Benchmarking for Best Practices in Inventory Integrity

**James R. Oldham, Terry R. Collins, Ph.D., P.E., Manuel D. Rossetti, Ph.D.,
and D. Amber Lehrman**
Department of Industrial Engineering
University of Arkansas
Fayetteville AR 72701 USA

Abstract

This is a study focused on benchmarking best practices concerning warehouse accuracy. Data is gathered from current warehouses and metrics are compared using benchmarking methodologies. These metrics are compared to operating procedures to find which policies are most viable for high accuracy levels.

Key Words
benchmarking, warehousing, inventory accuracy

1 Introduction

Kaiser Associates define benchmarking as "a process for rigorously measuring individual company performance versus the best-in-class companies and for using the analysis to meet and surpass the best-in-class. During this study, a gap analysis was performed that compared warehouse procedures to determine the best practices and focus on opportunities for change and adaptation. The purpose of the benchmarking study was to enable recommendations for improving transaction record accuracy and balance integrity, identifying policies for scheduling and conducting physical inventories, reviewing key metrics, and methods to sustain inventory integrity.

1.1 Benchmarking Methodology

Bogan and English define process benchmarking as focusing "on discrete work processes and operating systems, such as the customer complaint process, the billing process, the order and fulfillment process, etc" [1]. Since this benchmarking study focused on the inventory control processes, we performed a process benchmark study. A variety of benchmarking methodologies have been used successfully in industry. Each methodology involves the common elements of identifying the area to benchmark, gathering data on best-in-class companies, examining the gaps between the current processes and the benchmarked processes, and making recommendations to close the gaps. We used a modified version of the benchmarking process described by Bogan and English. Our methodology was as follows:

1. Document internal processes and customer needs
2. Determine performance metrics
3. Develop question set and survey instruments
4. Identify and select industry representatives
5. Measure industry with interviews and questionnaires
6. Normalize measures and compare performance
7. Identify industry best practices and enablers
8. Develop recommendations [1]

1.2 Identification of Performance Metrics

The identification of performance metrics was crucial to the success of this benchmarking study. We followed an iterative approach of first developing a list of all possible metrics that could be relevant to the study and then refining the list based on our understanding of the goals of the project.

A natural beginning point for developing a list of performance metrics came from the work of Dr. Edward H. Frazelle at the Georgia Institute of Technology. In 1992, Frazelle and his team devised a benchmarking questionnaire that outlined the basic warehouse metrics required to objectively compare different warehouses. With more than 100 warehouses contained in his study, Frazelle provided an excellent reference for basic warehouse performance metrics. Frazelle's study also provided valuable information for judging best-in-class performance and for interpreting data collected, such as warehouse accuracy levels, storage time, and order cycle time [2].

Additional performance metrics generated by our research team included: inventory methods, amount of material or separate stock keeping units (SKUs) handled by each warehouse, and the speed at which orders are placed and filled. After careful evaluation, the performance metrics were classified into six specific performance areas: basic warehouse metrics, inventory accuracy, inventory method, picking method, personnel issues, and software issues. These performance areas allowed the survey instrument to be organized into sections that addressed each of these key warehouse areas. The following section discusses the development and format of the survey instruments used within the study.

2 Format and Development of the Survey Instruments

Tompkins' Warehouse Management Handbook [3] outlined the proper warehousing terms to use in the formation of the question; this helped us ensure questions were written in an unambiguous way. The final iteration of the survey contained 51 questions. Because of the length of the questionnaire, we determined that a checkbox format was appropriate. This method reduced the variability in reporting statistics and helped to alleviate misunderstandings associated with reported values. A miscellaneous category was added to each question to allow the participants to briefly explain any differences in their policies, or if no choices properly described their operations.

All survey questions were evaluated to ensure that a sufficient number of answers were available. Questions with multiple parts were broken down into specific sections so that participants could skip questions that were not applicable. For example, if a warehouse did not use tolerance levels, the respondent could skip ahead to more relevant questions. A blank "Other" selection was available with each checkbox question to allow participants to explain any differences in policy; however, not all questions could be easily configured to checkbox-style questions. We utilized short-answer questions for the reporting of commonly recorded warehouse metrics and some software issues. In addition, some questions required the participant to numerically rank a series of activities for frequency and applicability. The following section discusses the contact method used to deliver this survey.

3 Company Contact Methodology

The company contact methodology took into account many different considerations such as the integrity of the study and desired scope of industry representation. The exact methodology and guidelines are detailed below.

A double blind contact methodology was used for the study. That is, the organizations within the study were not aware of each other's identity. This is to ensure confidentiality of reported results and to encourage participation in the study. Every time a member of the project team contacted a company, the following guidelines were used:

1. All conversations and letters were as professional and informative as possible.
2. All questions were answered as completely as possible while still remaining within the bounds of the study.
3. No company was given information regarding participation of any other company.

Representative industries were selected to participate in this study with the goal of finding as many different approaches to inventory integrity as possible. Using the contacts of the group members, we contacted the initial participants by telephone. Fifty warehouses were contacted in this manner; these initial contacts began in July 2000. To broaden the scope of the research, we used a bulk mailing list obtained from the American Production and Inventory Control Society (APICS), allowing us to send invitations to an additional 3,000 warehouse managers. The letters were sent through a bonded mail house, with no disclosure of the addresses or contacts listed on the mailer; the mailer was delivered in November 2000.

The overall company contact methodology proved effective in maintaining study integrity, ensuring a representative benchmarking group, and providing useful and accurate information from which to benchmark key areas of inventory integrity. Eighteen individual organizations are represented in this study; this represents the results through December 2000.

4 Analysis

During analysis, the responses were entered into an Excel spreadsheet. The spreadsheet was designed to facilitate the evaluation of best-in-class performance within each performance area during the analysis. From the information obtained in the basic warehouse metrics section, we determined the best-in-class performer for each metric and analyzed the methods used. The analysis of the benchmarking findings should indicate potential areas for improvement within inventory integrity policy. The areas of particular interest within the benchmarking study included:

- How does industry set tolerance levels for inventory accuracy reporting? Do tolerance levels disguise the true inventory accuracy rate?
- How does industry handle discrepancies at the time of picking? What methods are used to flag this type of error? How are customer needs fulfilled?
- Does industry perform cycle counting or 100% wall-to-wall inventories? If so, do they have an effect on inventory accuracy?
- What is the typical inventory accuracy rate that can be expected using the best practices?

The following sections present the resulting benchmarking analysis and key findings. We begin with the identification of the best-in-class performers.

4.1 Determining Best-In-Class Performance

Although several basic warehouse metrics were sampled with the survey, we felt four of these metrics were the most critical in deciding which warehouses were best-in-class. These four metrics were picking accuracy, inventory accuracy, store time, and order cycle time. Learning about the policies that lead to high picking and inventory accuracies was crucial for this study; also, store time and order cycle time showed the ability to handle items efficiently and effectively. For the purposes of this study, we defined each of the four metrics as explicitly as possible:

- Picking accuracy was defined as the total number of correct picks divided by the total number of picks. That is, assuming the appropriate quantity of items is available, did the picker select the correct quantity and the correct item type?
- Inventory accuracy was defined as the total number of accurate records divided by the number of records checked. This statistic was important to track how much time was wasted by pickers discovering errors.
- Store time was defined as the speed new inventory is stored in the warehouse. This "dock-to-stock" time looked at how fast new material was stored in the warehouse.
- Order cycle time was defined as the time it takes to complete an order once picking begins. That is, how long does it take from the moment picking begins until the order is shipped?

During analysis, some non-critical metrics were measured to help analyze which types of warehouses were included in this study. The square footage of the warehouses sampled ranged from just 20,000 sq. ft. up to 680,000 sq. ft., with an average size of 300,000 sq. ft. The number of SKUs stored ranged from just 150 to over 100,000, with an average of 18,000 SKUs. The dollar investment in material handling devices per square footage of warehouse space ranged from less than $1/sq. ft. up to $18/sq. ft., with an average of $5.8/sq. ft. This profile helped define the scope of each participant and their associated level of performance.

Figures 1-4 show the breakdown of the reported accuracies and warehousing times. We used the results of the Frazelle study for the basis on a world-class evaluation of each warehouse. For picking accuracy, an accuracy of 99.9% and higher represented world-class performance; two respondents fell into this range. For inventory accuracy, an accuracy of 99.9% and higher represented world-class performance; only one respondent fell into this range. For store time, a speed of less than 2 hours represented world-class performance; three respondents fell into this range. For order cycle time, a time of less than 2 hours represented world-class performance; three respondents fell into this range, with one respondent reporting <1 hour for order cycle time.

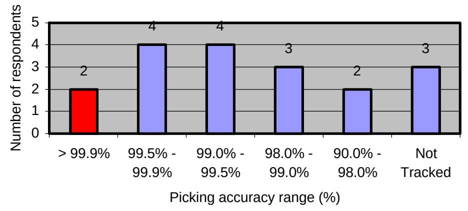

Figure 1. Picking accuracy

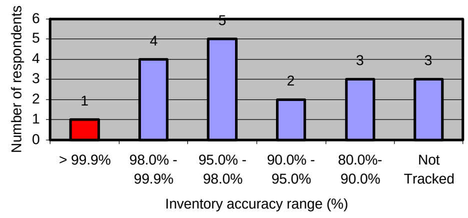

Figure 2. Inventory accuracy

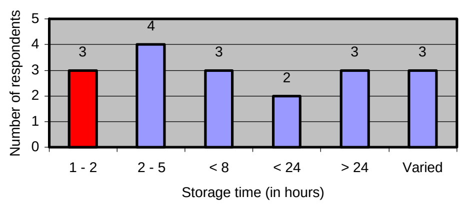

Figure 3. Store time

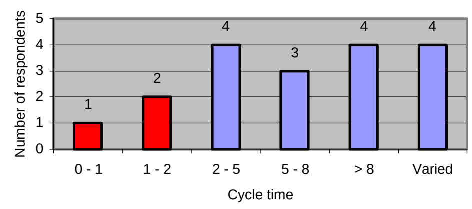

Figure 4. Order cycle time

4.2 Best-in-Class Responses

After the best-in-class performers were identified, the specific methods employed by these warehouses were investigated. Based on this analysis, the research team was able to provide definitive answers for each of the original four key questions posed in the study. Conclusions concerning tolerances, picking discrepancies, inventory types, and expected inventory accuracy rates were developed. The following presents our findings:

- ***How does industry set tolerance levels for inventory accuracy reporting?***

The best-in-class performer for inventory accuracy did not use tolerance levels when determining inventory accuracy. In addition, no allowances were made based on the dollar value of the SKU during the inventorying process. No other top performers reported using tolerance levels; therefore, the reported levels of accuracy were assumed correct and achievable.

- ***How does industry handle insufficient quantities at the time of picking? In particular, what inventory counting procedure does industry use when this occurs?***

When an insufficient quantity is discovered, the two best-in-class performers for picking accuracy check nearby locations for possible misplacement. An inventory is flagged and a second party comes to recheck the error. For the customers, these warehouses ship the quantity they have and continue filling the order at a later date, or per their customers' requirements.

However, our original definition of picking accuracy may warrant further investigation. As stated earlier, we defined picking accuracy as the number of correct picks divided by the total number of picks. This definition may not be the same across all respondents. For example, inventory record errors may cause errors to be incorrectly assigned to the picking process, while the true error was due to inaccurate records. Further research into the actual causes of picking accuracy and its relationship with inventory errors would help better understand this issue.

- ***Does industry perform cycle counting or 100% wall-to-wall inventories?***

All top performers for inventory accuracy used some method of cycle counting. The best-in-class performer used the techniques of single-person count, unawareness of actual record data (blind count), control group counting, and ABC counting to conduct these interval (cycle) counts. 100% wall-to-wall inventories were conducted on an annual basis. We were not able to ascertain a relationship between 100% wall-to-wall inventories and high inventory accuracy. We suspect that the continued use of 100% wall-to-wall inventories is primarily the result of financial reporting requirements.

- ***What is the typical inventory accuracy rate that can be expected?***

The absolute best-in-class performer achieved a reported 99.946% inventory accuracy rate. This level of performance was achieved through using cycle counting, using radio-frequency identification (RFID) for storing and picking operations, and utilizing a computer system that helps enforce and track these policies.

5 Recommendations

Based on the responses from the best-in-class performers, a modern warehouse management system (WMS) with radio frequency identification and communications is an essential enabler to a fully functional cycle count program. Wayman suggests that better inventory accuracy can be obtained via improved warehouse layout, material identification, inventory tracking systems, and training of personnel. It may not be conclusive from the responses of the BEST-IN-CLASS performers whether these issues had a major effect on BEST-IN-CLASS performer accuracy; however, based on Wayman's article, we might infer that these issues are pre-requisites for better accuracy. For example, an efficient and effective warehouse layout improves the overall storage function; thereby, allowing time for and enabling resources to be committed to issues involving accuracy. In addition, since material handling is a non-value adding function and since every time an item is handled introduces a chance for error, a layout that is optimized to reduce material handling and travel times is essential. The distribution and warehousing function and the inventory control function must be treated as an inter-related system. Even the best-intentioned inventory counting policies and procedures will not be effective unless supported by the appropriate execution of the policies and procedures [4].

Another significant issue discovered from the benchmarking analysis was the amount of budgetary support that was given to administer a warehouse management system. The best-in-class performers indicated personnel support of 3600 man-hours per year for dedicated inventory control personnel, which equates to approximately 5% of the total warehouse budget. It is recommended that warehouses evaluate their policy regarding the utilization of dedicated inventory personnel.

Based on the analysis of the processes and the reported use of cycle counting by best-in-class performers, we recommend that a standardized cycle count program be implemented for high inventory accuracy. A primary resource for developing a cycle count program can be found in the text by Brooks and Wilson [5]. Additional reference sources include Neeley and Meyer. Neeley offers guidelines to inventory managers for setting up an effective cycle counting program. The paper discusses the cost and benefit tradeoffs with using a cycle counting program [6]. Meyer presents a case study that illustrates the savings that can be obtained when a 95% inventory accuracy level is recorded versus a 65% inventory accuracy [7].

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