

# DYNAMIC SAFETY STOCK CALCULATION: ENSURING INVENTORY EFFICIENCY

Rohit Tapkir, Yogesh Shete  
*PPIC, Schindler India Pvt. Ltd., India*

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## 1. ABSTRACT

In today's volatile market environment, maintaining optimal inventory levels is critical for ensuring operational continuity and customer satisfaction. Safety stock serves as a buffer against uncertainties in demand and supply. However, traditional methods of calculating safety stock—based on static historical data—often fail to reflect real-time changes, leading to either excess inventory or stockouts.

This research introduces a dynamic safety stock model that adapts to actual consumption patterns and lead time variability. Unlike conventional approaches that rely on fixed historical averages, the proposed model uses a dynamic Average Daily Demand (ADD), derived from future requirements rather than past consumption. This forward-looking approach ensures that safety stock levels are responsive to upcoming demand fluctuations.

In project-based industries, where customer requirements frequently change, this method proves especially valuable. Adjustments in material IDs and specifications are common, and a static safety stock can lead to overstocking or obsolescence. By aligning safety stock with real-time demand, the dynamic model mitigates these risks and supports more agile inventory management.

Ultimately, this approach enhances inventory efficiency, reduces waste, and enables better resource allocation. The research highlights the importance of adaptive inventory strategies in modern supply chain management, offering a practical solution to the limitations of traditional safety stock methods.

## 2. INTRODUCTION

Global market competitiveness and the need to meet customer requirements have triggered an increase in uncertainty factors within the organizations. These factors are often related to manufacturing, transportation, demand, supply, or even external events, and can assume a short-term nature (e.g., increase, reduction, cancelation or even forward-backward movements of orders) or a long-term nature (e.g., price volatility). Coping with uncertainty is, therefore, relevant given that in addition to its unavoidably presence in real-world operational contexts, it is one of the key issues in supply chain management (SCM). Research studies, especially in the field of supply chain risk management (SCRM), have been focusing on the development of techniques able to manage uncertainty phenomena and their repercussions throughout the SC. As a “function of the cycle service level, demand uncertainty, the replenishment lead time, and the lead time uncertainty”, safety stocks are a suitable strategy to prevent stock-outs and to deal with supply and demand variability. In fact, despite the challenges inherent to their management, Koh et al. emphasize that safety stocks are one of the most robust strategies to soften supply and demand uncertainty. (João N.C. Gonçalves, 2020)

In today’s fast-moving and interconnected markets, coordination performance has become a key differentiator for industrial enterprises. Customers now expect not just competitive pricing and quality, but also fast and reliable delivery. Meet these expectations, companies often rely on safety stock to cushion against fluctuations in demand and supply. But traditional methods—based on fixed historical data—often fall short in today’s dynamic environment, leading to either overstocking or stockouts.

This paper presents a dynamic safety stock model that adapts to real-time changes in demand and lead times. Instead of relying on past consumption, the model uses a forward-looking Average Daily Demand (ADD), calculated from future requirements. This makes the safety stock more responsive and better aligned with actual needs.

The approach is especially useful in project-based industries, where customer requirements often change, and material specifications are updated. In such cases, a static safety stock can quickly become obsolete. By adjusting inventory levels dynamically, this model helps reduce waste, avoid obsolescence, and improve service levels.

What sets this method apart is its simplicity and practicality—it’s easy to implement and doesn’t require complex statistical tools. It strikes a balance between two often conflicting goals: supporting high delivery performance and keeping inventory costs low.

Ultimately, this research highlights the need for more adaptive inventory strategies in modern supply chains and offers a practical solution that can be readily adopted by industry professionals.

### 3. WHAT IS A DYNAMIC SAFETY STOCK?

Dynamic safety stock refers to the practice of adjusting safety stock levels based on changes in demand or supply variability over time. Safety stock is a quantity of inventory held in reserve to protect against uncertainty in demand or supply lead time.

Traditionally, safety stock is calculated using a static formula based on factors such as lead time, demand variability, and service level. However, this approach does not account for changes in demand or supply variability over time, which can lead to either overstocking or stockouts.

With dynamic safety stock, safety stock levels are periodically reevaluated and adjusted based on the latest demand and supply data. For example, if demand variability increases, safety stock levels can be raised to ensure that sufficient inventory is available to meet customer demand. Conversely, if supply lead time improves, safety stock levels can be lowered to reduce inventory carrying costs.

Dynamic safety stock can help companies perfect inventory levels, reduce stockouts, and improve customer service levels. However, it requires exact and prompt data, as well as sophisticated inventory management systems to support frequent adjustments to safety stock levels. (Ali, 2024)

### 4. RESEARCH METHODOLOGY

The following outlines the calculation method applied in our approach.

#### **Safety Stock Formula: -**

1.  $SS = ADD \times LT$

Where:

SS: Safety Stock

ADD: Average Daily Demand

LT: Lead Time

2.  $ADD = \text{Total Requirement} / \text{Total Requirement Days}$

#### 3. Illustration of Dynamic Safety Stock Calculation

**Example:** Material ID ABC123

#### Old Method:

- Lead Time (LT): 30 days
- Fixed Safety Stock (SS): 50 units (based on experience and consumption)

#### New Method:

- Total Requirement: 150 units
- Requirement Period: 60 days

### **Calculations:**

1. Average Daily Demand (ADD):

$$\begin{aligned} \text{ADD} &= \text{Total Requirement} / \text{Requirement Period} \\ &= 150 / 60 = 2.5 \text{ units/day ADD} \end{aligned}$$

2. Safety Stock (SS):

$$\begin{aligned} \text{SS} &= \text{ADD} \times \text{LT} \\ &= 2.5 \text{ units/day} \times 30 \text{ days} \\ &= 75 \text{ units} \end{aligned}$$

### **Comparison:**

- Old Method: Fixed Safety Stock = 50 units
- New Method: Dynamic Safety Stock = 75 units

## **5. ADVANTAGES OF THE NEW METHOD:**

- **Alignment with Demand:** The new method adjusts safety stock based on actual demand and lead time, ensuring more correct inventory levels.
- **Reduced Obsolescence:** By aligning safety stock with current requirements, the risk of keeping unnecessary inventory is minimized.
- **Balanced Inventory:** The dynamic calculation helps prevent stockouts and excess inventory, leading to more efficient inventory management.

## **6. CONCLUSION:**

The dynamic safety stock model presented in this study offers a practical and adaptive approach to inventory management, especially in environments characterized by fluctuating demand and evolving customer requirements. By shifting from a static, historically driven method to one based on future-oriented Average Daily Demand (ADD), the model ensures that safety stock levels are more accurately aligned with actual needs.

The illustrated example clearly shows how the dynamic method results in a more responsive inventory buffer—adjusting safety stock from 50 units (fixed) to 75 units (dynamic) based on projected demand. This not only improves service levels but also reduces the risk of stockouts and obsolescence, particularly in project-based industries where material requirements often change.

Moreover, the simplicity of the calculation makes it easy to implement in real-world scenarios without the need for complex statistical tools. Overall, this approach supports better decision-making, enhances supply chain agility, and contributes to more efficient resource use—making it a valuable strategy for modern inventory management.

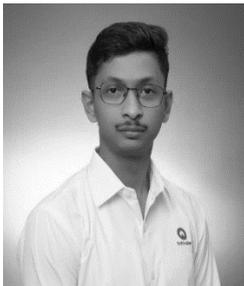
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## 8. BIOGRAPHICAL DETAILS:



**Mr. Rohit Vasant Tapkir** is a Senior PPIC Engineer at Schindler India Pvt. Ltd. in Pune, with 5 years of expertise in Inventory management, Supply Chain Coordination and production scheduling. He holds a Bachelor of Engineering in Mechanical from Savitribai Phule Pune University.



**Mr. Yogesh Shete** is an Assistant Manager at Schindler India Pvt Ltd. Pune, Holds bachelor's degree in production engineering from Pune University. He has 14 years of professional experience in Material planning, Inventory management and Supply chain management.