The Use of Benchmarking to Improve the Finished Goods Inventory Management for Food and Agricultural Product Manufacturer in Thailand

Mem. Muroran Inst. Tech., 65(2015) 15-22

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(Received 26th October 2015, Accepted 2nd February 2016)

Abstract

Problems found in the management of finished products within Thailand's food and agricultural industries include a high volume of finished goods having to be distributed, yet a lack of information being exchanged among the key players. This research study; therefore, employed benchmarking techniques to assess inventory management performance at the case study company and so improve its inventory management processes. The research methodology comprised of four main steps, according to the benchmarking process introduced by Xerox Corporation, these being: planning, analysis, integration and action. A study into the finished goods inventory processes at the case study organization covered four key processes, these being: the receipt of goods, the movement of goods for storage, the transportation of goods within the warehouse, and storage itself. Indicators were developed to ascertain the best practices and to analyze how those benchmarking partners could enable such practices. The results were then employed to develop the action plans for the case study company. In total 20 indicators were used in the research study in relation to finished product management. As a result of this research, an analysis of enablers for each activity and best practice led to the development of the action plans for the case study company; for it to use to improve the processes within its warehouse management operation.

Keywords: Inventory management, Benchmarking, Food and agricultural industries

1 INTRODUCTION

When talking about high income-generating industries in Thailand, there is no doubt that the food and agricultural industries as a whole are among those which generate the most income [(1)]. Thailand's food and agricultural industries have been an important part of the Thai economy, as well as the Thai way of life which focuses on agriculture. However, nowadays, the country's competitive capability has been declining. Furthermore, since the country embraced the concept of free trade areas, organizations have needed to enhance their competitiveness, and inventory management is considered a critical element of this, one that requires close attention. This is due to the fact that the main objective of inventory management is to create a balance between the needs of the organization and its customers [(2)], plus the fact that working capital becomes a sunk cost when it is held as inventory. One problem found in the food and agricultural industries is the high levels of inventory found among finished goods, often leading to congestion within warehouses. This also impacts on the quality of food and agricultural products with a limited shelf life [(3)]. Additionally, according to [(3)], there is lack of effective information exchange among manufacturers in Thailand's food and agricultural industries. As consequence, the Thai government is promoting industry clustering, through the creation of networks within and between industries; so as to strengthen them and enhance their process effectiveness [(4)].

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Benchmarking involves exchanging knowledge, experience and best practices between organizations, based on the concept that no one organization is good at everything, but that some organizations are better at doing things than others. Learning from other organizations' first-hand experience, and then applying this as appropriate can save time and reduce the number of operational steps required based on trial and error process [5]. Benchmarking is critical importance to management teams, as it can help improve performance effectiveness, through the selection of best practice and its application within one's own work processes. This does not reflect imitation, but rather a creation process based on learning first-hand.

According to previous research studies, benchmarking is employed in a variety of food and agricultural industries contexts; for example, benchmarking has been used in the supply chain of the food industries of Russia and Finland [6]; to examine the differences between Finnish and Russian food industry supply chains. The main objective is to find out the reasons for low productivity in Russian food. The results of the study suggest that differences in productivity can be attributed to the operating environment and the level of technology employed. Another research study [7] employed benchmarking to compare levels of participation in new product development among suppliers in the food industry in the Netherlands, using a questionnaire-based survey.

As part of this research, a study was conducted into the finished goods inventory processes of the case study company, which is a food and agricultural product manufacturer in Thailand and chiefly produces spices and processed agricultural products. Currently, the case study organization is experiencing a shortage of storage space for its finished goods, and as a result is having to rent additional warehouses. This results in higher costs and additional management processes. For this study, benchmarking was then used to improve the finished goods inventory management for the case study company. The aim was to create greater levels of knowledge sharing between it and its benchmarking partners based on the exchange of information, such as that related to operational processes. This information then used to drive related activities and to enhance management effectiveness. The results obtained were employed to improve finished goods inventory processes at the case study company.

2 RESEARCH METHODOLOGY

The research methodology was based on benchmarking initiatives carried out by Xerox Corporation [8], and comprised four key steps, these being: planning, analysis, integration and action, as shown in Figure 1. As part of the study a production action plan was also produced, this being presented to the case study company.

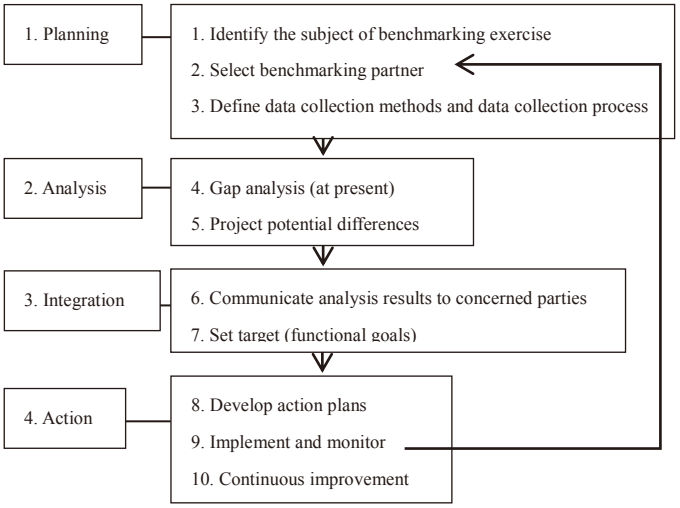

Fig. 1. Benchmarking steps introduced by Xerox Corporation [8]

From Fig.1, benchmarking can be divided into four key steps, as follows:

1. Planning
   - Select the benchmarking subject by identifying a problem area; one that requires improvement.
   - Identify potential benchmarking partners by selecting organizations with similar operational activities.
   - Identify the data collection method to be used, and the data to be collected, by identifying those key performance indicators (KPIs) relevant to the process.
2. Analysis
   - A gap analysis was conducted to determine how the benchmarking partners developed their best practices and what enablers they have used to attain such best practices
   - A projection of potential differences vis-à-vis the benchmarking partners was also conducted.
3. Integration
   - Integration was carried out by communicating the results to with key staff in the case study company, those responsible for relevant activities, and for the purpose of setting targets.
4. Action
   - Process action plans were developed based on the results obtained, then merged to create an overall action plan.
   - Implementation and monitoring was carried out to ensure that the results were consistent with the plan.
   - Continuous improvement was conducted through a review of the results and a comparison of these against those of the benchmarking partners, to determine whether

the organization should carry out further benchmarking.

3 RESEARCH RESULTS

The details of the research results are as follows:

3.1 Identification of the subject of the benchmarking exercise

When selecting an area for benchmarking, the objective should be a specific area or process requiring improvement [9], and the area selected should be consistent with the strategic direction of the company involved [10]. One major problem that many companies in the food and agricultural industries face is high finished goods inventory levels prior to distribution, as this impact adversely on the utilization of storage space within warehouses. The case study company is no exception to this, as it operates in the processed agricultural product manufacturing industry, for which production costs critically depend on raw materials prices at a given time. When prices fall, production rates increase, leading to the storage of more finished products, a shortage of storage space, and the creation of 'dead' stock, in which a large number of products go past their expiry date due to a lack of systematic inventory management. As a result, this research focused on the selection of a problem area in the warehouse management system at the case study company, for benchmarking against systems in other companies. The subject of the benchmarking exercise was identified to be the management of finished goods inventory. The finished goods warehousing process at the case study company is shown in Fig.2.

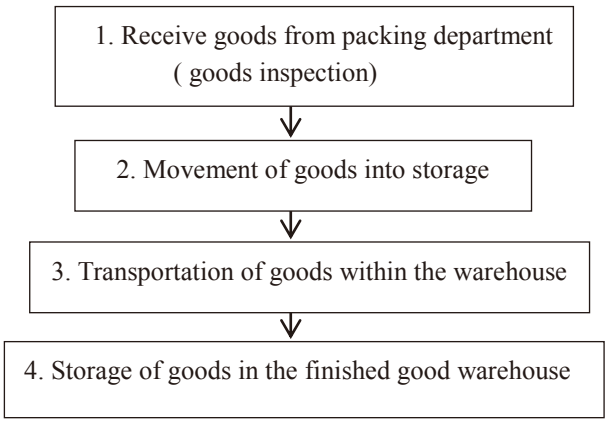

Fig. 2. Finished goods warehousing process at the case study company

The finished goods warehouse process can be divided into four key steps, as follows:

1. Receipt of goods; transporting products to the warehouse for receipt and storage.
2. Movement of goods: The process of moving goods into the warehouse, for storage.
3. Transportation of goods: The process of preparing the stored goods for transportation to the customer.
4. Storage: The process of goods arrangement, including storage methods and location assignment.

The researchers conducted a review of the previous research carried out on this topic and generated KPIs to use to carry out an assessment of the four key areas, as follows:

1. Receipt of goods (R) – At the case study company, this process begins with an examination of the documents attached to the finished goods. After verification of the documents, product information is logged in accordance with the product codes. The KPIs for this process are as follows:

- Complete and accurate inventory logging (R1) facilitates the dispatch of finished goods and helps reduce inventory levels [11].
- The warehouse management operational system (R2) helps ensure that inventory management and planning activities are managed in an appropriate and effective manner [12].
- Receipt of goods standards (R3) can help minimize steps in the overall process by eliminating unnecessary steps [13].
- Standard codes used for finished goods (R4) facilitate operational processes [14] and the systematic controls of activities in the finished goods warehouse.
- The inventory accuracy rate (R5) is employed to support financial and operational processes [15]

2. Movement of goods into storage (M) – After verification of the documents, the finished goods are moved into storage, based on the assignment of a location in accordance with the product category. The KPIs for this are described below.

- Put-away (M1) affects the overall warehouse KPIs, as this activity is concerned with the accuracy of information.
- Put-away rate (M2) [13] is an indicator used to assess the effectiveness of performance based on a unit of time.
- Design of storage process (M3) reflects the allocation of volumes to be moved into storage per cycle [13].

3. Transportation of goods within the warehouse (T) – After the finished goods have been stored, activities related to their transportation out of the warehouse are carried out, such as delivery to customers and random inspections by the quality control department. For the case study organization, finished goods are transported by cart or a forklift truck along designated routes, so as to prevent contamination. The KPIs for these activities are as follows:

- Design of the warehouse layout (T1) [13]; conducted in order to enhance competitiveness.

- Design of materials flows (T2) [13]; will be effective or not depending upon the type of warehouse management activities used at an organization.
- Order picking (T3) [16]; represents how effective each organization manages its warehouse system.
- Order picking speed (T4); indicates the amount of goods picked per time unit.

4. Storage (H) – The case study organization stores each type of finished goods with a safety stock maintained, in order to respond to customer requirements. Most finished goods are stored for no longer than their shelf-life, which is approximately one year. In addition, an extra warehouse is also used in case there is inadequate storage space. The KPIs for this process are described below:

- FIFO method (H1): A major concern of the food and agricultural industries is the shelf-life of products. Therefore, any organizations that can employ a FIFO (first in first out) method properly will be able to carry out its warehouse operations effectively [17].
- Management of dead stock in excess of six-month period (H2) should be considered, so as to facilitate the optimal use of finished goods storage space [17].
- Use of a computerized inventory management system (H3); to provide more accurate stock information [18].
- Review reserve storage (H4) when manufacturing seasonal products [13]
- Inventory turnover ratio (H5); employed to assess the effectiveness of the inventory management process [11].
- Inventory and opportunity cost (H6) are calculated in order to respond to changes in factors which do not impact on consumer demand [16].
- Warehouse space utilization ratio (H7) is calculated to improve the effectiveness of warehouse operations [16].
- Average inventory day (H8) is the period over which the company reserves finished goods, to respond to customer orders.

The assessment of each KPI could be divided into two, based on the types of data being used, as follows:

1. Quantitative data provided an assessment of the results in the form of numbers. In this research, quantitative data was collected from the actual operational processes and from interview with workers in the warehouse department.
2. Qualitative data was assessed jointly by the researchers and those responsible for particular activities, using a scoring rubric [19] with a scale from 1 to 5. The scores were obtained from an observation of the processes and from interviews with those directly involved in the activities.

In total there were 20 KPIs used for the finished goods inventory management process, and there were divided into five KPIs for receipt of goods, three KPIs for the movement of goods into storage, four KPIs for the transportation of goods, and eight KPIs for storage itself. In this paper; however, only two KPIs are described, as shown in Figure 3, for which the KPI for the receipt of goods (R3) is based on qualitative data, while the KPI for the put-away rate (M2) is based on quantitative data.

Table 1. Examples of indicators used for the receipt of goods and the movement of goods into storage

Objective	Assessment	Criteria
Receipt of goods *R3- Receipt of goods standards*		
Help eliminate unnecessary steps, so facilitating improved performance.	1 = Load and inspect goods before receiving 2 = Immediate movement of goods into storage 3 = Immediate transportation of goods for dispatch 4 = Immediate delivery to final customers 5 = Preparation prior to receiving goods	Assessment scored on a scale of 1 to 5
Movement of goods into storage *M2- Put-away rate*		
Put-away rate indicates how effective an organization carries out its storage activities	$(Total\ no.of\ products\ picked)/(No.of\ workers \times working\ hours)$ Unit: pallets/worker/hour	Score derived from the equation

3.2 Potential benchmarking partner selection

Even though competition among organizations is often intense, benchmarking can lead to cooperation between them [10]. Based on this idea, the organizations selected for the case study company were from the same business sector: the processed food and agricultural product manufacturing industries. Also located within the same province, these organizations employ the same level of warehouse management technology as the case study company, meaning they manage their finished goods warehouse by directly employing workers. Two companies met the criteria and agreed to participate in the benchmarking exercise, namely the case study company (Company C), Company A and Company B. The details of each

company are as follows:

1. The case study company itself is a small and medium-sized manufacturer of processed agricultural products, mainly spices and other processed foods. Its major customers are leading companies in the processed food and semi-finished products industries. At present, this organization is experiencing an issue with inadequate storage space for its finished goods, resulting in higher costs and additional management processes.
2. Company A is a small and medium-sized manufacturer of processed agricultural food products, mainly canned vegetables. Having built a strong base of domestic customers, the organization is now also competing on international markets.
3. Company B is a well-known Thai manufacturer and exporter of canned seasonal fruit and vegetables. Due to the wide variety of products it offers, the organization has been able to respond to consumer demand across all its product segments.

Based on this information, the researchers selected these benchmarking partner/companies, all from within the same industry. The results of an analysis of enablers were later presented to the case study organization; to solve the problems found within its finished goods inventory activities.

3.3 Data collection method and data collection process

Data collection is a process required within research to obtain both quantitative and qualitative data from selected sources, and for the effective analysis of enablers [10]. The data collection process for this study was carried out as follows:

1. Personal interviews with the warehouse supervisor and workers were conducted to obtain information on the operational activities related to the four warehouse work areas of concern, and all detailed responses were documented. An interview provides specific details and responses regarding the object of study. Prior to the interviews for this study, the researchers had to familiarize themselves with the questions, to ensure accuracy of the information to be incorporated into the KPI assessment.
2. Observation: The researchers collected data by observing worker operations, and data obtained was recorded without having to inquire further. This method was used for some KPIs, such as order picking speeds, by observing the operational processes used and recording the processing times for each activity. This was done to prevent workers from feeling nervous, and to obtain results as close to the actual day-to-day figures as possible.

3.4 Gap analysis

After obtaining the data and comparing the indicators from the three companies, an analysis was carried out of the processes and the qualitative and quantitative data concerning the operations, to determine as to which organizational best practices should be utilized by the case study company. Details of analysis are described below.

3.4.1. The analysis of the quantitative data included a gap analysis, which was conducted by collecting data on the finished goods warehouse management processes from the case study and the benchmarking partners. The results were then used as part of a gap analysis, such as of the order picking speeds (T4) of the companies, as detailed below.

Table 2. Example of Comparison of a Quantitative Indicator (T4)

Indicator	Measuring unit	Organization		
		A	B	C
T4 Order Picking Speed				
- No. of Products Picked	Pallet	25	18	25
- No. of Workers	Worker	5	4	4
- Time Employed	Hour	1.5	1	2
Order picking speed	Pallet/worker/hour	3.3	4.5	3.1

The order picking speed was calculated using equation (1):

$$(Total\ number\ of\ products\ picked)/(Number\ of\ workers \times working\ hours) \quad (1)$$

From the calculation, Company B achieved the best order picking speed, at 4.5 pallets/worker/hour, while the case study organization and Company A produced results of 3.1 pallets and 3.3 pallets respectively.

3.4.2. An analysis of qualitative data was conducted through the collection of data on operational processes within the organization, and the use of a scoring rubric based on a scale of 1 to 5 (least to most). The results were then compared against one another so as to determine the advantages and disadvantages of each process, which would lead to which represented best practice. For example, the indicator (H3) represents a computerized program employed in inventory management. A computerized program can effectively assist in warehouse management, such as by lowering finished goods inventory levels. It was found that all the study organizations employed a computerized

program in their warehouse departments, and in this study Organization A was found to have the most effective warehouse management program, one which provides detailed information on each product category. The results of the analysis of all KPIs are shown in Table 3.

Table 3. KPI comparison across all three study companies

Indicator code	Assessment score			Benchmark
	A	B	C*	
R1	5	5	5	-
R2	5	4	5	A,C
R3	2	2	5	C
R4	4	3	4	A,C
R5	97.23%	94.72%	93.58%	A
M1	1	1	1	-
M2	1	1	1	-
M3	3	3	3	-
T1	4	4	4	-
T2	2	2	3	C
T3	2	3	1	B
T4	3.3	4.5	3.13	B
H1	4	4	4	-
H2	4	3	3	A
H3	5	3	4	A
H4	4	2	2	A
H5	1	1	1	-
H6	4	2	1	A
H7	42.12%	35.85%	32.5%	A
H8	1	1	3	C

The results of the KPI comparison between the four key processes are shown in Table 2 and from these results one can draw the following conclusions:

1. Receipt of goods: The companies with the best practice for each activity, these being: basic warehouse management operations system (R2), receipt of goods standards (R3), a standard code for finished goods (R4), and the inventory accuracy rate (R5), were Company A and C, Company C, Company A and C, and Company A respectively.
2. As for movement of goods into storage, all the companies revealed similar results, and none of them achieved best practices.
3. For the transportation of goods within the warehouse, these activities being: design of material flows (T2), order picking (T3), and order picking speed (T4), the organizations with the best practice were Company C, Company B and Company B respectively.
4. The results of the assessment of storage activities in terms of the management of dead stock over a 6-month period (H2), the computerized inventory management system (H3), reserve storage (H4), inventory and opportunity costs (H6) and space utilization ratio (H7) showed that Company A achieved the best practices, while Company C attained the best practice in terms of average inventory days (H8).

3.5 Potential differences and enablers analysis

Enablers, meaning those factors that enable an organization to attain best practice, were identified for each individual KPIs so that the case study company would be able to apply them its own processes. Typically, there are a number of enabler analysis methods. In this case; however, the researchers analyzed potential enablers by visiting the case study company and holding a personal interview with the head of the warehouse department, to glean in-depth information on the best practices used. This facilitated an effective analysis of potential enablers. An example of such an analysis, of the KPI for order picking speed, is shown in Table 4.

Table 4. Example of enabler analysis

Action	Enabler
Picking orders quickly	- Clear categorization of finished goods -Storage locations are visibly recorded on a board

3.6 Communication of results to concerned parties

Any conclusions developed for the analysis of enablers across the benchmarking partners were presented to concerned parties within the case study organization, so as to set targets for improving inventory management operations.

3.7 Setting targets (functional goals)

The data collected and analyzed was then used to determine the targets, to be used; however, these required approval to be gained from all the concerned parties; in terms of their practicality. Table 5 shows the targets set for the order picking speed KPI.

Table 5. Example of Targets for the KPI (Order Picking Speed)

Indicator	Current Performance	Target	Deadline
Order picking speed (pallets/worker /hour)	3.13	4.5	March 2015

Based on the KPI developed for order picking speed (T4), the results show that the current order picking speed at the case study organization is 3.13

pallets/worker/hour. The researchers and head of the finished goods warehouse; therefore, set a target to increase the speed, to match that of the best performing benchmarked organization, which was 4.5 pallets/worker/hour. This target is to be achieved by March 2015.

The process improvement targets were set for three key areas, being: receipt of goods, transportation of goods within the warehouse, and storage. Also, the action plans for these process improvements were presented to the executive board for approval.

3.8 Development of action plans

There were two types of action plan presented to the case study organization, these being: actions that could be implemented immediately (Present: P), and actions that could be implemented in the future, or in the event of changes to related conditions (Future: F). These plans were to be set and evaluated in collaboration with the case study company, and included a person in charge, objectives, goals, a person responsible for action, a budget monitoring methods, and a timeline.

Table 6. Order Picking Action Plan

Action	Timeline			
	W1	W2	W3	W4
A–Presentation to executives	→			
B–Creation of finished goods warehouse layout		→	→	
C–Worker training; to improve understanding			→	→
D–Continuous improvement				→

Based on the timeline shown in Table 6, the researchers provided an example of the results from the enabler analysis (for order picking) to the case study organization. A summary of the actions required to adopt these process improvement steps, those adopted from Organization B, are as follows:

- Propose action plans to the executive; for budgetary approval
- Show the new warehouse layout on a board; locate finished goods at the front of the warehouse, so as to be visible to workers. The information on the board should include product codes, date of receipt and volumes.
- Train workers on how to better record information on the warehouse layout board
- Develop a process by applying methods most suitable to the organization.

These actions, undertaken by the head of warehouse department, will take approximately one month.

4 CONCLUSIONS

This research employed a benchmarking technique to identify and analyze the enablers of best practices of the activities in finished good inventory management, and then presented the findings of this analysis to the board of the case study organization. As a result, eight warehouse management improvement action plans were developed. The research results show that the adoption of these techniques at the case study company will improve its processes and save time, based as they are on enablers derived from a benchmarking exercise carried out with partner organizations.

ACKNOWLEDGMENT

This research study was conducted in collaboration with the three companies mentioned in the paper. The cooperation and assistance of these organizations in providing the information required was invaluable, and our thanks go to these companies.

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