

CHAPTER II LITERATURE REVIEW

2.1 Literature Review

According to a research done by Li, Wang, & Chan (2016) named “**A Robust Inventory Routing Policy under Inventory Inaccuracy and Replenishment Lead-Time**”, inaccuracy of stock record is universal among inventory systems. According to the researchers, out of 370,000 inventory records that are observed from 37 different retail stores, there is 65% of inventory imprecision. And their main objective in this research is to develop a method for delivering fresh products with reduced refreshment lead-time and less inventory imprecision. Hence; the result of this research is a genetic algorithm-based method for solving inventory imprecision and refreshment lead-time.

According to (Cannella, Dominguez, & Jose, 2016) in their article with the title “**Inventory Record Inaccuracy - The Impact of Structural Complexity and Lead Time Variability**” that presented an analysis of the impact of Inventory Record Inaccuracy (IRI) which mainly focused on lost sales that is caused by shrinkage, spoiled or damaged products.

Meanwhile, as discussed in an article by (Abd Karim, Nawawi, & Saiful Azlin Puteh Salin, 2016) titled “**Inventory Control Weakness - A Case Study of Lubricant Manufacturing Company**” which stated that most companies lack attention on regular cycle counting activities which is a standard operating activity to avoid Inventory Record Inaccuracy (IRI). Cycle counts can be conducted

monthly, yearly or yearly. But the more frequent the inventory count, the more error-free or matching between the stock of the system and the actual one.

Based on research by Djatmiko, Husain, & Maulani (2017) entitled **“Analyze and Record a Series of Corporate Sales Transactions On Web-Based Accounting Online System”** stated that a company’s activities cannot be separated from a series of sales and purchases. Sales activities need to be recorded for the sake of preventing employees’ manipulation. And because sales is a vital aspect of the company’s prosperity, the recording process needs to be done in real-time. With the help of a system that is available offline; ergo, provide comfortability. The result of the research was sales process recording is proved to be crucial in a company.

In a research by Kazancoglu, Ozkan-ozen, & Ozbiltekin (2018) entitled **“Resources, Conservation & Recycling Minimizing Losses in Milk Supply Chain with Sustainability: An Example from An Emerging Economy”**, they found out that one of the main emerging problems for the supply chain industry is food loss, it greatly influences against supply chain sustainability. Therefore, it gains the awareness of researchers, governments, and organizations due to its environmental influences including inefficient resource engagement and greenhouse gases resulted from the disposal of food losses. Thus; in this research, the researchers figured out that a sustainable solution is needed for solving food loss problems, which in this term is a desktop-based sales and inventory management system that would help a patisserie production company to minimize food losses.

Table 1 is displaying a summarize of the literary works of the researchers that the writers took inspiration from:

Table 1
Literature review conclusion, and summary

| Author | Title | Year | Summary |
|--|---|-------------|--|
| Yigit Kazancoglu, Yesim Deniz Ozkan Ozen, Melisa Ozbiltekin | Resources, Conservation & Recycling Minimizing Losses in Milk Supply Chain with Sustainability: An Example from An Emerging Economy | 2018 | According to the research, a sustainable solution is needed to minimize food loss. |
| M. Budi Djatmiko, Al Husain & Giandari Maulani | Analyze and Record a Series of Corporate Sales Transactions on Web-Based Accounting Online System | 2017 | The authors concluded a company's activities is a series of sales and purchases. Sales activities need to be recorded with the help of an offline system to prevent employee's manipulation and provide comfortability. |
| Ming Li, Zheng Wang, Felix T.S. Chan | Robust Inventory Routing Policy under Inventory Inaccuracy and Replenishment Lead-Time | 2016 | According to the researchers, the inaccuracy of stock records is universal among inventory systems. |
| Cannella, Salvatore Dominguez, Roberto Jose, M Framinan | Inventory Record Inaccuracy - The Impact of Structural Complexity and Lead Time Variability | 2016 | In this literature work, the researchers focused on shrinkage inventories that greatly caused Supply Chain costs. |
| Abd Karim, Norazira Nawawi, Anuar Saiful Azlin Puteh Salin, Ahmad | Inventory Control Weakness - A Case Study of Lubricant Manufacturing Company | 2016 | Proved that periodic inventory audit or cycle count is an effective approach to rectify inventory record inaccuracy. |

For the conclusion, the internship project will result in a flexible and sustainable inventory system that can lower the IRI rates (Cannella et al., 2016) and the system itself is highly demanded to solve employee's fraudulence such as the study case of (Djarmiko et al., 2017), also a periodic inventory auditing feature will be implemented into the system like the one that proved to be effective in (Abd Karim et al., 2016) research. The system will also act as a sustainable solution to solve inaccuracy of stock record which is common among inventory systems (Li et al., 2016). And according to (Kazancoglu et al., 2018), an effective sales and inventory management system can help to minimize food losses and double the sales of supply chain companies.

2.2 Theoretical Basis

2.2.1 Inventory

Inventory is usually used to describe the materials or goods that a business entity keeps for the end purpose of resale, inventory is always dynamic. It requires regular and cautious evaluation of both internal and external factors and control through forecasting and examining (Samanta, 2015).

2.2.2 Inventory Control

Inventory Control is the process of monitoring the flow of materials or goods. From the beginning of receiving goods to the ending of when goods are used in production or sales. Appropriate inventory control is needed for the economy and efficiency of inventory management (Le, 2017).

2.2.3 Database

The database is a systematic collection of information treated as a unit.

The purpose of a database is to accumulate, store and retrieve related information for use by information system or application (Vijayprasath, 2015). A database can be used for Data Visualization which is a study that presents abstracted information in certain schematic forms, often includes their own attributes and variables. The main goal of data visualization is to relay information graphically; thus, it delivers information obviously and effectively. Data Visualization often visualizes information using shapes, arts or charts along with percentages (Saquin & Marcial, 2016).

A database is a group of related files. And to be defined as a set of data that is organized to service many end-users or applications at a concurrent time by storing and managing data so that it appears to be in one place (Laudon, Laudon, & Elragal, 2016). The database is used for producing reports as well as storing information. Database consist of several elements (Decan, Goeminne, & Mens, 2018):

1. Tables

A table consists of records and fields that contain data. Tables also called datasheets. Every table in a database contains data of a different but related entity.

2. Records

Data from the input is saved into records. A record consist of fields and contains all of the data about an entity. Records appear as rows in database tables.

3. Fields

A field in a database table is part of a record and contains a single piece of data about the entity.

Database Management System (DBMS) is an application to design and maintain a database; thus, allow application users to retrieve data that they want without needing to make separate files or data definitions in their machine (Laudon et al., 2016). A DBMS is a software that controls the storage, organization, and retrieval of data (Vijayprasath, 2015).

Structured Query Language (SQL) is a powerful language to manage data held in a relational database management system (DBMS) (Kate, Satish, Bodkhe, & Joshi, 2018). The SQL was initially presented by Chamberlin and Boyce. Since then, it has been used to get data from databases and information system. SQL is one of the key factors for accepting relational databases and for the usage of storing and retrieving lots of data (Hudec, 2011). SQL consists of CRUD which is insert, update, select, delete commands and SQL is divided into four main instructions, which is:

1. Data Definition Language (DDL)

Data Definition Language (DDL) is utilized to define the database schema or structure. DDL is also used to set extra properties of the data. DDL instructions are the following: Create, Alter, Drop and more.

2. Data Manipulation Language (DML)

Data Manipulation Language (DML), those statements are used to manage data with schema objects. Example of DML: Insert, Select, Update, and Delete.

3. Data Control Language (DCL)

Data Control Language (DCL) is used to control access to data stored in a database or schema. Grant and Revoke are two instructions of DCL.

4. Transaction Control Language (TCL)

Transaction Control Language (TCL), the commands are utilized to manage transactions in a database. These are used to control changes made by DML instructions. It also enables DML instructions to be assembled into a rational transaction.

2.2.4 Information System

Data is unprocessed facts and figures that have no meaning. On the other hand, Information is processed data that is presented in context and has meaning.

Enterprise Reporting or so-called production reporting normally involves high-volume reports that execute on a daily basis. The reports can be in the form of graphs, tables or charts based. It is used as the normal distribution of information to decision-makers in an organization to help them in making decisions. Alternatively, the reports may be e-mailed straight to the high-level users or printing it out in hardcopy and then handing out in a timely manner (Saquin & Marcial, 2016).

In the simplest form, the information system (IS) is formed by the information itself. IS often used by human in almost any aspect of life, they enable the proper functioning, not only for organizations or companies but also for one's everyday life. According to P. Beynon Davies, an information system can be separated into three sections: formal, informal, and technical. Those distinctive

separations are beneficial for cognitive causes. IS model also has some core elements. Which is:

1. Customers

Every information system customers or so-called system users, which are divided into two categories: internal and external. External customers of an information system are those who visit a website for shopping, people looking for cooking a recipe or demanding tax saving tools. On the other side, the inner customer of an information system could be an employee accepting a salary from the payroll system, an employee using an information system for checking inventory and stock. The information system is designed to service what is best for outer customers. However, the information system should be good enough to also assist inner customers.

2. Products and Services

The result of data conversion is the services and products offered by companies. An information system can create products or services depending on the industry that it belongs to. In the clothing industry, clothes are manufactured based on customer's needs. Here custom design is the service and completed garments are the product. A comprehend system needs to content customer expectations and should provide products and services that meet customers' requirements and needs.

3. Business Process

Business activities consist of numerous processes, A business process may not be arranged formally. But an improvement in the business process directly impacts the performance of that business itself. An information

system can improve the business process by adding a step or removing a step in it, or by supplying pertinent information.

4. Communication Technology

Computers or communication technologies are the central parts of the information system model. Technology not just improves internal communication via chatting application, email and other connected communication tools. But also improve communication with the external through webinars or websites. Access to valuable information is quicker through the information system, consequently can supply a competitive edge in the digital age.

Below are the basic benefits and characteristics of the information system:

1. Update information on a concurrent basis.
2. A great improvement to the performance of work.
3. The potential to store large amounts of information.
4. Improving the standard of service by the company.
5. Creating new possibilities and job opportunities.
6. The potential to run 24x7 whenever and wherever.

But, the information system has some disadvantage too:

1. Data privacy aspect.
2. They need to have some knowledge of computers and how they work to operate in an information system.
3. Cost of the development and implementation of an information system.
4. Difficulties and failures in the process of development.

The basic tasks of an information system can be identified as below:

1. Storing data.
2. Processing data into information.
3. The deployment of information.
4. Demonstrating information into a perceivable form.

Based on research by Patterson, there are numerous categories of information system. Which is (Al-mamary et al., 2014b):

1. Management Information System (MIS)

Management Information System (MIS) is a system that process data to supply administrative and management staff with present information about personnel and account. An effective MIS is a modular system with detailed database design which can swiftly provide team members with related information about a program participant. By interconnecting each member, an MIS can improve communications, reduce the time spent catching up on staffing and on the phone throughout the operation time. It also allows the board to analyze trends and measure performance (Collins & Wickes, 2016).

MIS helps managers to manage organizations effectively and efficiently by providing the required information, this type of system is distinct from other information systems since it is designed to be used for evaluating and facilitating operational activities of an organization. According to O'Brien in a citation of (Shah, 2014) article, MIS plays an important role in the area of decision making as it can monitor by itself without distractions in a system, dictate a series of actions and take action to make system in control. In a research by (Saquin & Marcial, 2016), the researchers develop an

information system with a LAN-Based desktop application and it is mainly focused on the computerization and processing of student academic records in all academic departments. It consisted of several related modules with each different purpose.

2. Transaction Processing System (TPS)

Transaction Processing System (TPS) refers to the daily operational activities of a business entity. It is a set of information which processes the data transaction in database system that monitors transaction. It consists of batch processing and real-time processing which can be utilized for different scenario.

3. Decision Support System (DSS)

A Decision Support System (DSS) is used for aiding managerial level to make a business decision according to information available or that is generated from daily transaction or data from manual input. It also may include artificial intelligence (AI) or expert system that can give comprehend advice and comparison between different information.

4. Executive Information System

Executive Information System, also known as Executive Support System is a computer-based system that serves the information that is required by top executives to analyze and take decision. Often, the information is visualized in graphical format but with the capability to access more detailed data if it is needed. The information is generated from various transactions and systems into a coherent dashboard with easy to use navigation.

2.2.5 Integrated Development Environment (IDE)

Integrated Development Environment (IDE) provides a convenient standalone solution that supports developers during different phases of software development. Modern IDEs provide automated refactorings, assistance tools like code suggestion, code completion, integrated debuggers and even integrated version control (Amann, Proksch, Nadi, & Mezini, 2016).

2.2.6 Client-Server Architecture

Client-Server Architecture is an architecture where several client computers request and retrieve information or service from a centralized server computer. The server computer serves the other client computers with information and services. Client computers provide an interface to allow a user to request services to the server and ultimately display the results that server returns. Clients or so-called service requesters and servers which are service providers exchange numerous task in a distributed application is referred to Client-Server Architecture (Saquin & Marcial, 2016). This design architecture allows the hosting of information or services of a database in a central location, subsequently distributes resources like reporting services and other viewable information to other locations. Normally, in the client/server environment, computers are connected using network devices like hubs and routers to centrally connecting server and clients (Choudhary, Suman, & Gupta, 2014).

2.2.7 Unified Modeling Language (UML)

Unified Modeling Language (UML) is a collection of languages that mainly supports object-oriented programming of software design, in terms of objects, languages, and flows. UML is a tool for specifying software systems. With

the use of UML, which is a standardized diagram type that can help to visually portray a software system's architecture. It is viable to model almost any kind of software, both generally and specifically (Saquin & Marcial, 2016).

1. Use Case Diagram

A UML use case diagram describes a sequence of actions from the end user's perspective. The use case diagram uses circles to represent the relationship between actors. An actor can be a person, object or even an external system that interacts with the application itself (Huang, 2017).

2. Sequence Diagram

Sequence Diagram is an interaction-based diagram that is organized chronologically. The time progresses as you go down the page, what events are occurred and when, it details how each operation is carried out. The user, application, and database are described with arrows that indicate the messages that are exchanged A sequence diagram contain different purposes and parallel vertical lines that happen concurrently (Huang, 2017).

3. Class Diagram

A class diagram is a group of static modeling elements, such as classes and their operations, correlated like a graph between each model (Jena, Swain, & Mohapatra, 2014).

4. Activity Diagram

A diagram that shows the flow of control from activity to activity. It displays branch, control flow, concurrency, and object flow.

5. Entity Relationship Diagram

Entity Relationship Diagram (ERD) is a visualization of a set of entities where each entity is described and interacted with the other ones in a diagram, the entity can have many attributes. ERD can be defined as a conceptual and abstract data representation through the graphic to give information about the database in an information system. Using ERD can help database designers to convert this information to build database tables, the information obtained also helps to reach relational database schema (Almasree, 2015). Entities and entity relationships are the following:

1. Entity

An entity that can refer to a person, object or event that is important to an organization.

2. Attribute

The characteristic of an entity, typically become a field in the entity's table.

3. Relationship

The connection between two or more entities. There are many kinds of relationship in ERD, such as:

1. One to One (1:1) entity relationship

One entity is associated with only one other entity of a particular kind.

2. One to Many (1:M) entity relationship

This is the most general kind of relationship. Which one particular entity can be correlated to more than one distinctive entity.

3. Many to Many (M:N) entity relationship

As the name suggests, in this kind of relationship one entity can be associated with more than one entity, and vice-versa.

2.2.8 eXtended Markup Language (XML)

eXtended Markup Language (XML) is an SGML-based text model that is existing as a new standard to exchange and convey data. XML is the standard way of exchanging information on many datasets produced in an application or running database of an organization (Sun-Moon & Kyung-Yong, 2014). By using it, XML can explain meaningful information for itself. It can represent a number of attributes or definitions and often used for user interface design.

2.3 Development Tools

2.3.1 Visual Studio

Visual Studio is an Integrated Development Environment developed by Microsoft. It is utilized to develop programs for Windows OS, as well as websites. Visual Studio consists of numerous Microsoft software development platforms such as Windows Forms, Windows Presentation Foundation (WPF), Microsoft Silverlight, and Windows Store. Both native and managed code can be written (Tonny, Wong, Jocelyn, & Lee, 2015).

2.3.2 VB.Net

VB.Net is a Microsoft-proprietary and object-oriented computer programming language to combine the power of Dot Net Framework and common language runtime (CLR) with productive benefits that are authentication mark of visual basic. VB.Net has many improved features such as polymorphism, inheritance, abstraction, encapsulation, and more. Which makes it a high-level object-oriented language. And thus; provide language enhanced security, garbage collection, interoperability, and improved versioning support (Sharma & Khandait, 2015).

2.3.3 DevExpress WinForms

DevExpress WinForms is a set of GUI widgets, controls for Windows Forms Applications which are useful to create a desktop-based application and contains numerous additional features and functionalities, which is helpful during software development (De, 2014). In a research project by (Zhao & Ma, 2018) titled “Design and Implementation of Earthquake Emergency Response System Based on Grid Data”, the researchers used DevExpress as the UI tool to make system application interface precise and beautiful. DevExpress WinForms consists of more than 100 controls which are divided into four main categories and subcategories.

2.3.4 MySQL

MySQL is the open-source and most used relational database management system that was being developed in Sweden, 1995 and now owned by Oracle Corporation (Letkowski, 2015). MySQL can run on almost all platforms, including UNIX, Linux, and Windows.

2.3.5 MySQL Administrator

MySQL Administrator allows monitoring the Server operation, to configure the settings, to register tables and procedure, to access created schema, to grant user's privileges and set security options (Martinez-Garcia, 2015). MySQL Administrator also used to backup and restore the database in SQL Format.

2.3.6 MySQL Query Browser

MySQL Query Browser is free software, which renders a MySQL database with a user interface similar to Microsoft Access DBMS (Zidoum, Al-rasbi, & Al-awfi, 2015). It is a visual tool for creating, executing and optimizing SQL queries (Mani, S, N, & S, 2017). Also for viewing different schemas of a database (Gojare, Raut, Shiakh, Shinde, & B.Gote, 2017).

2.3.7 dbForge Studio For MySQL

dbForge Studio For MySQL is a MySQL enabled querying tool that is being used to create database connections, compare queries between connections/schemas and executing queries into each database. Because of its complex functionalities and multiple connections design, dbForge Studio For MySQL becomes a perfect tool for experts but not suitable for common users (Gao, 2017).