The Impact of Inventory Inaccuracy in the Food Manufacturing Industry: A Case Study
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Abstract
Inventory is one of the most important assets of an organization. In many industries, recorded inventory does not always match physical inventory. Inventory inaccuracy can negatively impact an organization’s financial strength, customer satisfaction, and competitive advantage. Accordingly, the purpose of this study was to investigate the impact of inventory inaccuracy in the food manufacturing industry. Data collection was conducted by observing the inventory management process and interviewing inventory management associates at food manufacturing plants in Pennsylvania, United States. Our findings suggest there are multiple departments involved in the inventory management process, and the causes of inventory inaccuracy can occur at various stages during processes such as receiving, the material usage recording process, and cycle counting. As a result, inventory inaccuracy impacts an organization’s resources and performance in terms of time, cost, and risk. The participants in this study also offered their perspectives to minimize inventory inaccuracy; some suggestions include proper training, clear procedures, increasing the accountability of associates, clear cycle count scheduling, and investing in an efficient system.

Key words: Inventory management, inventory inaccuracy, record accuracy, cycle counting, food manufacturing industry

INTRODUCTION
The concept of inventory management has received significant attention in many organizations. Inventories are considered an important asset and are critical for business success. Waller, Nachtmann, and Hunter (2006) indicated that a firm’s fate depends on its ability to manage inventory. In discussing the aspects of inventory management, one issue that often comes up and has a significant impact on the organization relates to the discrepancy between recorded inventory and physical inventory. This research focuses on inventory inaccuracy in terms of raw materials, with special emphasis on the food manufacturing industry.

In a competitive market, it is critical for businesses to maintain customer satisfaction and appreciable profitability. While organizations, particularly in the manufacturing industry, attempt to increase their productivity and efficiency, the issue of inaccuracies in inventory appears to be a challenge for the organizations in achieving their goals and objectives. Inventory inaccuracy has a considerable impact on various business units and functions within organizations. Businesses need to consider various costs associated with inventory inaccuracy; these costs include handling, carrying, and other risks to customer-related costs. Furthermore, according to Rajeev (2008), inventory inaccuracy costs are also associated with productivity lost, expediting shipping costs, potential losses due to the inability to meet customer demand, and frustration. Clearly, inventory inaccuracy has a direct impact on the firm’s financial strength and its competitive advantage.

OBJECTIVES
Bearing in mind the importance of inventory accuracy in the food manufacturing industry, the authors present the impact of inventory inaccuracy through qualitative analysis in a food manufacturing industry setting. The present study will address the following research questions:

1. How does inventory inaccuracy occur in the food manufacturing industry?
2. How does the food manufacturing industry respond to inventory inaccuracy?
3. What are the impacts of inventory inaccuracy on the food manufacturing industry?

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Available online www.bmdynamics.com
ISSN: 2047-7031

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4. What are the solutions or strategies the food manufacturing industry can apply to minimize inventory inaccuracy?

All qualitative data gathered for this study were analyzed. The findings and suggested strategies from this study are also discussed as a guide for practitioners to implement and apply as they see appropriate for their organizations.

LITERATURE REVIEW

Many scholars among different businesses and industries have scrutinized the subject of inventory inaccuracy in the research literature; however, most research literature tends to focus on finished goods and retail businesses. This section will focus more on inventory inaccuracy from the raw material and production aspect.

A firm’s stocks consist of a variety of inventory, including finished goods, work-in-progress material, and raw materials (Jou, Hui-Ming, Hsiao-Ching, Yao-Hung, & Wang, 2009). Jou et al. (2009) defined inventory accuracy as the instance where the recorded amount of the inventory in the system matches the actual physical level of stock. According to Kang and Gershwin (2004), perfect inventory records are difficult to maintain as many activities take place during business operations; thus, the inventory record is very likely to be incorrect, and it is a very common problem across many industries. Previous research has discussed various reasons why inventory records are inaccurate; the reasons range from external and internal theft, incorrect incoming and outgoing deliveries, transaction errors, and misplaced items (Fleisch & Tellkamp, 2005; Kang & Gershwin, 2004).

DeHoratius and Raman (2004) came up with some interesting findings regarding the extent of inventory record inaccuracy. In their research, they found that inventory record inaccuracy is related to sales, the number of stages in the supply chain, and product variety. As these variables increase, the extent of inventory record inaccuracies also increases. Information inaccuracy causes higher uncertainty for decision making, requiring higher levels of safety stock to achieve target service levels (Angulo, Nachtmann, & Waller, 2004).

Despite the fact that most research on inventory inaccuracy has been conducted at retail level, several studies have also been conducted at production level. Thiel, Hovelaque, and Vo (2010) studied the impact of inaccurate inventories on a multi-product batch production line with fixed capacity. Their research reveals that there is a non-monotone relationship between the inventory inaccuracy rate and the service quality level of different products sharing the same production line with fixed capacity and product priorities, in which the service level initially increases and then declines as the inaccuracy rate increases. Pujawan (2004) conducted a case study based on field observations in a shoe manufacturing company regarding schedule nervousness. His observations reveal that there were numerous causes of schedule changes in the manufacturing company, one being inaccurate inventory records and miscalculation of the material requirements, as well as problems in the availability of other raw materials during the production process.

The remedy used to solve inaccurate inventory records in the manufacturing industry is often based on cycle counting. Most companies implement a cycle count program to mitigate the inaccuracy of inventory records by physically counting and verifying the correctness of quantity data on a regular basis (Kok & Shang, 2007). Wilson (1995) suggests that the implementation of a cycle-counting program can be part of quality assurance analyses and inspection policies. Indeed, Gumrukcua, Rossetti, and Buyurgana (2008) present a simulation model of a two-echelon inventory system in which cycle counting is implemented. The results reveal that corrective cycle counting will effectively increase record accuracy and result in significant savings for the entire supply chain.

METHODOLOGY

The purpose of the present qualitative study was to investigate the impact of inventory inaccuracy in the food manufacturing industry. This section reviews the data collection and processing procedures. This qualitative study was conducted at food manufacturing plants in Pennsylvania in the United States through observation and interviewing methods. The authors observed the raw material inventory (packaging and ingredients) management process and interviewed inventory management associates who either had direct or indirect responsibility in the inventory management function. Interview
questions were developed to gather information about their daily tasks, challenges, causes of inventory inaccuracy, how they respond to inventory inaccuracy, and their suggestions/recommendations to manage inventory inaccuracy effectively.

The observations and interviews took place over a period of four weeks. During the data collection process, the authors observed all inventory management processes in terms of packaging and ingredients from the point of purchase order determination, purchase order creation, order submission to the supplier, receiving, recording, and cycle counting. All efficiencies and inefficiencies regarding the inventory process were noted. Once the observation was complete, the authors interviewed the inventory management associates privately one by one. The same questions were put to all participants. After the data were collected, all the observation results and responses were organized and reviewed prior to analysis. The observation and interview results were generalized to address each research question mentioned previously.

RESULTS AND DISCUSSION

In this section, the results of the interview and observation are presented, followed by the findings corresponding to each research question. The findings from this study are then evaluated and discussed.

The relationship of each department in the inventory management process

During the data collection period, the authors observed the inventory management process and interviewed inventory management associates. The associates who are responsible for inventory management have at least five years of work experience in the field. The observation and interview revealed that multiple departments/business units control or influence the inventory management process. The departments involved in this process include procurement, administration, production, receiving, and purchasing/contract development. Each department has its own responsibility related to inventory management; Table 1 (below) shows the departments’ major responsibilities.

Table 1: Responsibilities of each department related to inventory management

<table>
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<th>Department</th>
<th>Responsibilities</th>
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| Administration      | 1. Process transfer paperwork  
                      | 2. Enter receiving ticket into the system  
                      | 3. Backup/assist accounting department                                              |
| Accounting          | 1. Issue raw material usage based on production report  
                      | 2. Perform inventory reconciliation or adjustment  
                      | 3. Verify weekly cycle count  
                      | 4. Audit the setup of items process                                                 |
| Purchasing          | 1. Negotiate contracts with vendors  
                      | 2. Provide data regarding the availability of raw materials for each open contract |
| Material Management | 1. Create release order  
                      | 2. Determine quantity of the order  
                      | 3. Schedule pickup and delivery date  
                      | 4. Initiate transfer of raw materials between plants                               |
| Production          | 1. Maintain production formula data  
                      | 2. Provide production and usage reports                                             |
| Receiving           | 1. Receive the shipment of raw materials  
                      | 2. Maintain receiving log  
                      | 3. Supply raw materials to production  
                      | 4. Handle the shipping of raw materials between plants  
                      | 3. Perform a weekly blind cycle count                                              |

Eventually, the performance of each department is inter-related and has a direct and indirect impact on the efficiency of the inventory management process. Figure 1 (below) illustrates how each department is related.
Drivers of inventory inaccuracy
The issue of inventory inaccuracy appears to be a major problem within the food manufacturing industry, particularly in this case. From the findings in this study, although a cycle count is performed weekly, inventory inaccuracy still occurs frequently every week, at both plant and corporate level. At plant level, the accounting-ending inventory, which is calculated automatically in the system based on the quantity entered minus theoretical usage, does not match the physical quantity of the actual inventory. Inventory inaccuracy at plant level can occur at one or more stages of the inventory management process, including purchase order creation, physical receiving, receipt entries, usage calculations and inventory reconciliation. The multiple tools various departments use can also lead to inventory inaccuracy. These tools include SharePoint, Access, Excel, Data Loader, Outlook, and company’s financial system. The authors found that by using different tools, inventory management associates manually verify and transfer data. Because most of the process includes the manual collection and entry of data, there is an increased risk of potential errors. At corporate level, the mismanagement of contract balances has a direct impact on material availability, increasing the risk to supply.

Responses to inventory inaccuracy
When inventory inaccuracy occurs, inventory management associates address the issue in various ways to reduce the risk of production downtime. When inventory management associates reports indicate a discrepancy, the first step is to request an immediate recount, adjusting the inventory records accordingly. If it is determined that additional inventory is needed, the inventory management associates will evaluate their options in terms of shipping cost, delivery date and time, and the urgency with which the material is needed. Options often used include inter-unit transfer from other locations and expediting the shipment directly from the vendor’s warehouse. The preferred method is to utilize internal transfers; although this option requires the assistance of multiple departments in several locations, it proves to be the lower cost option. If other locations do not have the inventory on hand, the inventory management associates request an expedited delivery direct from the vendor at additional cost. Figure 2 (below) summarizes how they respond to this issue.
The impacts of inventory inaccuracy

During our data collection, we found that inventory inaccuracy has a significant impact on the organization’s performance. We will break the impacts of inventory inaccuracy into three categories:

1. **Time.** Inventory inaccuracy increases the time spent on the inventory management process. Additional time in multiple departments is spent on researching discrepancies, correcting systems data, communicating concerns, handling the material, and determining the impact to production.

2. **Cost.** Inventory inaccuracy impacts the organization’s financial performance in terms of the cost of goods sold. Increased costs are the result of expediting shipping, additional labor, and loss of production. Additionally, because of the potential for inaccuracy, manufacturing plants tend to carry excess inventory to minimize uncertainty, which increases inventory holding cost.

3. **Risk.** The impact inventory inaccuracy has on an organization is broad, and companies should consider mitigating the risk of such inaccuracies. When the physical inventory count is inaccurate, it undoubtedly impacts the decision-making process in an organization due to unreliable information (e.g., the inaccurate cost of the goods sold and the economic reorder point). Inventory inaccuracy also increases the risk of cutting orders or rescheduling the production line, directly impacting service to customers. Furthermore, the issue has a direct impact on inventory management associates in terms of job satisfaction; the associates interviewed reported a high level of stress associated with the risk of run-outs as well as a high level of frustration due to the lack of controlled processes.
RECOMMENDATIONS
During our data collection period, inventory management associates provided us with suggestions/recommendations to improve inventory accuracy in food manufacturing organizations. Suggestions made by inventory management associates are divided into five areas: (a) training, (b) procedures, (c) accountability, (d) scheduling, and (e) systems. Recommendations for each area are as follows:

1. **Training.** Training and job competencies for all positions associated with the inventory process should be developed, and each associate responsible for inventory management should receive comprehensive training; if applicable, this should include certification for the job. Furthermore, clarification on processes within various systems used to eliminate erroneous inventory variances should be given to the associates.

2. **Procedures.** It is important the inventory process is documented from “start to finish” to ensure accurate inventory record keeping. This requires that to report inventory accurately, the process should begin with the first person (receiving clerk) to come into contact with the material. Written procedures, guidelines, and a checklist for all steps (e.g., receiving, counting, and approving inventory variances) should be in place and published so associates across the organization can follow them consistently. Another recommendation related to the procedures mentioned by the inventory associates is to set consistent guidelines for counting partially used containers and material with unique units of measures. Before counting the inventory, it is important to record or account for the material staged for production or included in work in progress.

3. **Accountability.** The inventory management associates recommend establishing specific expectations of the material management associates and hold each accountable for errors. This can be done by designating people to be responsible for the accuracy of inventory counting and to have all associates involved in inventory counting sign the count on or off. Additionally, leadership in the plant should take the initiative to recognize, follow up, and solve known problems accordingly.

4. **Scheduling.** The inventory management associates also suggested that the cycle count should be conducted regularly and should occur during schedule downtime, which means the cycle count would be performed when production is stopped in order to get the actual number of inventory. This can be done by improving line efficiency to allow consistent production cutoff.

5. **Systems.** Investment in more technology, including the use of an integrated Enterprise Resource Planning (ERP) system in which all information is connected should be considered. If appropriate, some inventory items should be labeled clearly with a bar code and an identified inventory part number. Due to numerous types of inventory in the plants, a laptop or I-pad should be supplied to associates counting inventory on the floor.

CONCLUSION
Managing inventory in the food manufacturing industry poses challenges that are not shared by other non-food manufacturing businesses. The two main raw material requirements in food manufacturing are packaging and ingredients, both of which are affected by daily price fluctuations. The timing of the purchase of these materials as well as the cost of holding excess inventory has a direct impact on cash flow. In addition, the raw materials required in food manufacturing have a limited shelf life, affecting not only the cost but also the usefulness of excess material. Inventory in terms of packaging and ingredients is considered to be an important asset and is critical for business success within this industry. Although inventory inaccuracy is considered a very common problem across many industries, in the food manufacturing industry it has a direct impact on the firm’s financial strength and its competitive
advantage. The findings of this present qualitative study within the food manufacturing industry suggest that different drivers occur at various stages of the process that have a direct impact on the accuracy of inventory data. The organization in this study is aware of the importance of proper inventory management and continues to seek appropriate remedies to improve inefficiencies and inaccuracies in their processes. Based on the findings and recommended strategies, this study aims to guide practitioners to apply the findings in their organizations as deemed appropriate.

REFERENCES
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