A case study assessment of performance measurement in distribution centers

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Abstract
Managing supply-chain operations is critical to any company's ability to compete effectively. Success in today's markets depends on the ability to balance a stream of products and processes to stay competitive. Companies are constantly evaluating every area of operations to ensure that productivity and cost objectives are realistic and attainable. Research has been carried out to investigate the measurement systems used in today's distribution centers. Five distribution centers in the Pacific Northwest were selected for this study. The characteristics of these five distribution centers and their measurement systems are discussed in this paper. A cross-case analysis is provided, which gives a view of a typical measurement system used in today's distribution centers.

Introduction

Managing supply-chain and logistics activities is critical for a company to stay competitive. The prime objective of logistics is to ensure that materials and products are available at the right place, at the right time, and in the right quantities to satisfy demand or customers and to give a competitive advantage to the company. A good performance measurement system is a necessity for a company to grow and sustain industry leadership. The objective of this research is to understand and assess the measurement systems used in today's distribution facilities. A case study approach was used to study five distribution centers. A complete description of research methodology, from research issues to data collection is given below. A discussion of results based on the findings of the case studies is also included.

Research methodology

The research methodology used in this research has the following characteristics:

- Applied research with focus on exploratory and descriptive analysis to determine "best practices" and opportunities for improvement.
- The unit of analysis is the distribution center measurement system.
- Naturalistic inquiry with an inductive paradigm and both quantitative and qualitative data.
- A case study research approach.
- Sources of data include documentation, archival records, interviews, and direct observations.
- Validation of confidence of findings is addressed using triangulation, multiple data sources, multiple methods, and multiple perspectives.

The primary purpose of this research is to gain an understanding of performance measurement systems in distribution centers and identify best practices and areas for improvement. Thus the focus is on exploratory analysis where the objective is to explore a phenomenon to try to identify important issues, constructs, or develop hypotheses. This contrasts with descriptive, explanatory, or predictive research where the objectives are to simply describe by documenting a phenomenon in detail, explain relationships, or predict outcomes (Marshall and Rossman, 1989; Yin, 1989). The methodology uses summative evaluation, formative evaluation, and action research, all development-based approaches, that focus on intervention, improvement, or problem solving.

The unit of analysis is the element used to conduct the investigation. These might be the individuals in the organization, groups, program components, measurement system, or time periods. There are two units of analysis used in this research. One is the entire distribution center and the other is the measurement system.

This research followed the holistic-inductive paradigm, emphasizing three qualitative themes: naturalistic inquiry, inductive analysis, and qualitative data (Patton, 1990). Naturalistic inquiry consists of "studying real-world situations as they unfold naturally [in a] non-manipulative, unobtrusive, and non-controlling [manner]" with "openness to whatever emerges" and a "lack of predetermined constraints on outcomes" (Patton, 1990). Data gathered in this study is analyzed and interpreted inductively, which is "immersion in the details and specifics of the data to discover important categories, dimensions, and interrelationships; exploring genuinely open questions rather than testing theoretically derived (deductive) hypotheses" (Patton, 1990). Qualitative data is "detailed, thick description, inquiry in depth, direct quotations capturing people's personal perspectives and experiences" (Patton, 1990). In addition to the qualitative data, quantitative data is also collected to describe various aspects of the organization.

The research method used is the case study approach. The case study method allows the researcher to investigate a contemporary phenomenon within its real-life context when the boundaries between phenomenon and context are not clearly evident, and in which multiple sources of evidence are used (Yin, 1989). Case studies provide a special way of collecting, organizing, and analyzing data to gather comprehensive, systematic, and in-depth information about each case of interest.

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The case study method allows people being interviewed to describe experiences in their own language, rather than the researchers'. The case study method is the most appropriate method for this research because it is capable of handling both qualitative and quantitative data (Eisenhardt, 1989; Marshall and Rossman, 1989; Yin, 1989). A characteristic of case study research is the combination of data collection methods, such as interviews, questionnaires, and observations, discussed in the next section.

There are three ways to collect data from a system: ask, observe, and use system documentation. Evidence for case studies may come from various sources including documents, archival records, interviews, direct observation, participant-observation, and physical artifacts (Yin, 1989). In this study, all of these data collection methods were used, except for participant-observation.

There are four relevant tests relevant in evaluating the quality of any research study: construct validity, internal validity, external validity, and reliability (Yin, 1989). Internal validity is relevant only for explanatory or causal studies, not for descriptive or exploratory studies, and hence is not relevant for this research. The remaining three are relevant to this study.

To address construct validity, triangulation, a technique of combining different sources of evidence in a single study (Rossman and Wilson, 1985), was used. This combination of different sources is one of the major strengths of the case study approach (Yin, 1989). Other sources used in this study include interviews, documents, observations, and artifacts. The second tactic to address construct validity is to establish and maintain a chain of evidence, which would allow an external observer to follow the derivation of evidence from initial research questions to ultimate case study conclusions. Furthermore, the accuracy of a case study and hence its construct validity can be increased by having key case informants review drafts of the case study description.

Using replication logic in selecting case studies addresses external validity. Case study relies on analytical generalization (Eisenhardt, 1989; Yin, 1989), not statistical generalization as with experimental hypothesis-testing research. Once the replication is made, the results may be accepted even though further replications have not been performed (Yin, 1989).

To address reliability, the case study protocol was used to guide the research process. The protocol is a major tactic in increasing the reliability of case study research and is intended to guide the investigator in carrying out the case study (Yin, 1989). This includes instrument (i.e. the interview questions), as well as procedures and general rules that should be followed. The case study protocol used will be discussed in the following section.

Case study design

Two aspects of case study design are case study protocol and data collection process. The protocol contains the instrument and the procedures and general rules that should be followed in using the instrument. In addition to increasing the reliability, the case study protocol reminds the investigator what the case study is about and helps the investigator to carry out the case study.

There are three major components included in the case study protocol: purpose, key features of the case study method, and the organization of the protocol. As mentioned before, the purpose of this study is to understand the measurement system in distribution centers. The questions of interest include: What performance measures are used? Why are they used? How are they measured? Who measures them? The organization of the protocol outlines the procedure of how to carry out the field visit, designed case study questions, and the analysis plan.

The primary activities in the data collection stage were conducting the site visits for the case studies and collecting data as needed before and after a visit. Five distribution centers in northwest Oregon were selected as case study sites. Based on the companies' requests, all real name and locations of the distribution centers have been removed from this discussion. During site visits, data was collected through interviews, direct observations, and documentation provided by the management. Use of a tape recorder in the interviews assisted with data collection and accuracy. Filed notes written during and after the site visits captured observations of any relevant events and descriptions. Follow-up was performed after each site visit. Typed interviewed notes were sent to the interviewees, along with any follow-up questions. For each site, there were at least two follow-ups.

Data analysis

The purpose of qualitative inquiry is to produce findings through analysis, interpretation and presentation of findings. The challenge in data analysis is to "make sense of massive amounts of data, reduce the volume of information, identify significant patterns, and construct a framework for communicating the essence of what the data reveals" (Patton, 1990). Unfortunately, data analysis is the least structured phase of qualitative research (Eisenhardt, 1989; Miles and Huberman, 1984). Because statistical tests are not appropriate to be used to identify significant patterns in

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qualitative data, researchers rely on their own judgement, experience, and insight.

There are two major steps included in data analysis: within-case analysis and cross-case analysis. Within-case analysis entails becoming intimately familiar with each case individually and documenting it thoroughly. In cross-case analysis, similarities and differences across cases are explored.

Within-case analysis involves organizing the data by specific cases for in-depth study and is necessary to reduce the staggering volume of data (Eisenhardt, 1989). Three major steps, adapted from Patton (1990) were used in this study:

1 Assemble and organize the raw case data including interview transcripts, typed notes from observations, organization documentation, and other published articles about the case. All case data were summarized and organized into files for each distribution center.
2 Edit data, summarize the case information, eliminate redundant data, and organize topically for ready access.
3 Build data displays for each site datum. Two displays were constructed for each case, one for the characteristics of distribution centers, and one for the measurement system used in the distribution centers.

Once the data collection and displays for each case were completed, the search for cross-case patterns could begin. In reality, cross-case analysis overlaps with within-case analysis. Searching for patterns across cases forces researchers to go beyond initial impressions and look at the data in divergent ways (Eisenhardt, 1989). Studying the data in different ways helps to decrease the potential for errors and bias in formation processing. Patterns in qualitative data can be represented as dimensions, categories, classification schemes, and themes (Patton, 1990). Research questions were used as categories to look for within-case similarities and between-case differences. More specifically, the following categories were used to perform cross-case analysis: the measurement used in the distribution centers, how it is used, how often, and by whom. As in within-case analysis, data displays were useful in cross-case analysis to facilitate the search for patterns across cases. The primary purpose of displays is to describe, based on analysis of the patterns, the data. An unordered Meta-Matrix, which is a master chart assembling descriptive data from each of several sites in a standard format (Miles and Huberman, 1984), was used in cross-analysis. The unordered Meta-Matrices contained data on the types of measurement used in the five distribution centers in one display.

Results

Case study characteristics

Table I summarizes general information about each of the five case study sites or distribution centers (DCs). DC-A is a retail distribution center, which belongs to a chain department store. Six distribution centers are owned by this department store chain. Common goods processed in this DC include garments, shoes, cosmetics, gifts, and jewelry. DC-A has operated for 18 years and services 22 stores in Oregon, Washington, and Alaska. There are about 300 employees working in this distribution center, including two shifts and over 16 hours per day.

DC-B is a retail distribution center belonging to a supermarket chain. This supermarket chain owns ten distribution centers in the United States. DC-B is a new facility which opened one and a half years ago. The main commodities processed in this distribution center are grocery items, apparel, office supplies, electronics, and toys. No perishable items are distributed by DC-B. There are about 400 employees working in this facility, with distribution capacity of 50,000 cartons per day, servicing 40 chain stores in Oregon, Washington, Idaho, and Montana. This facility operates 19 hours per day.

DC-C is a wholesale apparel distribution center. This distribution center is four years old and is undergoing a major expansion at present. The capacity of DC-C is 50,000-60,000 units per day, with two shifts and over 22 hours of operations. DC-C is the major distribution center for the company processing domestic and international orders. There are over 1,000 customers serviced by this distribution center.

DC-D is another food /grocery retail distribution center. This distribution center is 28 years old and is in the process of moving to a new facility. At the time of interviewing, the company had already completed moving their perishable/frozen sections into the new facility. The capacity of the current facility is 90,000 cases per day. It serves 25 stores in Oregon, Washington, Idaho, Montana, and California.

Finally, DC-E is the largest distribution center among the cases. This distribution center is 21 years old and services 115 stores in Oregon, Washington, Idaho, Montana, Alaska, New Mexico, Nevada, Utah, and Arizona. There are two major facilities included in this distribution center: General Merchandise and Perishable/Frozen Food. Only the General Merchandise distribution center is discussed in this study.

The major functions in all five distribution centers are receiving, movement to storage, reserve storage, order selection, repack, preparing for shipping, and loading. Table II provides a brief description of these functions along with associated information flow. A variety of material handling systems are integral components of a distribution center. The primary material movement for the distribution centers in this study occurs via roller conveyors and associated sortation systems and forklift trucks.

Measurement system

The Appendix represents the results of cross-case analysis, which takes data across all sites and draws conclusions. This cross-case analysis provides a view of a typical measurement system used in today's distribution centers. In general, measurement systems in distribution centers are characterized by six categories: finance, operations, quality, safety, personnel, and customer satisfaction. In the following sections, the findings for each of these categories are detailed.

Finance

The first category is finance, which is a traditional performance measure emphasized over the years. It is clear that cost per unit is the common measurement used in all distribution centers in this study. However, there is some variation associated with this measurement. In DC-A, cost per unit is only

Table I
Characteristics of distribution centers

Distribution center	A	B	C	D	E
1 Type of industry	Retail	Retail	Wholesale	Retail	Retail
2 Average number of goods distributed	4,000-6,000 cartons/day	50,000 cartons/day	50,000-60,000 units/day	90,000 cases/day	800,000 units/day
3 Number of shifts (on floor)	2	2	2	3	3
4 Union/non union	Non-union	Non-union	Non-union	Union	Union
5 Per cent cross docking	≤ 1	≤ 5	None	≤ 2	≤ 5
6 Labeling/repack	Yes	Yes	Yes	Small repack no labeling	Yes
7 Number of employees	296	400	230	230	800 (including drivers and temporary employees)
8 Stores serviced	22	40	Over 1,000	25	115
9 States serviced	Oregon, Alaska, Washington	Oregon, Washington, Idaho, Montana	All States and international orders	Oregon, Washington, Idaho, Montana, California	Oregon, Washington, Idaho, Montana, Alaska, New Mexico, Nevada, Utah, Arizona
10 Years of operation	18	1.5	4	Site 1: 28 years Site 2: 1 year	21
11 Building size	320,000ft (2 levels)	616,140ft^2	265,000ft^2 (3 levels)	Site 1: 250,000ft^2 Site 2: 267,000ft^2 (Perishable only) (Potential: 800,000ft^2)	1,000,000ft^2 (only for general merchandise Dcs)
Truck doors				*Site 1 Site 2*	
12 Shipping (actual used)	30 (26)	75 (39)	16 (10)	26 (26) 52 (for both)	52 (52)
13 Receiving (actual used)	23 (20)	44 (20-25)	14 (6)	14 (14) 52 (for both	37 (37)
14 Pallet locations	N/A	38,269	10,700	40,000 73,316	
Types of material handling devices used					
15 Conveyor	Yes	Yes (2.97 miles)	Yes	No	Yes
16 Fork truck	Yes	Yes	Yes	Yes	Yes
17 ASRS	No	No	No	No	No (but has high rise system)

Table II
Functions of distribution centers

Distribution center operation	Description	Information flow
1 Receiving	Check, inspect, and sign for all merchandise received Unload the merchandise	Bill of lading Package invoice Purchased order
2 Movement to storage	Move merchandise to storage area	Movement ticket
3 Reserve storage	Put away	Storage location records
4 Order selection	Move to the designated area for order picking Order picking	Movement ticket Order picking ticket Order selection location record updated
5 Repack	Pack the merchandise according to the order	Unit identification Packing invoice
6 Preparing for shipping	Check the shipping information Mark any necessary container, box, or pallet	Sales order Packing invoice Stock record updated
7 Loading	Load the merchandise to the vehicle	Bill of lading (or a manifest) List of shipments carried by each vehicle

considered in terms of labor and this information is gathered on the daily basis. DC-C also monitors cost per unit on a daily basis by considering a variety of costs (e.g. labor cost, maintenance cost, and distribution cost). For DC-B, cost per unit is considered weekly, while DC-D and DC-E consider this measure over four-week periods.

In addition, both DC-A and DC-D use cost as percent to sale to indicate how much additional sales is needed to make profit. The other measure used in DC-E is the ratio of expense to the amount of inventory withdrawn and returned for both budgeted and actual use. This measurement gives management an insight on budget control. All of the financial measures are used by management of the five distribution centers.

Operations

The operations category includes six functional measurement areas: receiving, storage, order-picking, repack, shipping, and material handling system.

- *Receiving*. In receiving, either productivity or efficiency measures are used by all of the distribution centers to evaluate their receiving performance. Theoretically, productivity is defined as “the ratio of output to input” (Sink, 1985). Actually, for DC-B, DC-D, and DC-E, the measurements used to describe the performance of receiving are partial productivity measures based on a single input factor. The two centers, DC-D and DC-E, use the term efficiency for their partial productivity measures. On the other hand, DC-A uses efficiency to monitor receiving performance but uses the term “productivity index” to describe this measure. Efficiency is the degree to which the system utilizes the “right” things and is traditionally defined as the ratio of resources expected to be consumed to resources actually consumed (Sink, 1985). Interestingly, DC-C actually uses the reciprocal of efficiency to measure the performance of receiving but labels this metric as efficiency.
- *Storage*. DC-A and DC-B do not have specific measures to evaluate storage. DC-C uses “accuracy”, defined as the variance between actual and theoretical inventory level, to measure the storage function. In addition, utilization of pallet rack and case rack is also used to monitor the efficiency of storage space in DC-C. DC-D uses a similar measure: “cube utilization” to evaluate their space utilization. In addition to the utilization of storage space, “Put-Away” performance, an efficiency measure, is also applied to the storage function in DC-E.
- *Order-picking/repack/shipping*. For order-picking, repack, and shipping functions, both productivity and efficiency measures are used to measure performance. For order-picking and repack, all productivity measures are actually reciprocals of the traditional efficiency definition. Similar to the receiving function, DC-D and DC-E use partial productivity measures for shipping

but refer to them as efficiency measures. In addition, DC-C uses the percentage of order completed to monitor the performance of order-picking. All these measurements are used by either supervisors or management personnel to monitor the process and give an indication of how much more effort is needed to improve yield. To a limited degree, this information is shared with operators to improve morale and operational productivity.

- *Material handling system*. The common measure for this function is machine uptime or down time. The job completion ratio and the total maintenance cost are also used as indicators of performance. This information is shared with the maintenance department and integrated into the preventive maintenance programme.

Quality

Common measures used to track quality are percentage of "errors", such as the occurrence of mis-picked, mislabeled, or number of defects found. In addition, DC-C uses "shortages" of counted goods as a quality indicator. DC-A uses sampling to develop a Quality Index, defined as (1 – proportion of sample in error). The most unique quality measure, used in DC-B, is a risk analysis rating. At the beginning of a fiscal year, the company will establish the risk analysis rating goal for the year. This is based on the best practices of all distribution centers owned by this company. For each area (i.e., function or department), the performance of each distribution center will be compared with the benchmark distribution center in the form of a percentage. Thus, the best performing distribution center among all of their distribution centers will be rated as 100 per cent. The other distribution centers' performance will be scaled relative to this best practice. The overall performance for the entire corporation is determined by considering the average of the individual distribution center's score for a particular function. This corporate average is known as the pyramid value. The results of the benchmarking activity are shared with the distribution centers who compare their performance against the target and monitor their progress towards the goal. This system is the most systematic approach to measuring quality among the distribution centers in this study. However, this system may not be appropriate for every distribution center. All distribution centers owned by DC-B's parent company are standardized with the same facility layout, the same processing procedures, and the same organizational structure. This standardization provides the basis for the pyramid values.

Safety

There is a high degree of consistency across the cases for safety measurement. The number of accidents is used as a key measure in all the distribution centers. In addition, some distribution centers, like DC-B, use sampling to check for certain operation related behavior to monitor safety. Similarly, in DC-C and DC-D, safety violations or incidents are tracked every month to monitor the safety of facility. DC-E also characterizes the accidents into different injury types to help reduce the operation-related injuries. The safety-related information is shared with management and employees. Management uses this information to address safety issues such as workstation layout and work instructions, and seek better solutions to prevent work-related injuries.

Employee

The criteria to evaluate employee performance across all five distribution centers are identical: productivity (or efficiency) and attendance. In addition to these two measurements, DC-A also uses safety and teamwork flexibility as "proxy" attributes to assess employee performance. These measurements provide a basis for management review of employees.

Customer satisfaction

Unfortunately, measures of customer satisfaction were limited for both external and internal customers. The only information identified in this study is the feedback from customers on a case-by-case basis. No specific statistics, such as number of customer complaints or time to satisfy customer queries, are tracked to indicate the level of customer satisfaction.

It is surprising that even though distribution centers have been a topic of discussion for several decades, not much attention has been focused on performance assessment of distribution centers. The fundamental requirements of a performance measurement system, as described by Khadem and Lorber (1986), are:

- *Accountability*, so that employees know what they need to do to contribute to the company's goals.
- *Data system*, that allows performance information and productivity data to be gathered and analyzed.
- *Feedback*, to help employees interpret results from the data system and align their future performance with company goals and needs.
- *Recognition*, to reinforce desired behaviors through incentives such as team celebrations, bonuses, tokens of appreciation, or praising performance in public.

- *Training*, to ensure that employees have the skills and knowledge necessary to perform their jobs.

Based on this general performance measurement framework, the study identified numerous strengths of the measurement systems used in the distribution centers. Examples of "best practices" include:

- *Accountability* systems where the expectations are clearly communicated to employees and employees have access to information on their performance. Practices vary considerably, ranging from a formal communication system to short daily meetings at the start of the workday or shift to communicate performance and goals.
- *Data systems* that contain relevant and accurate data closely linked to functional areas, such as cost per unit in finance and productivity and efficiency in operations. Data systems provide timely information to management for decision making. These systems also allow for appropriate graphical, statistical, and time series analysis to establish variations and trends.
- *Formal feedback* structure at the organization level with focus on financial or system attributes that are used by top-level decision makers. Similar systems are not widely used at the employee-level where feedback is generally informal and unstructured.
- *Recognition system* that focuses on team or department performance. Incentives include team celebrations and recognition across the organization. "Internal competitions" are used for recognition and morale building.
- *Formal training* and orientation systems for new employees as well as those in service.

It should be pointed out that the use of "best practices" was not consistent across the five distribution centers; the extent of use varied significantly. Sound data systems and training programs were consistently used by the five distribution centers. The practice for the other three attributes, accountability, feedback, and recognition, varied from very formal systems to none at all. Furthermore, distribution centers were found to have a formal system for some of the measurement components as, for example, in the case of safety and some operational and financial measures, and a relatively unstructured approach for others, particularly with customers.

Summary

Some general findings from this study are as follows:

- Most distribution centers measure productivity or efficiency. However, the term productivity and efficiency were often used differently.
- The greatest opportunity for improvement appears to be in the area of customer satisfaction measures.
- Safety was the most consistently measured category. This is likely owing to legal requirements.
- There was only one distribution center (DC-B) that used three measures (productivity, quality, and safety) across all the functions.

As stated earlier, a good performance measurement system supports sound management decisions. A performance measurement system is effective if it provides high quality, reliable, and timely information to influence management decisions and employee behavior. While the measurement systems found in the cases studied were not "perfect," they did provide some information to support decision making.

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Appendix. Cross case analysis

Distribution Center	DC-A	DC-B	DC-C	DC-D	DC-E
FINANCE	• Labor Cost per Piece (Daily) $\frac{\text{Total salary dollars}}{\text{Total pieces processed}}$ • % to Sale (Monthly) $\frac{(\text{Total expense} - \text{sales})}{\text{Sales}}$ or $\frac{\text{Total expenses}}{\text{Sales}}$	• Cost per Unit (Weekly) $\frac{\text{Total cost}}{\text{Total units}}$	• Total Cost per Piece (Daily) $\frac{\text{Total expenses}}{\text{Total units processed}}$	• Cost as % of Sales (4 week & Quarterly) $\frac{\text{Total cost}}{\text{Total sales}}$ • Cost per Piece Shipped (4 week & Quarterly) $\frac{\text{Total cost}}{\text{Total pieces shipped}}$ • Cost per Ton Handled (4 week & Quarterly) $\frac{\text{Total cost}}{\text{Total tons handled}}$ • Average Loaded Wage (4 week & Quarterly) $\frac{\text{Total labors cost*}}{\text{Total hours worked}}$ *Includes supervisory and support personnel	• Cost per Unit (4 week) $\frac{\text{Total cost}}{\text{Total units}}$ • Ratio of expenses to \$ of inventory withdrawn and returned (for both budget and actual) (4 week) $\frac{\text{Actual expenses}}{\text{\$ of inventory withdrawn \& returned}}$ and $\frac{\text{Budgeted expenses}}{\text{\$ of inventory withdrawn \& returned}}$
OPERATIONS					
1. RECEIVING	• Productivity Index (Daily) $\frac{\text{Total standard hours}}{\text{Total available hours}}$ • Quality Index (Daily) $1 - \frac{\text{\# of pieces found in error}}{\text{Total \# of pieces sampled}}$	• Productivity (Weekly) $\frac{\text{Volume processed}}{\text{Total hours}}$ • Safety (ORI Frequency) (Weekly) $\frac{\text{\# of OSHA recordable incidents}}{\text{Total hours worked}}$ • Quality (Weekly) Risk Analysis Rating	• Units (carton) per Month (Monthly) • Efficiency (Daily) $\frac{\text{Actual time}}{\text{Standard time}}$ • Average \$ per unit (Monthly)	• Efficiency (Tons per hour) (Daily & Weekly) $\frac{\text{Total tons received}}{\text{Total man hours}}$	• Efficiency (Daily & Weekly) $\frac{\text{Total cases received}}{\text{Total hours}}$ • # of Trailers Unloaded per Day (Daily & Weekly) $\frac{\text{Total \# of trailers unloaded}}{\text{Total \# of days}}$

Distribution Center	DC-A	DC-B	DC-C	DC-D	DC-E
2. STORAGE	• N/A	• N/A	• Accuracy (Semi-Yearly) • Utilization of Pallet Rack (Monthly) • Utilization of Case Rack (Monthly)	• Cube Utilization (% Filled) (Daily & Weekly) $\frac{\text{Total cubic feet occupied}}{\text{Total cubic feet}}$	• Reserve Utilization (% of Empty Reserved Space) (Weekly & Daily in busy season) $\frac{\text{\# of pallets positions empty}}{\text{\# of total positions}}$ • Put-Away Performance $\frac{\text{Actual minutes}}{\text{Standard minutes}}$
3. ORDER-PICKING	• N/A	• Productivity (Weekly) $\frac{\text{Volume processed}}{\text{Total hours}}$ • Safety (Weekly) • Quality (Weekly)	• % of Orders Completed (Daily) • Efficiency (daily) $\frac{\text{Actual time}}{\text{Standard time}}$	• Efficiency (SE Performance) (Weekly & 6 weeks) $\frac{\text{Total hours worked}}{\text{Scheduled expected hours}}$	• Performance Productivity (Daily) $\frac{\text{Actual hours}}{\text{Planned work hours}}$
4. REPACK	• Productivity Index (Daily) • Quality Index (Daily)	• Department Productivity: SSP (Store Shipped Pack) per Hour (Weekly) $\frac{\text{Actual SSP packed}}{\text{Planned SSP packed}}$ • Team Productivity (Weekly) $\frac{\text{Total SSP packed}}{\text{Hours worked by team}}$ • Safety (Weekly) • Quality (Weekly)	• Units (Cartons) per Week (Weekly) • Efficiency (Daily) $\frac{\text{Actual time}}{\text{Standard time}}$	• Efficiency (SE Performance) (Weekly & 6 weeks) $\frac{\text{Total hours worked}}{\text{Scheduled expected hours}}$	• Performance Productivity (Daily) $\frac{\text{Actual hours}}{\text{Planned work hours}}$
5. SHIPPING	• Productivity Index (Daily) • Quality Index (Daily) • Cost per Piece (Daily) • % to Sales (Monthly)	• Productivity (Weekly) = Cartons per Hour or Trailer Filled (Avg. # of Cartons) • Safety (Weekly) • Quality (Weekly)	• Total Volume Shipped (Daily) • Quality of Shipping (Daily): The amount of returns, or carrier mis-shipment problems	• Efficiency (Daily & Weekly) $\frac{\text{Total tons shipped}}{\text{Total man hours}}$ • Delivery Time (Daily)	• Efficiency (Pallet/hour) (Daily) $\frac{\text{Actual pallets shipped}}{\text{Planned pallets}}$

Distribution Center	DC-A	DC-B	DC-C	DC-D	DC-E
6. MHS	• Completion Ratio (Weekly) Actual # of jobs finished / Total # of jobs	• Conveyor Uptime (Weekly): Total production time – down time • Sorter Uptime: Production time – down time • Safety Check (Weekly) • % of Orders Completed (Weekly)	• System Uptime (Daily): Operation time – down time • % of returns on sorter (Every 6 months) # of packages returned / # of packages processed • # of garments placed on the tray correctly per person (Every 6 months)	• Total Maintenance Cost (4 weeks & Quarterly) • Life Cycle Expectation = Life (years) of equipment	• # of Cases per Hour (Sorter) (Continuously, not used) Total # of cases passed / Total hours operated • % of Mis-Sorts (Sorter) (Continuously) Total # of cases mis-sorted / Total # of cases sorted • Conveyor Down time: Total minutes down per shift
QUALITY	• Quality Index (Daily) 1 – # of pieces found in error / Total # of pieces sampled • % of Sampling (Daily) # of pieces checked / Total # of pieces processed	• Risk Analysis Rating (Weekly): (% of the pyramid value as compared to other Dcs)	• % Defective (Monthly) # of defects / Total # checked • Vendor Charge Backs (Monthly) • Shortage (Monthly) • Damaged Cartons Shipped (Monthly) • % of Mis-Labeled Cartons (Monthly)	• # of Mis-Picks per Order per Selector (Daily) • # of Errors per Hour (or per Piece) (Daily) Total # of errors / Total picking hours or Total # of errors / Total picking hours	• % Mis-Picked (Daily, Weekly & 4-weeks) Total # of units mis-picked / Total # of units sampled • # of Cases Damaged per Period: (# of cases thrown away or donated)
SAFETY	• Productivity Index (Daily) • Safety (Monthly) • Attendance (Daily) • Teamwork Flexibility (Supervisor's opinion)	• Productivity (Weekly) Volume Processed / Total Hours • Attendance (Weekly)	• Efficiency (Supervisor's opinion) # of pieces processed / Total time • Attendance (Monthly)	• Efficiency (for all activity areas) (Weekly) • Attendance (Weekly)	• Performance Productivity (Weekly) Actual hours / Planned work hours • Attendance (Weekly)
CUSTOMER SATISFACTION	• Feedback	• Feedback	• Feedback	• Feedback from Stores	• Feedback from Stores