Keeping the Books Straight
Receiving & Tracking Raw Materials Inventory
Dr. Peter Green

Introduction

This white paper by Dr. Peter Green is one of a series about the conflicts between the needs of accounting and the needs of operations staff in industrial organizations. This white paper is about how to accurately track raw inventory and how to reconcile the different needs of accounting and operations in this important area.

At first this would appear to be a trivial topic but it turns out to have a number of surprising twists and turns. These can cause all sorts of issues and problems, especially when an inventory tracking system automatically exchanges data with an accounting system.

Please note that I have tried to avoid the use of "accounting" debits and credits so as to make this white paper understandable by operations managers as well as by "green-eye-shade" accountants.

Conflicts between Accounting and Operations

From an accounting system viewpoint, the following steps are taken to receive materials:

1. Enter a Purchase Order (PO) into your accounting system and issue it to a supplier

2. When the materials are received, record the receipt as an Accounts Payable (AP) in your receiving system and increase the inventory (as an asset on the company's books).

3. When the materials are withdraw from inventory, record the reduction in inventory assets and add to cost of goods sold or the expense of making a product.

The first issue arises, as to when to consider materials received. There are a number of alternatives that I have seen my clients use:

1. When the materials are unloaded from the truck at the receiving dock - the normal operational definition.

2. When incoming materials have passed quality control (QC) inspection. This is an alternate definition favored by accounting as they don't want to pay suppliers for defective materials. But this can cause big problems for operations with untracked materials as these materials, which have failed QC inspection, have to be moved to an MRB (Material Review Board) quarantine area until they are shipped back to a supplier

or accepted into inventory, probably at a lower grade and at a lower price to be paid to the supplier.

3. When accounting receives an invoice from its suppliers. This often happens when market pricing is used. Here, accounting cannot enter the materials into their inventory because they do not know the market price, and hence value of the materials, they are being charged for, until they receive the invoice. This can cause a 30 to 90 days delay in updating the inventory in the accounting system, waiting for the supplier invoice to arrive.

The next issue arises with customer-owned materials. Many of my clients do "toll" processing whereby they take in customer (or third party) owned materials and process them for a fee.

These materials need to be tracked from an operational viewpoint but suppliers should not be paid for them and their value should not be added to the organizations inventory assets on their balance sheet. Some accountants "fudge" this issue by carrying customer owned materials as zero value inventory but this leads to all sorts of distortions in financial data, such as calculating the average unit cost of a class of materials.

The third major issue is when to recognize raw materials inventory as having been withdrawn from inventory. Here again, there are multiple methods in use:

1. When materials are used to make a product or are shipped to a customer. This is the normal operations tracking definition but can lead to a major problem for accounting due to the "black-hole" problem. If this definition is used for accounting purposes, the asset value of the company will be reduced when materials are used for making products and is not increased again until the resultant products are shipped to customers. This can cause major swings in company value.

2. Backflushing raw materials inventory when products, which they were used to make, are shipped based on the product BOMs (Bills of Materials). This accounting practice avoids the "black-hole" problem but can results in huge discrepancies between "accounting" inventory and "operational" inventory due to the delay between using inventory and shipping products. This is sometimes "improved" on by Backflushing the raw materials when finished products are entered into inventory but still does not take into account scrap, rework and other wastage that makes the actual BOMs inaccurate.

3. When raw materials are picked for production or shipping. This is really an MRP (Materials Requirements Planning) "hack" so the inventory levels recorded in an ERP (Enterprise Resource Planning) system reflect the available inventory and not the physical inventory. This enables MRP to be run to decide what materials to make or buy based on the available inventory. Problems arise because the picked materials still exist and need to be tracked from an operational viewpoint until they are used or shipped. Also picked materials can easily be "stolen" for higher priority jobs or customer orders, after they are picked.

Resolving the Conflicts

The first thing to recognize is that accounting and operations have different "world-views". Accounting needs to accurately value its inventory and to make sure that its suppliers get paid what is due to them. Operations needs to accurately track its materials in real-time so as to make sure customer orders get delivered on time.

As we have seen from the prior section, these two goals are often in conflict from the viewpoint of tracking inventory. In an environment where the operations staff use paper forms and manual keyboard data entry into Excel spreadsheets to track their inventory, the discrepancies are handled by people doing duplicate data entry, feeding the accounting or ERP system the data it wants to see, when it needs it.

But, when we use a barcode tracking system to track the inventory from an operational viewpoint, all sorts of issues arise when this system has to automatically exchange data with an accounting or ERP system, to avoid duplicate data entry.
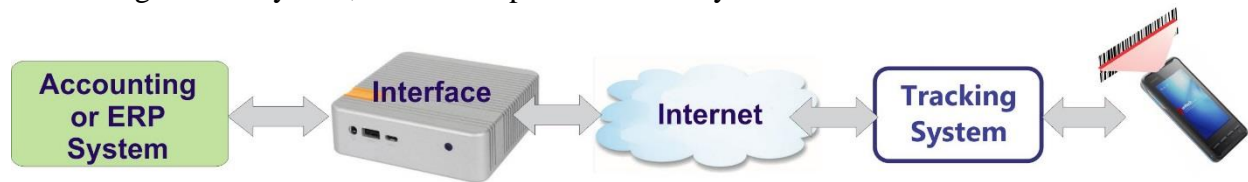
When we think of the accounting and operations tracking systems as having different and often conflicting requirements, we come to recognize that the interface between them has to have a lot of "smarts" built-in to resolve the differences between the two world-views.

By recognizing that these are different systems, with different goals, we can avoid trying to find one system that meets the needs of both accounting and operational tracking, and to provide the accounting staff with a system that meets their needs and the operations staff with a real-time tracking system that meets their goals.

While we could run these as two separate systems, using people to do manual data entry into both systems, which is inefficient and mistake prone. It is far more efficient to use computer software to move data between these two systems but it is important to recognize that the interface is not a mere data mover but needs to have a large amount of built-in intelligence both as to the data that needs to be moved and the timing of the data transfer.

Upon detail examination of the requirements for this interface, it quickly becomes apparent that it is a specialized form of real-time Artificial Intelligence (AI) engine which contains the rules that govern what information is transferred between the systems and when.

When implementing interfaces between an accounting or ERP system and a real-time barcode operations tracking system, such as BellHawk (www.BellHawk.com), I like to use the MilramX (www.MilramX.com) automated data exchange software platform, which is a rules-based expert system in which systems integrators and IT staff can set the data transfer rules based on importing Excel spreadsheets, which makes data transfers easier to set-up.

This enables the interface to be tailored to the, often conflicting, accounting and operations tracking needs of different organizations without needing to incur the great expense and time delays needed to develop such as interface "from scratch".

How an Intelligent Interface Solves some of the Conflicts

Some of the ways that an intelligent interface can resolve some of the conflicts between the needs of accounting and the needs of the operation staff are:

1. Accounting systems carry a large amount of proprietary information about customers and suppliers. Only a small amount of this is required for operational use. By automatically updating the tracking system when relevant data changes access to proprietary data is restricted to accounting personnel.

2. Purchase orders can be entered into an accounting system and automatically transferred to the tracking system where they can be used to generate barcoded receiving sheets. Barcoded receiving sheets can also be generated from advanced shipment notices for customer owned materials. This enables both company owned and customer owned materials to be received uniformly, which helps prevent mistakes.

3. Materials are tracked as soon as they are received in the barcode tracking system, including tracking details such as lot and serial numbers and expiration dates, which are typically of no interest to an accounting system.

4. When materials are received, the interface sends receipts against the PO to the accounting system, but only for company owned materials. This enables the accounting system to pay its suppliers and track the value of its inventory assets but not to have to track customer or third party owned materials.

5. In a barcode tracking system, such as BellHawk, each container of materials is tracked using a license-plate-number (LPN) tracking barcode attached to each container. This enables the quality control status of each container to be tracked (waiting for inspection, passed or failed inspection, needing MRB resolution, etc.). If required, the interface can wait to notify the accounting system of a receipt until the materials have passed inspection. This also enables the accounting system to be notified about the disposition of MRB materials.

6. When materials are picked for a production job or shipment to a customer, they are still tracked as physical inventory in the barcode tracking system, but their status is simply changed. The action of picking the inventory can be reported by the interface to an ERP system to enable the ERP system to track available inventory for MRP planning purposes.

7. When materials are used on a job or shipped to a customer, this is tracked in the barcode tracking system but need not be reported to the accounting system by the interface at the time that this occurred (to avoid the "black-hole" accounting issue). Instead the accounting system can still use back-flushing methods to reduce the inventory in the accounting system only when the finished products are reported by the interface as having been shipped.

8. If materials picked for one job or order are reassigned and used for another job or order this is tracked in the barcode tracking system but not typically reported to the accounting system by the interface.

9. A barcode tracking system, such as BellHawk, can track the accumulated cost (labor, materials, & machine time) of making work-in-process (WIP) materials and roll these up into the cost of making products. If needed, this increasing WIP inventory value can be tracked by the accounting system, and offset against inventory withdrawn, instead of assuming the asset value of a WIP product is its raw materials cost until the product is completed. This provides a much more accurate tracking of the company's asset value that is not subject to artificial fluctuations and can account for the productive consumption of labor and machine time to make products.

10. Sometimes, as in the case of steel and gold, the value of inventory is based on spot or market prices rather than the price that the materials were purchased at. An intelligent interface can periodically update an accounting system to account for these fluctuations.

11. The prices at which materials with the same part number were purchased can fluctuate significantly over time. With the use of an intelligent interface, the value at which inventory changes are accounted for can reflect the actual cost of the materials used or a running average cost rather than resorting to artifices such as basing the inventory value on purchased materials tranches.

12. Barcode tracking systems like BellHawk track containers of material but they do not track inventory or its history. A typical interface will add up the quantity and value of the materials in each container, once a night, and report this to the accounting system as an inventory snapshot (similar to that derived from taking inventory). This can then be used by the accounting system to adjust its inventory value and to track the variation of inventory over a long period of time.

Commentary

I have sat through a number of meetings at which people have argued whether the accounting or operational view of inventory is the correct view. The answer is both and neither. An accounting system is a tool that enables the accounting staff to do their job while the barcode tracking system enables the operations management staff to do their job. But the two are very different.

By using an intelligent interface between the two systems, we can have the benefits of using systems tailored to the specific needs of their user community and yet avoid the time wasted and mistakes made in duplicate data entry.

Answers to some common questions that I get asked:

- Are these interfaces easy to implement? No. Just like any AI system they tend to be complex because the underlying issues they address are complex. But through the use of tools like MilramX much of the "grunt" work of implementing these interfaces can be minimized.

- You have previously developed an interface to my ERP or accounting system. Will that work out-of-the-box for my organization? No. Every organization has unique accounting and operations tracking needs. As a result, every interface has to be tailored to the needs of each specific client.

- Is implementing an intelligent interface worthwhile? Usually yes, both in terms of operational efficiency and cost savings, but we strongly recommend starting out having

people act as the interface between the two systems so that the implementation team can extract the rules that the people use and integrate these into the intelligent interface.

Author

Dr. Peter Green is an expert in the application of computer technology to solve real-time operations tracking and management problems for manufacturers and other industrial organizations. He is the architect of the BellHawk real-time operations tracking and decision support software platform and the MilramX automated data exchange software platform. He is also an expert in how to embed Artificial Intelligence knowledge into operations management systems so as to assist managers to run their operations more efficiently.

Dr. Green was educated at Leeds University in England, where he received his BSEE and Ph.D. degrees. As well as holding a number of industry positions, Dr. Green was previously a senior member of the research staff at MIT and a Professor at WPI.

Dr. Green serves as Technical Director of KnarrTek Inc., which distributes and supports the BellHawk and MilramX software. KnarrTek assists its partners, who are barcode equipment resellers and systems integrators, to implement materials tracking and traceability and real-time operations management solutions for clients throughout North America and the UK.

Dr. Green is also the Technical Director of Milramco LLC which developed the BellHawk and MilramX software in collaboration with a number of partners. Milramco owns the BellHawk and MilramX intellectual property rights which are licensed to a number of partners. Please see www.BellHawk.com and www.MilramX.com for details about this software.

For more information about this paper, or to send comments or suggestions, please contact pgreen@Milramco.com.

Copyright