THE KEY DEVELOPMENT TO ENHANCE INVENTORY MANAGEMENT FOR A NEW INSECT SNACK FOOD SME IN THAILAND

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ABSTRACT

The research aims to determine the importance of inventory management practices especially in regard to the sustainability of new SMEs, and to determine a general approach for SME inventory management that supports such sustainability. The research seeks to answer the research questions and to discuss the case study of a fresh start-up Thai SME to obtain inventory improvements which can benefit new businesses through enhanced inventory management. To find a balance between inventory performance and winning a market share requires a good strategy and an approach that applies the concept of agility with the flexibility to support the SME's business growth and sustainability. However, judging which inventory management tools are appropriate for each case is problematic. Understanding and learning from previous experience may enable success in inventory management, and various types of basic operational experience can help them to achieve sustainable success.

KEYWORDS: inventory management, non-moving inventory, new entrepreneurs, SME, sustainability

1. Introduction

Inventory management is a key challenge in regard to business sustainability, especially for small- and medium-sized enterprises (SMEs) or new entrepreneurs who strive for success. The inventory is a part of process in which businesses invest their core competencies to generate sales and income for the business. Changes in the global economy require SMEs to compete in the value chain originally occupied by big businesses.

Global environmental change is calling for a completely new system of values, which brings new challenges for SMEs [1]. There are many uncertainties that impact inventory management which create risks to the business, for example, customer requirements, forecast accuracy, production constraints, inventory strategy, and product life-cycle all of which can affect profitability.

This research seeks to answer two interesting questions: what is the importance of inventory management practices for SMEs, especially in regard to the sustainability of the new business in the market? and what should be the general approach for SME inventory management that supports business sustainability? The research addresses the research questions explored in the literature review and reports a case study of a fresh start-up Thai SME in the insect snack food industry that employs a set of inventory improvement tools. Any improvements to inventory management that result from this study can be of benefit new entrepreneurs.

2.   Literature Review

In this part, literature that is related to the two research questions is evaluated. The importance of inventory management for new business performance is considered, especially in regard to sustainability. This may affect individual business performance in some dimensions; however, it may be necessary for SMEs to handle their inventory as a part of profitability improvement [2]. For instance, the number of days that the inventory is held by the firm can impact corporate profitability [3]. Many start-up SMEs aim for sustainability but rapidly changing market forces and the need to focus on marketing make it a difficult challenge [1]. Uncertainty in the business environment encourages firms to maintain high levels of inventory. However, inventory performance is often one of the lowest priorities for SMEs to focus on, with a greater focus given to marketing and other activities in an attempt to follow their own strategy to achieve sustainability [4]. Inventory can be considered as hidden waste that impacts a company in terms of working capital, interest payments, cost of production and labor overheads [5].

The key focus is for SME operations to be sustainable. A successful business employs strategy which aim at enhancing the sustainability of the business. In the past decade, many businesses have 6 to transform their operations to adopt sustainability practices, such as focusing on enhancing the value-added process in the supply chain or by setting up a robust

collaborated supply chain network on the raw materials side to cope with uncertain demand [6]. However, SMEs seem to be at an advantage in working collaboratively compared to larger enterprises by adopting technology to optimize their sustainability practices, and also by rapidly responding in the supply chain, which is essential in addressing the systemic problems that affect supply chain sustainability [7]. By employing the concept of lean production, which focuses on value creation and the reduction of waste, a business can achieve business sustainability. For instance, the focus on 7-waste reduction and increased production schedule flexibility can assist in managing uncertain demand. Ketsarapong et al [5] stated that "the 7-waste perspective of production flexibility is gained after implementation, which can lead to reductions in waste and inventory". However, to enhance sustainability, SMEs may consider the following influencing factors: developing necessary sustainability capabilities, creating a positive attitude in the organization to have confidence in sustainability and creating attractive sustainable business practices [8]. Sustainable development focuses on the following three areas: Smart growth realized by focusing on knowledge and innovation, sustainable growth by making production more efficient and inclusive growth with the acquisition of improved labor skills [9].

Similarly, the supply chain management collaboration concept can help SMEs to enhance sustainability by focusing on value creation and waste to meet customer requirements. The business creates partnerships in some areas of supply chain management i.e. beginning with the R&D phase in a case of hi-tech SMEs that may help to enhance the significant positive effect on overall firm performance [10]. Also, inventory management practices have a positive influence as a result of the owner/managers' attitude and knowledge of inventory management, which may reduce the cost factor, which has a negative influence [11]. SMEs that do not perform well in the inventory management system practices, technical knowledge, supply chain management practice and information technology, must have initiatives to ensure that the business can perform and be able to sustain it at an appropriate level [12, 13]. Knowledge of supply chain, purchasing and inventory concepts is required as well as knowledge in regard to physical distribution, supply chain design/redesign, risk pooling through process optimization. This, when brought into consideration by managers, will provide the key concepts of supply chain integration and coordination as well as fundamental process optimization to their business [14]. The firm's operational performance is related to lean implementation and the understanding of lean thinking at the SME and its

impact on performance [15]. For example, the business strategy is focused on meeting the needs of customers to gain more benefit from market expansion, which may require building up inventory as the Agility concept is not directly aimed at reducing cost; however, if the business can manage their supply well, a decreased inventory shows that the business is going in the right direction by increasing their working capital, which would directly benefit their books [16]. Additionally, efficient inventory management through stock levels, engagement of skilled store personnel, and the use of automated inventory control determination will eliminate problems resulting from a sudden lack of inventory, thus reducing; the resultant low production capacity utilization, loss of production time, and so improving the overall efficiency of the manufacturing SMEs [17]. These factors demonstrate the importance of inventory management practices for the sustainability of new businesses in the market.

The next research question, which is in regard to the general approach of SME inventory management that supports business sustainability, will be discussed as follows. In general, inventory management varies according to the characteristics of each business, such as an ageing inventory or a low inventory turnover ratio, and other issues which impact the business's cash flow. There are many systematic approaches or tools that can be applied to help to fix the inventory issue and to perform effective inventory management operations. An effective inventory management system monitors the total material flow process and minimizes the randomness process. Its goal implementation and targets are set at different levels of management. SMEs should understand each component of the system for material flow planning, control and regulation in order to have a well-managed system. If a company does not have efficient inventory management, ways to improve it are required [18]. Furthermore, the Sales Operation Planning (S&OP) tool can support inventory management by considerably improving S&OP [19]. An example is the FMCG business, for whom inventory management is a key challenging factor to their business. Poor inventory management can result in not being able to satisfy demand. An inventory level that is too high or too low can result in organizational failure. Inventory management is required for the business to stay competitive, to be flexible enough to meet demand at low cost, which is difficult to manage and control as it is difficult to know when to order and how much to order [20]. Accurate and robust demand forecasts impact effective inventory management performance and decision making, such as the level of safety stocks. The combined forecasts approach can help to reduce forecast errors, which is essential in managing the

level of aversion to risk and uncertainty for companies [21]. The other concepts can also support SME operations by establishing a basic system, enhancing flexibility and agility, despite the lack of resources, and by improving production and flexibility by creating an intelligent network of factories based on innovation, agility and the JIT philosophy [22]. Moreover, the agility approach can help SMEs to cope with current growing competitiveness, organizations must be a step ahead of the competition, and innovations and products must be ready for the market much more quickly. The key focus in regard to changes in demand is to be flexible and to react quickly. The agility method application can be a success through short iterations, quick release and feedback [23]. In addition, a postponement approach has been recognized as a strategy to manage uncertainty in demand. Both manufacturing postponement and ordering postponement can help SMEs in terms of their flexibility, volume and mix of products [24]. This can be described as a related approach helps to improve the inventory management performance.

Furthermore, direct tools can also be involved in inventory performance. There are many applications that may help SME operations and get good results. 'The rule of thumb' is the most popular inventory management technique [11, 13]. This is a simple technique that can help reduce frustration in SME operations. Inventory management challenges are too numerous to count; however, the 'four rules of thumb for Better Inventory Management' may be considered by SMEs: 1st Rule- Get real-time inventory status information; 2nd Rule- Do not rely on manual processes; 3rd Rule- Everyone should get access to the information they need to perform their work; 4th Rule- Just know that you cannot scale a manual inventory system [25]. Therefore, many manual tasks limit the opportunity to utilize resources or for process optimization. The next approach is ABC analysis, which can help SMEs to determine high profit items in the inventory store [26]. Inventory performance measured by inventory turnover can be applied to help to control the inventory in wider business areas in the supply chain, such as the retail business, and to help their suppliers to perform well [27]. As an approach to micro-operation tactics to improve the inventory control performance, this is an example in operations that focuses on reducing search time, which can help to reduce costs in the store. LIFO is the most effective method for the storing of fast-selling items [26].

SMEs often have the same problems, but limited expertise and resources perhaps create the biggest issue, such as the system to control the inventory [19]. However, the lack of skilled personnel to use inventory models, inadequate data and a low-level of information

communication technology in SMEs obstruct inventory decision making. The use of Information Communication Technology applications for data management and quantitative inventory decision models is a priority for SMEs to enable good inventory management practices [28]. Although Mass Customization in SMEs is an approach that can be adopted to assist in coping with fluctuations and to obtain a competitive advantage by increasing communication and collaboration with customers and suppliers, designs can be integrated through manufacturing technology, tools, and techniques; the quality and flexibility processes can be improved and controlled, and organizational support can be provided [29]. There are many tools, approaches, techniques or tactics that can help in managing the inventory. However, focusing on knowledge and attitude in regard to the selected tools for inventory management is key for SMEs to be successful and sustainable in business.

The following sections will describe the case study of a new leading SME in the insect snack food industry whose challenge is to improve their inventory management.

3.   Basic information on the case study

A new business opportunity in the snack food industry is based on the use of insects. The Food and Agriculture Organization of the United Nations (FAO) released a 200-page report named "Edible insects: Future prospects for food and feed security" which states that insects will become a future source of food in western countries. The opportunity to produce food from insects has shifted from localized consumption to mass production in factories for global distribution. The FAO predicts from the world's population may reach 9,000 million people by 2050, which may cause a shortage of food for both humans and animals. As a result, alternative protein sources including edible insects such as crickets, are potential protein food supplies for the world's population [30].

The case study is a 4-year-old SME that is a new business leader in insect snack foods. For the last 3 years, they have had the largest market share in this business. Their products are mainly sold through modern trading channels. The company's annual growth rate is, on average, 4-5%. The main products are nine flavor varieties of two kinds of insect that can be converted into snacks. The supply chain of this case study starts at the insect farm, which has 2 types, owned farms and supplier's farm which supply the insects to the general market. The main insects that are used for these snacks are crickets and silkworms which are generally consumed in upcountry areas of Thailand. Figure 1 shows the supply chain map for this case

study. The internal operation process to plan supply ordering starts with sales forecasts for each channel, which will be sent to the MRP system to order appropriate levels of raw materials. The business will produce products based on the monthly forecast at the beginning of the month. Customer orders will diminish the inventory of finished goods as the orders are completed.
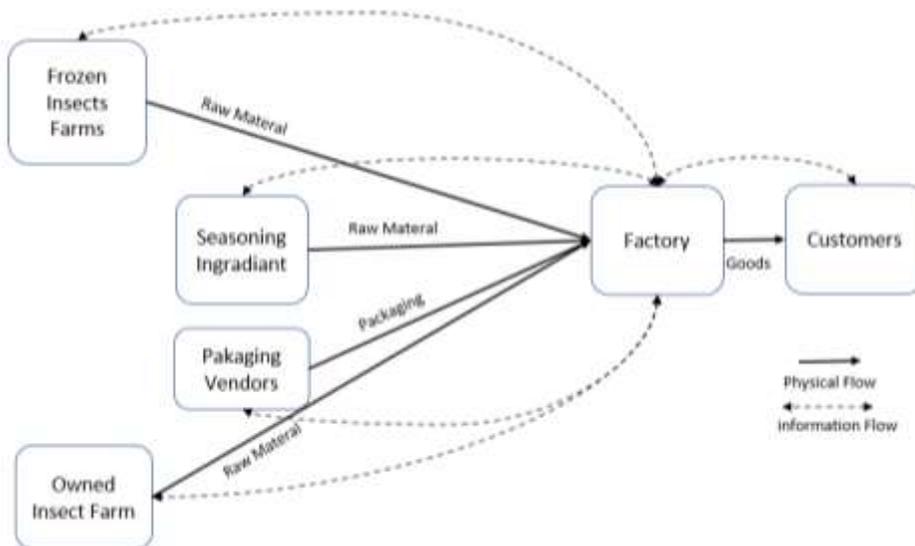

Figure 1   Insect snack supply chain map

The current business management needs to reduce the risk of shortages in meeting the orders of their customers. Therefore, to achieve a high service level of finished goods, a safety stock level up to 30% of the inventory plan is set. The company also faces the issue of inventory that is sitting in the warehouse. The ageing inventory value is about $30,000 on average per month (13% of the total inventory value over 45 days). Thus, the challenge of inventory management has been the key focus over the past 2 years. High sales orders with a high level of inventory seems to be a good sign for the business; however, it can be a bad sign if the ageing inventory is hard to sell because of the customer product specification that requires a product to be less than 6-9 months old after the manufacturing date.

4.   Learning from the case study

If finished goods remain in the warehouse too long, the business needs to conduct root cause analysis to fix this issue. By employing the brainstorming approach with stakeholders,

it was found that the main cause of this problem resulted from producing an incorrect number of finished goods which cannot be sold within a certain period. Therefore, the deep analysis revealed that the monthly sales forecast which was used as an input into the monthly production schedule had a low level of accuracy compared to month-end sales results. The production schedule was set and fixed base on the monthly forecast to meet the level of customer demand. The Forecast discrepancy seems to a significant issue that creates inventory problems. Moreover, the reduced inventory level must take into account the impact of the short lead-time order from modern trade customers. If the order was released but business cannot be completed within an acceptable time frame, penalties have to be paid, which may impact long-term customer confidence.

The other cause of this problem lies in understanding the importance of inventory, which means employing good practice for inventory management. Having a good inventory cycle is not good enough for start-up SMEs, as inventory optimization must also be applied to help the business to be sustainable. Therefore, information and performance measurement are required and the information should be available in good time. To address this issue, complete cooperation throughout the organization is required. There are two possible actions: corrective actions and preventive actions, which will help the company to reduce and prevent the further ageing of inventory.

In regard to corrective actions, the inventory in the warehouse has a limited time remaining for sale, so rapid action is necessary to sell it as soon as possible. Ageing inventory must be sold and a more robust marketing strategy must be employed to reduce the levels of ageing stock. There are also various limits in regard to the age of products and product shelf life which can be divided into three groups as shown in table 1. Customer group#1 expect that finished goods are not more 45 days older than the manufacturing date and the product shelf life limit is 8 months. This is different from other customers with lower specifications on ageing after the manufacturing date limit of 60 days or 90 days with a shelf-life of 1 year. The aging products which do not qualify for customers in group#1 can be sold to other customers, which requires the marketing team to seek the right channel to sell this stock as fast as possible. Most of the corrective actions that must be focused in the marketing approach involve how fast that business can deliver products to the correct market channel. In some cases, the finished products are packed into the correct snack bag which vary according to customer specifications, such as differences in the packing weight and the

details on the packaging. Therefore, the company has to repack the finished goods to match current demand to make a quick sale. This proposal has both technical and financial feasibility. From a technical viewpoint, the reverse process requires manpower to adjust the old stock and put it back into the current packing process. This process will create additional cost of about 18%. However, this process can help this SME to salvage the dead stock value and turn it back into cash. The SMEs can employ corrective actions by reducing the ageing inventory from about $30,000 to $9,000 (9%) in terms of the inventory value and the portion of aging inventory over 90 days is reduced to 0% of the inventory value.

Table 1   Product ageing for the Customer group focus

Customer Group	Manufacturing date limit (Days)	Shelf-life limit
#1	45	8months
#2	60	1Year
#3	90	1Year

Preventive actions can improve this issue from occurring in the future. Regarding the sales forecast discrepancy, the forecast information used in the production plan is a month's data without any review or recheck, production is already completed and the finished goods are in the warehouse. The inventory ageing starts from this day. In addition, they do not measure the level of inventory in the store; they just follow the production plan that is set at the beginning of the month. Consequently, the business has set up a new strategy which is called "The 3 Re Scheme" The operation has three steps: Review, Reschedule, and Retarget as can be seen in Figure 2. This approach can help to maintain focus on agility to meet customer requirements and to enhance operational flexibility.

● The review step is the process in which the performance of the forecast, the sales, the production schedule and the inventory is reviewed. In this stage, a review schedule of at least 2-4 times a month is set up, based on the class of products.

● The reschedule step is the process that uses review forecasts to make a new production schedule that will result in holding less inventory.

• The retarget step is the process that sets up a new target for the inventory level. This step can also include an inventory review and a plan to process the ageing inventory, which may occur when demand is uncertain.
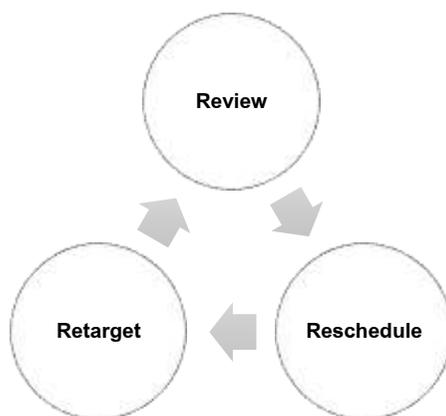

Figure 2   The 3 Re scheme

Another possible course of action is to set up inventory performance measurement, which could be done in various ways. In the past, the inventory department only controlled the quality of inventory. They did not employ an approach for inventory control optimization, which requires additional information to be collected from their daily operations and reported properly, and performance measurement which needs to be set to monitor performance. The indicators that are applied to monitor inventory performance include inventory value, inventory ageing, and the inventory turnover ratio. Each parameter monitors each dimension. Firstly, the inventory value shows the value of the stock. Secondly, inventory ageing shows the time that the inventory sits in stock, which wastes money from an operational point of view. Lastly, the inventory turnover ratio shows the number of times the inventory has been replaced over a given period [31]. The turnover can be calculated by the ratio of cost of goods sold and average inventory value, which help to monitor the performance of each individual good that generates cash for the business. The demand for inventory is shown by the number of goods that are sold. The data are collected and converted into inventory performance information for further review. Visual management of the inventory is carried out to make it easy to identify ageing inventory by employing traffic light colors to indicate age. A green color code is used for items that are normal; a yellow color code represents

inventory aged between 45 and 60 days, which is considered as ageing stock, and a red color code is used for items that are in stock for over 60 days, which have almost expired and require quick action, similar to the case that was described in the corrective action approach.

The next action is inventory optimization which starts with inventory classification. This approach classifies inventory according to certain criteria. For instance, ABC analysis uses the value of inventory as a criterion while XYZ analysis uses the turnover ratio (TR) as a criterion which represents the demand for the item under consideration. Both analyses can be combined into a 3x3 matrix which has 9 sets of inventories. In this case, ABC analysis uses two levels of inventory value as criteria, at $5,000 and $2,500. These values come from the average individual inventory amount that covers around 1-2 weeks. The XYZ criteria use the level of inventory turnover ratio (TR) at 4 and 9 rounds per quarter. Therefore, these will divide the inventory into 9 groups as can be seen in table 2. The groups I(CX), and II(CY) are the groups that have better performance for the SME compared to the groups VIII(AY), and IX(AZ) that have poor inventory performance. The others groups III(CZ), IV(BX), V(BY), VI(BZ), and VII(AX) are the groups with moderate performance, where groups III, IV, V seem to be better than the groups VI and VII.

Table 2   The inventory classification matric by ABC & XYZ

ABC & XYZ	X(TR>9)	Y(9$\geq$TR$\geq$4)	Z(TR<4)
A (>$5,000)	VII	VIII	IX
B ($5,000-$2,500)	IV	V	VI
C ($\leq$$2,500)	I	II	III

The business also employs visual control as another method for each inventory group and can select the best business strategy for the inventory. This classification also helps to encourage the proper optimization strategies or tools, for example, the safety stock level policy, the production scheme, or the monitoring factors for each inventory item to obtain better results for inventory control, for instance, the plan to keep most inventory in groups I-II and minimize the inventory in groups VII-IX. Moreover, other inventory optimization tools that can help to reduce the inventory are related to production quantity. The small batch

production approach helps to increase production flexibility and can allow a scheduling of goods that meet customer requirements.

In this case, the company set up a steering committee to work on the inventory approach strategies and execute them in their operations. The committee is group comprising related functions such as sales and marketing, production planning, the inventory and logistics which meets once a week to review and initiate actions to improve their inventory plan. The nine inventory groups mentioned above are regrouped by the committee into three larger groups as follows:

1)　The groups of good performance, groups I-II. These groups have a high demand volume, so they need to maintain a safety stock level for 0.5 to 1 week, and apply the weekly production plan which needs to schedule the production to cover 1-2 weeks' demand. The items in this group can also be used in cases where other groups cannot complete their production batch size.

2)　The poor performance groups, groups VIII-IX: these groups need to monitor their performance such as the accuracy of forecasts and correct order processing because the left-over stock can quickly become ageing stock. Safety stock is not necessary. The purchase quantity and lead-time must be strictly controlled based on accurate information. The products must be produced and shipped to close the order as soon as possible.

3)　The last group is for moderate performance, which is between good and bad inventory performance. The item demand seems to be uncertain but the business cannot ignore these items for business reasons. However, this group's inventory management is challenging because it can easier move to the poor performance group. In contrast, if demand rises, it can join the good performance group. The approach of this group is strictly focused on the weekly review. The safety stock level can be produced at times of full production capacity, so the production capacity needs to be reported to make sure that the SME has enough production capacity to cover rush orders. The suggested level of safety stock can be considered according to the level of production. For instance, if the production capacity is allocated to other products, this seems to signal increasing demand from the market. Therefore, the items in this group need to be considered to produce both the required stock and the safety stock.

The result of the actions mentioned above provided the SME with important knowledge about inventory management by focusing on the inventory on a day-to-day basis.

A systematic planning and inventory review process can improve inventory performance to deal with the uncertain demand in the market by maintaining a focus on enhancing flexibility and agility to meet customer requirements. As a result, the value of deadstock, or non-active inventory, was reduced from 12.8% to 3.9% (by 8.9%) and the portion of ageing inventory in the group over 90 days was reduced to 0% of the inventory value. The TR was improved from 2.9 to 7.8 on the items that are sold to the customers in group#1. Furthermore, inventory classification that focuses on the three inventory indicators, Ageing, Amount and Demand, can help the business to employ an appropriate strategy for each group of inventories to enable the business to better manage their inventory.

5. Conclusion and Contribution

This research reveals the importance of inventory management practices and offers a general approach to inventory management which can enhance the SME's sustainability in the market. Much research has indicated that inventory management is one of the keys to success for businesses in many countries. However, the focus on inventory performance may be a lower priority for the SME's management when compared to winning a bigger market share. However, the SME could apply the concepts of agility and flexibility to support the SME's aim to achieve improved business growth and sustainability and also reduce the risks resulting from uncertainty in the market. The SMEs management may need to focus on the knowledge and attitudes in the management of their operations to get result in terms of inventory performance.

The research also seeks a general approach to inventory management for SMEs. The suggestion from the literature suggests that many inventory approaches can benefit SME operations such as focusing on S&OP and reducing F/C errors, which both have impacts on, for example, the level of safety stock. Enhancing flexibility in terms of capacity, employing the postponement concept, and monitoring the mix of production, which may require synchronization between the operations, can help SMEs to cope with uncertain demand and yield good inventory performance. Various general operational tools and concepts used by SMEs help in inventory management, such as the rule-of-thumb, ABC analysis, and inventory turnover. Furthermore, common processes which need to be employed to enhance performance include a good communication process between internal and external parties may have an impact on performance. The suggestion is that technology

supports good practice and results in business sustainability. Basic inventory tools are fundamental to the business in order to strictly maintain performance, to push the business towards its goals and to be successful in new markets

In the case of new SMEs, a business could adopt operating practices to cope with market uncertainty that focus on inventory management performance. In regard to inventory management, it is difficult to judge which tools can be used to fit all cases. Understanding and learning from previous experience are the key shortcuts to success in inventory management, especially for a new business that lacks experience from an operational standpoint. In the case study, general tools were selected and applied to improve their business process, such as the rule-of-thumb, ABC analysis, inventory turnover, and inventory ageing analyses. Also, focusing on the risk prioritization in order to maintain the service level to customer affects inventory performance. Mostly, SMEs focus on key competitive advantages; however, basic operational experience can help them achieve quicker and sustainable success. Therefore, innovations in operations management, for instance, basic inventory management, can help to reduce operational risk and keep the focus on future opportunities. Such actions can help this SME to reduce deadstock, or non-active inventory by 9% and the aging inventory in the group over 90 days reduced to 0%. Inventory turnover rose by 166% (from 3 to 8). The business can use these findings to develop an appropriate inventory strategy.

Acknowledgement

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