

PAPER • OPEN ACCESS

The Implementation of Barcode on Warehouse Management System for Warehouse Efficiency

To cite this article: Nadya Amanda Istiqomah *et al* 2020 *J. Phys.: Conf. Ser.* **1573** 012038

View the [article online](#) for updates and enhancements.

You may also like

- [Designing a computerization management production system in PT Akrilik Kurnia Kencana using barcode](#)
Rudy Vernando Silalahi, Ishak and Marciello
- [A Stereoscopic Warehouse Stocktaking Method Based on Machine Vision](#)
Tao Peisheng, Dao Ronggui and Zhang Yubin
- [A survey on barcode RFID and NFC](#)
P Thanapal, J Prabhu and Mridula Jakhar



ECS
The
Electrochemical
Society
Advancing solid state &
electrochemical science & technology

DISCOVER
how sustainability
intersects with
electrochemistry & solid
state science research

The Implementation of Barcode on Warehouse Management System for Warehouse Efficiency

Nadya Amanda Istiqomah*, Putri Fara Sansabilla, Doddy Himawan, Muhammad Rifni

Institute of Transportation and Logistic Trisakti, Jakarta, Indonesia

*Email: nadyamnda@gmail.com

Abstract. Technology has the power to affect and shape modern life aspects. Technology has speed up and simplify every task. One of those technologies that we currently use is Barcode. Barcode system can be implemented in the warehouse management system. By using Barcode in every process of the warehouse management system, it helps to minimize human error and provide accurate data in a real-time. Barcode also helps to integrate every process and improves efficiency in the warehouse management system. However, there are lots of warehouses that using manual handling. Therefore, in this research authors would like to discuss about the implementation of the barcode in the warehouse management system to improve warehouse efficiency. This research is conducted by using the qualitative method because this method will explain in depth the process in the warehouse management system as well as data collecting by conducting a semi-structural interview. Authors recommended barcode implementation in the warehouse management system to achieve warehouse efficiency.

1. Introduction

The development of technologies in the digitalized era has developed rapidly. Today especially, we have entered the industrial revolution 4.0, where all of our life aspects needs a touch of technology. Indonesia has taken part in the advancement of technology especially in the digital industrial revolution 4.0. One of the examples of industrial revolution 4.0 implementation in the logistics industry is the utilization of barcode in the warehouse management system [1].

The warehouse is a very important aspect in supply chain network because they have very fundamental functions that supports goods movement, products storage, cargo groupings, stock collection storage and assembles the shipments [2]. When goods flow is not smooth, it will create problems in the supply and distribution of goods. Inventory management certainly requires in order to smoothen supply chain processes. The layout of goods or items in the storage room will affect the business organization in terms of goods flow, quality, capacity, flexibility so that it will increase efficiency in the warehouse process. [3] Moreover, the user expected to have a system that manages and record every goods that enters and exit the warehouse. Labeling process for every single goods and barcoding for every document must be done correctly in order to simplify recording and tracking



process with the system in real-time. Controlling the goods in a company is very important. Furthermore, the user needs a Warehouse Management System (WMS) to control warehouse activity [4]. WMS is a database information technology that is being used to increase warehouse efficiency by coordinating integrated storage activity and maintain accurate inventory by recording every transaction to support storage operation [5][6]. The purpose of the Warehouse Management System is to control every process that occurs within the warehouse such as receiving, putaway, order processing/picking, outbound checking, loading, stock take/stock opname. The computerized Warehouse management system is utilized as a tool to control goods availability in the warehouse [3].

Barcode label is a visual that consists of a composition of bars that have a set of numbers underneath it. It is a representation of a data that can be translated by a certain type of machine. Normally, the data on the barcode contains a visual of an object. Barcode can be scanned with a specific optical scanner called Barcode Scanner (RF Machine). Barcode scanner is a tool that utilizes infrared that record and translates barcodes from the image into an alphanumeric digit [7].

Currently, many warehouses in Indonesia implemented barcode into their warehouse management system. The implementation of barcode in warehouse management system has many benefits such as speeding up goods in and out in the warehouse in a real-time, identify goods and the location in order to simplify racking and picking, improve data accuracy, improves customer service, reduce the possibility of stock out, reduce handling costs in warehouses, and reduce human errors that occur due to manual handling, these things can increase efficiency in the warehouse..

2. Research Method

This research utilizes Qualitative approach to describe the details in how to apply barcode in every process in Warehouse Management System such as receiving, putaway, order processing/picking, checking outbound, loading and stock opname to improve efficiency in the warehouse. Data collection was done through a structured interview, semi-structured and in-depth interview. The data analysis techniques used in this study was an approach developed by Miles and Huberman that included (after data collection) data reduction, data separation from unfocused and too detailed one so that the data could reveal patterns or themes. Next was to display the data (data display) that served to help understand for advanced analysis of certain information or event. The last process is the conclusion of the analysis based on the pattern and theme. Withdrawal conclusion is done continuously and simultaneously with the data reduction and data display [8].

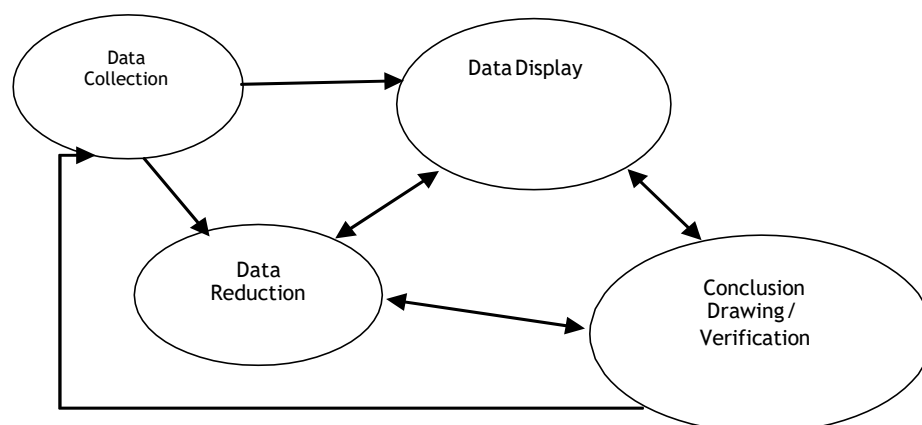


Figure 1. Data Processing Technique

Source: Miles, Huberman, & Saldana (2014)

The data sources in this paper are informants who have the ability and information expertise that are in accordance with this study (purposive). Because this study aims to determine the implementation of barcodes in warehouse management systems for warehouse efficiency, the information needed is information from warehousing professionals, especially in warehouse management systems.

The informants in this study were:

1. Mr. Zefriadi as Outbound Warehouse Administrator in Bonded Logistics Center PT Agility International.
2. Mr. Prasasti Lembah Budi as Warehouse Administrator Leader in Bonded Logistics Center PT Agility International.
3. Mr. Dian Anom Baskoro as Sr. Contract Logistics Manager in RPX Logistics

3. Result and Discussion

In the warehouse is needed a system to control and operate warehouse activities. The system is called the Warehouse Management System. There are several processes in the Warehouse Management System, namely: (1) Receiving; (2) Putaway; (3) Order processing/Picking; (4) Checking Outbound; (5) Loading; and (6) Stock Take/Stock Opname. In every process that exist in this Warehouse Management System, one of the tools is Barcode. There are two main components that use on implementing barcode, namely barcode labels and barcode scanners (RF machines).

Barcode label is a visual that consists of a composition of bars that have a set of numbers underneath it. It is a representation of data that can be translated by a certain type of machine. Normally, the data on the barcode contains a visual of an object. Barcode can be scanned with specific optical scanner called Barcode Scanner (RF Machine). Barcode scanner is a tool that utilizes infrared that record and translates barcodes from the image into an alphanumeric digit [7]. The barcode scanner then transmitted the data or information to the Warehouse Management System database. The numbers that appear show the information of products such as price, number of products in stock, product description (color, size, model, etc.), and storage location.

The implementation of the barcode in every process in the Warehouse Management System will be explained as follows:

1. Receiving. Receiving is the process of receipt goods from a truck or container into a warehouse [9]. In this process, the first thing to do is match the documents with physical goods such as the type and quantity. The document is called Receiving Note. In the Receiving Note, there are barcodes, types, and quantities of goods. After matching the documents with physical goods, then scan the barcode on the receiving note, which will be shown the type and quantity of goods. After that scan the barcode on each goods, and the warehouse management system will be automatically updated the stock of goods. But the stock is meant not a stock that actually already in the warehouse, because the goods have not been placed in the warehouse however the goods are still in the staging area, and not ready yet for ordering. The advantages of implementing barcodes in the receiving process are can minimize errors in receipt of goods and can speed up the receipt of goods, after receipts of goods the data will be automatically updated on the warehouse management system in a real-time so the data will be more accurate.
2. Putaway. After the goods are received, the next process is putaway. Putaway is an activity of placing goods in the storage area. In this putaway process, the goods are usually placed on a high rack [9]. After the goods are received, the system will be automatically print a putaway form which containing the product, quantity, and location of the goods. In this putaway process, the first thing to do is scan the barcode in the putaway form and then scan the barcode on each product that will be stored, the system will be automatically indicated where the location of the goods must be stored. Then the warehouse staff or officer scanning the barcode at the storage location, if the destination of location can be scanned it means the location is already appropriate. The next step is scanning a barcode on the goods that will be stored and put the goods in the appropriate place (bulking). After the goods have been placed in the appropriate place, putaway completed will be shown in the barcode. After the putaway is completed, the Warehouse Management System will be automatically updating the stock. The stock in the putaway process is intended the actual stock in the warehouse which is ready and able to order. On the warehouse management system there are two ways to determine the storage location, which are free flow and dedicated. Free flow means that the warehouse management system will recommend locations to store goods randomly,

meanwhile dedicated means that the warehouse management system is managed by the operator to be able to recommend locations to stored goods according to the type of goods. Both of the ways have their own advantages and disadvantages. The advantage of Free Flow is the space in the warehouse can be utilized optimally, while the disadvantage of Free Flow is the system will be randomly select the place to store the goods so the location of the goods on the rack is not neat according to the type of goods. The advantage of dedicated is the goods will be neatly arranged according to the type of goods and make the picker more easier when picking the goods, while the disadvantage of dedicated is if the space in one layer of the rack or storage place is already full the system will recommend another place to store the goods and usually the storage location will be far apart.

3. Order Processing / Picking. Picking is the activity of preparing and picking up goods in the warehouse according to the picking list. The person who does the picking process is called a picker. The picking list contains the order number, type of goods, quantity of goods, and location for picking up the goods. When to start picking process, the picker must be scan the barcode on the picking list and then will be shown the information of the goods, the number of quantity of the goods ordered, and the storage location of the goods to be picked. Then the picker scans the barcode at the storage location and if the location is appropriate, the picker able to scan the barcode on the goods that have to be picked according to the picking list. In the picking process, the picker must be picking up the goods according to the location and ordinal of the goods that are on the picking list, if it does not accordance with the picking list the system will be automatically rejected, this is called picking route [10]. Picking route will increase efficiency in the warehouse because it can be set the step of the picker to picking up the goods in the sequence on the picking list, so the picking process can be more directed. After the picking process is completed, the warehouse management system will update; (1) the stock of goods at the storage location is reduced, (2) the stock inventory has changed, it means all of the stock in the warehouse has changed, and (3) the order completed. The advantage of using barcodes in the picking process is able to minimize the location and goods errors picked up by the picker and speed up the picker when picking up the goods.
4. Outbound checking. Checking is a process to check the goods that have been picked by the picker according to the picking list before the goods are actually out from the warehouse. The person who does checking process is called a checker. Outbound checking is done in the staging out area. In this outbound checking process, the picker must submit the order number namely picking list and also the physical of the products to the checker. The barcode of the picking list will be scanned by a checker then the order number, type of the goods, and quantity of goods picked up by the picker will be seen. After that, the checker will check the physical of the goods. Checking of the physical of the goods is called quality control, it aims to ensure the goods which will be sent are in good condition, then continue with the process of packing the goods. Packing is the process to pack the goods that are intended to make the goods safe during the shipping process. If the goods picked is accordance with the order, the checker will be confirmed and the warehouse management system will be automatically updating that the goods are ready to be shipped. Then the system will be automatically print the packing list. The advantages of using a barcode in the outbound checking process are can help to find out a lack or excess quantity of the goods picked by the picker, to find out the feasibility and quality of the goods to be shipped, reducing human error in checking goods, speeding up to deliver information/data in a real-time so that the data obtained will be more accurate, and minimize paper use.
5. Loading. Loading is the process of load the goods into a truck or container that will be sent to the destination. In the loading process the first thing to do is scan the barcode on the packing list. The packing list is a detailed list of the types and quantities of goods in the packing. The packing list contains the packing number, the contents of each packing, net weight, and size. The function of the packing list is to make it easier to know the contents of the goods in the packing if at any time there is an inspection. After the goods enters the truck or container, the manifest is declared

completed. Then the warehouse management system will be automatically updating that the order is dispatched. The advantage of using barcodes in the loading process is that it can speed up the issued of manifests for shipping. In this process a transaction between the driver and the warehouse is represented by the checker. This process is really needed to be considered because the correct or not of the goods ordered and destination is determined. The handover process needs to be done clearly, so the accountability for the problems that might arise later can be allocated. Several things that need to be considered in this process include the wholeness physical of goods (not damage/ crack or defective), the quantity and type of goods according to the packing list, the destination area in the correct route order and make sure there is a receipt such as (initial / driver name and car number and departure time) from the warehouse and also the correct documents.

6. Take / Stock Opname. Stock take / stock opname is an activity of checking the whole inventory stock in the warehouse. The first thing to do when doing this stock opname is scanned the barcode in the stock opname document. The document of stock opname is contained the goods name, the number of quantity of the goods, and location of goods storage. After that, start by checking the stock in each location by scanning the location barcode first, then scanning each goods, this process is done in a whole storage place in the warehouse. After the process completed, the Stock Taking / Stock Opname report will be automatically issued, which reports the goods has been opname. The purpose of the stock take / stock opname is the data in the warehouse is in accordance with its actual condition, so that the stock data can be more accurate.

In the warehouse, the activities to do are not only the step of the process above, but also there are several activities carried out, one of the activity is the stock movement. When to do stock movement also able to use barcodes, because barcode can be simplify the process. Stock movement is the movement of goods in a storage area in the Warehouse. If the stock inventory on the pick face has reached a minimum stock, the Warehouse Management System will be commanding the replacement. Replacement is done to fulfill the maximum stock at the pick face. In this process there is a document called Replacement Form. When the officer wants to make a replacement, the first thing to do is scan the barcode on the Replacement form, then the location and goods must be replaced will be seen. After that the officer scans the barcode at the bottom of the storage rack, if it is appropriate then the goods are able to be dropped from bulking to the pick face.

4. Conclusion

By Implementing barcodes in warehouses has many advantages, such as able to minimize errors in receipt of goods and speeding up the receipt of goods, can automatically determine the location of storage, minimize errors in storing goods at the storage area, minimize location and goods picked errors by the picker, speeding up picker in picking up of goods, can help to find out a lack or excess quantity of goods, know the feasibility and quality of the goods to be shipped, reduce human errors in checking goods, minimize paper use, and speeding up the issued of manifest for shipping. In addition, the implementation of barcodes can speed up the deliver of information/data reports obtained from the Receiving process; Putaway; Order Processing / Picking; Outbound Checking; Loading; and Stock Take / Opname will be automatically updated on the Warehouse Management System in a real- time so that the data obtained is accurate [11]. Thus, the implementation of barcodes on the warehouse management system able to increase efficiency in warehouses. Every process in the warehouse that has been equipped with barcodes can be done faster and more directed than the warehouse that still uses manual handling. Therefore, the warehouse needs to implement this barcode technology to its warehouse management system to achieve efficiency in the warehouse. The authors recommended barcode implementation in the warehouse management system to achieve warehouse efficiency.

5. References

- [1] Cabral Ribeiro, Priscilla Cristina & Simoes Gomes, Carlos Francisco & Matos Freire, K. A. de. Warehouse Management System : A Bibliometric Study. Research Paper, (October), 15. Retrieved, 2016.
from https://www.researchgate.net/publication/308905673_WAREHOUSE_MANAGEMENT_SYSTEM_A_BIBLIOMETRIC_STUDY
- [2] Andre Langevin, Riopel Diana. Logistics Systems: Design and Optimization, Springer, New York, 2015.
- [3] Haslindah, A., Fadhli, M., & Mansyur, R. Pengaruh Implementasi Warehouse Management System Terhadap Inventory Control Finish Good Berbasis Barcode Pt . Dharana Inti Boga. 12, 2017.
- [4] Sihombing, O. P. ANALISIS PROSES BISNIS DAN KEBUTUHAN WAREHOUSE MANAGEMENT SYSTEM (WMS) UKM ONLINE, n.d.
- [5] Shiau, J. Y., & Lee, M. C. A warehouse management system with sequential picking for multi-container deliveries. Computers and Industrial Engineering, 58(3), 382–392, 2010. <https://doi.org/10.1016/j.cie.2009.04.017>
- [6] Atieh, A. M., Kaylani, H., Al-Abdallat, Y., Qaderi, A., Ghoul, L., Jaradat, L., & Hdairis, I. Performance Improvement of Inventory Management System Processes by an Automated Warehouse Management System. Procedia CIRP, 41, 568–572, 2015. <https://doi.org/10.1016/j.procir.2015.12.122>
- [7] Hashim, N. M. Z., Ibrahim, N. a, Saad, N. M., Sakaguchi, F., & Zakaria, Z. Barcode Recognition System. International Journal of Emerging Trends & Technology in Computer Science (IJETTCS), 2(4), 278–283, 2013. Retrieved from <http://www.ijettcs.org/Volume2Issue4/IJETTCS-2013-08-19-097.pdf> Fávero, L., Nascimento, S., & Verdinelli, M. A. Deployment Warehouse Management System: Case study in a Distributor Center and Wholesaler. Future Journal , 8(2), 61–88, 2016.
- [8] Miles, M. B., Huberman, M. a, & Saldana, J. Drawing and Verfyng Conclusions. Qualitative Data Analysis: A Methods Sourcebook, 275–322, 2014. <https://doi.org/January 11, 2016>.
- [9] Miralam, M. Impact of Implementing Warehouse Management System on Auto Spare Part Industry Market in Saudi Arabia. 6(3), 56–74, 2017.
- [10] Weidinger, F. Picker routing in rectangular mixed shelves warehouses. Computers and Operations Research, 95, 139–150, 2018. <https://doi.org/10.1016/j.cor.2018.03.012>
- [11] Yao, A. C., & Carlson, J. G. Impact of real-time data communication on inventory management. International Journal of Production Economics, 59(1), 213–219, 1999. [https://doi.org/10.1016/S0925-5273\(98\)00234-5](https://doi.org/10.1016/S0925-5273(98)00234-5)