name	Cost/Unit	Annual Sales	Leadtime	EOQ	Frequency	ROP	ABC	Status of Product	Edit
1	KB-05-23754	Scott interfold hand towel	1550	248000	1	1420	180	787	a	ON	Edit
2	KB-06-91000	Kleenex facial tissue 170's	680	285200	1	893	155	905	a	ON	Edit
3	AB858745698242A	Double A A4 paper	550	327000	3	2253	150	314	a	ON	Edit
4	88858741738995A	Double A A4 report book	1200	146900	3	1023	148	1399	a	ON	Edit
5	KB-03-93717	Kimsoft jumbo roll tissue compact 1-ply	600	256000	1	1909	138	813	a	ON	Edit
6	KB-05-27011	Scott standard compact towels	1000	142400	1	1103	133	452	a	ON	Edit
7	KB-03-03817	Scott 24 rolls 2-ply	500	264500	1	2126	128	840	a	ON	Edit
8	AB858741732177A	Double A B5 notebook professional 70 gram	1270	96000	3	804	123	994	a	ON	Edit
9	AB858741720242A	Double A A5 notebook professional (ring binder) 70 gram	1320	82600	3	731	116	787	a	ON	Edit
10	KB-03-0407003	Kimsoft 24 rolls 2-ply	420	217400	1	2103	107	690	a	ON	Edit
11	AB858741720259B	Double A A6 notebook professional 70 gram	1100	58400	3	653	89	556	b	ON	Edit
12	PB004	Fest foam box 600 ml	680	91000	2	1037	88	578	b	ON	Edit
13	VS-02-15003-3	Evostar paper water cone cup (4500 cups)	550	86000	3	1121	77	819	b	ON	Edit
14	RO26	Fest bin square box 1,000 ml	980	38200	2	560	68	243	b	ON	Edit

Figure 4.10: Product Editing Page

SKU  
KB-05-23754

Product Name  
Scott interfold hand towel

Cost/Unit Annual Sales Leadtime  
1050 248000 1

EDQ Frequency Reordering Point  
1420 180 787

Update Cancel

Figure 4.11: Product Editing Form

#### 4.6.2.7 Update Daily Sales Form

This update daily sales page provides features for an officer to update new daily sales details into the database.

LTK INTERTRADING

Update Daily Sales  
Please enter correct data and recheck data before updating the daily sales

USER: officer@ltk.com  
ROLE: Officer

Product ID	Product Name	Latest left in stock	Arrival Quantity	Daily Sales
1	1- Scott interfold hand towel	0	0	0

Update

Product ID	SKU	Product Name	Left in stock	ROP
1	KB-05-23754	Scott interfold hand towel	700	787
2	KB-06-91000	Kleenex facial tissue 170's	432	905
3	A8858745698242A	Double A A4 paper	3300	314
4	B8858741738995A	Double A A4 report book	1400	1399
5	KB-03-93717	Kimsoft jumbo roll tissue compact 1-ply	700	813
6	KB-05-27011	Scott standard compact towels	150	452
7	KB-03-03817	Scott 24 rolls 2-ply	800	840
8	A8858741732177A	Double A B5 notebook professional 70 gram	1000	914
9	A8858741720242A	Double A A5 notebook professional (ring binder) 70 gram	1000	787
10	KB-03-0407003	Kimsoft 24 rolls 2-ply	1000	690
11	A88587417202598	Double A A6 notebook professional 70 gram	600	556

Figure 4.12: Update Daily Sales Form

## 4.6.3 Suppliers

### 4.6.3.1 Order Table for Supplier

This order page shows all order that stored in the database. This page provides features for changing order status as table below.

Table 4.16: Definition of stored variables in database

Status	Definition
REQUESTING	shows a request for an order
ACCEPTING	shows an acceptance for the request of an order
NEGOTIATING	shows a negotiation needed for an order
REJECTING	shows a rejection and a request of deletion for an order
SHIPPING	shows a confirmation and a shipping status to LTK

Order ID	SKU - Product	Quantity	Order Status	Remarks	Supplier	Price Requested	Timestamp	REQUESTING	ACCEPTING	NEGOTIATING	REJECTING	SHIPPING
10	KB-03-03712Aqarius bath tissue jumbo roll dispenser 70270	100	REQUESTING		Kimberly-Clark Professional	50000	2021-05-28 11:17:06					
9	KB-01-70260Aqarius jumbo roll toilet tissue	20	NEGOTIATING		Kimberly-Clark Professional	8500	2021-05-28 11:02:59					
8	KB-03-037045cott jumbo roll tissue 1 ply	100	NEGOTIATING	ASAP	Kimberly-Clark Professional	15000	2021-05-28 11:01:50					
7	KB-05-23782Kleenex roll towel	230	ACCEPTING	ASAP	Kimberly-Clark Professional	75000	2021-05-28 11:00:51					
6	KB-05-237545cott interfold hand towel	1200	SHIPPING		Kimberly-Clark Professional	32400	2021-05-27 16:50:52					

Figure 4.13: Order Table for Supplier

### 4.6.3.2 Purchasing Order Table for Supplier

This purchasing order page shows all order that stored in the database. This page provides print feature for a purchasing order document.

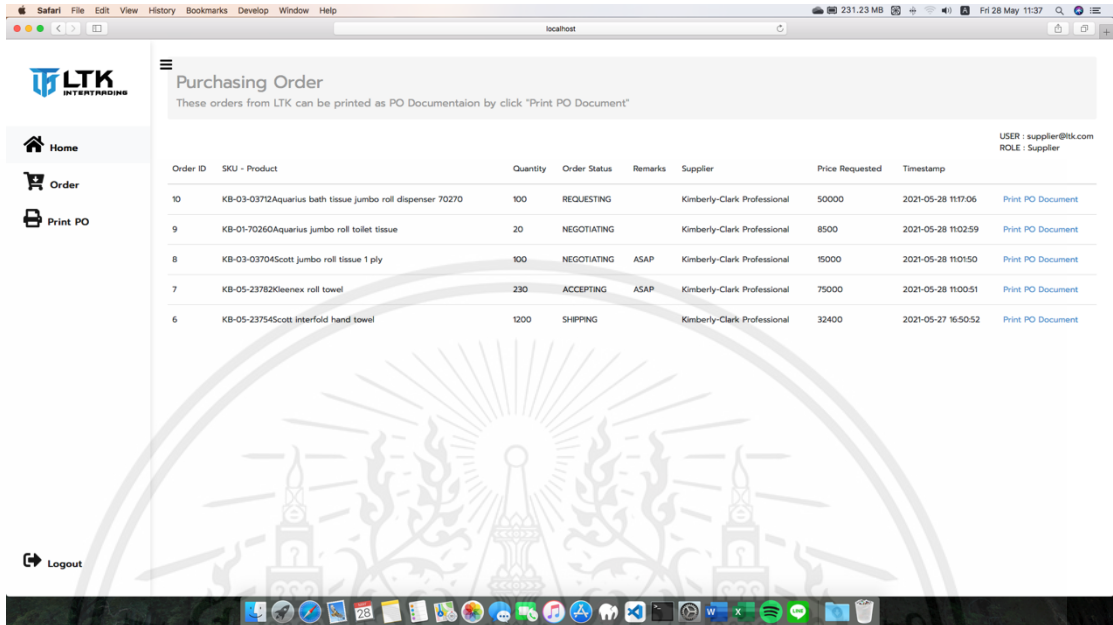


Figure 4.14: Purchasing Order Table for Supplier

### 4.6.4 Log in

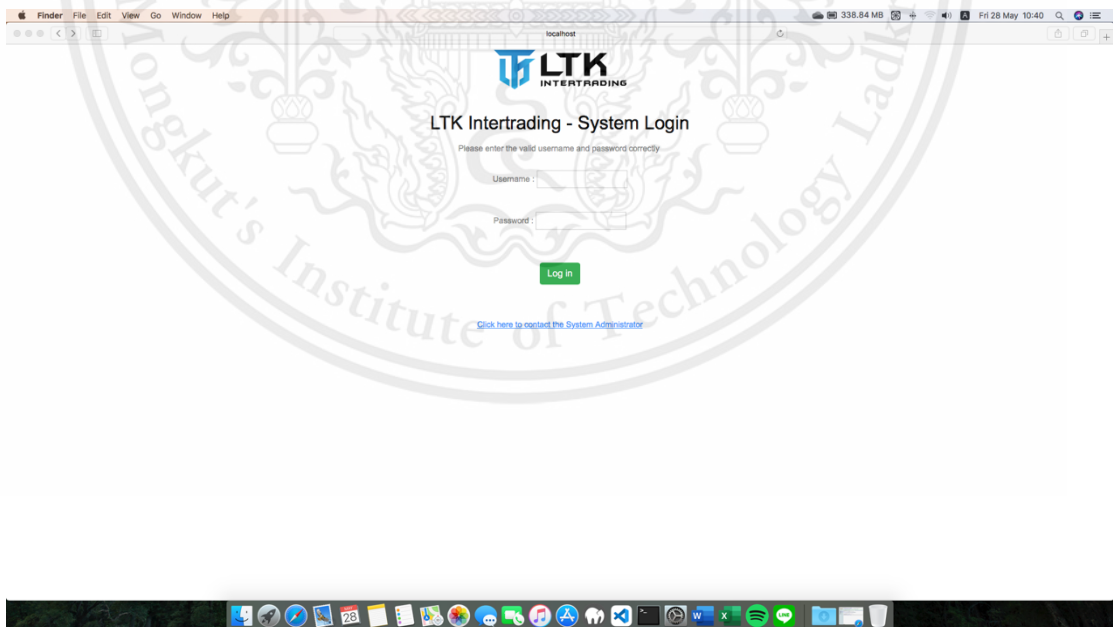


Figure 4.15: Log in page

## 4.6.5 Simulated Purchasing Order Document

LTK Intertrading - Supplier

28/5/2564 BE 11:42



### Purchasing Order LTK Intertrading Co., Ltd.

**Deliver To :** KIMBERLY-CLARK PROFESSIONAL  
(THAILAND) CO., LTD. Flr. 32-33, United Center  
Tower, 323Silom Road, Bang Rak 10500 +66-2-230-  
3003 kcpthailand@kcc.com

**Ship To :** LTK Intertrading CO., LTD. 10/39  
Bansuan Chonburi Thailand 20000 +66-94-986-  
6659 info@ltk.com

**PO number :** POLTK7

**DATE :** 2021-05-28 11:00:51

SKU-Product	Quantity	Price	Remarks
KB-05-23782Kleenex roll towel	230	75000	ASAP

\*\*This webpage document is generated automatically by the system. All subjected data on this webpage document will be valid with authorized signature only.\*\*

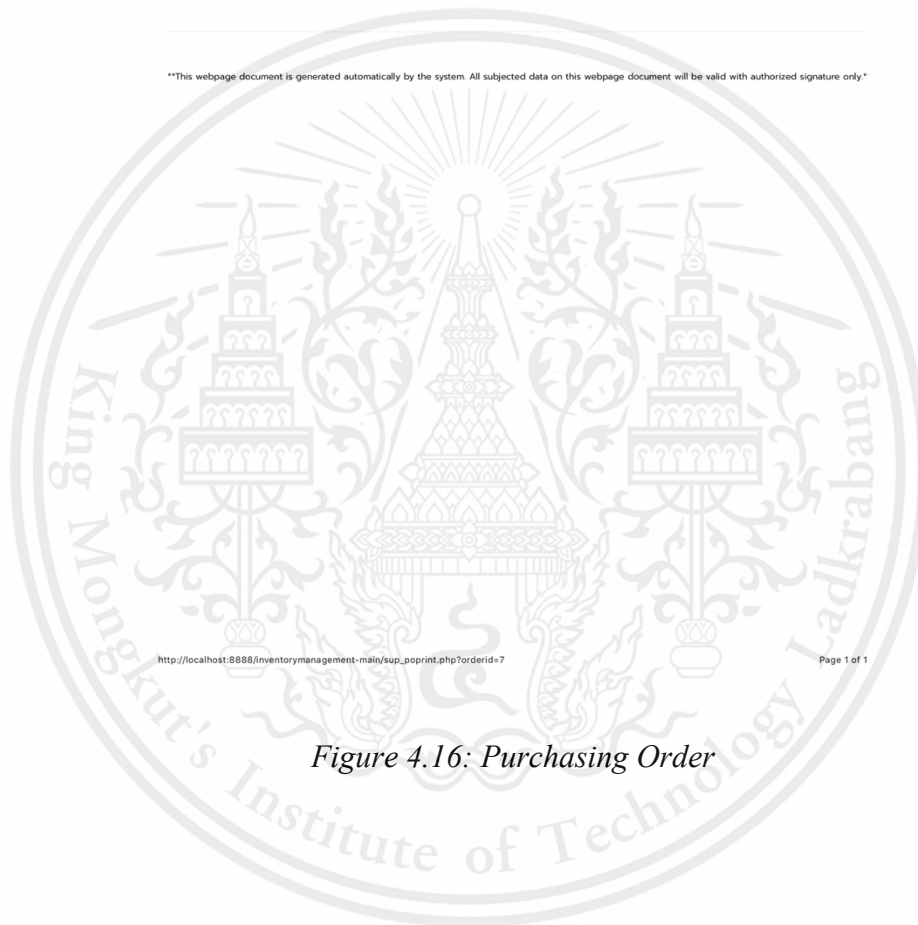


Figure 4.16: Purchasing Order

# Chapter 5

## Conclusion

As a result of economic order quantity compared with the original method of LTK Intertrading company limited by using product data of total 119 items. The products classify into three groups by ABC analysis classification which found that group A has 10 product (71.42 % inventory value), group B has 41 products (22.76 inventory value), and group C has 68 products (5.82% inventory value).

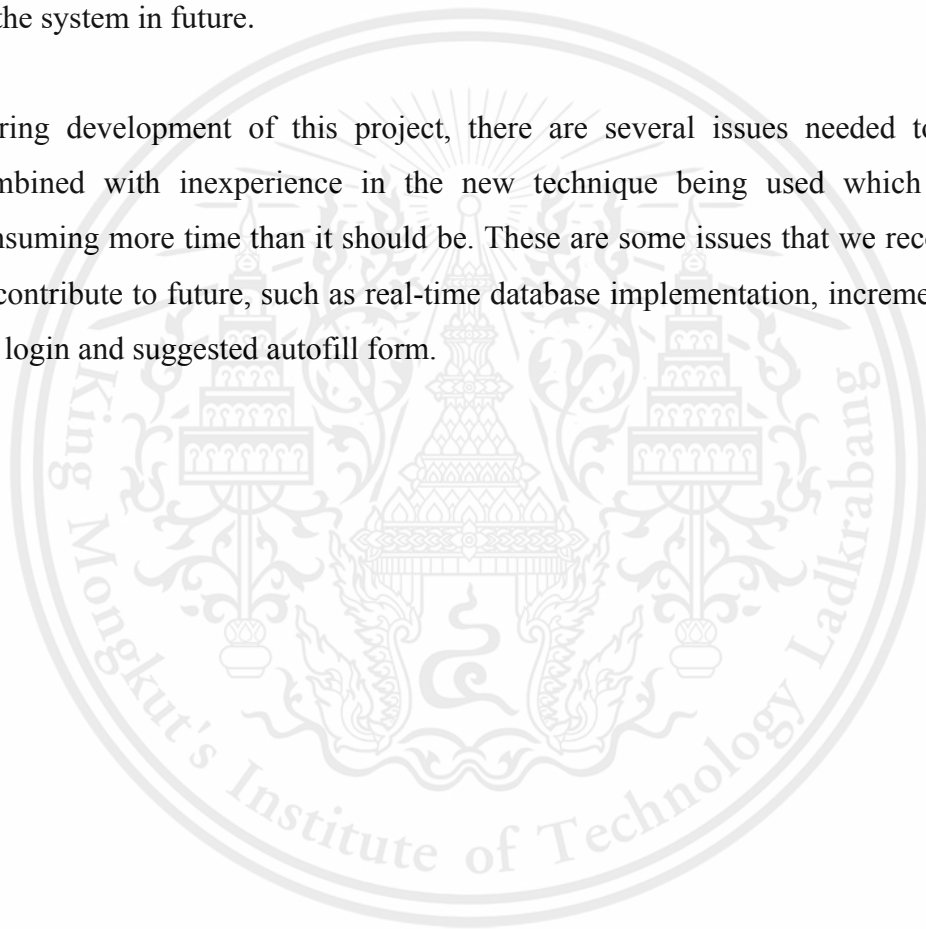
All 119 products in the research have used economic order quantity to manage inventory proper way to help and solve the problem when the employees order the product, they can use EOQ as a quantity guideline to make an order to supplier. EOQ can reduce cost compared to the original method. Keeping product in inventory by applying reorder point to let them know when they need to make an order again.

Inventory management data applies into software to replace manual method. In the program consists of three parts which are admin, officer, and supplier. Employees can look up left amount of each product, lead time, optimal order quantity, reorder point. They can also make an order to supplier through this inventory program and get update the status of order from the supplier. Supplier can see purchasing order and update order status. Moreover, software program can notify them when left amount of each product touch to reorder point.

Even software inventory management is useful in term of managing and controlling inventory amount but now it still gets confused of how to use the software and need to develop more function that can apply to another department in the business

The experiment for this system was initiated through localhost. The localhost performs all of features but there was some error from the actual scenario. The system available on localhost web-browser platform for 10 employees testing. The localhost testing starts from 14<sup>th</sup> May 2021 10:00 to 14<sup>th</sup> May 2021 11:00 (1 Hours session). The localhost testing focuses on user's feedback and new requirements for improvement of the system in future.

During development of this project, there are several issues needed to be fixed combined with inexperience in the new technique being used which results in consuming more time than it should be. These are some issues that we recommended to contribute to future, such as real-time database implementation, increment security for login and suggested autofill form.



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