

Optimizing Warehouse Management with Radio Frequency Identification: RFID of Manufacturing Industries

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Abstract: The researcher aims to warehouse Study, Warehouse Management Using RFID Technology, Problems and Obstacles in Implementing RFID Systems in Warehouse Management Solutions using RFID systems in warehouse management, and warehouse Management, Manufacturing industries of Hanon Systems (Thailand) Co., Ltd. The research tools were Studying the tendency of more broken products and to study the possibility of bringing RFID technology to work in the warehouse of the manufacturing industry. by technical and financial analysis From initial investment in warehouse management with Radio Frequency Identification: RFID and payback period and study the rate of return on investment (ROI) in a period of 1 year. The results discovered in this study 1. Technical Analysis There will be a specific analysis of the operational processes in the warehouse of the Manufacturing industries of Hanon Systems (Thailand) Co., Ltd. only which covers the process of receiving, distributing, and counting the goods Product packing (Bagging Line) with the following processes Receiving of goods (Receiving) with the following process. Product storage (Put away & Picking) with the following processes. Dispatch with the following processes: Inventory Management with the following processes

Keywords: Optimizing Warehouse Management, Radio Frequency Identification: RFID, Manufacturing industries

1. Background

To improve conditions, the analysts have advised the government to promote investments in the EEC areas to boost employment and revenue in the sector. The economic analytical center under TMB Thanachart Bank said the manufacturing sector is responsible for about 27 percent of Thailand's gross domestic product (GDP) and employs about 9 million people. The center said since the emergence of Covid-19 in late 2019, the demand for Thai products has dropped drastically, affecting growth in the sector. The sale of the country's manufactured products has dropped 16.2 percent from 6 trillion baht in 2019 to 5 trillion baht in 2020. TTB Analytics cited the data from the Office of Industrial Economics which said that from 2017 to 2021, the manufacturing sector's revenue has expanded 1.3 percent year on year on average. Domestic sales expanded 1.7 percent, while exports expanded 0.6 percent year on year on average. The center said in 2020, the sale of manufactured products had dropped in almost the entire industrial sector due to Covid-19 lockdowns. Food and consumer products only saw slightly increasing consumption in the domestic market, while only a handful of products enjoyed significantly increasing demands during the outbreak, such as medical gloves. The manufacturing output in the computer and electronics industry also saw steady growth during the pandemic as they were not affected by employees being forced to work from home.

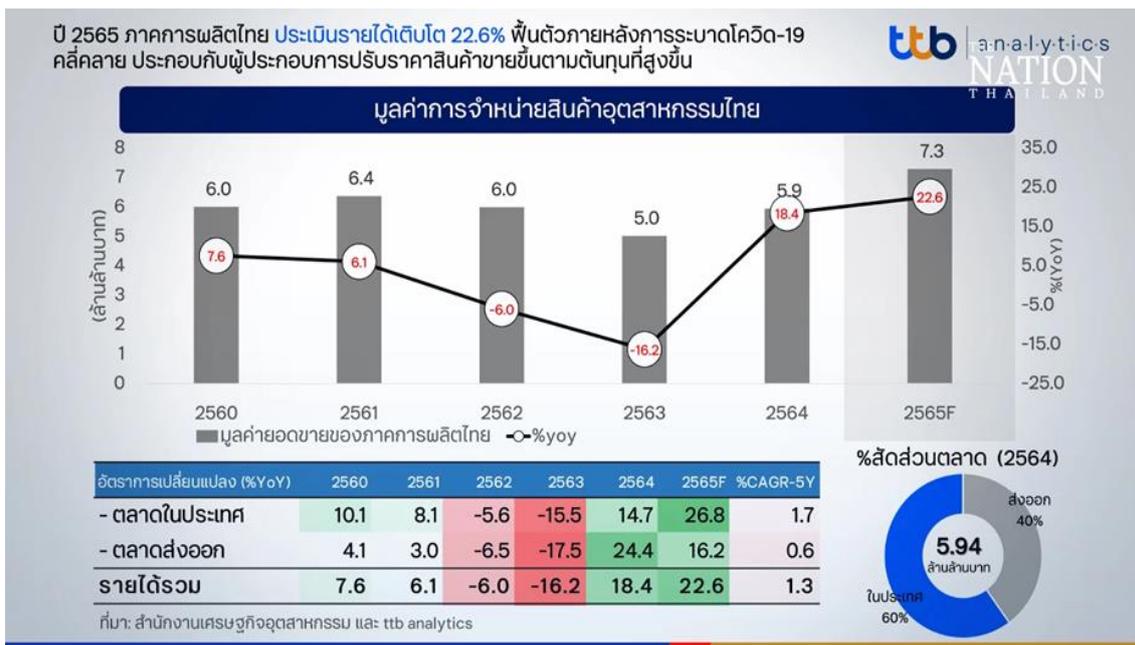


Fig.1. Sales value of Thai industrial products Year 2017-2022

TTB Analytics said the manufacturing sector bounced back in 2021 as more Covid-19 restrictions were eased, allowing people to resume economic activities. Sales of manufactured products in 2021 expanded 18.4 percent year on year, though most industries have boosted their output, two have yet to fully recover from the impact of the pandemic, namely beverage and construction materials. The beverage industry relies on exports and has not recovered because many countries are keeping their borders closed, while the construction industry is losing out due to a drop in people's purchasing power.

TTB Analytics said in 2022, the sales of manufactured products rose 22.6 percent year on year, though this is mainly due to inflated prices as the sales volume is nearly at the same level as before Covid-19. The center warned that though sales show an improving trend, manufacturers are suffering from rising costs and a significant drop in profits. TTB Analytics added that in the past five years, growth in the manufacturing sector has been limited to large industries such as automotive components, energy, chemicals, food, and electronics, all of which had been severely affected by decreasing demand during the pandemic. "To ensure continued growth and comprehensive revenue distribution across the entire manufacturing sector, the government must promote investment in new S-curve industries, especially in the Eastern Economic Corridor [EEC] areas, which will also boost employment in local communities," said the center. TTB Analytics said industries that need immediate investment promotion include food processing, biotechnology, digital, automation system and robotics, aircraft, and national security technology. "As the Covid-19 outbreak is nearly at an end, the government must focus on investment promotion aspects to ensure steady growth of the country's economy, including attracting foreign direct investment and building infrastructure and ecosystem for target industries, which will surely help boost GDP expansion to 5 percent annually soon," said the center. TTB Analytics, however, forecasts economic growth in 2022 at 3.2 percent and 3.7 percent in 2023, with a major contribution from the tourism industry.

In the current state of the manufacturing industry, there are many forms of competition in the market. both in terms of price, and quality But since plastic pellets are replaceable products. Therefore, the price competition situation is not much different. Therefore, to compete under this type of market condition, manufacturers need to consider the cost of goods. to increase competitiveness with both domestic and international competitors Due to the growth rate of business (Business Grows) that is up to 3,000 tons per day (equivalent to 90,000 tons per month). For this reason, it is necessary to deliver quality products and services in time to meet the needs of customers. With the most economical cost to be able to compete with competitors in the business by working in a hurry and responding to the needs of customers urgently. Resulting in many problems occurring However, the aforementioned problems resulted in higher operating costs and product costs. For this reason, the researcher chose to study "Increasing Warehouse Management Efficiency with RFID System.

RFID is a widely adopted and mature technology used in manufacturing, supply chains, warehouse, and inventory handling, document tracking and management systems, access control, electronic toll collection, waste management, cashless payments, animal tracking, ticketing, and so on. In its simplest form, the RFID tag could be used for product identification by just reading the product identification code. In such a scenario RFID system would serve a similar role as a well-known bar code labeling system. However, there are several important advantages of RFID tags over bar code labeling systems: RFID tags already on the product could be rewritten, reused (recommissioned), or killed, depending on product status and user application. It is not possible to change the bar code label without producing and applying a new one on each product. RFID tags can hold more information which could also be site-specific or event specific (i.e. error log written during production test procedure). RFID tags can be read when out of sight, or within a product. RFID tags could also be used within a sterile or hostile environment. RFID tags do not wear out, they are not susceptible to dirt, and it is not possible to scan (and later forge) product codes without proper equipment. Despite all this, it is not likely that RFID technology would completely replace optical bar code systems (EAN systems). Simple EAN labels will always be less expensive, which will be of most importance for many high-volume, low-cost products. It is not just because of the lower tag price, RFID readers are also more expensive to produce, set up, and maintain than barcode scanners. EAN label optical scanning is often also more reliable. RFID tags might be difficult to read reliably from metallic containers, bottles containing liquids, and in some other cases, depending on a specific environment. It is usually a good idea to consult the RFID expert before the installation. The user will probably have to do some fine-tuning of the RFID system including the reader antenna setup and positioning after the installation to make sure the system would perform as expected. It is very important to understand the RF technology used behind the scene to be able to select the proper RFID solution. A potential user should understand the differences and limitations which could result from the improper choice of tags, their frequency range, improper antenna placement, or some other misunderstood aspects of the RFID technology. Considering all this, it is no wonder that RFID technology was slowly gaining momentum. It took a lot of time and effort to come to the point where mass production could lower the price of technology making it usable for more applications. As was often the case in electronic industry history, the collaboration of government (military applications), universities, and some key industry companies resulted in solid standardization, paving the way for commercial success.

Fig.2. Radio Frequency Identification (RFID).

2. Methods

The research tools were Studying the tendency of more broken products and to study the possibility of bringing RFID technology to work in the warehouse of the manufacturing industry. by technical and financial analysis From initial investment in warehouse management with Radio Frequency Identification: RFID and payback period and study the rate of return on investment (ROI) in a period of 1 year.

3. Results

The results discovered in this study

1. Technical Analysis There will be a specific analysis of the operational processes in the warehouse of the Manufacturing industries of Hanon Systems (Thailand) Co., Ltd. Only which covers the process of receiving, distributing, and counting the goods

1.1 Product packing (Bagging Line) with the following processes

1.1.1 When production is full, pallets are attached with RFID tags at the end of the packing line.

1.1.2 The system will send information

1.1.3 TS and SAP will update the forklift to know the location to keep the product and reduce errors as well as reduce costs.

1.2 Receiving of goods (Receiving) with the following process

1.2.1 When the product is off the production line or truck. There will be a count of goods. enter the warehouse by yourself RFID scan attached to the entrance or portable by scanning the Pallet Tag.

1.2.2 The obtained data can be sent to TS or SAP system immediately.

1.2.3 The system will order the Forklift driver to pick up the goods for storage immediately.

Received is to help inspect products from the production line can be done more quickly, No longer wasting time checking items one by one, reducing human error and improving inventory management efficiency.

1.3 Product storage (Put away & Picking) with the following processes.

1.3.1 Separate fast-moving and slow-moving goods by the information recorded in the RFID Tag.

1.3.2 Separate storage as allocated by the system

1.3.3 The movement of goods and activities that will occur. The system will be ordered by the staff.

Follow the Monitor and Handheld as a manager, the benefit is that employees have a system to make decisions easier and faster, if they do something wrong, there will be a warning system from the device, and the system will bind the product to the location, making it possible to know various information. Can And employees will not be able to make mistakes.

1.4 Dispatch with the following processes:

1.4.1 RFID Tag is placed on the pallet

1.4.2 RFID Tag Attached to Location

1.4.3 RFID Leader Use Portable Handheld 1.4.4 When delivering goods, scan at the location and Tag on Pallet (use Portable Handheld). The work is faster and more accurate, which can result in fewer problems with dispensing mistakes. Including various expenses incurred is reduced.

1.5 Inventory Management with the following processes

1.5.1 RFID Tag attached to the location.

1.5.2 When counting goods, scan at Location and Tag on Pallet to confirm storage location and product information match.

1.5.3 When the product information and location are correct, it can better manage moving, picking, and counting by utilizing handhelds to help, which can transfer data for processing directly. Without having to enter new information

1.5.4 In the case of updating information Able to update new information into an RFID tag.

Fig.3. Inventory Management with the following processes.

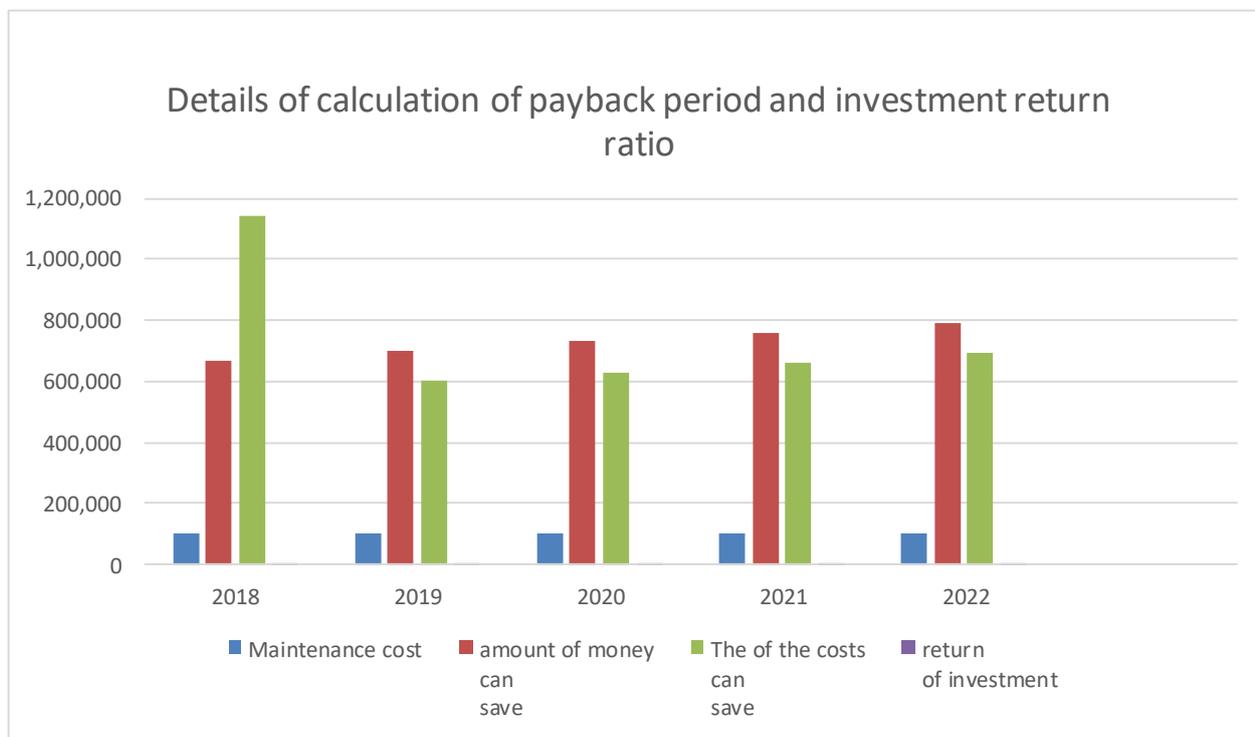


Figure 4: Histogram

In the years 2018 – 2022, it was found that the return on investment ratio increased from 37.01% to 43.71% in 2010 due to higher profitability from the analysis of the feasibility. Both technically and financially, the RFID system will be able to solve the problem of wrong delivery and product damage better than the bar code system. It also helps to maximize the benefits of work. Enabling the company to compete effectively with competitors after calculating the cost savings for the years 2020, 2021, and 2022, which is equal to 60,485 baht, 79,197 baht, and 86,642 baht respectively.

4. Discussion

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5. References

1. Caidingping. Statistical analysis of the modern logistics industry and the national economy[J]. Logistics, 2006, 3 vol.21, no.1, Mar.
2. China Statistical Yearbook 2005, National Bureau of Statistics, 2005.Fangqiuyan. Analysis of the interaction between economic development and the logistics industry [J]. Logistics Technology, 2005, no.3:11.
3. Huanghai, Xutao. Analysis of the relationship between economic development and the logistics industry [J]. Logistics Technology, 2006, vol.3, no.2:112.
4. Huanglijin. Network Economy and modern logistics [J]. Theory Perspective, 2002, no.5:15.
5. Khomsan Laosillapacharoen (2018) The Strategy for Increasing Exported Quantity of Thai Furniture Industry, ACADEMIC JOURNAL BANGKOKTHONBURI UNIVERSITY Vol.7 No.1 January - June 2018P.30-43.
6. Li, Yang, Liu. The empirical study of the relationship between the logistics industry and the national economy [J]. Journal of Wuhan University of Technology, 2006, no.6:8.
7. Lixiaoxi. Logistics and the development of China's economy [J]. Modern Logistics, 2004, vol.4, (in Chinese)
8. Liu Nan, Li Yan. The relationship between economic growth and modern logistics [J]. Project Management Journal, 2007, no. 1:151.
9. Liupengfei, Xieruhe. Logistics and economic relations [J]. China Logistics and Procurement, 2003.
10. Liupengfei, Xieruhe. Logistics and economic relations [J]. Academic Research, 2004, vol.19, no.1: 68-71.
11. Marc Juhel, the role of the logistics industry in the economy [J]. Logistics Technology, 2002, no.2:41.
12. Maliqiang, China's economic development needs the establishment of a modern logistics system[J]. Logistics Forum, 2006, no.33:152.
13. Shangjin, Yangyou, Lixiaohong. Cluster analysis and examples discriminant of economic development in the region[J]. West China Normal University, 2005, no.2:263.
14. The impact of economic development on the development of the logistics industry empirical study [J]. Produced by the Forum, 2003:38.
15. Wangyanhua. The economic development and modern logistics [J]. Modern Logistics, 2006, no.5:67.
16. Wangjun. Empirical analysis of China's logistics industry in economic growth [J]. Academic Research, 2005, no.2:20.
17. Wangzuo. Logistics development [J]. Logistics Technology, (in Chinese) 2006:24.
18. Wangxuhui. The development of the logistics industry in Japan [J]. Modern Japanese Economy, 2005, no.2:25.
19. Wujining. Logistics industry and economic growth [J]. Logistics Technology, 2006, no.6:13.
20. Zhangwenjie. Regional economic development and logistics [J]. Logistics Technology, 2004.
21. Zhaoxujie. Statistical analysis and forecast of economic growth and logistics industry [J], 2004, vol.29, no.5:887-890.
22. Zhu Hong-wen (2007)The Research on Relationship between Economy Development and Logistics Development Based on Statistical Analysis. International Conference on Management Science and Engineering (ICMSE)