

Design and Build Inventory System using EOQ and ROP Methods (Case Study: CV. Ziefa Karya)

Rapida Hanim Lubis^{1)*}, Fitri Aini Nasution²⁾, Angga Putra Juledi³⁾

¹⁾²⁾³⁾Universitas Labuhanbatu, Indonesia

¹⁾rapidahanimlubis@gmail.com, ²⁾fitriaininasution689@gmail.com, ³⁾anggapj19@gmail.com

Submitted : Apr 30, 2022 | **Accepted** : May 12, 2022 | **Published** : May 12, 2022

Abstract: As a construction company that manages large quantities of incoming and outgoing goods, CV. Ziefa Karya must carry out an inventory control process, to determine the number of products to be re-supplied in a fast and accurate manner. But what happened was the opposite, with the inventory control process that was still manual, the owner of the company experienced various losses because he did not record goods and went out regularly. Based on these problems, this study tries to provide a solution in order to facilitate the management of inventory. CV. Ziefa Karya must have an inventory system that can manage the supply of goods properly. This study aims to build an inventory system based on information systems on CV. Ziefa Karya by applying the Economic Order Quantity (EOQ) and Reorder Point (ROP) methods. The system development method used is Model Driven Development (MDD) which includes: interviews, observations, literature studies, problem analysis, needs analysis, design, construction, and implementation. From the results of implementation and testing, it is found that the implementation of EOP and ROP in the application has succeeded in making the inventory system function properly. From these results it can be concluded that to build an inventory system on CV. Ziefa Karya uses the EOQ and ROP methods which can provide fast, precise, and accurate information, so the Model Driven Development (MDD) method must be used.

Keywords: EOQ; Inventory; ROP; Stock; Ziefa Karya.

INTRODUCTION

Ziefa Karya is a company in the form of a limited partnership (CV) domiciled in Labuhanbatu. CV. Ziefa Karya is a construction company that has experience in working on national projects with sub-classifications: implementing services for single residential building construction and coupling, implementing services for commercial building construction, implementing services for educational building construction, implementing services for building construction, implementing services for the construction of waterways, ports, dams, and water resources infrastructure, and implementing services for the construction of highways (except flyovers), roads, railroads, and airport runways (INDOKONTRAKTOR, 2019).

As a construction company, Ziefa Karya certainly has a warehouse to stock up building materials for housing projects and other building constructions. In carrying out inventory control operations, to determine the number of products to be re-supplied, the company owner looks at the daily expenses, while to determine when to place an order (restock), the company owner looks at the average expenditure of goods from the previous day. With the inventory control process being carried out as it is today, company owners experience various kinds of problems. Such as forgetting to record items that must be provided back so that it can lead to the emptiness of one of the items that should be provided and unable to meet construction needs. Based on these problems, CV. Ziefa Karya really needs an inventory application that can determine the number of items to be ordered at a time and when to reorder the item.

Several previous studies have examined the inventory system. Hasanudin has designed an inventory system at PT. Nusantara Sejahtera Jaya, the Information System that has been produced in this design can manage incoming and outgoing goods data, stock data, ordering goods in one web-based application properly (Hasanudin, 2018). By using the waterfall method, the inventory system at the Rosadah Store can help make the

*name of corresponding author



This is an Creative Commons License This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.

transaction process easier and more efficient (Muflihin, Dhika, & Handayani, 2020). The inventory system applied to Oto Bento is very helpful in data processing so that the consumer order transaction process and report generation becomes faster and more accurate (Hay's, Sugiyarta, & Winungkas, 2018).

This study aims to build an inventory system that can be used to manage computer-based inventory at CV. Ziefa Karya. The author tries to provide a solution to the problems above by creating an information system to provide easy management of incoming and outgoing inventory at CV. Ziefa Karya. The method applied to this inventory system is the Economic Order Quantity (EOQ) method and is also supported by the Reorder Point (ROP) method. The formulation of the problem in this study is how to build an inventory system using the EOQ and ROP systems that can provide fast, precise, and accurate information.

LITERATURE REVIEW

Inventory is a number of goods provided by companies or producers, both raw goods and finished goods, which aim to meet consumer demand (Mufida, Rahmawati, & Hertiana, 2019). Inventory can also be said as the management or control of inventory in the industry (Singh & Verma, 2018). Although inventory is an idle resource, no company can operate without inventory (Sridhar, Vishnu, & Sridharan, 2021). A good company in managing inventory for customer needs will also be able to manage its business well, for that the inventory system is something important for the company (Zalukhu & Handriani, 2019).

Economic Order Quantity (EOQ) or Economic Lot Size (ELS) is the most famous and oldest inventory management method (Godichaud & Amodeo, 2019). This model can be used for both purchased and homemade supplies, and is widely used today because it is relatively easy to use (Nobil, Sedigh, & Cárdenas-Barrón, 2020). This model is able to answer questions about when an order or purchase should be made and how much quantity should be ordered so that the total cost (the sum of the ordering cost and the storage cost) is kept to a minimum (Khalilpourazari & Pasandideh, 2019). EOQ is an inventory management method which, when applied to a company, will be able to reduce ordering costs and goods storage costs (Purwoko & Lusiana, 2018).

After the amount of material purchased at a minimal cost is determined, the next problem is when the company must order again so that the company does not run out of stock. Reorder Point (ROP) is the process of how the raw materials ordered by the company can be ordered right when the inventory is safety stock or equal to zero (Rezaei, Baboli, Shahzad, & Tonadre, 2018). The ROP explains when it should be ordered again, so that the material ordered is received on time (Díaz, Paternina-Arboleda, Martínez-Flores, & Jimenez-Barros, 2020). There are two factors that determine the reorder point, namely: safety stock is the minimum inventory that is in the company, and the need for goods per period (Nguyen, Aduyasak, & Landry, 2021). If the demand for the product is not known with certainty, then there is a possibility of running out of stock. To overcome this, the warehouse often chooses to store safety stock.

METHOD

The research framework is used in this study to find out the problems or deficiencies in the CV. Ziefa Karya so that it can build an inventory system application. The research framework on the implementation of this system uses the Model Driven Development (MDD) method. The following is the research framework as shown in Figure 1.

*name of corresponding author



This is an Creative Commons License This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.

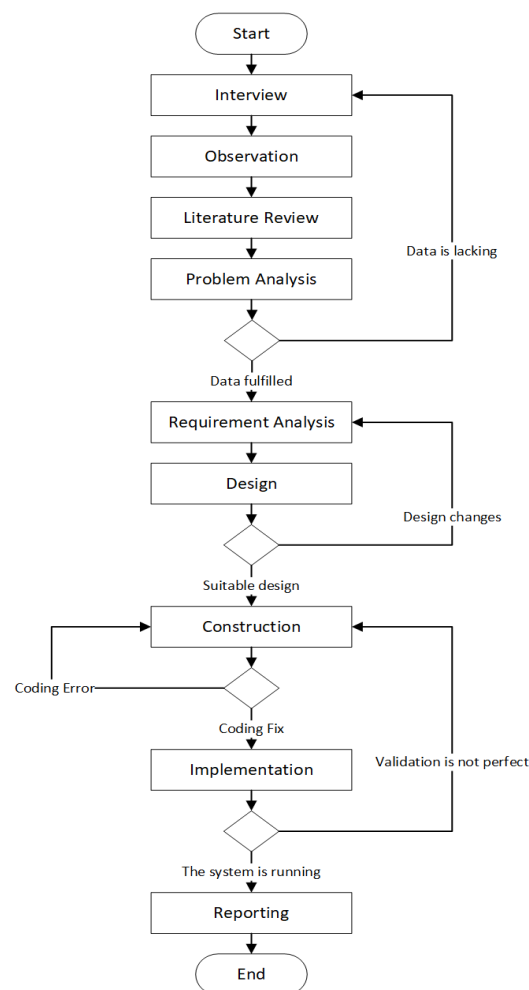


Fig 1. Research Framework

Observation

The first step in conducting this research is to identify the problem, look at the facts and evidence about the research, then take notes. This research was started by visiting CV. Ziefa Karya, then met with the owner of the company to ask for permission to conduct research and interviews regarding the management of goods data at the company.

Problem analysis

On CV. Ziefa Karya, recording inventory notes is still manual. When the company forgets to record the goods needed by the reseller or distributor, the company cannot meet consumer needs. Store notes or inventory items are still stacked in one place. Based on these problems, this inventory system will use the Economic Order Quantity (EOQ) method to determine the quantity of goods to be ordered in the future and the Reorder Point (ROP) to determine when to re-stock.

Requirements Analysis

The requirements analysis required consists of 4, namely: procedure requirements, main application requirements, software requirements, and hardware requirements.

Design

There are several design stages of the process that will be carried out, namely: model design with use case diagrams, class diagrams, and activity diagrams. Database design and interface design.

*name of corresponding author



This is an Creative Commons License This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.

Construction

Making this application is built using the PHP programming language software and MySQL DBMS, CSS Framework.

Implementation

The implementation stage is the process of testing the application using the black box method to test the functionality of the application. If at this stage there are still shortcomings, it will return to the initial investigation stage until it gets the right results, then proceed to the next stage.

RESULT

After going through the design, construction and system implementation stages. Then the results obtained will be described in the following explanation. At this stage the software is described with an analytical model using Use Case diagrams. The analysis is used for the initial mapping of the behavior signaled by the application system into the modeling elements. To assist the design and complete the design documentation. Use Diagram of this system is illustrated in Figure 1.

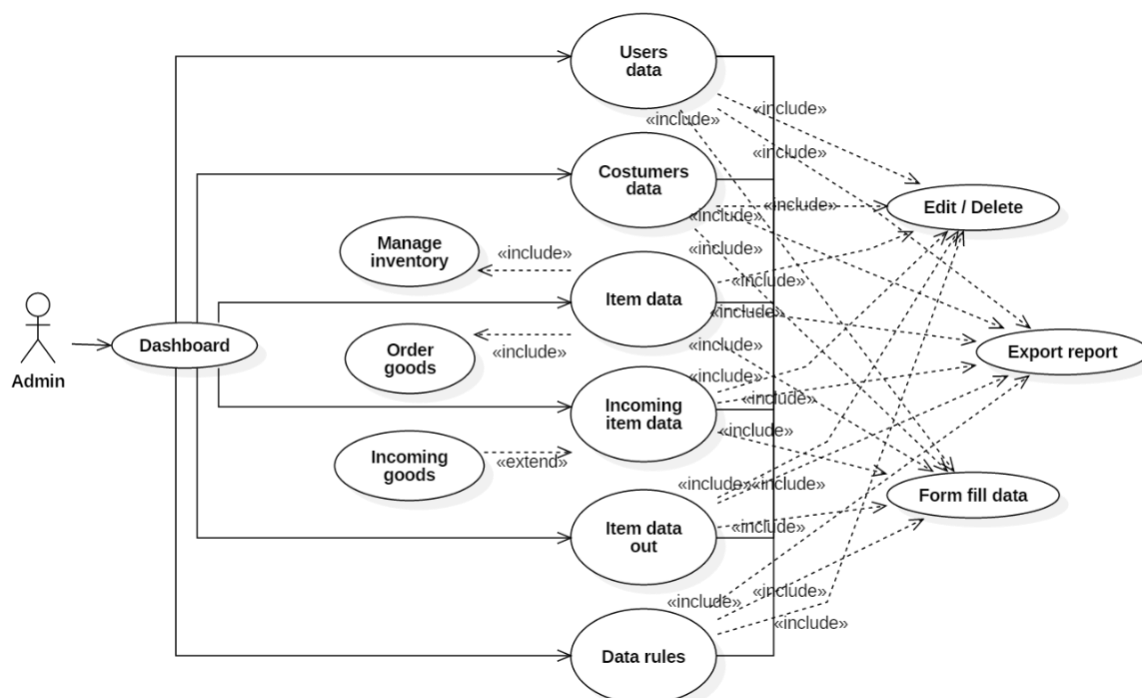


Fig 1. Use Case Diagram

Employees are admins of the company who are given the authority to manage (maintenance) applications. In the developed system, the administrator's role is held by the employee. Employees can view and change all system data, and can fix errors that occur in the system. In this system, employees log into the inventory system. In this system, employees can input data, delete data, process data for incoming goods, outgoing goods, customer data, reports, rules and others.

*name of corresponding author



This is an Creative Commons License This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.

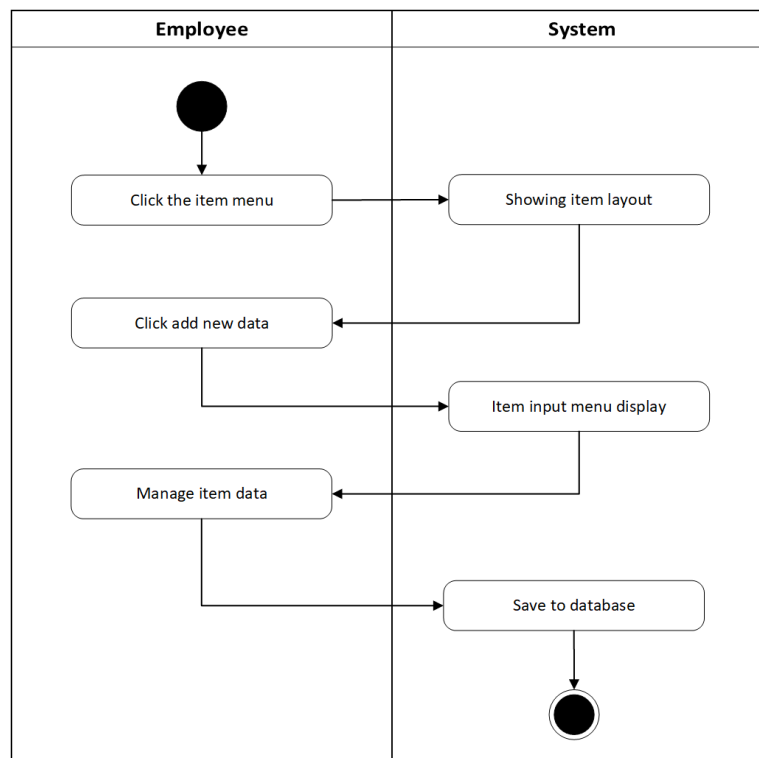


Fig 2. Goods Processing Activity Diagram

In the Activity Figure, the goods data processing diagram describes the process of inputting goods data into the system, the employee clicks the goods menu and then the goods layout will appear then the employee or company owner clicks the add new data button and the system displays the goods data input form, then the employee manages the goods data (can input or change existing data) then press the submit button then the data will be automatically saved into the database.

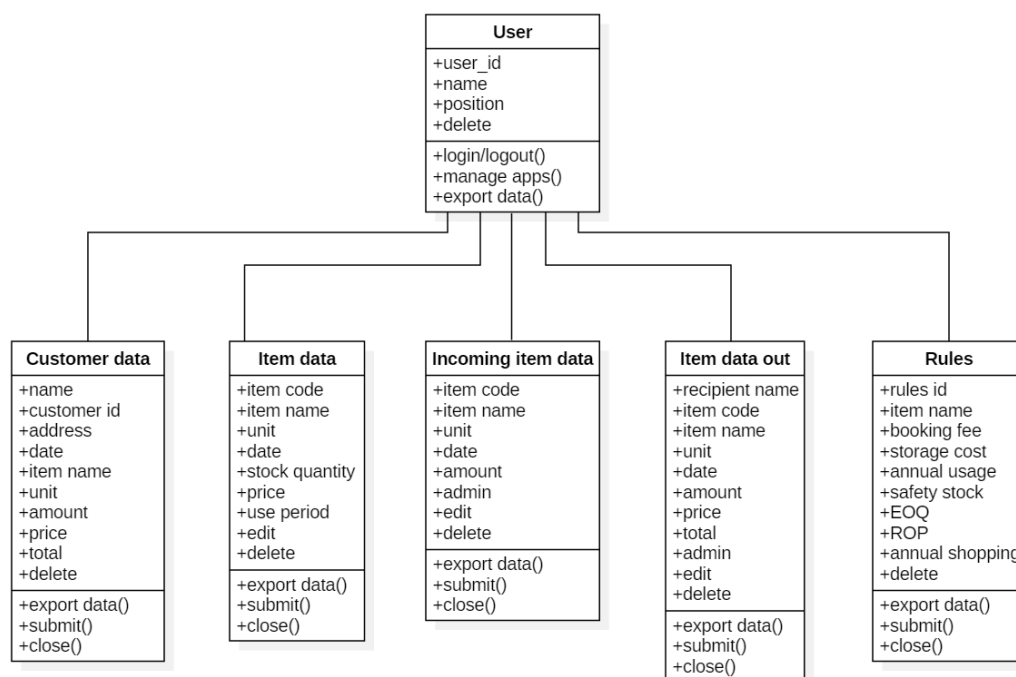


Fig 3. Class Diagram

*name of corresponding author



This is an Creative Commons License This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.

In the class diagram shown in Figure 3, it is known that there are several tables in the database structure where the user table is interrelated with customer data tables, goods data, incoming goods data, outgoing goods data, and rules, which means that a user can access the tables.

Based on the design carried out, it is known that there are several display forms in the inventory application that aim to facilitate the user in operating which consists of Login, Dashboard, Goods Data Page, Incoming Goods Page, Outgoing Goods Page, User Page, Item Data Content Form, Data Content Form Goods In, Form Fill Out Goods Data.

Fig 4. Login Page

The login page in Figure 4 is made to secure user data so that not just anyone can access it, there is a username box to fill in the user's username, a password box to fill in the user's password, the option to remind me to make the system remember the user's username and password and a login button to login to system.

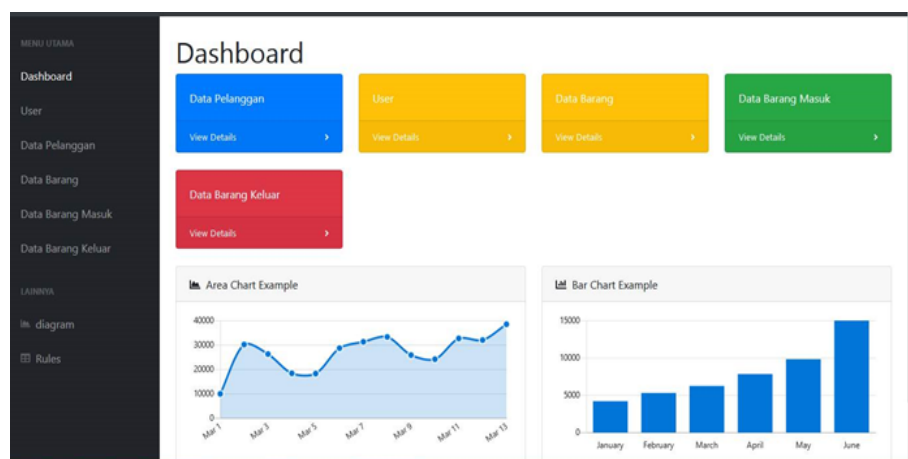


Fig 5. Dashboard Page

The application dashboard in Figure 5 is the initial view of the inventory system and in it there are various buttons that can be accessed by the user. By clicking on the customer data menu, users can see details of existing customers, which in this case are housing developers, both private and government. In the item data menu, the user can view detailed item data on the system which will display a list of items consisting of item code, item name, unit, date, stock amount, price, use period and edit/delete. The incoming goods data input menu is so that the application obtains data to be managed and can display the latest item data, if there are incoming goods but the user does not input the incoming goods data, the data will not be processed by the application, so the application will display the amount data. inaccurate item. The data input menu for outgoing goods is so that the application obtains data to be managed and can display the latest data, if there are items out but the user does not input the data for the outgoing goods, the data will not be processed by the application, so the application will display the data for outgoing goods. which is not accurate.

*name of corresponding author



This is an Creative Commons License This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.

DISCUSSIONS

As explained in the introduction, this system was built by applying the Economic Order Quantity (EOQ) and Reorder Point (ROP) methods to manage inventory on CV. Ziefa Karya. So that method has also been implemented in program code generation as shown in Figure 6 below.

```
<tr>
<td><?=$i++;?></td>
<td><?=$idrules;?></td>
<td><?=$namabarang;?></td>
<td><?=$biayapemesanan;?></td>
<td><?=$biayapenyimpanan;?></td>
<td><?=$penggunaanpertahun;?></td>
<td><?=$safetystock;?></td>
<td><?=$eoq = round (sqrt(2 * $penggunaanpertahun * $biayapemesanan / $biayapenyimpanan));?></td>
<td><?=$rop = round ($safetystock + $penggunaanpertahun / 365);?></td>
<td><?=$leadtime = round ($penggunaanpertahun / $eoq);?></td>
<td>
```

Fig 6. Implementation of EOQ and ROP Methods

In Figure 6 above, it can be seen the use of the EOQ and ROP formulas. To apply EOQ according to the EOQ formula: $\{(2D \times S) / H\}$, then the program code writes `eoq = round (sqrt(2 x usage per year x ordering cost / storage cost))`. Meanwhile, to apply the ROP according to the ROP formula: $SS + (D/365)$, then the program code is written in the code `rop = round (safety stock + usage per year / 365)`.

Table 1. Calculation of EOQ and ROP

Booking Fee	Storage Fee	Annual Usage	Safety Stock	EOQ	ROP	Annual Shopping
10000	2000	500	20	71	21	7

In Table 1 above, it can be seen that the application displays EOQ = 71 and ROP = 21. The following is a manual calculation:

- Calculating EOQ
Formula = $\{(2D \times S) / H\}$
D = Product usage per year, S = ordering cost, H = holding cost per period.
D = 500, S = 10,000, H = 2,000
 $EOQ = (2) \times (500) \times (10,000) : (2,000) = 5,000 = 70.710678118655$ rounded up to "71" for EOQ
- Calculating ROP
Formula = $SS + (D/365)$
SS = Safety Stock, D = Usage/Year
SS = 20, D = 500 pcs
 $20 + (500 / 365) = 21.369863013699$ rounded up to "21" for ROP
- Calculating annual expenditure
Formula = D / EOQ
D = Annual usage, EOQ
D = 500, EOQ = 71
 $500 : 71 = 7.0422535211268$ in total rounded to "7" for yearly customers

Note: the company can spend 7 times in one year with a total spending of 71 units in each shopping to meet the needs of the company.

CONCLUSION

After implementing and testing the system, the results obtained. From these results it can be concluded that to build an inventory system on CV. Ziefa Karya uses the EOQ and ROP methods which can provide fast, precise, and accurate information, so what must be done is the use of the Model Driven Development (MDD) method which includes: interviews, observations, literature studies, problem analysis, needs analysis, design, construction, and implementation.

*name of corresponding author



This is an Creative Commons License This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.

REFERENCES

- Díaz, R. D. S., Paternina-Arboleda, C. D., Martínez-Flores, J. L., & Jimenez-Barros, M. A. (2020). Economic order quantity for perishables with decreasing willingness to purchase during their life cycle. *Operations Research Perspectives*, 7, 100146. <https://doi.org/https://doi.org/10.1016/j.orp.2020.100146>
- Godichaud, M., & Amodio, L. (2019). EOQ models with stockouts for disassembly systems. *IFAC-PapersOnLine*, 52(13), 1681–1686. <https://doi.org/https://doi.org/10.1016/j.ifacol.2019.11.442>
- Hasanudin, M. (2018). Rancang dan Bangun Sistem Informasi Inventori Barang Berbasis Web (Studi Kasus PT. Nusantara Sejahtera Jaya). *Jurnal IKRA-ITH Informatika*, 2(3), 24–37. <https://doi.org/10.29207/resti.v4i4.2218>
- Hay's, R. N., Sugiyarta, A., & Winungkas, D. E. (2018). Aplikasi Inventory Terintegrasi Order System Konsumen Pada Oto Bento Perumnas Cilegon Menggunakan Metode Waterfall. *Jurnal ProTekInfo*, 5(September), 22–25.
- INDOKONTRAKTOR. (2019). CV. Ziefa Karya. Retrieved April 12, 2022, from indokontraktor.com website: <https://indokontraktor.com/business/cv-ziefa-karya>
- Khalilpourazari, S., & Pasandideh, S. H. R. (2019). Modeling and optimization of multi-item multi-constrained EOQ model for growing items. *Knowledge-Based Systems*, 164, 150–162. <https://doi.org/https://doi.org/10.1016/j.knosys.2018.10.032>
- Mufida, E., Rahmawati, E., & Hertiana, H. (2019). Rancang Bangun Sistem Informasi Inventory Pada Salon Kecantikan. *Jurnal Mantik Penusa*, 3(3), 99–102.
- Muflihini, H. H., Dhika, H., & Handayani, S. (2020). Perancangan Sistem Informasi Inventory Pada Toko Rosadah. *Bianglala Informatika*, 8(2), 91–99. <https://doi.org/10.31294/bi.v8i2.8712>
- Nguyen, D. T., Adulyasak, Y., & Landry, S. (2021). Research manuscript: The Bullwhip Effect in rule-based supply chain planning systems—A case-based simulation at a hard goods retailer. *Omega*, 98, 102121. <https://doi.org/https://doi.org/10.1016/j.omega.2019.102121>
- Nobil, A. H., Sedigh, A. H. A., & Cárdenas-Barrón, L. E. (2020). Reorder point for the EOQ inventory model with imperfect quality items. *Ain Shams Engineering Journal*, 11(4), 1339–1343. <https://doi.org/https://doi.org/10.1016/j.asej.2020.03.004>
- Purwoko, B. P., & Lusiana. (2018). Penggunaan Metode Economic Quantity Order (EOQ) untuk Mengoptimalkan Biaya Persediaan pada PT. Alphacon Valfindo Periode 2016. *The Asis Pacifid Journal of Management Studies*, 5(2), 87–104. <https://doi.org/10.1016/j.fopow.2017.08.035>
- Rezaei, H., Baboli, A., Shahzad, M. K., & Tonadre, R. (2018). A new methodology to optimize target stock level for unpredictable demand of spare parts: A Case Study in Business Aircrafts' Industry. *IFAC-PapersOnLine*, 51(11), 538–543. <https://doi.org/https://doi.org/10.1016/j.ifacol.2018.08.374>
- Singh, D., & Verma, A. (2018). Inventory Management in Supply Chain. *Materials Today: Proceedings*, 5(2, Part 1), 3867–3872. <https://doi.org/https://doi.org/10.1016/j.matpr.2017.11.641>
- Sridhar, P., Vishnu, C. R., & Sridharan, R. (2021). Simulation of inventory management systems in retail stores: A case study. *Materials Today: Proceedings*, 47, 5130–5134. <https://doi.org/https://doi.org/10.1016/j.matpr.2021.05.314>
- Zalukhu, S., & Handriani, I. (2019). Analisa dan Perancangan Aplikasi Sistem Inventory (Studi Kasus: PT. Cakra Medika Utama). *JSAI (Journal Scientific and Applied Informatics)*, 2(1), 116–122. <https://doi.org/10.36085/jsai.v2i1.153>

*name of corresponding author



This is an Creative Commons License This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.