FRI-2B.412-1-EM1-08

# SPECIFICS OF THE MODELS FOR REORDER POINT INTEGRATED INTO POPULAR ERP SYSTEMS[9]

**Pr. Assist. Prof. Igor Sheludko, PhD**
Department of Business Development and Innovation
University of Ruse "Angel Kanchev"
Phone: +359-82-888-495
E-mail: isheludko@uni-ruse.bg

***Abstract:*** *Reorder point is a widely used instrument for stock replenishment automatisation. The basic implementation has only a few parameters that can estimate the moment when the new purchase order should be made. It makes it simple for embedding into ERP and IMS systems, and understandable to the users. However, the simple model has a number of limitations. There are a lot of advanced modifications for the basic model of recording point. The purpose of this article is to review this particular functionality in some popular ERP systems. Despite the fact that some of ERP have closed, we still could make some assumptions, based on the parameters used to calculate reorder points. The article follows the conclusions of other researchers, stating that a reorder point instrument based on the simple models would be inefficient in cases of seasonal products, new products, products at the end of their life cycle etc. Thus, its implementation in an ERP system should be either limited to some particular group of products with low-variable consumption or be modified to reflect more complex stock dynamics.*

***Keywords:*** *Inventory management, procurement, reorder point, ERP.*

***JEL Codes****: M10, M20*

## INTRODUCTION

The market of ERP (Enterprise planning systems) and IMS (Inventory management systems) is high competitor field. In case the developers are willing to compete with the most popular business management eco-systems they should enforce their competitor advantages in the following areas: integrations, shared database, automation, analytics and reporting, security (Baluch, 2024). This way to improve their market offer, ERP developers are pushed to integrate automated tools for business workflow automatisation. On the other hand, there often are situations, where an automatisation feature exists in an ERP system, but the users refuse to use them. This paper focuses on some specific field in the automation area – automatic tasks for repurchasing products on stock. So why would users prefer controlling stock level manually instead of relying on mathematical modelling, artificial intelligence or other tools that could do it automatically? This article reviews the basic reorder point model, that often is integrated into popular ERP systems. The paper shows some of the limitations of the basic model. On this basis it assumes, why would users reject using the basic reorder point model. It also shows the potential fields of improvement for the reorder point model, in case the managers want the developer to adapt other model modification for their particular products.

## EXPOSITION

Reorder Point - signal level for the manager to purchase the item. This is the level (e.g. number of items) below which the stock should not fall without the attention of the supply specialist. Upon reaching this level, the specialist usually orders a new batch of the item. R is calculated so that the stock in the warehouse is just enough for the time required for delivery. This way, the item is always in stock, the new lot arrives close to when the old one runs out.

- The following values are important for defining the reorder point

[9] This publication was financed under project number 24-BM-01 "Researching the challenges and perspectives for Bulgarian organizations in the context of economic digitalization and internationalization", carried out by the National Scientific Research Fund of Bulgaria and the University of Ruse.

- The baseline for the stock level (usually safety stock level)
- The expected consumption level for the lead time window (usually, based on average consumption)

Replenishment lead time (usually fixed value, according to the vendor contracts)

**ROP calculation models**

$$R = \bar{d}L + SS \quad (1)$$

R - the critical stock level for reordering; d - average daily consumption; L - time of execution of a delivery order after a request; SS - amount of safety stock.

Using the formula of the reorder point an automatic reordering task can be assigned. If we assume that the order volume is 30 pcs ($Q_{ord}$ = 30) we can create the stock dynamic model, simulating this reordering process:

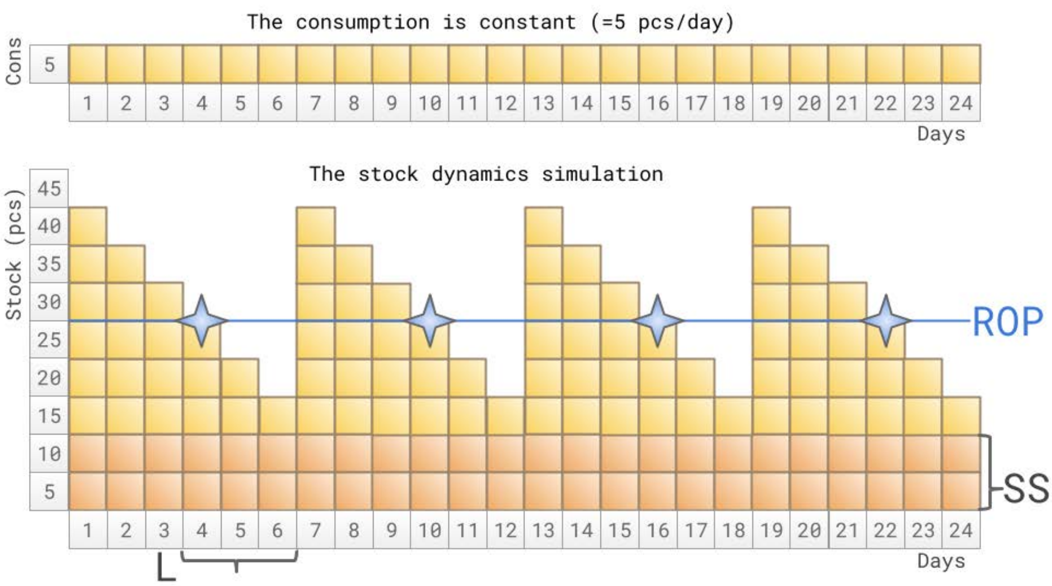


Fig. 1. Stock dynamics simulation (ROP activated; Qord = 30; SS = 10; L = 3; d = 5).

**Limitations of the basic model and modifications of reorder point models**

There are a lot of modifications being developed for the reorder point mathematical model. They could overcome some of the limitations of the basic reorder model. Some of them include:

- inadequate reorder point quantity due to the terms of minimal order quantity (MOQ) in the vendor contract (Muriel et al, 2022);
- shorten the available reaction time because of the losses, caused by imperfect quality of the items in stock (Nobil et al, 2020)
- ignoring a time slot for making new order as the model does not consider aggregate fill rate for the items (van Doselaar et al, 2021)
- demand seasonality also plays a crucial role in determining the optimal policy. Generally, dynamic policies generate fewer orders than static policies (Sakulsom & Tharmmaphornphilas, 2024)

The list of limitations mentioned above is a little part of the limitations researchers meet using reorder point models. Thus, if an ERP system includes a ROP toolkit based on the basic reorder point formula, the manager should check if the particular item is suitable for such a model (i.e. the item has low-variability, non-seasonal demand etc). Using the ROP toolkit without considering the specifics of the item/vendor assumes high risk of item shortages or overstocking (causing higher holding cost)

The list of limitations mentioned above is a little part of the limitations researchers meet using reorder point models. Thus, if an ERP system includes a ROP toolkit based on the basic reorder point formula, the manager should check if the particular item is suitable for such a model (i.e. the item has low-variability, non-seasonal demand etc). Using the ROP toolkit without considering the specifics of the item/vendor assumes high risk of item shortages or overstocking (causing higher holding cost)

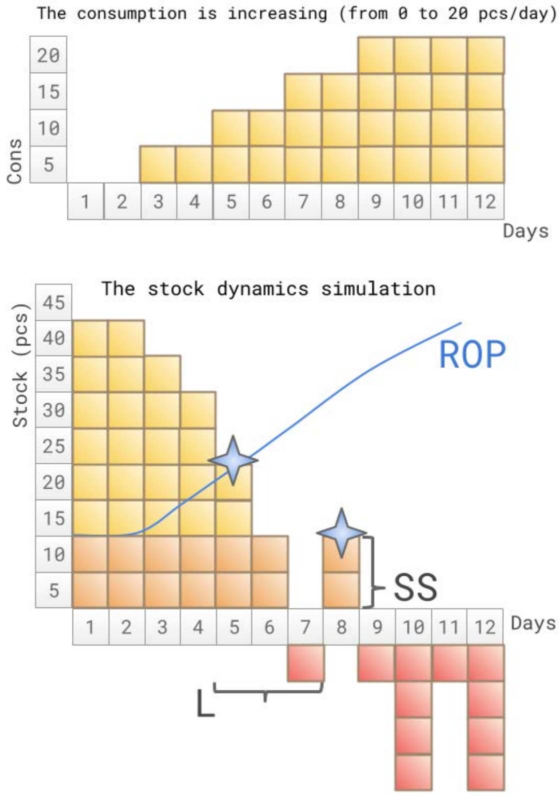


Fig. 2. Stock dynamics simulation for increasing demand (ROP activated; Qord = 30; SS = 10; L = 3; d = {0;0;5;5;10;10;15;15;20;20;20;20}).

As can be seen, in case of increasing consumption, the basic ROP model can lead to stock cutoffs. Moreover, even the cases of predictable consumption growth can be problematic. For example, if the company expects increased consumption on the vacations or planned promo period - the basic ROP model, based on average past consumption would not be able to prevent stock cutoffs. The opposite situation (decreasing consumption) would also lead to inadequate actions. For example, the basic ROP model would offer the manager to purchase more ice-cream, dependless of the market situation - i.e. the end of the season.

**Replenishment process in popular ERP systems**

In spite of the fact that ROP models are instruments for Decision making support systems, they often can be met in popular ERP systems. The basic idea behind the embedding the ROP toolkit in ERP is to develop an automated replenishment control centre. As the data from the transactions in the ERP system is being processed in real-time, the procurement manager is able to decrease reaction time for making the purchase orders.

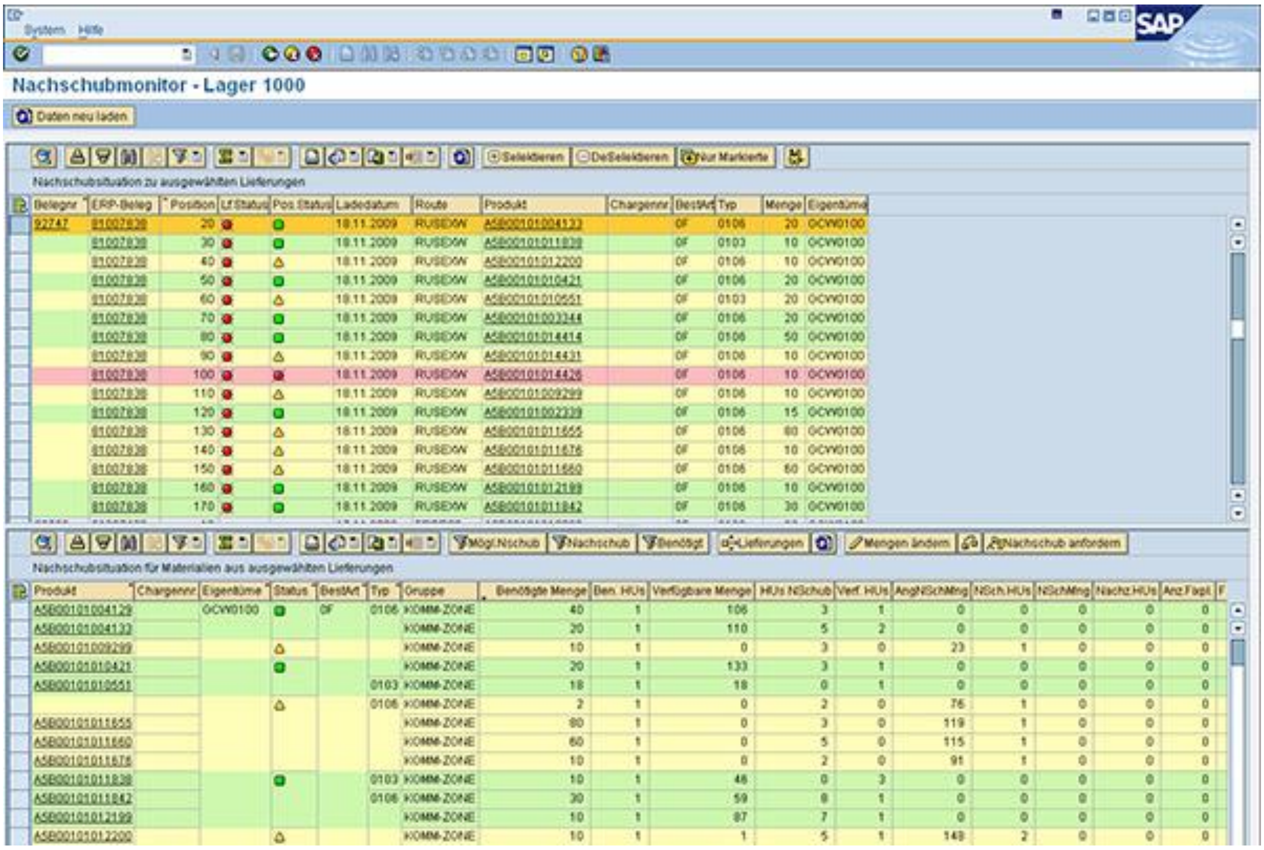


Fig. 5. Example of prioritisation of purchase orders - Replenishment monitor in SAP. Source: logiplus.de

**Integration of the ROP toolkit into popular ERP systems**

**SAP** (Source: help.sap.com/docs/)

In reorder point planning, procurement is triggered when the sum of plant stock and firmed receipts falls below the reorder point. The following values are important for defining the reorder point:

- Safety stock
- Average consumption
- Replenishment lead time
- The following values are important for defining the safety stock:
- Past consumption values (historical data) or future requirements
- Vendor/production delivery timelines
- Service level to be achieved
- Forecast error, that is, the deviation from the expected requirements

**Oracle Business Suite** (Source: https://docs.oracle.com/)

Reorder point planning uses demand forecasts to decide when to order a new quantity to avoid dipping into safety stock. Reorder point planning suggests a new order for an item when the available quantity-on-hand quantity plus planned receipts-drops below the item's safety stock level plus forecast demand for the item during its replenishment lead time. The suggested order quantity is an economic order quantity that minimises the total cost of ordering and carrying inventory. Oracle Inventory can automatically generate requisitions to inform your purchasing department that a replenishment order is required to supply your organisation. Order lead time is the total of the item's processing, preprocessing, and post-processing lead times. If the forecast is correct and the order arrives on time, the inventory level should be right at the safety stock level at the time of receipt. In cases where the desired safety stock level changes during the order lead time, Oracle Inventory uses the largest safety stock quantity during the lead time.

**Microsoft NAV** (Source: https://learn.microsoft.com/en-us/dynamics-nav-app/)
The planning system will suggest a forward-scheduled supply order at the point when the projected inventory passes below the reorder point. The reorder point reflects a certain inventory level. However, inventory levels can move significantly during the time bucket and, therefore, the planning system must constantly monitor the projected available inventory. As we can see this ERP uses projected inventory level for setting up the reordering policy. Projected inventory includes allocated stock (i.e. reserved stock)

**Customisation of the reordering polices in ERP systems**
As every business has its own specifics, the customisation is one of the key factors for competitiveness of any ERP system. Usually, it represents the possibility for users to develop their own tools and modules. Thus, even if the basic reorder tool is not applicable for the particular company it has the option to purchase a module development with the "right" reorder level logical model integrated into it or to develop such module themselves. The author assumes that most of SMEs have financial limitations to accept this option. In a situation where the integrated tool shows inadequate hints, and there are no perspectives on its modification – the users may "mute" the integrated tool and continue to control the stock level manually.

## CONCLUSIONS

The basic reorder point model works well in very tight constraints. The real workflows should rely on planned and forecasted consumption instead of average consumption in the past. The models with fixed parameters (i.e. projected demand, lead time, safety stock level) can under- or overestimate the reorder level. Nevertheless, the basic model with fixed parameters is often integrated into popular ERP systems. Consequentially this tool can give the users inadequate reordering point projections. The users meet the disparity between the model estimations and the reality. This disparity can be the reason for users to ignore the further system signals on reordering or blocking the tool. Contemporary ERP systems have customisation possibilities. If a company has enough resources, it can purchase the development of a tool, that would fit the needs for its particular workflows and product specifics. Such modification might include using forecasts for projecting the future inventory level, including future reservations and seasonality effects, expiration dates of the products in stock, available time slots for delivery, complex lead times (i.e. considering weekends, national holidays in different countries), etc.

## REFERENCES

Baluch, A. (2024) Best ERP Systems Of 2024. Forbes Advisor. URL: https://www.forbes.com/advisor/business/software/best-erp-systems/ (Accessed on 08.10.2024).

van Donselaar, K., Broekmeulen, R. and de Kok, T. (2021) "Heuristics for setting reorder levels in periodic review inventory systems with an aggregate service constraint," *International Journal of Production Economics*, 237. Available at: https://doi.org/10.1016/j.ijpe.2021.108137.

Khorasani, S.T. *et al.* (no date) *INVENTORY CONTROL AND OPTIMIZATION OF REORDER POINT: A CASE STUDY*. Available at: https://www.researchgate.net/publication/379333236.

Mihaylova, L. and Papazov, E. (2024) "Strategic Management of Small and Medium-Sized Enterprises - Is There Space for Functional Strategies?," *TEM Journal*, 13(2), pp. 1277–1282. Available at: https://doi.org/10.18421/TEM132-41.

Muriel, A., Chugh, T. and Prokle, M. (2022) "Efficient algorithms for the joint replenishment problem with minimum order quantities," *European Journal of Operational Research*, 300(1), pp. 137–150. Available at: https://doi.org/10.1016/J.EJOR.2021.07.025.

Nobil, A.H., Sedigh, A.H.A. and Cárdenas-Barrón, L.E. (2020) "Reorder point for the EOQ inventory model with imperfect quality items," *Ain Shams Engineering Journal*, 11(4), pp. 1339–1343. Available at: https://doi.org/10.1016/J.ASEJ.2020.03.004.

Penchev, P. and Vitliemov, P. (2021) "Production Planning as Key Element for the Operational Effectiveness of Industrial Enterprises," in *Proceedings of University of Ruse "Angel Kanchev", Volume 60, book 5.1. Economics and Management, Ruse, University of Ruse "Angel Kanchev."* Ruse, pp. 29–38.

Sakulsom, N. and Tharmmaphornphilas, W. (2024) "Multi-Mode Replenishment Strategies for Periodic-Review in Two-Echelon Systems Under Seasonal Demand," *Journal of Industrial Engineering and Management*, 17(2), pp. 562–582. Available at: https://doi.org/10.3926/jiem.7207.

Sheludko, I. (2023) "Developing spreadsheet model for organizing replenishment process in small and medium enterprises," in *International Scientific Journal "Industry 4.0."* Borovets, Bulgaria, pp. 57–59.

Vediappan, M.K. and Kamali, R. (no date) "EOQ model with one time price discount involves reorder points." Available at: https://doi.org/10.48047/NQ.2022.20.16.NQ880336.