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Twelve High-Level Business Requirements To Achieve Best Practice Inventory Management Optimization

Executive Summary

The application of a decision-support system incorporating a best practice methodology provides inventory managers with a consistent and powerful tool for managing their responsibilities allowing them to be significantly more effective in their job.

One particular area where technology can improve asset management outcomes is the area of inventory optimization. Improved inventory management of Maintenance Repair and Operations (MRO) spares and consumables has resulted in the following typical benefits:

- Significant reductions in the funds invested in safety stock (15 - 25%)
- Reduced write-offs of surplus and obsolete stock (5 - 20%)
- A reduction in stock-outs (10 - 25%) resulting in improved availability and reduced disruption to activities
- Reduced administrative costs in replenishing inventory (10 - 25%)
- Reduced time in managing inventory (33 - 66%)

This document provides a practical guide to the specific elements of an ideal inventory optimization system. It identifies 12 high-level business requirements to analyze and optimize inventory spares and consumables. The inventory analysis and optimization tool, Oniqua Inventory Optimizer, uses a specialist methodology which forms the basis of this paper. Inventory Optimizer is used by a large number of mining companies throughout the world to complement and enhance both legacy and integrated Enterprise Resource Planning (ERP) systems.

Specifically, the following business requirements have been identified and discussed:

1. Criticality Analysis
2. Demand Forecasting
3. Lead Time Forecasting
4. Issue Size Forecasting

5. Economic Modeling
6. Optimization of Reordering Parameters
7. Exception Management
8. Inventory Segmentation

9. Spares Risk Assessment
10. Spares Pooling
11. Knowledge Capture
12. Inventory Key Performance Indicator Reporting

Inventory Management for MRO Inventory

To achieve the business requirements stated in this paper, Oniqua Inventory Optimizer meets the management requirements of Maintenance Repair and Operations (MRO) inventory with the following characteristics:

- High criticality
- Long lead time
- High price
- Generally infrequent and highly variable usage
- Sometimes low data quality

Best Practice Inventory Management

The outlined 12 business requirements are based on the functionality of Oniqua Inventory Optimizer. These are fundamental to achieving best practice inventory management which results in significant inventory reductions:

1. Criticality Analysis

Capable of automatically generating a recommended criticality (business impact code) for each stock item by analysis of:

- Application (where used and fitted)
- Commodity classifications
- Practical "real-world" considerations or "work-arounds"
- Supplier or Original Equipment Manufacturer
- Price
- Other factors and business rules

2. Demand Forecasting

Demand forecasting capabilities include:

- Selection of appropriate forecasting algorithms
- Ability to automatically select algorithms for each stock item
- Use of forecasting and statistical distributions that are appropriate for a wide range of spares items including slow moving and lumpy demand (eg. Poisson, Negative Binomial, Binomial, Normal)
- Ability to apply clipping and filtering techniques to manage abnormal data
- Ability to isolate planned maintenance and project demand from unplanned demand
- Ability to use knowledge of expected future events or trends to apply demand profiles to future forecasts.

For example, the commissioning of additional haul trucks may be expected to increase demand for certain inventory items.

3. Lead Time Forecasting

Forecast lead time is a key factor in determining optimal safety stocks. Lead time forecasting capabilities of Oniqua Inventory Optimizer include:

- Ability to forecast average lead time using purchase order and receipts history
- Appropriate filtering and clipping techniques to eliminate abnormal data
- Ability to over-ride lead times as required
- Calculation of lead time variance and use of this variable in calculating expected service level

4. Issue Size Forecasting

The number of units typically required for an application (the issue size) is also a key factor in determining stock levels. Issue size forecasting capabilities include:

- Ability to forecast average issue size using issues history
- Appropriate filtering and clipping techniques to eliminate abnormal data
- Ability to over-ride forecast issue size as required
- Calculation of issue size variance and use of this variable in calculating expected service level

5. Economic Modeling

Characteristics of the Inventory Optimizer system allow a user-defined economic model to be constructed and bulk "what-if" modeling of inventory trade-off decisions. Economic modeling includes:

- Modeling of inventory holding cost for different types of items
- Modeling of total replenishment costs for different purchasing methods
- Modeling of expediting or emergency freight costs
- Modeling of stock-out costs based on criticality and duration of stock-out
- Comparison of existing and optimized results for statistics such as:
    - Inventory value
    - Service level
    - Turnover
    - Annual inventory costs

6. Optimization of Reordering Parameters

The main determiner of inventory outcomes is the reordering parameters (minimum, maximum levels) used by the Materials Management system (ERP) to generate replenishment orders. These reordering parameters should be optimized on a periodic basis to reflect changes in usage, lead time, criticality and other factors. The optimization process includes:

- Selection of appropriate algorithms to optimize minimum and maximum stocking levels
- Use of the economic cost model which considers costs of holding inventory, replenishment, expediting and stock-outs as a preferred alternative to a fixed service level approach
- Ability to analyze groups of items rather than one-by-one
- Ability to perform "what-if" modeling and compare optimized results against current inventory performance
- Ability to consider use of "real-world" constraints including:
    - Maximum bin capacity
    - Storage capacity
    - Standard pack sizes
    - Set sizes

7. Exception Management

For large inventories, a "management by exception" approach is required so that inventory review time is focused on high value or problem items. Exception management capabilities include:

- Ability for users to define any number of exception conditions with related alert thresholds
- Ability to search, sort and filter by exceptions
- Mechanisms to exclude changes to reordering parameters for items with exception conditions

8. Inventory Segmentation

The use of inventory segmentation techniques provides a management framework for inventory which recognizes that a number of different management techniques are required for various item profiles. The segmentation system in Oniqua Inventory Optimizer offers the following capabilities:

- Ability to segment the inventory based on characteristics such as:
  - Usage value
  - Holding value
  - Movement frequency
  - Availability
  - Criticality
  - Commodity
  - Stock holding method
- Ability to automatically apply structured policies or business rules to the management of each inventory segment for example:
  - Manual control of special items
  - Review of potentially obsolete items
  - Items suitable for statistical optimization
  - Items that can be made non-stocked
  - Surplus and obsolete for disposal

9. Spares Risk Assessment

The inventories typically held by mining will include a high proportion of spares that are high cost, critical, have little or no expected usage and require long lead times to receive. The management of such items requires the following techniques:

- Risk modeling of affect of holding zero, one or two sets
- Ability to perform sensitivity analysis around expected Mean-Time-Between-Demand and stock-out cost
- Ability to model or over-ride all inputs to the stocking decision
- Decision-support tools to assist in new stock purchasing or deferred replacement decisions
- Ability to model the repairable item replenishment cycle

10. Spares Pooling

Significant reductions in overall safety stock investment are possible through the pooling or sharing of high value, infrequent items (insurance spares) across multiple sites. To facilitate such arrangements, the Inventory Optimizer system:

- Identifies common spares that are suitable for sharing
- Determines the optimal number of pooled spares to be held
- Determines the optimal location for holding the spares

11. Knowledge Capture

The capture of organizational knowledge relating to inventory items is an important business process in preventing mistakes and re-investigation. Oniqua's knowledge capture:

- Allows the capture of notes and commentary about inventory items
- Provides an audit trail for decisions
- Ensures high data quality for input parameters and classification codes
- Provides reminders when reviews are due

12. Inventory Key Performance Indicators (KPI) Reporting

Inventory key performance reporting is important to allow progress in improving inventory management to be tracked. KPI reporting includes:

- Large selection of pre-defined inventory management reports
- Ability to automatically capture a large selection of pre-defined inventory KPIs
- Ability for users to customize reports and statistics

Conclusion

Gaining a competitive advantage in today's mining industry requires a positive mind set towards innovation and technology. Without technology solutions companies are left to struggle with manual processes such as; standard ERP system functionality, ad-hoc databases or spreadsheets which have all proven to be labor intensive, prone to error and impossible to sustain on a repetitive basis. Oniqua Inventory Optimizer is best practice inventory management for asset intensive industries. Project risk is minimized through a proof of concept approach and a guaranteed return on investment.

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