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Minimizing Excessive Inventory Losses in a Ceylon Tea Manufacturing Company

Masters in Global
Business Management
Spring 2023

KAMK • University
of Applied Sciences

Abstract

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Title of the Publication: Minimizing Excessive Inventory Losses in a Ceylon Tea Manufacturing Company

Degree Title: Masters in Global Business Management

Keywords: inventory losses, inventory write-offs, losses, profit, raw material, cost, tea, manufacture, quality, machine maintenance, end product

The purpose of this thesis is to analyze excessive inventory losses experienced by a Ceylon tea manufacturing company and provide feasible and productive suggestions to solve the problem. The study also outlines the recommendations on how to minimize the impact of such excessive inventory losses. Therefore, this study leads to investigating the reasons for excessive inventory write-offs and how it can be minimized to increase the company's profitability as much as possible. The commissioner, Ceylon tea manufacturing company is referred as COMPANY X throughout this report.

The COMPANY X has been experiencing many cash losses due to the excessive inventory write-offs that they had been charging to the profit and loss statements of the company for many years. It is important to reduce the inventory write-offs to reduce the burden on profitability of COMPANY X.

The research methodology employed in this study is qualitative in nature, utilizing a case study approach. Data was collected through unstructured questionnaires administered to key stakeholders within COMPANY X, including factory managers, senior officers in the operations management team, and factory workers, via online interviews.

Through the analysis of gathered data, this study provides insights and understanding on the factors contributing to COMPANY X's inventory write-offs. By understanding the root causes, feasible and productive suggestions are formulated to tackle the problem effectively.

The recommendations outlined in this thesis aim to minimize the impact of excessive inventory losses on COMPANY X's profitability. Implementing these suggestions is anticipated to not only reduce the financial burden but also optimize operational efficiency within the company.

1 Introduction

The selected organization for this study is a tea manufacturing company operating within the Sri Lankan tea industry, known for producing Ceylon black tea. The company, referred to as COMPANY X for confidentiality, faces significant operational challenges related to inventory management. The research aims to identify the root causes of excessive inventory write-offs and propose actionable solutions to mitigate these losses.

Sri Lanka, historically known for its Ceylon tea, introduced by British planter James Taylor in 1867, plays a vital role in the global tea market. In 2023, tea exports contributed 11.26% to Sri Lanka's merchandise export income (Sri Lanka Export Development Board, 2024). COMPANY X, which owns two tea manufacturing factories, is an integral part of this industry. However, COMPANY X has been experiencing substantial cash losses due to excessive inventory write-offs, significantly impacting their profitability. Figure 1.1 depicts the magnitude of the excessive inventory losses that COMPANY X has been experiencing for the past three years.

Description	Year end 31st Dec 2020	Year end 31st Dec 2021	Year end 31st Dec 2022	Average for 3 years
Inventory Value (Before write-off) - Rs	90,914,945	115,469,527	123,833,933	110,072,802
Inventory Written-off - Actuals - Rs	13,249,622	11,747,830	12,850,760	12,616,071
Inventory Written-off as a % of Inventory - Rs	14.57%	10.17%	10.38%	11.46%

Figure 1.1 Inventory written- off COMPANY X (LKR)

According to the above company data, we can see the significance of the COMPANY X's problem they are experiencing due to inventory losses. This confirms the COMPANY X is losing a significant amount of business cash and profits as a result of inventory losses. This problem is becoming serious since every year end the company has happened to do an inventory write-off with the existing operational practices.

The origin of tea leaves supply chain is the tea gardens. The point of consumption is the tea factory. This supply chain has three main parties. Those are the tea leave growers, made tea manufacturers and the agents. Therefore, to establish an efficient supply chain in this business the

proper coordination and understanding between these parties will be a must. (Paul & Mondal, 2018).

The primary aim of this thesis is to reduce COMPANY X's inventory write-offs to at least 4% of their total inventory value. The research problem is the continuous excessive inventory losses experienced by COMPANY X. To address this issue, the following research questions will be explored:

a) What are the significant root causes of the excessive inventory losses at COMPANY X?
b) What strategies can be implemented to reduce inventory write-offs to the targeted level?

This study employs case study research strategy deeply study the operational issues faced by COMPANY X. By focusing on a single entity, the research will provide detailed insights into the problem and potential solutions. Case studies are particularly suitable for exploring complex phenomena within their real-life contexts (Greenberg et al., 1977, p. 1532), making them ideal for this research. The research approach used in this study is qualitative interactive approach.
Data collection involves gathering rich, detailed information through unstructured interviews and observations, allowing researchers to capture the complexity of the phenomenon under study (Creswell & Poth, 2017). The data will focus on COMPANY X's current inventory management practices, production, storage, and distribution processes. Unstructured open-ended questionnaires will be utilized to gather qualitative data from COMPANY X's factory managers, senior officers in the operations management team, and factory workers.

A comprehensive and logical data analysis will be performed on the gathered qualitative data to identify the root causes of the excessive inventory write-offs. This analysis will help in pinpointing the most significant factors contributing to the problem.
The research focuses on the operational issue of excessive inventory write-offs at COMPANY X, a significant problem causing considerable financial strain. The necessity of this research lies in its potential to provide feasible solutions to reduce these losses, thereby enhancing COMPANY X's profitability and operational efficiency.

The study will be conducted at COMPANY X's tea manufacturing facilities in Sri Lanka. Data collection will involve engaging with key personnel within the company to understand the opera-

tional processes and challenges leading to inventory write-offs. The findings will be applicable not only to COMPANY X but could also benefit other tea manufacturers in Sri Lanka facing similar issues.

The research focuses on the operational issue of excessive inventory write-offs at COMPANY X, a significant problem causing considerable financial strain. The necessity of this research lies in its potential to provide feasible solutions to reduce these losses, thereby enhancing COMPANY X's profitability and operational efficiency. Experiencing tea drinking is dynamic in different countries and it has a sensory modalities and emotional reactions. (Zhang et al., 2018, p. 1357). When the tea manufacturing companies are well structured to manufacture quality tea continuously then they can attract very good prices for their products, then automatically the company will have stronger revenue cash flows that are created as a result. Then again, the entire supply chain gets stronger. Then again as a result the chances of inventory losses also will become very minimal.

The study will be conducted at COMPANY X's tea manufacturing facilities in Sri Lanka. Data collection will involve engaging with key personnel within the company to understand the operational processes and challenges leading to inventory write-offs. The findings will be applicable not only to COMPANY X but could also benefit other tea manufacturers in Sri Lanka facing similar issues.

The research design outlines the following steps;

i. Identification and justification of the research problem.
ii. Selection of appropriate research methodology and data collection methods.
iii. Execution of a comprehensive data analysis to identify root causes.
iv. Development of actionable recommendations based on the analysis.

By systematically addressing these steps, the study aims to provide COMPANY X with practical solutions to minimize inventory write-offs, thereby improving their financial health and operational efficiency.

2 Excessive Inventory Losses

2.1 Unnecessary Inventory Losses

Inventory losses due to quality problems and other issues are inevitable in any product manufacturing business, but maintaining a proper control in that is very important for a business to operate successfully with a smooth supply chain without burning business cash flows. Having a proper supply chain management system is a key for success in any business industry. In this, to protect the inventories and to make a quality product the concept total quality management (TQM) plays a major role. As a result of this, now all the generations are very much interested in TQM practices (Neumann & Dul, 2010, p. 923). For any quality management system to work well we need both the top management and the other workforce to work with team spirit (Solomon, 1996, p. 32). Therefore, all the operational roles of each employee have to contribute to the overall quality improvement process of the organization and there must be one quality culture within the organization. (Moktadir et al., 2018, p. 631) explained that maintaining product quality will make sure customer satisfaction and reliability for of the organizations products and services and this is the way for an organization to make business growth in this competitive business environment.

Intensifying the global market competition has pushed organizations to focus more on product quality which is the only way out to outperform the competitors. In this process of quality improvement, organizations have to invest in various types of resources to work with TQM practices and then only you can improve your company performances as expected (Kumar & Sharma, 2017, p. 218). TQM practices help organizations to achieve customer satisfaction by many ways including; continuous improvement in manufacturing operations, improved performance, improved product quality, high productivity in manufacture, low-cost manufacture, faster delivery of products, optimizing the use of company resources, etc. (Muruganantham et al., 2018, p. 525). Also, organizations need to keep in mind that failure to make their customers satisfied will deviate the organization from a sustainable business model and then the employees of the organization also will start to become dissatisfied (Lagrosen & Lagrosen, 2019, p. 10). If we are to create a sustainable business, we need to be competitive in the business (Rajesh, 2018, p. 74).

Therefore, a proper integration of sustainable business model with TQM practices is mandatory for a progressive business organization (Bastas & Liyanage, 2019, p. 11).

There can be many reasons for organizations to fail in TQM practices. Therefore, understanding the exact reasons for such a failure is very crucial. Because then only we can go for relevant corrective actions to make sure a smooth flow of TQM practices within the organization where product quality can be guaranteed that increase customer satisfaction and overall business performance resulting business success. The effort of employees will be a very important factor to create a successful product quality improvement process in an organization. Continuous improvement is only a segment of quality management. But when it comes to TQM implementation, employee engagement will play a major role (Prakash et al., 2017, p. 80). Also, any coworker is also considered an important factory in successful implementation of TQM practices (Grover, Agrawal, & Khan, 2006, p. 447). In many instances many authors have highlighted the importance of human resources involvement in establishing quality cultures in organizations (Bou & Beltran, 2005, p. 71). Further, (Kufidu & Vouzas, 1998, p. 818) explained that employees from top to bottom should get the responsibility for quality process.

On the other hand, researchers like Lau & Idris (2001, p. 51) explained that the success of TQM practices are also depending on other factors like, continuity in employment, culture, trust, top management function, team work, etc. and they have been classified as soft success factors of an organization. Also, (Ho et al., 1999, p.2) identified relationships between top management, employee relations, quality management practices, training, customer satisfaction and they further classified human aspects as training & employee relations and operational roles as the work of top management. Sharma (1997) explained that quality issues emerge in organizations due to many reasons like, employee mindset and work culture and not the skills and the knowledge. In the same way, resistance to change is also a factor that limits the success of quality management work. Therefore, for successful implementation of TQM practices, you have to train the entire staff with the same effort also you should take necessary timely actions to enrich employee task lists. (Padhi & Palo, 2005) identified some key human aspects also that are required to implement proper TQM practices such as, vision, innovation, leadership, ethics, creativity, mental conditions, communication, quality awareness, vision, recognition and rewards, moral and attitude, sensitivity for customer satisfaction, teamwork, involvement and commit-

ment to achieve successful results, etc. Also, (Poonawalla, 1999, p. 85) mentioned human involvement as one of the key things to achieve success in TQM practices.

(Glover, 1993, p. 48) showed that the organizations that are not practicing TQM might lose potential market shares in competition. (Lagrosen & Lagrosen, 2019, p. 2) explained that successful organizations in TQM implementation have been able to develop sustainable businesses. (Rajesh, 2018, p. 74) explained that understanding the barriers to TQM practices will make it easy for the organizations to overcome such obstacles. As per the literature, there can be many such limitations such as, not relying on training, not optimizing the manufacturing processes, trying to fast track TQM process unnecessarily, failure to test, poor concern on quality, insufficient top management involvement, insufficient supplier information, inappropriate leadership, ineffective teams, delays in training programs, planning issues, inappropriate feedbacks, benchmarking with unsuitable practices, lack of coordination between departments, and many more.

Nowadays the manufacturing industries are experiencing much advancement. As a result, many professional, researchers are focusing more on the manufacturing industries. In this both total productive maintenance (TPM) and total quality management (TQM) have been heavily studied and documented various view points of the same also have been documented in literature. (Chugani et al., 2017, p. 7) showed that both TQM and TPM have been very popular during last few decades when it comes to efficient business transformation work processes. Further, (Modgil & Sharma, 2016, p. 353) explained that the highly increasing customer demand for many products has increased the requirement for product quality in a very big way. Also, they further explained that the manufacturing industries have developed a lot during past few decades and as a result there had been massive changes in customer expectations, technology, product and processes and so on. Therefore, it is a vital thing for any manufacturing organization to understand this truth. Then they will be able to have more focus on their products or else the inventories and work towards to get the maximum benefits out of it without experiencing unnecessary losses like write-offs to the most valuable asset in business which is the inventory.

As far as all of these important past literatures are concerned it is clear that holding an inventory is a very crucial requirement in any business. The entire effort of a manufacturer of products is reflected as inventory before selling them to their customers. Even for an organization doing trading business, inventory is the key item in business. Without an inventory there is no business. If there is no business, then there is no profit. If there is no profit then there is no going concern in the business. Inventory is made by processing required raw materials. There can be many raw materials suppliers for one particular product manufacturer. Then such manufacturer may process such raw materials collected and make a product and that could either be sold to an end customer or else he might sell it to another person to use that as a raw material in some other manufacturing process as per the requirement. These entire interconnected processes are called a supply chain. If we are not working in a systematic manner, we might lose the track of what we are doing at some point. In such a situation all our efforts might not become meaningful and we might have to incur many losses in production.

2.2 Raw Material Quality

It is not an easy task to maintain a continuous flow of quality raw material intakes to in any product manufacturing business since there are many obstacles to that which need to be strategically addressed. The process of quality management including raw material quality management has been able to provide solutions to many organizational problems for past many decades. As a result, such quality management has been recognized as a management philosophy that has immensely helped organizations to achieve continuous development (Wang et al., 2012, p. 119). Further many organizations have looked at the requirement for quality management not only for their development but also to the parties representing their supply chain as well (Mellat-Parast, 2013, p. 511) Quality management of the supply chain parties is important. (Soares et al., 2017, p. 122). This entire process includes quality planning, control & improvement activities (Juran, 1992). In most of the instances the raw material requirements of organizations are sourced from the external third-party suppliers which represent the initial part of the supply chain of such organizations. The importance of the quality management in one's supply chain has been discussed in detail by (Sharma & Modgil, 2015, p. 905). (Huo et al., 2016, p.236) in a more comprehensive manner. They explained how this process could analyze and

make continuous improvements to the products, services and processes of an organization that will eventually help the organization to make their customers satisfied with a proper value addition.

(Huo et al., 2016, p.236), has classified the core dimensions of supply chain quality management in to main three categories for analyzing convenience as, integration of internal quality, supplier quality, and customer quality. In this the supplier quality integration is considered as external quality integration. A major part of the raw material quality is depending on the raw material supplier. Therefore, the supplier quality integration plays a major role to make sure the required quality level of the raw material intakes for any organization. There are three main themes to discuss under supplier quality integration. They are, Procurement Strategy, Supplier Development and Supplier Involvement.

(Degraeve & Roodhooft, 2001, p. 22) explained the importance of having a procurement strategy for any organization. Further, (Paularaj et al., 2006, p. 107) pointed that, about 60% of the manufacturing cost of a manufacturing organization consists of the raw material cost. As a result, in case if there is a problem with the quality of the raw materials the hit on the company's profitability and the cash flow will be huge. Therefore, the procurement strategy of an organization must mainly focus on how best they can have a better relationship with the raw material suppliers.

(Krause et al., 2007, p. 528) showed that if a manufacturing organization work towards the development of their suppliers over the time, there will be massive positive impacts for the manufacturing organization in terms of raw material quality, quality delivery by which the overall performance of the manufacturers could be developed to a very high level.

(Bartlett et al.,2007, p. 294) explained the importance of having a very good close relationship with the raw material suppliers and getting them involved in collecting relevant information to develop the business. This process will support any manufacturing organization to improve their products, absorb new technological know-how, understand the business environment, make collaborative decisions concerning raw material buying, and so on.

Identifying and working with the correct & important raw material suppliers will be immensely important for a manufacturing company to collect a lot of new knowledge regarding the raw material supply and quality.

(Lyles et al., 2008, p. 167) has mentioned that over the years the supply chain activities of organizations have got complicated in many ways and as a result the quality of the supplier performances also has come down in a drastic manner. This situation has a direct impact on the quality of the raw materials supplied by such suppliers where the manufacturers have to face many quality issues in their raw materials and as a result, they have happened to incur many financial losses. (Mellat-Parast, 2015, p. 346) mentioned the supply chain partnership strategies as one of the main solutions that organizations have used to come out of this situation. (Camuffo et al. 2007, p. 1257) mentioned that sharing the business risk between the raw material supplier and the end product manufacturer is a very much appropriate method to reduce the business risk arising due to issues in raw material quality. According to (Fan et al. 2027, p.63) The quality of the raw material can be increased by the delegation of risk between the raw material supplier and the manufacturer. This valuable concept of sharing risk has been named as supply chain risk management (SCRM) in the literature published by (Norrman & Jansson, 2004, p. 434). Further, (Manu & Mentzer, 2008, p. 192) explained, this method helps the manufacturer to reduce losses incurring due to unforeseen uncertainties in the upstream supply chain activities. Also, (Harland et al., 2004, p.2) have mentioned the importance of sharing the related rewards between the raw material suppliers and the manufacturers to further strengthen this SCRM process.

(Chao et al. 2009, p. 1122) mentioned that some organizations who are buying raw materials from outside suppliers are entering into contractual agreements with such outside suppliers to share any external product failure cost that may incur in the manufacturing process & products due to a quality issue in raw materials supplied. Also, (Lambert et al. 1996, p. 2) mentioned the importance of this partnership to have a win-win situation in business and for each party to be more responsible on their part in business. The specialty in this supplier chain partnership (SCP) is that not only the benefits but also the costs are shared between the raw material supplier and the final product manufacturer. In this way, they have created a situation to minimize the business risks and losses that may occur due to quality issues in the raw material intakes. (Cousins, 2005, p. 403) explained the benefits that can be shared between the two parties both the raw

material supplier and the manufacturer as the incentives that could be generated due to cost savings, manufacturing process improvements, product quality developments and so on.

Further, (Christopher, 2000, p. 39) explained that as per the current market competition and the continuously changing business patterns and the environment, a single organization cannot stand alone if they are to be successful in business on a sustainable basis. Therefore, this collaboration in terms of business or supply chain partnership has become a must for any organization. If not the operational managers of manufacturing organizations will have to face many challenges due to this uncertainty in the marketplace in sourcing a continuous supply of raw materials in the required quality standards.

On the other hand, (Li et al. 2015, p. 83) mentioned about a negative side to this collaboration. That is, mainly because of the high uncertainty levels in the market place, in some instances both the parties might not be able to make a good balance in the raw material process. In other words, their collective efforts to establish a quality raw material supply might not work in the expected manner. Because there can be many challenges to both parties that are unavoidable for both parties. Therefore, in a situation like that, this exercise might not provide the expected results. In such an environment, even though most of the researchers have highlighted the importance of risk sharing for success, in many cases when things have gone wrong, the raw materials buyers have happened to absorb the entire cost or the losses incurred due to issues in raw material quality.

The other major issue faced by the manufacturing organizations if the inability to collect all necessary information related to the raw material buying process which is called the information asymmetry (Ekanayake, 2004, p. 49) It is important to collect required details about raw materials (Zu & Kaynak, 2012, p. 423). In most of such situations, the manufacturers have experienced moral hazards as a result of raw material suppliers breaking their promise for the required quality level of the raw materials. This is cheating the manufacturer by the raw material suppliers. This is the worst-case scenario that could happen in an agency relationship between the raw material supplier and the manufacturer. (Eisenhardt, 1989) showed some methods to solve these issues that could arise due to agency relationships such as, behavioral based mechanisms and outcome-based mechanisms.

The business model of a supply chain network initially talks about their “Supplier Affiliation Process” which is driven on the capacity, capability and very importantly the quality management system where the quality of the raw material intake is assessed in a very high level.

Therefore, as per this analysis of past literature, it is clear that having a proper communication with the suppliers, providing opportunities to them and getting them involved in business and maintaining a proper procurement system in the company, etc. will definitely make a clear path to make sure a continuous flow of quality raw material intakes to a manufacturing organization as much as possible

2.3 Machine Maintenance

It is a fact that there is no possibility to operate a product manufacturing organization with zero machine breakdowns but having a proper system in place to monitor and control machine breakdowns will lead to operational business success in multiple ways. Keeping an effective machine maintenance system within the organization is the key to achieving this success. In this way, they can minimize unnecessary machine downtime and possible losses to the manufacturer and products (Fore & Zuze, 2010, p. 85). It is necessary to implement a machine maintenance system (Muthiah et al., 2008, p. 811). In this exercise, the overall equipment effectiveness (OEE) plays a key role. This key parameter can help organizations to see the gaps in tolerated level versus the actual machine run times. Then based on that they can plan to remedy the bottlenecks in the production process and also, and they can plan for new developments as well. Improving the efficiency of machine lines in manufacturing operations is the main expectation of organizations which can be measured in the OEE index (Zennaro et al., 2018, p. 965). OEE is one of the most traditional tools of total productive maintenance (TPM) of which optimization is the key target of any manufacturing organization.

Most of the food manufacturing industries are now moving into manufacturing automation systems where the production machinery is kept in a line to make a flow of manufacture. In this way they have been able to reduce a lot of labor work and have saved a lot on labor payments (Zennaro et al., 2018, p. 965). As a result, they have been able to save lot of time and to maximize the production time as well.

When it comes to food products manufacture, having a smoothly set up line of machineries is a key requirement. Because, when something goes wrong with the machinery, most of the times the entire set of raw materials that are there in the machineries might become in vain and might have to be discarded. This is a very costly scenario for many manufacturing organizations. OEE implementation and its unique monitoring system will be immensely helpful for organizations to improve product quality and then to develop a sustainable business for the organization.

As explained by (Ljungberg, 1998, p. 495), OEE is one of the most productive tools to monitor plant & machinery working conditions where we can plan for concepts like zero stoppage, zero wastage, etc. These machine related stoppage issues can be categorized in to main six components such as; machine breakdown, issues in set ups and adjustments, machine idling due to minor stoppage, loss of speed, quality defects and reworks, loss of yields (Ljungberg, 1998, p. 498). The main objectives of total productive maintenance (TPM) are, reducing the life cycle cost of machinery, reducing the six major losses, increase of OEE index. Achievement of all of these objectives will lead to establish a reliable manufacturing system (Konecny & Thun, 2011, p. 496). OEE is a useful index to monitor the effective performance of one machine alone as well as a fleet of machineries (Ljungberg, 1998). Not only that, proper use of OEE will lead to reduce overtime work expenses, to identify unseen capacity, possibility to delay major capital expenses, and so on (Muchiri & Pintelon, 2008, p. 3517). Establishing and maintaining a proper OEE system in the organization is always less costly compared to investing in new or improved machinery, working extensive hours, etc. When you improve your OEE system in a systematic manner, automatically your production capacity gets improved, production quality of products will improve, reduce the production downtimes and as a whole that will improve your overall manufacturing process and the product quality.

The major parameters of calculating OEE includes, performance, availability and quality rate (Sivakumar & Saravanan, 2011, p. 96). (Fam et al., 2018, p. 461) showed the relationship of overall equipment efficiency to the lean manufacturing methods. For this study they used paper manufacturing industry one-year information and it was very much successful. Singh, (Clements & Sonwaney, 2018, p. 246) explained the as to how OEE could be measured in a way that helps to quantify the manufacturing operational efficiency also explained each matrix that represent each loss categories. Having said all of these, some publications have said that the results of OEE

are about 25 percent below the expected outcomes (Parida et al., 2014, p. 2). On the other hand, (Garza-Reyes et al., 2010, p. 48) explained that OEE its working mechanism is well-accepted for performance measurement. According to (Bamber et al., 2003, p. 223), OEE is a very good tool for performance measurement, as it focuses on product quality, productivity, and machinery conditions all at once.

Further, (Sohal et al., 2010, p. 2) showed as to how OEE helps to maintain long term effectiveness of equipment by allowing them to restore the equipment back to normal condition all the time which reduces the production losses to a greater level. (Zammori, 2014, p. 451) also showed as to how OEE could help to identify day-to-day operational issues in equipment that help a lot in minimizing machine down time and to improve machine maintenance to a greater level. (Tang 2019, p. 21) identified & proposed a new method based on OEE for the identification of bottlenecks in large and complex machinery in manufacturing operations. Also, (Nallusamy, 2016, p. 119) explained, how OEE is useful to make a quality product and to make timely deliveries that is directly correlated to end customer satisfaction. Kumar et al., identified how OEE could be of use to identify many hidden costs to a manufacturing organization. Further, (Phogat & Gupta, 2017, p. 226) showed the main problems to machine maintenance issues as, not having adequate support from top management, measurement errors in OEE, inappropriate strategic planning, etc. Also, (De Ron & Rooda, 2005, p. 190) has mentioned that the OEE is a must for high volume-based manufacturing businesses where a small mistake in machinery might be a reason to discard the entire lot of raw materials used in machine and the related products. So that manufacturers will be able to minimize such possible massive losses in production. (Abdelbar et al. 2019, p. 90) had proposed a new OEE based indicator to support production managers to identify three-dimensional analysis to have improvements in production time, production cost and production quality aspects separately. Further, (Zuashkiani et al., 2011, p. 74) showed as to how OEE could be used to improve the overall productivity and effectiveness of overall operating performance of a manufacturing organization.

Further, (Wang, 2006, p. 655) mentioned that proper execution of OEE system in an organization will be very much useful in developing a proper and effective maintenance policy statement that led to continuous developments in machine maintenance. Also, Liberopoulos and Tsarouhas (2002, p. 62) mentioned that specially in food manufacturing industry, it is mandatory to have an uninterrupted manufacture in order to make sure the productivity and also to maintain

the food product quality. In a manufacturing organization, the production requirements and the machine maintenance requirements may conflict most of the times. (Berrichi et al., 2009, p. 62), explained that such conflicts are a result of unfulfilled production demands that resulted due to unavailability of machine time as required. In most of the situations this is due to inappropriate machine maintenance.

2.4 End Product Quality

Maintaining a product manufacturer that is free from quality issues is not at all a possible task but having a proper system in place will be definitely of immense support for any manufacturing organization to minimize quality issues in end products to a greater level. For many years, in literature, it has been discussed the importance of end product quality as a part of Supply Chain Quality Management (SCQM) where the sustainability and the growth of an organization depend on (Robinson & Malhotra, 2005, p. 315). End product quality plays a vital role in supply chain quality management (Yang & Wei, 2013, p. 74). The SCQM which consists of planned coordination between the partner organizations in the supply chain is the process by which we can ensure an improved quality in end product or service. SCQM has heavily supported organizations to eliminate the defects in products. This process has been capable of eliminating defects in the entire supply chain. In this SCQM will help to reduce many product quality related risks in the entire supply chain and thereby works as a risk mitigation strategy (Juttner, 2005, p. 120). By this way the organizations could reach to their organizational objectives efficiently (Yang & Wei, 2013, p. 76). As a result of this, organizations will be able to increase the customer satisfaction levels and also, they will be able to build very strong product brands in their industries (Aberdeen Research Group, 2004). During the past there years has been much research work on food product quality as a result of many food product related scandals happened (Doug, 2013, p. 380) Food product quality maintenance is more complex (Leat & Revoredo-Giha, 2013, p. 219), many food product quality standards were evolved based on the research done during last few year (Whipple et al., 2009, p. 574). As per the nature of food products, the related quality management practices have become complex compared to other product types. As a result, naturally the impact of quality difference on food products is also huge in size. For example, an incident of food contamination may have massive negative impacts on product brands

and industries. Therefore, it will not be a just laboratory test like in other cases (Schoenherr et al., 2015, p. 1662). In cases where the product quality has not come to accepted levels, many organizations have happened to recall their products from many countries around the world to comply with the conformities in product quality (Roth et al., 2008, p. 22). It has been said that the certification practices from one side (Hammoudi et al., 2009, p. 469) and company reputation from the other side (Woerkum & Lieshout, 2007, p. 355) would together help organizations to improve product quality and safety. Even though there is much literature available, still there are many issues in industries concerning product quality and integration in supply chain activities to make sure minimum product quality standards both in food products as well as other products.

The usage of both tangible and intangible resources will be meaningful only if the organization could have a productive strategy in business to convert such resources in to value adding end products that make sure superior customer satisfaction with a great brand promise s (Barney & Arikan, 2006, p. 124). Many studies have shown as to how implementation of production protocols, supply chain management processes and practices, information technology, etc. have proved product quality in business operations and food safety controls. As per Banterle & Stranieri, 2008, p. 560, a strategic resource transmits complete, timely information regarding products in the supply chain. A very good food traceability system gives rise to very good food quality assurance (Aung and Chang, 2014, p. 172). However, when it comes to food products a customer might have to face the risk of consuming a less quality product. Because, until the customer consumes it, he will not be able to realize food product defects which is an inherent uncertainty in food products (Cho and Hooker, 2004) which is a cause of information asymmetry. It is not only the food product consumer who faces this unfortunate situation, but also the manufacturers face the same risk due to the same level of information asymmetry. Because, until such time the manufacturer uses raw material in production, he is also not aware of the defects or the quality issues in the raw materials that are taken for making food products. Especially, in international business both the manufacturer and the consumer face this situation in a big way due to geographical dispersion, etc. (Roth et al., 2008, p. 22).

Due to many such reasons, managing product quality has been identified as a very crucial activity around the world in almost all the industries. As a result, there are many studies and research work being carried out around the world for quality management (Nair, 2006, p. 948). As a re-

sult, there had been many studies carried out to see the correlation between quality management and successful organizational operations where total quality management (TQM) has been a key finding (Tari et al., 2007, p. 483). The quality management practices may have to vary depending on the nature of the industry, business, etc., many studies have introduced guidelines and conceptual frameworks to describe practices in quality management. It is important to have conformance to ISO standards when it comes to tea processing technology. (Aroyeun et al., 2012, p. 317). When the manufacturing factories have obtained certifications from recognized bodies like ISO, HACCP, Etc. the attraction to the end products of that particular company among the buyers will be more.

After identifying the importance of quality management for sustainable business, many governments around the world have introduced their national quality management systems and quality awarding systems to support total quality management (TQM) by which they expect to enhance the reliability of the products and services that they buy or sell in international business and trade. National quality awards are given to the companies that have maintained the quality standards in their products and services. Not only the local communities but also the international corporations and the communities also get the trust to use their products and services. Krishnan (2016, p. 246) mentioned that there had been many studies to explain broader areas of quality management including, quality awards, TQM, etc. Also, these studies have shown the importance of such quality management practices for the product and service quality of such organizations and the edge that an organization could obtain within the current competitive business environment (Meftah & Gibson, 2013, p. 920).

(Johansson et al., 2013, p. 32) identified quality management as a business philosophy. In this TQM has been discussed for its use and its importance in quality management for many decades. Studies have shown that the capacity of organizations have a relationship to their involvement in obtaining product quality achievements. Also, the studies of (Garvin, 1991, p. 80) showed that there is a positively correlated link between TQM practices and customer satisfaction, organizational profitability, productivity, and so on. (Wisner & Eakins, 1994, p. 8) explained that the organizations that focused on and achieved product quality through commonly accepted mechanisms have been able to beat the market competition in a big way.

At present, a major part of the business world is a representation of the small and medium business community. Also, it is a fact that the business environments are getting more and more complex and the customer expectation levels are also getting very advanced. As a result, every one of us is experiencing a massive global competition in business. In a situation like this, establishing a quality assurance certification system in a business organization has become a very much innovative and successful thing around the world (Maurand-Valet, 2015, p. 123). It is important to set up a proper worldwide accepted quality assurance certification system (Eve & Sprimont, 2016, p. 77). On the other hand, there are complains about the cost of certification and the additional activities that are to be completed in this process (Fekari, 2011, p. 164). As a result, it has been a little bit of a controversial situation in developing quality assurance certification systems when comparing the benefits and the cost factors (Sleilati & Aubert, 2012, p. 10) Implementation of a quality assurance system increases the cost factor though it is important to the organization (Lakhal, 2014, p. 38). Having said all of these, (Fekari, 2011, p. 164) explained that there is no adequate literature yet to discuss the SMEs and their interest in quality management certification systems.

As per the available literature, the history of quality assurance systems has evidence in even Egyptian times. Therefore, even at that time, there had been evidence for written quality assurance systems for making graves. Not only that, in the Second World War time USA people also used quality assurance systems for military work, nuclear industries, airplane industries, and so on. Then in the 1980s, people started to use these systems heavily in making electronic items, automotive manufacture, Information Technology related developments, etc. (Gorgeu & Mathieu, 1996, p. 223). As a result of these developments in quality assurance systems, consumers of such products and services got a mechanism to understand the nature and the quality level of those and they were able to obtain a minimum guarantee over such products and services. They further explained that the implementation of such a reliable quality assurance system could establish confidence in the minds of the customers regarding the products and the services that they are going to buy. As a result of these systems, organizations had to be well organized in manufacturing to ensure consistency in product and service quality assurance.

Also, in this process, one person’s valuable knowledge gets dissolved into many other people as explained by Eve & Sprimont (2016, p. 27) which someone might consider as a disadvantage to them. Also, (Boiral, 2002, p. 34) explained that there can be a lot of resistance from employees

to practice quality assurance system-related work. Because, most of the time there will be additional requirements to maintain documentation work, etc.

3 Research Strategy and methods

3.1 Case Study Research Strategy

The research strategy employed in this thesis is a case study approach, selected for its relevance in exploring complex phenomena within their real-life context. This method is particularly suitable for studying knowledge utilization and decision-making behaviors, which are inherently tied to their environment (Greenberg et al., 1977, p.1532). Case studies allow for an in-depth understanding of a specific situation, offering rich insights that other methods may not capture as effectively.

Case study research is well-documented for its ability to handle qualitative data, accommodating various traditions and approaches such as grounded theory (Strauss & Corbin, 1990, p. 57). The method is highly adaptable and allows researchers to explore the multifaceted nature of a problem comprehensively. By examining COMPANY X's excessive inventory losses within its specific operational context, the case study method provides a nuanced understanding that is critical for developing targeted solutions.

Additionally, the interactive research approach complements the case study strategy. Interactive research is action-oriented, aiming to produce actionable knowledge that can inform policy, practice, or social change (Reason & Bradbury, 2001, p 14). It emphasizes reflexivity, encouraging both researchers and participants to reflect critically on their assumptions, perspectives, and roles. This approach is particularly beneficial in a dynamic business environment like COMPANY X, where the goal is to address practical issues and implement effective changes.

3.2 Data Collection Methods

Qualitative research methods were chosen for their ability to capture rich, detailed information about the complex and context-dependent phenomenon of inventory management at COMPANY X. Data collection involved multiple methods, including unstructured interviews, observations, focus groups, and document analysis. These methods allow researchers to gather com-

prehensive data in natural settings, providing a holistic view of the problem (Creswell & Poth, 2017, p. 43).

Unstructured interviews were the primary data collection method. These interviews are advantageous because they allow participants to express themselves freely, yielding detailed data that captures nuances and complexities not easily captured by structured methods (Kvale & Brinkmann, 2009, p. 123). Unstructured interviews provide deep insights into participants' thoughts, feelings, and lived experiences, offering a more profound understanding of the phenomenon under study (Kvale & Brinkmann, 2009, p.125). They also enable researchers to explore new ideas and hypotheses that may emerge during the interview process, leading to serendipitous discoveries and novel insights (Seidman, 2006, p. 10).

For this study, unstructured interviews were conducted with key stakeholders at COMPANY X, including a factory manager, a tea factory officer, a tea factory supervisor, and three randomly selected factory workers. These interviews were held remotely via video conference, video calls, and audio calls. The interview questions were developed based on observations of internal company records and relevant literature, focusing on three main categories: raw material quality, machine maintenance, and end product quality.

3.3 Research Process and Results

The research process was designed to systematically address the problem of excessive inventory losses at COMPANY X. The data collection methods were carefully selected to gather relevant information, which was then organized and analyzed to identify root causes and develop potential solutions. The process involved several stages;

3.3.1 Data Collection

Qualitative data was collected through unstructured interviews and company records. Interviews were conducted remotely, and the survey focused on identifying reasons for inventory losses. Interview questions were formed based on three main categories: raw material quality,

machine maintenance, and end product quality. Data was collected from internal company records and interviews with employees from different employment levels and job categories.

3.3.2 Qualitative Analysis Process

Thematic analysis was employed to analyze the collected data. This method involves systematically coding and categorizing data to identify recurring themes that capture important aspects of the phenomenon under investigation (Braun & Clarke, 2012, p.57). “An organized compressed, assembly of information that permits conclusion drawing and action” (Miles & Huberman, 1994, p.11) Accordingly the thematic analysis process consists of three link stages, i.e. data reduction, data display and data conclusion drawing depicted in figure 3.1

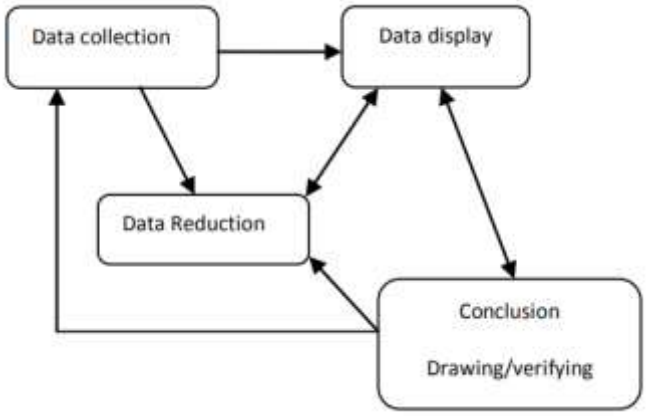


Figure 3.1: Component of data analysis: interactive model in Miles & Huberman (1994, p.12)

Thematic analysis is a widely used qualitative method for identifying, analyzing, and reporting patterns or themes within qualitative data. It involves systematically coding and categorizing data to identify recurring themes that capture important aspects of the phenomenon under investigation. Thematic analysis can be applied to various types of qualitative data, including interview transcripts, survey responses, focus group discussions, and written texts. The collected data through the survey and interviews were analyzed by applying a qualitative analysis process. “Thematic Analysis (TA) is an accessible, flexible, and increasingly popular method of qualitative data analysis.” (Braun, & Clarke, ,2012, P. 57). Accordingly, the stages of the analysis pro-

cess of the study explained in several stages. The analysis process consisted of several stages briefly explained in below;

- Data Preparation

Interviews and observations of company documents constituted the major part of data generation. The data was reviewed and organized for analysis, and a reduction table was prepared.

- Familiarization with Data

Interview transcripts and company data were read multiple times to gain an understanding of the problem. Initial notes and observations were made to familiarize the data regarding excessive inventory losses.

- Initial Coding

Meaningful units of text related to inventory management, quality management, inventory write-offs, raw material quality, machine maintenance, and end product quality were identified and recorded.

- Generation of Themes

Codes were grouped into broader themes based on similarities and patterns identified across the data. Three main themes were identified: raw material quality, machine maintenance, and end product quality

- Review and Refinement

Themes were reviewed and refined through an iterative process. Data was systematically organized under the three main themes.

- Interpretation and Analysis

Findings were interpreted within the broader context of the research objectives. The analysis revealed critical insights into the factors contributing to excessive inventory losses at COMPANY X. Raw material quality, machine maintenance, and end product quality were identified as significant areas requiring attention.

- Reporting Results were reported clearly and concisely.

The data collected revealed three primary factors contributing to excessive inventory losses: raw material quality, machine maintenance, and end product quality. Each of these themes presents unique challenges and opportunities for improvement.

3.3.3 Fishbone Diagram

Finding out proper root causes for the identified problem will be more important in finding suitable solutions for the problem. In this the Fishbone Diagram which is also called “Cause and effect diagram” or the “Ishikawa Diagram” will be very much useful. The Ishikawa diagram is one of the non-numeric tools that help us discover the important links between the various variables and the possible causes that influence a particular problem. The diagram provides a graphical illustration of the link between a result and the factors that determine this result, and also helps to address the causes and eliminate those. (Luca & Luca, 2019, P. 5)

3.4 Justification of the Research Strategy and Methods

The chosen research strategy and methods are justified by their ability to provide a comprehensive and detailed understanding of the complex issue of inventory losses at COMPANY X. The case study approach allows for an in-depth exploration of the problem within its specific context, which is crucial for developing effective solutions. The interactive research

approach ensures that the study remains action-oriented and relevant to practical applications, fostering meaningful changes within the company.

The qualitative data collection methods, particularly unstructured interviews, are appropriate for capturing the nuanced and context-dependent nature of the problem. These methods enable the collection of rich, detailed data that can reveal underlying factors and lead to actionable insights. The thematic analysis process ensures that the data is systematically analyzed, allowing for the identification of key themes and patterns that inform the development of targeted solutions.

It can be concluded that the research strategy and methods employed in this thesis are well-suited to address the research problem. They provide the necessary depth and flexibility to explore the complex phenomenon of inventory losses at COMPANY X and develop feaciable solutions to mitigate these losses.

The fishbone diagram is used to find root causes of the study due to its structured approach, visual representation, collaborative nature, focus on root causes, emphasis on cause-effect relationships, and ease of use. By leveraging this tool, COMPANY X can systematically identify and address the underlying issues contributing to inventory losses, leading to more effective and sustainable solutions.

4 Research Process and Results

The aim of this study is to provide insights to overcome the problem of excessive inventory losses in COMPANY X. Based on the research problem of excessive inventory losses faced by the COMPANY X, the data sources were identified and data collection methods were designed. Relevant data is collected, organized systematically and analyzed to find root causes for the problem. After the identification of root causes, the possible solutions were developed based on the literature and the analyzed data. When considering the study of minimizing unnecessary inventory losses in COMPANY X, the case study method is the most suitable strategy for researching the problem. Therefore, in this study, the case study research strategy is used.

4.1 Data Collection

Required qualitative data was collected through unstructured interviews and company records. Unstructured interviews were conducted remotely as video conference, video calls and audio calls during 25.02.24 -8-03-24 and the interviews focused on finding reasons for the inventory losses, current practices, procedures and documents maintained by the company.

The interview questions were developed under three main categories;

1. Raw material quality
2. Machine maintenance
3. End product quality

According to above main categories, the interview questions and sub questions were developed. (Appendix 24)

Data is collected referencing internal company records and interviews with employees. Interviewees were selected from different employment levels and different job categories. Accordingly, a Factory manager, tea factory officer, tea factory supervisor and randomly selected three

factory workers were interviewed. Unstructured interviews were conducted using open ended questions.

4.1.1 Interviews

Based on the literature and the in co-operation with the Financial Manager of the COMPANY X, the interviews were designed. Accordingly, excess inventory losses, raw material quality, machine maintenance and end product quality related literature are used to design questions and areas of survey to find root causes and develop possible solutions. The content of online interviews was recorded with the prior consent of interviewees and the anonymity is kept throughout reporting.

The interview questions used to gather the necessary data and allow the interviewees to express their ideas freely. To observe the fact and figures related to the case, several documents were referred. The relevant data is taken from several internal company records. (Appendix 25) The Document Summary table, Appendix contains all references of relevant facts and figures which were taken from company data management system. These data were provided by the factory manager while having the interview with the approval from the finance manager and the Managing Director of the company.

The table (Appendix 26) summarizes key findings from interviews conducted with various personnel within COMPANY X regarding inventory management, raw material quality, machine maintenance, and end product quality.

Inventory Management

- The average inventory value from 2020 to 2022 was Rs. 110 million.
- The average inventory write-off value during the same period was Rs. 12 million.
- Inventory write-offs accounted for approximately 11% of inventory values.

Raw Material Quality

- The expected good green leaf quality percentage level is 65%.
- The average actual good green leaf quality percentage level from 2020 to 2022 was 58%.
- The negative variance in good leaf quality percentage was 7%.
- The current raw material selection procedure involves selecting sample batches from random lorry loads to check quality levels.

Machine Maintenance

- The tolerable machine breakdown hours per year for the company are 288.
- The average actual machine breakdown hours from 2020 to 2022 were 614.
- The negative variance in machine breakdown hours was 326 per year, representing a 113% deviation.
- There was a lack of a proper machine maintenance work plan within the company.

End Product Quality

- The average tolerable end product quality rejections per year are 6,000.
- The average actual end product quality rejections from 2020 to 2022 were 17,900.
- The negative variance in annual average end product quality rejections was 11,900 per year, representing a 199% deviation.
- The company currently lacks a specifically defined system to ensure end product quality.

The interviews and the observation of the provided facts and figures revealed significant discrepancies between expected standards and actual performance in inventory management, raw material quality, machine maintenance, and end product quality. These findings underscore the

need for systematic improvements across these areas to reduce inventory losses and enhance overall efficiency and product quality within COMPANY X.

4.1.2 Data Preparation

In this study, interviews and observation of company documents became the major part of data generation with regard to the case of excessive inventory losses in the COMPANY X. After studying the literature with regard to the background of the case the interview questions were drafted. Unstructured interviews were taken place and employees from different backgrounds and from different layers of the company were interviewed. The interview questions were designed to gather data relevant to the case and consist of open-ended questions related to inventory management system of the company with regard to input, manufacturing process and the output processes. The interviews were recorded and transcribed. The company data which the author referred for this study was extracts from the company internal data resources which was provided by the managerial layer members, with the consent of relevant officials of the COMPANY X. All relevant facts and figures were provided at the interview. The author could observe the data and use relevant data for this study. Transcripts of interviews and facts and figures gathered from company documents was carefully reviewed and organized for analysis. Accordingly, a reduction table is prepared (Appendix 26).

4.1.3 Familiarization with Data

The interview transcripts were read multiple times to gain an understanding of the nature of the problem. The facts and figures provided by the interviewees and the extracts from the company data was read multiple times. Familiarize themselves with the data by reading through the transcripts multiple times helps to familiarize the data regarding the case of excessive inventory losses. To gain an understanding of the content of the interviews, data gathered from the company documents were recorded. Initial notes and observations were developed in this stage.

4.1.4 Initial Coding

In this stage, several units of texts related to the study were identified. Accordingly, the meaningful units of text were recorded from the gathered data which is related to the inventory management system, quality management system, inventory write-offs, raw material quality, machine maintenance and the end product quality.

4.1.5 Generation of Themes

Codes will be grouped into broader themes based on similarities and patterns identified across the data. According to the interview data which was initially coded, the three themes were identified, that is raw material quality, machine maintenance and end product quality. These themes represent the main areas to be considered while studying the main issue and also the structure to the data. A study framework is developed accordingly.

4.1.6 Review and Refinement

Themes were reviewed and refined through an iterative process. Data was clearly labeled under the three main categories, raw material quality, machine maintenance and end product quality. Each piece of data was carefully labeled and categorized under the three main themes that are raw material quality, machine maintenance and end product quality. Accordingly, the data was systematically organized and the themes are accurately focusing on the issues related to inventory losses in Company X.

4.1.7 Interpretation and Analysis

After studying the relevant literature and the gathered data, the interpreting of findings taken place within the broader context of the research objectives. To analyze the implications of the

identified themes, drawing connections between them and offering insights into the underlying factors contributing to inventory losses and inventory write–offs.

The analysis revealed critical insights into the factors contributing to excessive inventory losses at COMPANY X. According to the study framework, raw material quality, machine maintenance, and end product quality highlight significant areas that require attention for improving inventory management. The systematic analysis and interpretation of data provided a clear understanding of the root causes and potential solutions for the inventory management issues faced by the company.

4.2 Overview of Company X

COMPANY X is a tea manufacturing company and has three tea manufacturing factories located in different parts of Sri Lanka. The output of the company is exported and they obtain Sri Lanka Tea Board Tea Ratification approval for each sales order separately. The balance amount of the tea manufacture of COMPANY X is sold through the Sri Lanka Tea Auctions and a very small proportion of the tea manufacture is sold to local buyers adhering to the guidelines and the approvals of the Sri Lanka Tea Board. COMPANY X is a company that generates Rs. 450 Mn to Rs. 500 Mn revenue per year approximately. COMPANY X has 60 employees approximately and a labor carder of 160 approximately. The company produces two types of main tea types. They are Orthodox tea and CTC tea. Under both of these types there are broader two categories of tea called main tea grades and off grades. Orthodox tea main grades comprise sub tea grades such as, OP, OP1, OPA, FBOP, BOP, BOP1, BOPF, Pekoe, etc. Orthodox tea off grades comprises sub tea grades such as, Dust, BM, FNGS, BOPIA, etc. On the other hand, CTC tea main grades comprise sub tea grades such as, PD, PF, PF1, etc. Also, CTC tea off grades comprise sub tea grades such as, Dust, Dust 1, etc.

4.2.1 Organizational Analysis

In analyzing COMPANY X, the relevant information was collected from the internal sources of the company and the interviews had with the managerial level employees. After conducting the interviews and referring the company details, the data was collected and the analysis was taken place. The information was provided by a factory manager of the company who is in the senior managerial level position. Also, the information collected from the interviews had with other managerial level employees been used in the organizational analysis.

4.2.2 Porter's Five Forces Analysis

The table 4.1 depicts the organizational analysis according to the Porter's Five Forces theory.

Porter's Five Forces	Affect	Analysis
Threat of new entrants	Medium	Influenced by the need for established tea plantations and export infrastructure. The presence of entry barriers such as the need for agricultural land, knowledge of tea cultivation, and export channels can deter potential new entrants.

Porter's Five Forces	Affect	Analysis
Bargaining Power of Suppliers	Moderate	The bargaining power of suppliers is moderate. The industry consists of a mix of large tea estates and smallholder tea farmers. Whole large estates have more bargaining power. Whereas huge domains may have more bargaining control the nearness of numerous smallholder ranchers can give choices to source tea takes off which can adjust the control energetic.
Bargaining Power of Buyers	Moderate	Whereas huge domains may have more control the nearness of numerous smallholder ranchers can give choices to source tea takes off, which can adjust the control energetically.
The threat of substitute products	Low	The threat of substitute products for Ceylon tea is low. Ceylon tea is known for its unique flavour profile and quality, making it difficult for other products to directly substitute it.
Rivalry Among Existing competitors (Moderate)	Moderate	Competition exists both in the global and specialty markets. Factors contribution to rivalry includes product quality, brand reputation, marketing strategies and market share.

Table 4.1 Porter's Five Forces Analysis of Company X

After analyzing the COMPANY X using Porter's Five Forces Analysis method, the identified problem or the operational issue of the company is analyzed in detail with the internal company information, etc. by giving consideration to see the significance of the problem by analyzing the cost and benefits of solving or mitigating the negative impact of such issue and the corresponding impact to the company. Table 4.2 explains the SWOT analysis of the Company X.

Potential Strengths	Potential Weaknesses
• Availability of strong cash flows to finance company working capital requirements provided by the Parent Company. • Competitive advantage over most of the other tea manufacturing factories in solidity in business model. • Highly motivated employees. • Strong sales & marketing arm in parent company.	• Inability of the company to control & mitigate the existing excessive inventory write-offs. • Week operational process that leads to excessive inventory write-offs affecting company profitability. • Inability to maintain quality raw material intakes. • Excessive machine breakdowns due to poor machine maintenance. • Heavy end product quality rejections due to end product quality issues.
Potential Opportunities	Potential External Threats
• The opportunity to expand the company's business operations in Sri Lanka by establishing a fully fine-tuned business operation without cash flow leakages.	• In the long run if company is continuously making losses due to excessive inventory write-offs, the parent company may consider a different business model.

• The opportunity to make strong supplier partnerships to maintain raw material quality. • Opportunity to implement proper systems and to mitigate excessive machine breakdowns. • Opportunity to implement proper end product quality assurance system to improve the end product quality. • Opportunity to put proper systems in place to reduce excessive inventory-write-offs.	• Operational issues in manufacturing division de motivate manufacturing employees and be a reason for them to leave and join competitors. • Excessive end product rejections can destroy the product brand name. • Suppliers with poor raw material quality can destroy the total company business plans and targets.

Table 4.2 SWOT Analysis of Company X

4.2.3 Strengths

Since COMPANY X is well equipped with strong cash flows in business operations, the existing losses incurred by the company as inventory write-offs have not been taken in to consideration as a massive issue and they have not prioritized this issue in finding solutions compared to the existing other business matters. Also, from the other hand COMPANY X is a fully owned subsidiary company of COMPANY X which is a USA based company focusing on tea export sales and export markets. Therefore, the business solidity of COMPANY X is guaranteed. But as far as the numbers are concerned it is fully worth for the company to seriously look in to this operational issue of excessive inventory write-offs and to save the company business value addition for the shareholders. The highly motivated employees are another key strength of COMPANY X.

4.2.4 Weaknesses

The company's management has not been able to mitigate the negative financial impacts coming from the excessive inventory write-offs incurring in the company. Also, the company has not been able to take timely actions to strengthen the internal control procedures of the company that are suitable to monitor and mitigate the financial losses incurring due to excessive inventory write-offs. Also, the company has not been able to maintain a continuous flow of proper quality raw materials which destroys the end product quality. In the same way, they have not placed a proper system in place for machine maintenance which has led to excessive machine breakdowns. The end products of the company have suffered in quality results many end product quality rejections for the company.

4.2.5 Opportunities

The company has very strong finance cash flows as a result of the strong market position and the export sales coordinated by the parent company. As a result, if the COMPANY X could strategize to make sure the company is not losing cash flows due to unnecessary excessive inventory write-offs, then they could easily convince the parent company to expand their business operations in Sri Lanka. Also, they have the opportunity to maintain proper partnerships with suppliers to maintain a continuous raw material flow with minimum quality. They can place proper machine maintenance system in factories to reduce existing machine breakdowns drastically. Also, they can easily place a proper end product quality assurance system in place and improve their product quality to a greater level.

4.2.6 Threats

In time to come if COMPANY X could not stop excessive inventory write-offs in the company, at one point of time the parent company can plan for a different business model and consider a different business arrangement in Sri Lanka that could generate more value for them than COMPANY XE. Also, the operational issues in manufacturing division de motivate the employees and be a reason for them to leave the organization and join the competitors. Excessive end

product quality rejections could easily destroy the brand image of the products. Also, the poor-quality raw material suppliers can easily destroy the company business plans and targets.

4.3 Key Problem

COMPANY X has been experiencing many cash losses due to the excessive inventory losses which can be calculated as inventory write-offs. The company is experiencing excessive Inventory write-offs that they had been charging to Profit and Loss statements of the company for many years. As per the parent company's core business model operated at the moment, having the backward integration with COMPANY X to have own tea manufacturing arm has been a crucial requirement which has a direct relationship and a direct link to their sales and marketing model. Therefore, continuing the COMPANY X manufacturing arm without making unnecessary burdens and losses to the overall group business is a mandatory requirement.

Therefore, at the moment COMPANY X management is evaluating various mechanisms & options to mitigate such excessive inventory write-offs that are resulting massive cash losses to COMPANY X. The amount of such losses incurred in COMPANY X due to excessive inventory write-offs as an average for last three years were about 11.46 % of the inventory values at the year ends and in value such losses were around Rs 12.6 Mn per year in average. Therefore, finding out significant root causes for these inventory write-offs is very important for COMPANY X operation. Then COMPANY X can implement corrective actions where necessary as soon as possible.

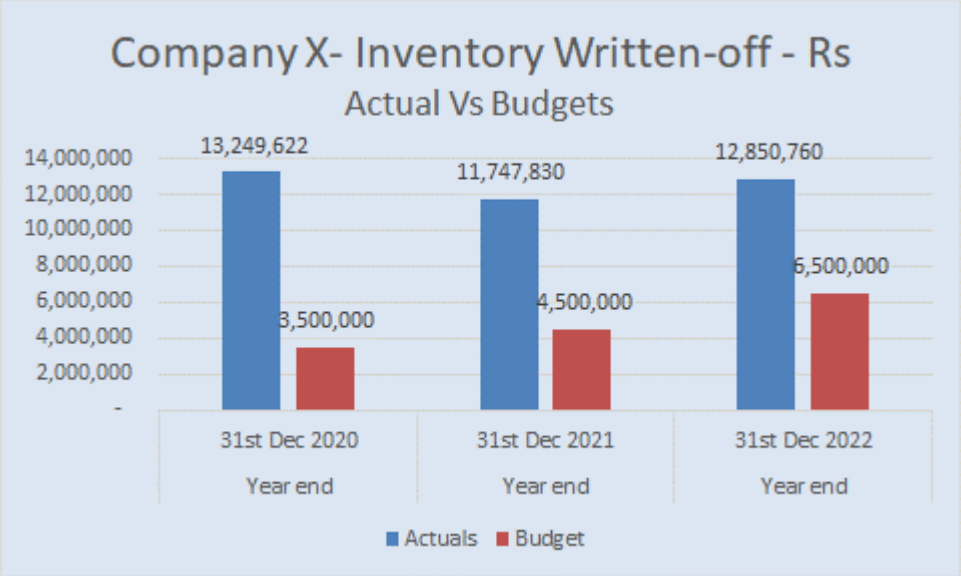
4.4 Description of the Problem

The table 5.3 and the figures mentioned under the topic description of the problem depicts the existence of a massive problem within the company's business operation and explains the magnitude of the excessive inventory losses that COMPANY X has been experiencing for the past years.

Description	Year end 31st Dec 2020	Year end 31st Dec 2021	Year end 31st Dec 2022	Average for 3 years
Inventory Value (Before write-off) - Rs	90,914,945	115,469,527	123,833,933	110,072,802
Inventory Written-off - Actuals - Rs	13,249,622	11,747,830	12,850,760	12,616,071
Inventory Written-off as a % of Inventory - Rs	14.57%	10.17%	10.38%	11.46%
Inventory Write-off - Annual Budget - Rs	3,500,000	4,500,000	6,500,000	4,833,333

Source: Company data

Table 4.3: COMPANY X's Inventory Write-offs Actual Vs Budgeted & as a % of inventory values from year 2020 to 2022



Source: Company Data

Figure 4.1: COMPANY X's Inventory Write-offs from year 2020 to 2022 in graphical form – Actual Vs Budgeted

As per the above company data we can see the significance of the COMPANY X's problem they are experiencing due to excessive inventory write-offs. There are massive differences in actual inventory value written off compared to the annual budgeted values. As far as the last three-year averages are concerned the inventory write-offs have represented 11.46% of the period end inventory value which is amounting to Rs. 12.6 Mn as the last three-year average. This confirms that COMPANY X is burning a significant amount of business cash and profits as a result of inventory write off. This problem is becoming so serious, since every year end, the company has

happened to do an inventory write-off with the existing operational practices. Therefore, the company needs to find solid solutions to mitigate the massive negative impact of this problem.

When analyzing the internal company records in COMPANY X to find out details with regard to this operational issue in COMPANY X, it was further found that some of the other related areas having concerns with performance gaps. One such related area was the raw materials quality of the company which has a direct link to the end products or to the tea stocks of the company. The following figure 2.3, 2.4 & 2.5 represents such performance gaps clearly in terms of expected and actual green leaf quality percentages. The expected raw material (Green Leaf) good leaf percentage is said to be 65% as far as the tea industry norms are concerned. But there were massive variances observed when looking at the actual good leaf percentages of the company raw materials. This variation of expected versus actual green leaf raw materials good leaf quality represented a 7% performance gap (65% - 58%) as far as the three years 2020, 2021 & 2022 averages were concerned which is huge in value.

	Year ending 31st Dec 2020	Year ending 31st Dec 2021	Year ending 31st Dec 2022	Average for 3 years
Green Leaf - Expected Good Leaf Quality (Tea Industry Standard)	65%	65%	65%	65%
Green Leaf - Actual Good Leaf Quality	58%	60%	57%	58%
Good Leaf Quality Variance	-7%	-5%	-8%	-7%

Source: Company Data

Table 4.4: COMPANY X's Raw Material (Green Leaf) Quality – Expected Good Leaf Quality (Tea Industry Norm) compared to Actual Good Leaf Quality (Annual Averages)

Source: Company Data

Figure 4.2: COMPANY X's Raw Material (Green Leaf) Quality – Expected Good Leaf Quality (Tea Industry Norm) compared to Actual Good Leaf Quality (Annual Averages)

Month	Year ending 31st Dec 2020	Year ending 31st Dec 2021	Year ending 31st Dec 2022	Average for 3 years
Jan	56%	60%	56%	57%
Feb	57%	60%	57%	58%
Mar	56%	60%	58%	58%
Apr	58%	56%	59%	58%
May	60%	60%	59%	60%
Jun	57%	58%	58%	58%
Jul	56%	59%	58%	58%
Aug	58%	60%	57%	58%
Sep	58%	63%	58%	60%
Oct	59%	60%	57%	59%
Nov	60%	59%	56%	58%
Dec	57%	60%	56%	58%
Full Year	58%	60%	57%	58%

Source: Company Data

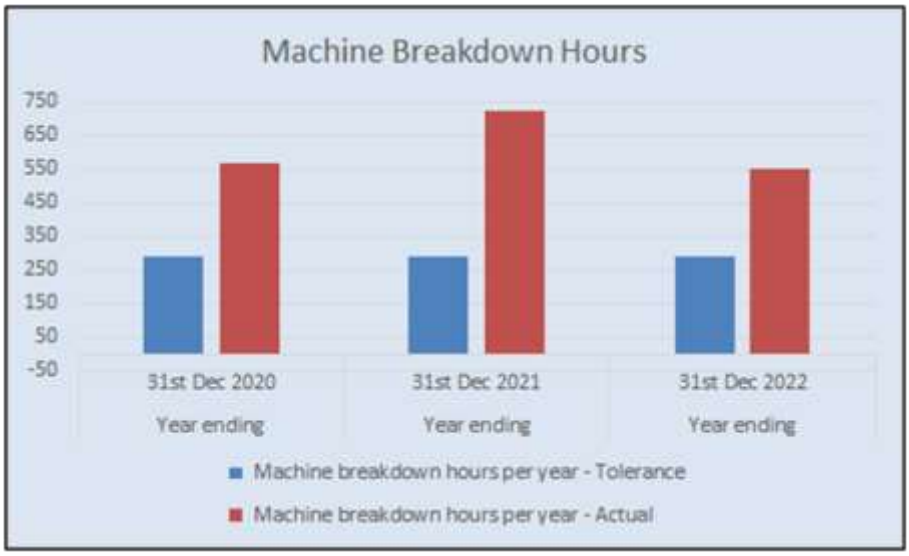
Table 4.5: COMPANY X's Raw Material (Green Leaf) Actual Good Leaf Quality Percentages (monthly and annual averages)

In the same way the internal company records of COMPANY X represented another concerning area with performance gaps that has connections to the COMPANY X's main problem of excessive inventory write-offs. That is the number of machine breakdown hour tolerance of the company per year and the actual machine breakdown hours per year incurred. Machinery breakdown hours of a company may affect the end product quality of the company in multiple ways. Being a tea manufacturing company, in COMPANY X tea factories there are many machines involved in tea manufacture. This machine process includes tea withering machines, tea rolling machines, tea drying machines, tea sorters, tea color sorters and so on. COMPANY X has experienced many machine breakdown hours in all of these machines altogether. In tea manufacturing, machines like tea driers, tea withering machines and tea rolling machines are very critical machine points to make a good quality end product. But when there is a machine breakdown, the tea stocks that are getting processed in such machine can have drastic impacts on its quality. Sometimes, when the tea drier machines get breakdowns, the tea processing in the machine can get over fired and can get burnet drastically and can get damaged heavily. Also, if a withering machine comes across a machine breakdown, the tea in that machine can get drastically damaged resulting a poor-quality end product. Therefore, in that way these machine breakdowns can damage the tea end product quality drastically that will eventually lead to inventory write-offs at the year end. The following figures 2.6, 2.7 & 2.8 represent such tolerated and actual machinery breakdown hours and the related performance gaps for the years 2020, 2021 and 2022 both monthly and annually. This performance gap between the actual and the tolerated number of machine breakdown hours represented a variance of almost 113% (326 hours) as far as the three-year results for 2020, 2021 & 2022 were concerned which was huge in value.

	Year ending 31st Dec 2020	Year ending 31st Dec 2021	Year ending 31st Dec 2022	Average for 3 years
Machine breakdown hours per year - Tolerance	288	288	288	288
Machine breakdown hours per year - Actual	568	722	551	614
Current Variance in Machine Breakdown Hrs	-280	-434	-263	-326
Current Variance in Machine Breakdown Hrs - as a %	-97%	-151%	-91%	-113%

Source: Company Data

Table 4.6: COMPANY X's Machine Breakdown Hours – Tolerance Level Vs Actual (Annually)



Source: Company Data

Figure 4.3: COMPANY X's Machine Breakdown Hours – Tolerance Level Vs Actual (Annually)

Month	Year ending 31st Dec 2020	Year ending 31st Dec 2021	Year ending 31st Dec 2022	Average for 3 years
Jan	72	48	63	61
Feb	48	76	36	53
Mar	42	72	14	43
Apr	24	66	12	34
May	72	48	44	55
Jun	60	36	69	55
Jul	56	72	48	59
Aug	48	32	14	31
Sep	30	72	60	54
Oct	62	84	72	73
Nov	20	44	72	45
Dec	34	72	48	51
Full Year	568	722	551	614

Source: Company Data

Table 4.7: COMPANY X's Machine Breakdown Hours – Actual - monthly and annual totals

Also, the further analysis of the internal company records revealed that COMPANY X had been experiencing product quality rejections from Sri Lanka Tea Board and from their customers which represented the following performance gap during years 2020, 2021 & 2022 as depicted in figures 2.9, 2.10 & 2.11 respectively. This was a performance deviation of 199% compared to company tolerance level when the actual three-year product quality rejections for 2020, 2021 & 2022 were concerned which is huge in value.

	Year ending 31st Dec 2020	Year ending 31st Dec 2021	Year ending 31st Dec 2022	Average for 3 years
Product Quality Rejections per year - Tolerance (kg)	6,000	6,000	6,000	6,000
Product Quality Rejections per year - Actual (kg)	16,650	19,350	17,750	17,917
Current Annual Variance in Product Quality Rejections (kg)	(10,650)	(13,350)	(11,750)	(11,917)
Current Annual Variance in Product Quality Rejections (kg) as a %	-178%	-223%	-196%	-199%

Source: Company Data

Table 4.8: COMPANY X's Annual Product Quality Rejections – Tolerance Level Vs Actuals (in kgs)

Source: Company Data

Figure 4.4: COMPANY X's Annual Product Quality Rejections – Tolerance Vs Actuals (in kgs)

Month	Year ending 31st Dec 2020	Year ending 31st Dec 2021	Year ending 31st Dec 2022	Average for 3 years
Jan	1,800	4,000	500	2,100
Feb	700	1,800	3,000	1,833
Mar	1,600	1,500	1,400	1,500
Apr	900	900	1,500	1,100
May	600	1,000	2,000	1,200
Jun	450	1,500	500	817
Jul	800	700	1,200	900
Aug	1,400	300	1,600	1,100
Sep	2,000	2,250	900	1,717
Oct	700	2,500	2,400	1,867
Nov	2,100	2,000	2,000	2,033
Dec	3,600	900	750	1,750
Full Year	16,650	19,350	17,750	17,917

Source: Company Data

Table 4.9: COMPANY X's Product Quality Rejections – Actuals – monthly and annual totals (in kgs)

4.5 Analysis of the problem

In this research the identified operational issue of the organization is excessive inventory write-offs at COMPANY X. As per the root course analysis done by way of a fish bone diagram identified three major areas that require in depth study in finding solutions to the issue. Such root courses are raw material quality, machine set-up and maintenance and end product quality. By analyzing such root courses, it was found that they are so significant areas to look at and they require immediate suggestions to improve if the operational issue is to be sorted out to a greater level.

According to the relevant literature review carried out in chapter 2, section 2.2, raw material quality. It became evident that maintaining a minimum level of raw material quality is a must in sourcing required raw material to the manufacturing process of the company. In this process

maintaining proper communication & understanding with the raw material suppliers is a crucial requirement. Because the sustainability of any supply chain in any business industry could be ensured only if that proper communication and understanding works well to have a proper mechanism to have a continuous flow of quality raw materials to the manufacturing organization. Then only the quality of the product output can be ensured. In this scenario the raw material is tea green leaves and the processed product is the bulk made tea.

Then the identified second root course of the operational issue was machine set-up and maintenance. The literature review carried out in this chapter also signified the top requirement of having a proper machine maintenance mechanism in a manufacturing organization. A properly planned machinery maintenance plan and a strategy will definitely help a manufacturing organization to keep the overall equipment effectiveness at a very high level. As a result, such organization will be able to have a smooth production line process without disturbing the factory manufacturing capacity while maintaining the required product quality. Especially in a food manufacturing organization it is a mandatory requirement to have an uninterrupted manufacturing flow to have very good unit cost control as well as to have optimized capacity utilization.

Then the third identified root course to the operational issue is end product quality. The analyzed literature in this chapter clarifies the utmost importance to make sure a quality product for any organization. Because the base of the business of a manufacturing organization or even for a trading organization for that matter, having a quality product is a key to sustain in business with the existing competitive and complex business environment. Because the customer satisfaction which is the key for a sustainable business is totally depending on the quality of the products they produce. If you fail in quality, the collapse of the business and the market share against the competition is unavoidable.

Therefore, the detailed literature in this study also proves that the criticality of the identified three root causes for the operational issue at COMPANY X. Therefore, considering those facts the following Study Framework was developed to show the linkage between the COMPANY X's operational issue and the said three root causes as depicted in figure 4.5

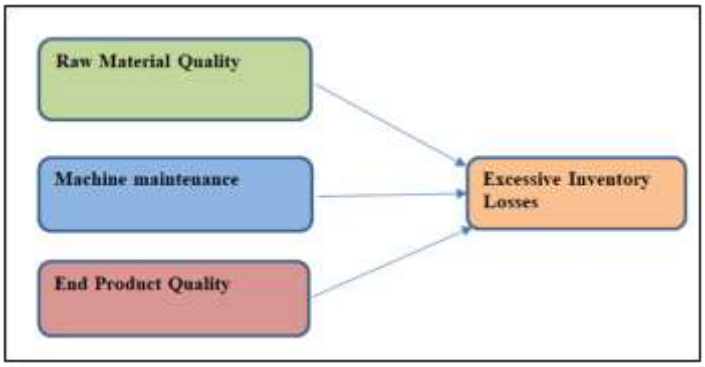


Figure 4.5 Study Framework

The “Fishbone Diagram” depicted in figure 4.6 prepared to find out root causes for the COMPA-NY X’s problem.

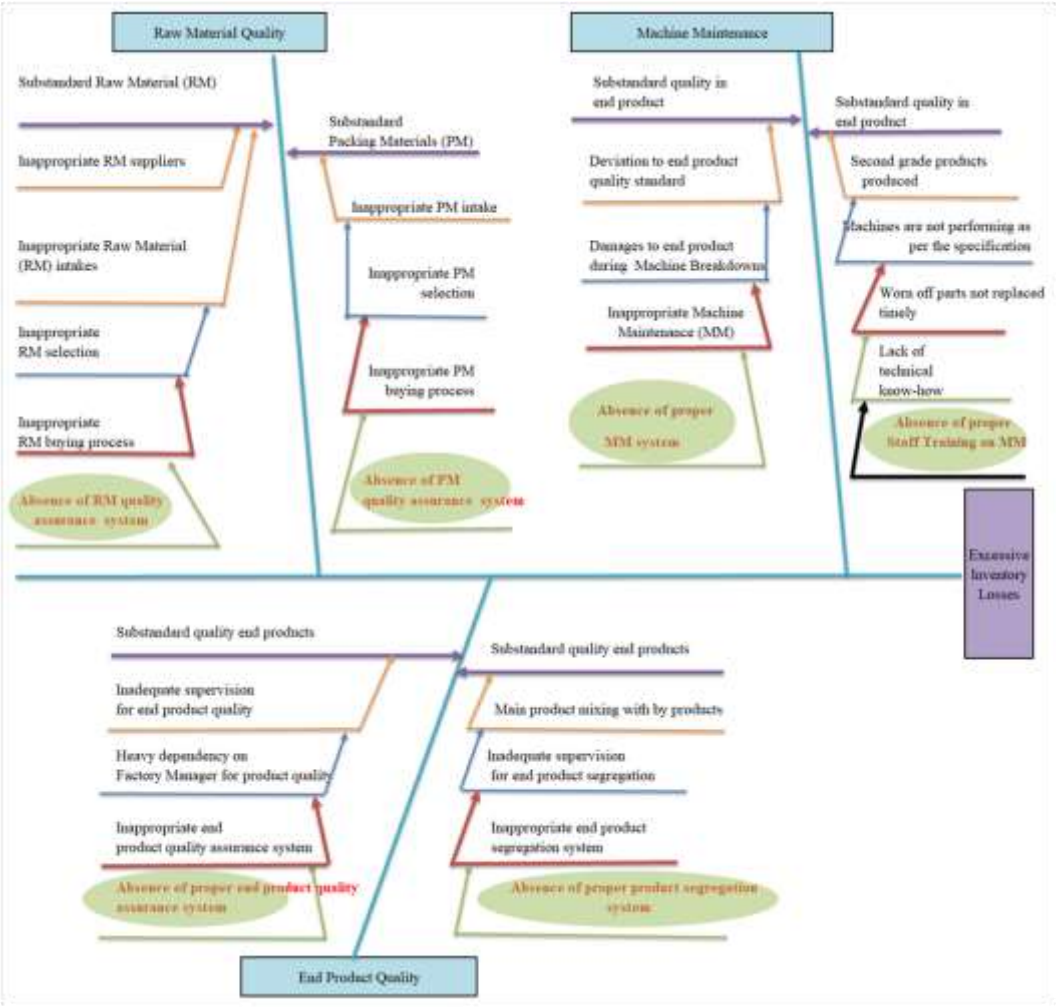


Figure 4.6 Fishbone Diagram-Root course analyses

According to the figure 4.6, Fishbone Diagram the crucial root causes could be identified for the COMPANY X's problem of excessive inventory losses. The inadequate work plans & strategies to establish a quality raw material intake for the company where a massive competition is prevailing among the tea manufacturing factories to buy raw material green leaf. If COMPANY X does not plan & strategies properly & wisely in such a competitive environment, it will definitely result in selection of poor-quality raw material suppliers with low quality raw material intakes coming in to COMPANY X & as a result the end product quality suffers resulting inventory write-offs. At present the raw material selection criteria has not been fine-tuned to the required level to buy only the raw materials with the required quality levels and in correct weight. When buying raw materials in tea manufacturing business, the weighing point is a critical point. At this point accepting the raw material green leaf with the required quality in correct weight is a must. Specially before buying green leaf, the water content in it needs to be judged properly before accepting. If not, we will not be able to mark the correct weight. If the weight is not correct the company has to pay for the water weight as well unnecessarily. Then it will be unnecessary burden on inventory value and sometime later we have to write-off that extra cost to the income statement of the company to correct the inventory value. On the other hand, before buying and accepting green leaf, it is important to identify the damaged & unsuitable green leaf weight. If not, the company has to pay for such damaged & unsuitable green leaf also. Then again, the value of the final inventory will be unnecessarily burdened with such extra costs. As a result, time to time there will be requirements to write off such extra costs coming to the inventory to the income statement.

On the other hand, the factory manager is the key person based in the factory premises full time and he is assigned with the total responsibility to make sure the acceptance of quality raw materials in the correct weight. Therefore, the factory manager has to be smart enough to talk to the suppliers and to negotiate with them in this regard. On the other hand, it is a fact that some of the previous factory managers have been sacked after getting caught for fraudulent activities related to raw material purchasing & payment process. Therefore, it is a must for the factory manager to implement a proper internal control system and a proper monitoring system in the factory when buying raw materials. But unfortunately, COMPANY X has suffered a lot in the absence of such proper system in place, by taking in poor quality raw materials that ended

up with poor quality end products which resulted excessive inventory write-offs for the company.

COMPANY X maintains records to monitor the quality level of the raw material green leaf intakes. This is done based on the selected raw material samples on a daily basis. The expected good quality green leaf raw material percentage of the company has been set as 65% which is the industry standard. In this the company selects samples with about 40 to 50 green leave segments. From that sample they identify the leaf segments with 3 or 4 leaves, then they segregate them as good quality leaf. Then the balance with more than 3 or 4 leaves are segregated as low-quality leaf. Then a percentage for the good quality leaf segment is calculated & recorded which the company expects to be 65%. But unfortunately, the actual average good quality green leaf percentage of the company had been 58% (Table 4.4) as per the last three-year records. Therefore, the available company information shows the significance of the raw material quality issue in the company which has led to the COMPANY X's problem of excessive inventory write-offs.

Non-availability of proper end product quality assurance system in the company also has resulted accumulation of inferior quality products in the company. Also, the company has been heavily depending on the factory manager for product quality but ultimately the product quality has suffered a lot due to inadequate supervision for quality resulting excessive inventory write-offs at COMPANY X. As a result of this the company has experienced massive amounts of inventory rejections from SLTB and their customer. As per the company records this is a 199% (Table 4.8) variance with the company tolerance level of product quality rejections which is massive in value.

Also, the inadequate training has resulted lack of technical know-how in factory staff to properly attend to machine maintenance in the factory machineries by properly attending to timely repairs and maintenance. Also, there had been no proper machine maintenance system in the company. As a result of this the company has experienced massive machine breakdown hours. This is about 614 machine breakdown hours per year (Table 4.6) as an average for last three years which is a 113% performance variance as per the company tolerance level of machine breakdown hours. When there are machine breakdowns the raw material and the products that are in production process get damaged in multiple ways. Specially the tea in drier machines get

heavily damaged in a sudden machine breakdown. Basically, the entire tea load in the drier could catch fire and can get burnt resulting a useless product that ends up with a inventory write-off. As a result of this situation, massive amount of the products in the manufacturing process of the company has suffered a lot in terms of quality as a result of product damages incurred due to many machine breakdowns which was a result of having no proper machine maintenance system in the company. This has been a major reason for the excessive inventory write-offs in COMPANY X.

4.6 Development workshop

The development workshop with COMPANY X regarding the research report on minimizing excessive inventory losses was an important step in addressing the operational challenges faced by the Ceylon tea manufacturer. The workshop held online and focused on discussing the findings and recommendations outlined in the research report, aiming to gather insights from team members and align on strategies for implementation. The development workshop served as a platform for collaborative engagement and alignment among COMPANY X team members regarding the proposed strategies for minimizing excessive inventory losses. The recommendations outlined in the research report were discussed in detail, and action plans were formulated to implement these solutions effectively.

The research problem addressed in the study was the excessive inventory losses experienced by COMPANY X, with the objective of reducing inventory write-offs from an annual average of 11.46% to 4% of the year-end inventory value. The study utilized qualitative methods such as thematic analysis, observations, and unstructured interviews, conducted within the framework of a case study.

During the online workshop, participants joined from different locations remotely engaged in discussions to identified root causes of the inventory losses, namely raw material quality, machine maintenance, and end product quality. The literature review provided insights into potential solutions, such as Total Quality Management (TQM), supply chain management practices, and ISO certifications. Specific recommendations were developed for each study component to address the identified root causes. For instance, under the study component of Raw Material

Quality, recommendations included implementing a raw material quality control system, obtaining regular supplier feedback, and introducing incentives for quality suppliers. Similarly, for Machine Maintenance, recommendations focused on implementing Overall Equipment Effectiveness (OEE) procedures and providing relevant training to staff members.

The workshop discussions also emphasized the importance of monitoring and evaluating the implementation progress of the recommended solutions. Key performance indicators (KPIs) were identified to measure the success of the interventions, such as reducing machine breakdown hours and product quality rejections.

4.7 Generation of solutions

Under the three main study components which were identified, the current situation and the proposed solutions were explained. The table 4.10 describes the link between study component, study objectives and techniques.

No	Study Component	Study Objectives	Techniques
1	Raw Material Quality	To increase the raw material (green leaf) good leaf quality from the current level of 58% to 65% or more good leaf count percentage which is the Tea Industry Standard (This is accounting to a 7% increase).	Good Leaf Count Tests. Obtaining "Regular Supplier Feedbacks" by meeting green leaf suppliers regularly to evaluate and discuss the raw material quality matters. Offering Incentives to good/quality leaf suppliers.
2	Machine Maintenance	To monitor and increase Overall Equipment Effectiveness and thereby to reduce the existing average annual machine breakdown MB) hours from 614 hours per year to 288 hours per year (This is a 113% reduction in MB Hrs.)	Overall Equipment Effectiveness (OEE)

No	Study Component	Study Objectives	Techniques
3	End Product Quality	To reduce the annual average product quality rejections from 17,917 kg per year to 6,000 kg per year (This is a 199% decrease in product quality rejections). To increase customer satisfaction.	Product Certification: ISO 9001 and ISO 22000

Table 4.10: Study Component, Objectives and Techniques

4.7.1 Study component 1: Raw Material Quality

As per the analysis done with the internal company information of COMPANY X, it was evident that the raw material quality (green leaf quality) that had been taken in to the factory for tea processing was not up to the minimum standards that are required. As per the tea industry norm when the tea green leaf raw materials are taken in to the factory, it is expected to maintain a minimum good leaf quality standard percentage of 65%. That means, if we raise a sample of green leaves form a green leaf bulk load, it has to reflect that good leaf percentage of 65%. Also, it has to be the same percentage if samples raised and checked from any corner of that particular green leaf bulk load. This process of sample testing is called as “Good Leaf Count Test” in the tea industry. In this particular sample test, once a tea leaf sample is raised from the bulk supply load, it is divided in to two green leaf segments. One segment is classified as “good leaf” if the green leaf particle is with the top 3 or 4 leaves of a tea plant. And then the other leaf segment is kept separately. Then such good leaf segment and the other leaf segment is counted to see the number of leaf particles. For example, if the leaf sample had 20 leaf particles and from that if 13 particles were classified as “Good Leaf”, then the total leaf sample is identified as a 65% good leaf sample. In this example the other 7 leaf segments can be having more than 3 or 4 leaves of a tea plant. So that, as per the commonly accepted norm in the tea industry, such leaf samples resulting 65% or more good leaf percentage is said to be representing a green leaf load having the expected minimum quality in raw material green leaf.

As far as COMPANY X’s current position is concerned the internal company records have never represented overall 65% good leaf percentage for the raw material green leaf intakes for any

time period specially in last three years 2020, 2021& 2022. The actual three-year annual averages good leaf percentages of the company had been 58% (Figure 4.3) for the years ended 31st December 2020, 2021& 2022. Please see the Appendix 3 for details. The main reason for this situation is that, COMPANY X's raw material purchasing process owners had not taken that extra effort to achieve this 65% good leaf percentage threshold. In other words, the company's raw material purchasing process and the team had allowed the raw material leaf that are representing a good leaf percentage less than 65% to enter the factory for tea processing throughout the years. As a result, COMPANY X had not been able to make sure the required quality in the end products (made tea) and had experienced excessive inventory write-offs at each of the financial year end. Also, COMPANY X had never had close and continuous communications with the green leaf suppliers to obtain regular supplier feedbacks to assess the quality levels of the raw material green leaf supply. At the same time, COMPANY X had not taken any initiative to assess the quality levels of the green leaf suppliers and had never paid any incentives to encourage good quality leaf suppliers for the factory.

- Solution(s) development for Raw Material Quality

Therefore, as far as COMPANY X's current position with regard to their raw material quality level is concerned, it has become a mandatory requirement for the company to strictly adhere to and achieve this 65% good leaf percentage minimum requirement in overall raw material green leaf purchases which has already been an industry norm as well. In this the component objective is to improve the current level of good leaf percentage 58% (Table4.4) by another 7% to reach the minimum standard of 65% good leaf quality. This will be immensely helpful for COMPANY X to achieve the main study objective of minimizing the excessive inventory write-offs in COMPANY X.

The main solution is to carry out good leaf count tests as necessary for each and every green 111leaf bulk supply load. In most of the times green leaf loads are coming to the factory in lorry loads. So that the raw material green leaf receiving officers in the factory must raise sufficient number of leaf samples from each such lorry load coming in to the factory. Approximately raising and evaluating a minimum of 4 or 5 random samples from each lorry load might provide a more accurate evaluation result for each lorry load of green leaves. Then based on such sample

evaluations the company will be able to assess whether such raw material lorry loads are representing 65% or above good leaf percentage. If the overall good leaf percentage is 65% or more, then the company can let that lorry load of raw materials to come in to the factory. If not, if the lorry load is representing a good leaf percentage less than 65% based on the sample evaluation, then even reluctantly the company has to reject such lorry load. In this situation, considering the minimum green leaf intake target requirements, the company can take a calculated risk and allow only a few lorries loads of green leaf that are representing less than 65% good leaf to come in to the factory. This exceptional situation has to be managed with exceptional care having understood the calculated risk of falling behind the raw material quality standards and this is only to make sure the minimum raw material quantity required to maintain the minimum production capacity in the factory in order to absorb the factory overheads in a sustainable manner.

Further, while following this process of improving the raw material quality by doing good leaf count tests the company should parallel implement a proper mechanism to have regular communications and meetings with the raw material green leaf suppliers to have regular supplier feedbacks to evaluate and discuss about the quality standards of the raw materials. In this process, the company has to discuss with suppliers the importance of having a continuous flow of quality raw material intakes with 65% or more good leaf percentages to make sure a quality product in the factory and thereby to make sure a sustainable development in the total supply chain in the tea business. In this effort, the company could consider and pay incentive payments for the suppliers who are willing to supply raw materials with 65% or above good leaf percentage continuously where a win-win situation could be established. By this way the company will be able to create a solid green leaf supplier base that could continuously supply green leaf with 65% or more good leaf percentage which will open up the opportunity to have a more sustainable business for both the supplier and the company or in other words to create a more sustainable supply chain.

Therefore, to arrest this critical situation the solution development suggested by the author is as follows.

i. Agreeing the format and preparation of “Good Leaf Count Test Sheet” to check raw material green leaf samples (Appendix 4).

ii. Completing “Good Leaf Count Test Sheet” for each and every raw material lorry load by raising green leaf samples. Then, checking the sample test results and approval or rejection of the green leaf lorry load.

iii. Scheduling a “Green Leaf Supplier Monthly Meeting Plan” to meet green leaf raw material suppliers to obtain “Regular Supplier Feedbacks” and to discuss raw material quality matters (Appendix 5).

iv. Execution of the raw material supplier meeting plan to obtain supplier feedbacks and updating “Green Leaf Supplier Meeting Discussion Point Summary Sheet” (Appendix 6).

v. Identifying good leaf raw materials suppliers and making arrangements to pay incentives to motivate them and to make sure continuous supply of quality raw materials. The format to be used in this is “List of good leaf suppliers for incentive payments” (Appendix

4.7.2 Study component 2: Machine Maintenance

As per the existing situation, the observation of the internal company records of COMPANY X represented a huge number of machine break down hours during many months of the year. As an average COMPANY X had approximately 614 (Table 4.6) machine breakdown hours per year as far as last three-year records were concerned. Please see the Appendix 8 for details. There had not been a proper machine maintenance work plan in COMPANY X in the past. As a result of this situation COMPANY X’s many of the tea stocks have happened to be written-off due to damages specially in drier machine process due to excessive machine breakdown hours resulting due to poor machine maintenance. Please see the Appendix 8 for details. In tea manufacturing process there are specific set of tea machineries that are being used. Please see the Appendix 10 for details. In this the tea drier machine is a more critical machine in the production process. Tea drier is used to take the moisture content out as required from the raw material green leaf to make the final made tea product. If the tea drier machines are not in order or having breakdown issues as a result of poor maintenance and all that there can be massive losses to the tea stocks. Basically, the tea stocks could be burnt out drastically resulting unnecessary discards and write-offs to tea inventories. Therefore, under this study component the main objec-

tive is to bring down the machine breakdown hours (specially including the drier machine) by 113% to bring it back to the tolerated level of machine breakdown time of the company.

- Solution(s) development for Machine Maintenance

Therefore, in this situation COMPANY X has to focus more on Overall Equipment Effectiveness (OEE) a lot to bring down the machine breakdown hours by 113% which is the key objective under this study component that will eventually support the main objective of the company to reduce unnecessary damages to tea stocks and thereby to reduce excessive inventory write-offs in COMPANY X.

In this process of measuring and controlling OEE, there are main three aspects to look at. They are availability, performance and quality. There are standard formulas to compute and monitor each of these segments in OEE. Under this study in evaluating OEE, the major concern is to be given to the third component of OEE which is “Quality” and that is more crucial to solve the main problem in COMPANY X which is to reduce excessive inventory write-offs in the company. When the machine maintenance is done with a proper plan under OEE, COMPANY X should be able to achieve the key objective of this study component to reduce machine breakdown hours by 113% to bring it down to the company tolerated level. And as a result, they will be able to maintain a good quality product coming out of the machines and thereby to support the main objective of the study to reduce excessive inventory write-offs in COMPANY X. Further, by this way COMPANY X would be able to improve their OEE of the company to the highest possible level which could be represented as follows.

OEE = Availability * Performance * Quality

Therefore, to arrest this situation the solution development suggested by the author is as follows.

a. Agreeing the format and preparation of Overall Equipment Effectiveness (OEE) Computation Sheets (Appendix 11).
b. Providing OEE training programs to Factory Manager and the senior officers in the tea factory operation.
c. Updating OEE documentation requirements regularly as required and assessment of the report findings and providing corrective action plans as necessary.

4.7.3 Study component 3: End Product Quality

Sri Lanka Tea Board (SLTB) is the main governing body in Sri Lanka who controls the quality of the teas sold in the country. From a national business importance point of view this is a very crucial requirement for the sustainability of the Sri Lankan tea industry. Because the world demand for Sri Lankan tea had been there for many years based on the quality of the teas exported from the country. Periodically the officers from Sri Lanka Tea Board carry out physical quality checks of the teas manufactured by tea manufacturing companies in Sri Lanka. This is a sample-based quality checking process carried out by SLTB. During these quality checks if LTB finds any tea invoice or a tea stock that is not up to the minimum quality standards of Ceylon Tea, they will immediately take actions to denature such tea stocks immediately in front of such officers at the expense of the company. As per the internal company records of COMPANY X, there had been many tea invoices that had been identified by SLTB as not suitable teas for sale in Sri Lanka. Please see the Appendix 12.

On the other hand, when the tea is sold to customers through the Sri Lanka Tea Auction, such customers take such tea stocks to their tea stores and do quality checks before they are used in value adding and manufacturing processes. At that time also, if such customers find any quality issues in such tea stocks, they also take immediate actions to notify the seller about the quality issue and reject the entire tea lot and claim for a cash refund as well. This process is taking place with the assistance of tea brokers who does the tea auction sales on behalf of the company representing the SLTB. As far as COMPANY X is concerned, there had been many instances where customers have rejected the teas sold by COMPANY X. Please see the Appendix 13.

Therefore, it was evident that COMPANY X had not maintained a proper system to make sure the quality of their end product at the moment. This prevailing situation in COMPANY X has resulted an annual average of 11,917 kg (Table 4.8) of tea rejections done by both SLTB & customers as far as three-year information for 2020, 2021& 2022 were concerned. This was a 199% (Table4.8) variance between the tolerated and the actual number of tea kg rejections in the company.

- Solution(s) development for End Product Quality

In this the author of this report is suggesting for COMPANY X to obtain ISO certifications from a well-recognized certification body for the company products and manufacturing process. In a situation like this, the most important certifications for COMPANY X would be ISO 9001 and ISO 22000. The international standard for quality management system is the ISO 9001. If a company requires obtaining this certification, they have to follow the requirements stipulated in ISO 9001 standard. This certification provides a guarantee to the customers of the organization ensuring that the products manufactured by such company are constantly meeting the regulatory and customer requirements with continuous improvements.

On the other hand, ISO 22000 is the certification that an organization could obtain to make sure the existence of a proper food safety management system in the organization. This will be an absolutely complementing certification for the ISO 9001 as well since both put together immensely support the organization to create superior confidence in customers about the products of the company where the customer satisfaction could be optimized in a massive way.

As a result of these certifications and the related binding regulatory and other requirements, COMPANY X manufacturing process would be compelled to maintain that minimum required quality standards in manufacturing their end products. Therefore, by this way COMPANY X will be able to achieve a 199% reduction in tea product rejections by SLTB and their customers and thereby to bring it down to the company tolerated level of tea rejections.

Therefore, to arrest this situation the solution development suggested by the author is as follows.

i. Appointing an “ISO Certification Process Committee” in the organization (Appendix 14).
ii. Evaluating and selecting a suitable ISO certification providing body.
iii. Signing an agreement with the selected ISO certification providing body.
iv. Providing ISO training sessions to “ISO Certification Process Committee” and the internal employees as necessary.
v. Assigning required tasks to be done to the members of the “ISO Certification Process Committee” as per the guidelines given by the ISO certification providing body.

vi. Obtaining ISO 9001 & ISO 22000 certifications for COMPANY X tea factories (Appendix 15) and continuous follow up to make sure all the requirements are in place to comply with the ISO regulations.

4.8 Resource Allocation

Resource allocation is an important aspect of implementing the proposed solutions for improving raw material quality, machine maintenance, and end product quality at COMPANY X. Appendix 27 outlines the specific study components, proposed solutions, necessary references, and the resources required for effective execution. This structured approach ensures that each aspect of the process is adequately addressed, and the appropriate personnel are involved at each stage, from preparation and evaluation to implementation and review.

4.8.1 Cost Estimates

A detailed breakdown of the estimated costs associated with the proposed solutions aimed at improving raw material quality, machine maintenance, and end product quality at COMPANY X is developed (appendix 28).

The total cost for these initiatives over a 12-month period is estimated at LKR 2,815,030. For raw material quality, costs include the preparation of “Good Leaf Count Test Sheets” and associated meeting plans, with significant expenses dedicated to incentivizing suppliers, totaling LKR 2,100,522. Machine maintenance improvements, including training programs for key personnel on Overall Equipment Effectiveness (OEE), will require LKR 35,000. Enhancing end product quality through the appointment of an ISO Certification Process Committee and associated certification processes is estimated to cost LKR 679,509. These estimates encompass the necessary resources and activities outlined in Appendices II (n-1) through II (n-5), reflecting a comprehensive approach to address the operational challenges and improve the overall efficiency and quality of the tea manufacturing proces

A comprehensive Benefit-Cost Analysis (BCA) has been conducted to evaluate the financial viability of the proposed improvements at COMPANY X. The analysis identifies both direct and indirect tangible benefits, as well as any quantifiable intangible benefits, over a 12-month period. The direct tangible benefits include substantial working capital savings from the expected reduction in inventory write-offs, estimated at LKR 8,213,159. Additionally, indirect tangible benefits comprise contributions from protected inventory and increased annual production due to product certification, amounting to LKR 1,449,381 and LKR 5,288,462 respectively. The total tangible benefits are valued at LKR 14,951,001. When compared to the total estimated study costs of LKR 2,815,030, the net benefits amount to LKR 12,135,971, resulting in a Benefit/Cost Ratio of 5.31. This favorable ratio indicates that the benefits significantly outweigh the costs, highlighting the overall financial soundness and strategic value of the proposed solutions. (appendix 29)

4.9 Reccomendations

Implementing the recommendations will significantly benefit COMPANY X by reducing inventory losses, improving product quality, and enhancing profitability. This will also lead to increased customer satisfaction and a stronger competitive position in the market.

In finding solutions to the COMPANY X's main operational issue of excessive inventory write-offs, the author of this report has identified three key areas of concern namely; raw material quality issues, machine maintenance issues and end product quality issues. In the detailed analysis of these three segments the author has found key root cause under each such component to be looked at deeply to solve the main problem of COMPANY X. In this, the author found that the absence of proper raw material quality control system, absence of proper machine maintenance system and absence of proper end product quality assurance system. The proposed solutions of the author to overcome this main problem of COMPANY X is planned to be executed within a period of one year to see the expected positive result to bring down the existing excessive inventory write-offs of COMPANY X from 11.46% (Figure 1.1) level to 4% level as a percentage of the year-end inventory value. In implementing the solutions, for each study component or for each key root cause, COMPANY X should give the same weightage for each such solutions

if they are to get the maximum benefits of this study to reduce excessive inventory write-offs in COMPANY X. In this selectively buying each and every lorry load with required minimum quality of 65% good leaf percentage will become a must. Also, obtaining continuous supplier feedback with regard to raw material quality matters would be a key to success. In the same way assessing the quality of raw material and based on that selecting the suppliers and paying them incentives in a very transparent and accurate manner also will be a key success point for COMPANY X to make sure continuous quality raw material intakes to their factories which will eventually make a good quality product for COMPANY X. Also, having a proper planned way to implement the use of OEE measurement system and providing relevant training to staff will definitely make massive change in company machine maintenance and will result in reducing machine breakdowns which eventually support to protect and make a quality end product for COMPANY X. In the same way, if the meaningfully work on the product certification system and the training on ISO, COMPANY X will surely be able to make a super quality product. In this entire process, the total responsibility of the proper execution of such action plans, techniques and solutions should be taken by the company management. Because, all of these recommended activities will produce good result only if the COMPANY X management could successfully embrace that change management effort.

The main recommendation is to carry out the good leaf quality sample checks of raw materials on a daily basis covering all the raw material lorry loads that are coming to the factory. Also, it is very important to select the random samples of green leaf with a proper understanding to cover maximum possible leaf segments in each lorry load. Then the sample-based quality assessment of the entire lorry load could be more realistic and accurate. In this way the results of this sample-based quality checks could be evaluated and see on a monthly basis by looking at the quality improvement levels in the end product. So that on an ongoing basis COMPANY X could come to an assessment to understand the year end possible value of inventory write-offs. And then COMPANY X will be able to experience the expected results of this event work in one year's time when it comes to evaluations and verifications to assess the inventory write-off requirements. In the same way COMPANY X should continuously focus on day in day out to have regular supplier feedbacks to discuss about the raw material quality matters. In the same way COMPANY X should try to be wiser in listing out quality leaf suppliers for incentive payments. If COMPANY X could take such decisions wisely, the success of all of these efforts and the

achievement of the objectives set in this study component will be a reality for sure. In this way COMPANY X will be able to increase the good leaf quality level of their raw materials from 58% to 65% which is an increase of 7% as expected and thereby to improve the overall green leaf good leaf quality up to 65% which is the tea industry norm.

In this study, COMPANY X should give more attention to have the timely and duly completion of overall equipment effectiveness computation sheets. Thereby they will be able to have a proper and ongoing understanding of the real behaviors of the machineries in manufacturing operation. The behaviors of critically important machines like tea driers should be looked at more carefully. Then COMPANY X will be able to even forecast the possible machine breakdowns to come well in advance based on those continuous assessments and observations. So that COMPANY X will be able to be proactively strategize in planning the continuous flow of product manufacture by taking timely and necessary corrective actions while improving the end product quality in a more stable manner. Therefore, within a period of one-year COMPANY X will be able to see the expected results of these planned activities. Also, COMPANY X should obtain the maximum benefits of the planned staff training programs in such a way providing opportunity to the relevant staff to be more advanced in machine maintenance. In this way the employee engagement and commitment towards this process will be increased in a greater manner. Also, such staff will become more tactful and innovative in finding best solutions to manage machine breakdowns and machine maintenance in the factory. This process also could be monitored and evaluated on a monthly basis for actual and tolerated levels of machine breakdown hours and machine maintenance process improvements. And ultimately COMPANY X will be able to bring down the existing machine breakdown hours from 614 hours to 288 hours per year which is a 113% reduction to reach the COMPANY X's tolerated level of machine breakdown hours while establishing superior machine maintenance system in the company by which the negative impact on COMPANY X's product quality could be reduced and excessive inventory write-offs also could be reduced.

In this study component COMPANY X should mainly focus to obtain the real benefits of the ISO 9001 and ISO 22000 certification process. The ISO documentation process needs to be looked at very seriously. It has to be aligned to the real manufacturing and other related operational work in the factories and it should not be just a form filling exercise done just before the ISO periodical audits are carried out. Therefore, in such a way if COMPANY X could obtain the real benefits

of these certification processes, then surely by the end of year one COMPANY X will be able to experience the expected results of all of these activities. Also, COMPANY X should obtain the maximum benefits of the ISO training sessions. In this COMPANY X should try to improve the knowledge of their staff and workers regarding the ISO certification process and its enormous benefits to the company in terms of product quality improvement, increasing the customer satisfaction, saving lot of money for the company by reducing unnecessary and excessive inventory write-offs in the company, possibility to share a portion of such gains among the staff and the workers as well and so on. In this way at the end of year one COMPANY X will be able to see the expected results of all of these activities for sure by reducing the end product quality rejections from 17,917 kg to 6,000 kg per year which is a 199% reduction compared to COMPANY X's tolerated product quality rejections to actual rejections which will eventually help COMPANY X to reduce their existing excessive inventory write-offs up to the expected level of this study of 4% of the year-end inventory value. Research objective, output and outcome is explained in a summary table (appendix 30)

5 Conclusion

The research problem of this study is excessive inventory losses experienced by the COMPANY X and to achieve the aim of this study, the relevant literature was studied and explained under four basic categories in Chapter 2 to minimize the inventory losses experienced by the Ceylon tea manufacturer, a systematic data collection method and analysis process was carried out accordingly. The study is carried out as a case study and the qualitative analysis is taken place. In this study, the objective is to reduce the inventory losses in COMPANY X, inventory write-offs up to 4% of the year-end inventory value. Therefore, this study report initially analyzed the company information in detail to understand the nature of this problem and to find out the concerning areas attached to it in the company operations. In this, a very comprehensive root course analysis had been carried out and the author of this report found that there are main three operational segments to look at namely, raw material quality, machine maintenance and end product quality. In this analysis it was found that there are couple of root causes to this and three of them as critical namely, absence of raw material quality control system, absence of proper machine maintenance system and absence of proper end product quality assurance system. Therefore, this report has set objectives for each of these study components to be achieved that will eventually result in achieving the overall objective of this study. In this, the author of this report has done a very comprehensive analysis of the available literature related to each of those study components and the main operational issue in the company and has identified suitable and required techniques to execute to achieve such objectives separately for each and every study component. Also, the author has lined up solutions separately for each of those study components. Then the author has provided a detailed listing of the resources required to carry out each of these techniques and solution plans relevant to each of those study components. In the same way the author has listed out a detailed report of the cost estimates required to carry out those activities separately for each study component. Thereafter the author has provided a detailed and a comprehensive benefit-cost analysis of this entire study work. Also, the study outputs and study outcomes relevant to each of the study components also have been provided in detail. Finally, the author has provided a detailed discussion of findings and recommendations for each of the study components of this analysis which will lead to reducing the excessive inventory losses in COMPANY X.

The primary objective of this research was to identify and provide solutions to the excessive inventory losses experienced by COMPANY X, aiming to reduce the inventory write-offs to 4% of the year-end inventory value. This study was conducted as a case study with a qualitative analysis approach, including a thorough examination of company data, unstructured interviews, and an extensive review of relevant literature.

The research successfully identified three main components contributing to the excessive inventory losses at COMPANY X: raw material quality, machine maintenance, and end product quality. Each component was analyzed to determine the root causes and feasible solutions were proposed based on literature and industry best practices.

COMPANY X faced an average annual inventory write-off of 11.46%, translating to Rs. 12.6 million. By implementing a robust supply chain management system and Total Quality Management (TQM) practices as recommended in the literature, COMPANY X aims to reduce inventory write-offs to 4%. These improvements target the identified root causes: raw material quality, machine maintenance, and end product quality.

The absence of a proper raw material quality control system resulted in only 58% good leaf quality, compared to the industry standard of 65%. The study proposed introducing "Good Leaf Count Test Sheets" and obtaining regular supplier feedback to ensure better raw material quality. Implementing these measures is expected to improve raw material quality by 7%, aligning with the industry standard.

COMPANY X experienced an average of 614 machine breakdown hours annually due to inadequate maintenance. By adopting Overall Equipment Effectiveness (OEE) procedures and providing relevant staff training, COMPANY X can reduce machine breakdown hours by 113%, improving machine reliability and reducing inventory write-offs.

When consider about end product quality, the lack of a proper end product quality assurance system led to significant product rejections, averaging 17,917 kgs annually. Obtaining ISO 9001 and ISO 22000 certifications was recommended to enhance product quality. This approach is expected to reduce product rejections by 199%, bringing them within the company’s tolerated level and contributing to reduced inventory write-offs.

To address the primary issue, a holistic approach focusing on raw material quality, machine maintenance, and end product quality must be implemented. Ensuring the proper implementation of action plans and management's commitment to change management are important factors for success. Daily quality checks and continuous supplier feedback are essential. Maintaining quality suppliers and maintaining transparent communication will improve raw material quality, aligning with industry standards. Timely completion of OEE sheets and predictive maintenance strategies will reduce machine breakdowns. Staff training programs will enhance machine maintenance skills, reducing breakdown hours and improving product quality. So, certification processes should be thoroughly integrated into operational practices. Regular training and genuine implementation of ISO standards will enhance product quality, reduce rejections, and minimize inventory write-offs.

The study's findings and recommendations align with established theoretical frameworks explained in Chapter 2. The application of these theories in a practical context demonstrates their relevance and effectiveness in addressing real-world business problems.

This study has contributed to the development of expertise in supply chain management, quality control, and operational efficiency. The comprehensive approach taken in this research provides a robust framework for addressing similar challenges in the future, enhancing both theoretical knowledge and practical skills.

6 Discussion

The primary research problem addressed in this study is the excessive inventory losses experienced by COMPANY X, a Ceylon tea manufacturer. The objective was to reduce inventory write-offs from an annual average of 11.46% of the year-end inventory value to 4%. The research was conducted through a case study approach, utilizing qualitative methods such as thematic analysis, observations, and unstructured interviews. The research is carried out as a case study. The relevant literature is studied. Observation of company data and unstructured interviews were taken place to gather data related to the study. The research data was analyzed as qualitative analysis method, thematic analysis and more details about the analysis process is in chapter 4, 4.2 section. The root causes for the problem is analyzed and three main study components were identified. Studying the relevant literature, the feasible and productive suggestions were developed to overcome the problem of excessive inventory losses.

The identified operational issue in COMPANY X was, experiencing excessive inventory write-offs for many years. In this COMPANY X had experienced 11.46% inventory write-offs as a percentage of the inventory values for last three years alone and this was amounting to an annual average of Rs. 12.6 million. Therefore, the main objective of this research was to find and recommend solutions to this operational issue. In this, the main prominence was given to explore the available literature to find such solutions. In this the studied literature explained many scientific solutions to this problem. In this, Patrick Neumann and Dul, 2010, p. 923 had explained that having a proper supply chain management system in the company will be a key to business success. They further explained that in this, the Total Quality Management (TQM) provides a better path to make a quality product. Further in this the literature had provided many recommendations and solutions to treat the main root causes (Raw material quality, machine maintenance, end product quality) of COMPANY X's operational issue. Therefore, as a result of the execution of such solutions, COMPANY X will definitely be able to reduce their existing excessive inventory write-offs from current level of 11.46 % of the year-end inventory value to 4% of the year-end inventory value as expected by COMPANY X.

Under the study component of Raw Material Quality, absence of proper raw material quality control system in COMPANY X has been one of the key root causes for COMPANY X's main prob-

lem of excessive inventory write-offs. As a result, COMPANY X had maintained only a 58% (Table4.4) good leaf average for last three years alone which is a 7% variance from the tea industry standard of 65% good leaf expectation in raw material intakes. The literature review carried out in this report explained well the relationship of raw material quality to the end product. In this, Huo et al., 2014, had explained under supply chain quality management, the importance of supplier quality integration as a core component and a requirement. Therefore, if we are to improve raw material quality, the immediate party to get in touch with is the raw materials supplier. In this, the study provided solutions to improve the raw material quality in COMPANY X. In this the main thing was to introduce "Good Leaf Count Test Sheets" (Appendix 4) to evaluate raw material green leaf quality level before accepting them to the tea manufacture. It is important to have a close relationship with the suppliers by obtaining "Regular Supplier Feedbacks", to improve the raw material quality. Also, paying Incentives to the quality raw material suppliers and so is important. Therefore, by this way COMPANY X will be able to improve their raw material quality to bring it to the tea industry norm of 65%. This will be an improvement of 7% in raw material quality in COMPANY X and this will definitely improve the end product quality in COMPANY X and reduce the excessive inventory write-offs in COMPANY X in big way.

Under this study component, the identified main root cause was the absence of proper machine maintenance system. As a result, COMPANY X has experienced an average of 614 (Table 4.6) machine breakdown hours during last three years alone. The reviewed literature in this report clarified as to how this sort of issue has a link to the main problem of COMPANY X. In this, (Zuze, 2010, p. 85) explained that it is really important to have an effective machine maintenance system in place in a company to bring down the machine breakdown hours that cause a major reason to bring down the quality of the end products by incurring product damages and so on. Implementing a proper machine maintenance system is necessary to maintain end product quality (Muthiah et al., 2008, p. 811). Before, based on the literature the study has suggested to have Overall Equipment Effectiveness (OEE) procedures in COMPANY X as a tool to have better productive maintenance in COMPANY X's machineries which will be much helpful for COMPANY X maintain performance, availability and quality in machineries. As a result of proper record and report maintenance in OEE, COMPANY X will be able to regularly assess the machine maintenance levels and provide corrective action plans as required. This will help COMPANY X to reduce machine breakdown hours by 113% to reach COMPANY X's tolerated level of machine

breakdown hours. With regard to this, first reduce the possible damages in the tea stocks and then to reduce unnecessary inventory write-offs in COMPANY X. In this providing proper training on OEE to the staff members will also be a major success factor for COMPANY X to reach to their component and main objectives.

In this study component, the mainly identified root cause was absence of proper end product quality assurance system. As a result of this, COMPANY X had experienced many end product quality rejections. Both SLTB and the customers of COMPANY X had rejected many tea invoices for last three years alone and these had amounted to 17,917 kgs (Table 5.8) as an average for last three years and this was a deviation of 199% (Table 5.8) from the company tolerated level. In the review of literature in this report, (Robinson & Malhotra, 2005, p. 315) explained the importance of maintaining end product quality as a part of supply chain quality management (SCQM) which is a tool that immensely support an organization to eliminate defects in products. Also, the literature had explained that it is a must to have quality management especially in food manufacture. Also, (Hammond et al., 2009, p. 469) had explained that product certification practices have been a very much useful tool to ensure and improve the end product quality as well as the safety. Further the literature has stressed that in this process TQM is also a key area to consider to make sure end product quality. Therefore, the author of this report has suggested COMPANY X to obtain ISO 9001 and ISO 22000 certifications as solutions to this COMPANY X's end product quality issues that had become a huge reason for COMPANY X's excessive inventory write-offs. By this way COMPANY X would be able to reduce their product quality rejections by 199% and then to bring down the product quality rejections to the tolerated level of COMPANY X. As a result, there will be many outcomes to COMPANY X such as, increased product quality, increasing the company profitability, reducing inventory write-offs, increasing sales revenue and so on.

Further research could explore additional factors affecting inventory losses, such as raw material quality maintenance of Ceylon Tea, employee engagement and technological advancements in Ceylon tea supply chain management. Additionally, a longitudinal study to assess the long-term impact of the implemented changes would provide valuable insights into their sustainability and effectiveness.

This study contains a systematic data collection and analysis process, ensuring the reliability and validity of the findings. The recommendations provided in this study are based on well-established theoretical frameworks (Chapter 2) and industry practices, which can be applied in similar contexts.

The study adhered to ethical guidelines, ensuring accurate representation of data and unbiased analysis. All participants in unstructured interviews were informed about the purpose of the study, and their confidentiality was maintained throughout the research.

The findings and recommendations are transferable to other companies within the Ceylon tea industry facing similar issues. The methodologies and frameworks used in this study can be adapted to different contexts, providing a valuable reference for other organizations.

The comprehensive plan addresses various important aspects of COMPANY X's operations, aiming to reduce the inventory losses, improve efficiency, product quality, and profitability while fostering better supplier relationships and customer satisfaction.

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Appendices

Appendix 1

Research data management plan for the thesis

1. General description of the data

What type of research data (for example interview, survey, observation) is collected or used in the thesis?

Structured Interviews and observation of internal company records are used for the data collection of this study.

2. Documentation and quality of the data

How is the research data documented, for example, what kind of identifying information is used? How is the quality of the data and its documentation ensured?

In this study the interview data is gathered manually from several parties and digitally documented by the author. All other data gathering and analysis is done digitally. According to the structured interview questionnaire, the is gathered and stored digitally and the qualitative analysis is done. Finally, the outcome of the study is generated based on the analysis of gathered data. The documented data is always backed up digitally. To access the internal data one to one conversational methods used as interviews and the several copies of documents were collected physically as confidential documents.

3. Storage and backup

How is the data stored? How is its information security ensured (for example, access to the data) during the thesis process? Who gets to access and process the data?

The data relevant to the study is stored in the PC of the author and shared with the supervisor. The access and process of data is handled by the author and the supervisor only.

The data is stored basically in the PC and the backup is e mailed with a password protected word file.

4. Ethical and legal issues related to storage

How are possible ethical questions related to the storage of the data (for example, sensitive information linked to individuals, access to the data by others) considered? How are ownership and usage rights of the data managed?

The main concern of the data protection of this study is the sensitive internal data and the interview data with regard to the company. The name of the company kept anonymous and names of the interviewees are also kept anonymous. The ownership of data in this thesis belongs to the author and the data is edited and handled by the author.

5. Opening of the data and long-term storage

Would it be possible to use the data later? How is this enabled?

The data relevant to the thesis is stored digitally for the further reference and all the relevant files are password protected to enhance the data security. The analyzed data is kept separately and the final report contains several raw data as well as analyzed data.

All the relevant data is stored digitally for the future as password-protected files which can be used by the author in future.

Appendix 2

Time Management Plan

Task No	Task	ctober 202				vember 20				cember 20				nuary 202				bruary 202				March 2024				April 2024			
		Week				Week				Week				Week				Week				Week				Week			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1	Proposal submission																												
2	Proposal approval																												
3	Discussion with the Supervisor																												
4	Submission of Thesis Plan for approval																												
5	Final submission of Thesis plan																												
6	Presentation of Thesis plan																												
7	Analysis company record																												
8	Conducting Surveys/interviews																												
9	Data Analysis																												
10	Providing Recommendations																												
11	Final Report & Submission for approvals																												
12	Final Report & Submission																												

Appendix 3

Raw Material (Green Leaf) - Actual quality - Monthly and Annual Averages (Good Leaf %)

Month	Year ending 31st Dec 2020	Year ending 31st Dec 2021	Year ending 31st Dec 2022	Average for 3 years
Jan	56%	60%	56%	57%
Feb	57%	60%	57%	58%
Mar	56%	60%	58%	58%
Apr	58%	56%	59%	58%
May	60%	60%	59%	60%
Jun	57%	58%	58%	58%
Jul	56%	59%	58%	58%
Aug	58%	60%	57%	58%
Sep	58%	63%	58%	60%
Oct	59%	60%	57%	59%
Nov	60%	59%	56%	58%
Dec	57%	60%	56%	58%
Full Year	58%	60%	57%	58%

Source: Company Data

Appendix 4

Good Leaf Count Test Sheet Format

COMPANY X (PVT) LTD

Good Leaf Count Test Sheet (GLCTS)

Factory Name ..... **GLCTS No : .....**
Date .....

Supplier Route Name .....
Lorry Number .....
Driver Name .....
Total Green Leaf (kg) .....

Sample - 1

	No of Units	%
Good Leaf Segments		
Other Leaf Segments		
Total leaf segments	-	-

Sample - 2

	No of Units	%
Good Leaf Segments		
Other Leaf Segments		
Total leaf segments	-	-

Sample - 3

	No of Units	%
Good Leaf Segments		
Other Leaf Segments		
Total leaf segments	-	-

Sample - 4

	No of Units	%
Good Leaf Segments		
Other Leaf Segments		
Total leaf segments	-	-

Sample - 5

	No of Units	%
Good Leaf Segments		
Other Leaf Segments		
Total leaf segments	-	-

Total Samples

	No of Units	%
Good Leaf Segments	-	
Other Leaf Segments	-	
Total leaf segments	-	-

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Prepared By
Assistant Tea Factory Officer

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Checked By
Tea Factory Officer

.....
Lorry Load Approved / Rejected By
Tea Factory Manager

Comments
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Review & comments by
Operations Manager

Appendix 5

Green Leaf Supplier Monthly Meeting Plan

COMPANY X (PVT) LTD

Green Leaf Supplier Monthly Meeting Plan (GLSMMP)

Factory Name ..... **GLSMMP No : .....**

Month & Year .....

SN	Supplier Code	Supplier Name	Planned Visit Date	Actual Visit Date
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

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Prepared By
Tea Factory Manager

.....
Approved By
Operations Manager

Appendix 6

Green Leaf Supplier Meeting Discussion Point Summary Sheet

COMPANY X (PVT) LTD

Green Leaf Supplier Meeting Discussion Point Summary Sheet (GLSMDPSS)

Factory Name ..... **GLSMDPSS No : .....**
Month & Year .....

Supplier Code .....
Supplier Name .....
Planned Visit Date .....
Actual Visit Date .....

Meeting Discussion Points

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Prepared By
Tea Factory Manager

Review & Comments

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Reviewed & Commented By
Operations Manager

Appendix 7

List of good leaf suppliers for Incentive Payments

COMPANY X (PVT) LTD

List of good leaf suppliers for incentive payments (GLSFIP)

Factory Name ..... **GLSFIP No : .....**

Month & Year .....

SN	Supplier Code	Supplier Name	Suggested Incentive Rs	Approved / Rejected
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

.....
Prepared By
Tea Factory Manager

.....
Approved / Rejected By
Operations Manager

Appendix 8

Machine breakdown hours – monthly and annual totals

Month	Year ending 31st Dec 2020	Year ending 31st Dec 2021	Year ending 31st Dec 2022	Average for 3 years
Jan	72	48	63	61
Feb	48	76	36	53
Mar	42	72	14	43
Apr	24	66	12	34
May	72	48	44	55
Jun	60	36	69	55
Jul	56	72	48	59
Aug	48	32	14	31
Sep	30	72	60	54
Oct	62	84	72	73
Nov	20	44	72	45
Dec	34	72	48	51
Full Year	568	722	551	614

Appendix 9

Tea stocks (kg) written-off due to damages in drier process due to poor machine maintenance

Month	Year ending 31st Dec 2020	Year ending 31st Dec 2021	Year ending 31st Dec 2022	Average for 3 years
Jan	1,600	850	1,350	1,267
Feb	1,050	2,180	750	1,327
Mar	990	1,640	277	969
Apr	310	1,590	384	761
May	1,040	1,125	1,180	1,115
Jun	1,800	1,095	1,840	1,578
Jul	1,100	1,810	1,100	1,337
Aug	1,120	2,340	311	1,257
Sep	1,100	1,765	1,190	1,352
Oct	1,080	1,780	1,710	1,523
Nov	350	2,290	1,790	1,477
Dec	1,140	1,660	1,045	1,282
Full Year	1,057	1,677	1,077	1,270

Appendix 10

Machineries used in tea manufacturing process

Process No	Manufacturing Proces Name	Machines Used
1	Withering Process	Withering Trughs
2	Rolling Process	Rollers
3	Fermentation Process	……..
4	Drying Process	Drier
5	Shifting Process	Shifters
6	Color Sorting Process	Color Sorters
7	Packing	……..

Appendix 11

Overall Equipment Effectiveness (OEE) computation sheet

NOTES
In the process of recording, measuring and controlling OEE, there are three main aspects to look at. They are availability, performance and quality. They are computed based on predetermined standard formulas for monitoring purposes.

In assessing the "Availability" which is the first segment monitored under OEE, the following formula should be used. In this "Run Time" represents the actual production time net of the time lost due to machine breakdowns, etc. And the planned production time is the normal production capacity of the machine. In OEE the target is to increase the availability as much as possible.

Availability = Run Time / Planned Production Time

In this the "Run Time" is computed as follows.

Run Time = Planned Production Time – Stop Time

On the other hand, "Performance" the second segment focused under OEE is calculated as follows where performance is the ratio of net run time to run time. In OEE the expectation is to maximize the performance as much as possible.

Performance = Net Run Time / Run Time

Then the third segment to be assessed under OEE is "Quality" which is computed as follows. In this the good work count is compared as a proportion of the total work count. The expectation in OEE is to maximize the quality as much as possible.

Quality = Good Count / Total Count

So that the final result of those three computations will be OEE which is as follows.
OEE = Availability * Performance * Quality

COMPANY X (PVT) LTD

Overall Equipment Effectiveness Computation Sheet (OEECS)

Factory Name ..... **OEECS No : .....**

Month & Year .....

Date	Machine	Computation	Daily Count
1	Drier	(A). Availability = Run Time / Planned Production Time	
		(B). Performance = Net Run Time / Run Time	
		(C). Quality = Good Count / Total Count	
		OEE = A * B * C	
2	Drier	(A). Availability = Run Time / Planned Production Time	
		(B). Performance = Net Run Time / Run Time	
		(C). Quality = Good Count / Total Count	
		OEE = A * B * C	
3	Drier	(A). Availability = Run Time / Planned Production Time	
		(B). Performance = Net Run Time / Run Time	
		(C). Quality = Good Count / Total Count	
		OEE = A * B * C	
4	Drier	(A). Availability = Run Time / Planned Production Time	
		(B). Performance = Net Run Time / Run Time	
		(C). Quality = Good Count / Total Count	
		OEE = A * B * C	
5	Drier	(A). Availability = Run Time / Planned Production Time	
		(B). Performance = Net Run Time / Run Time	
		(C). Quality = Good Count / Total Count	
		OEE = A * B * C	

.....
Prepared By
Asst. Tea Factory Officer

.....
Checked By
Tea Factory Officer

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.....
.....

.....
Review & Comments
Tea Factory Manager

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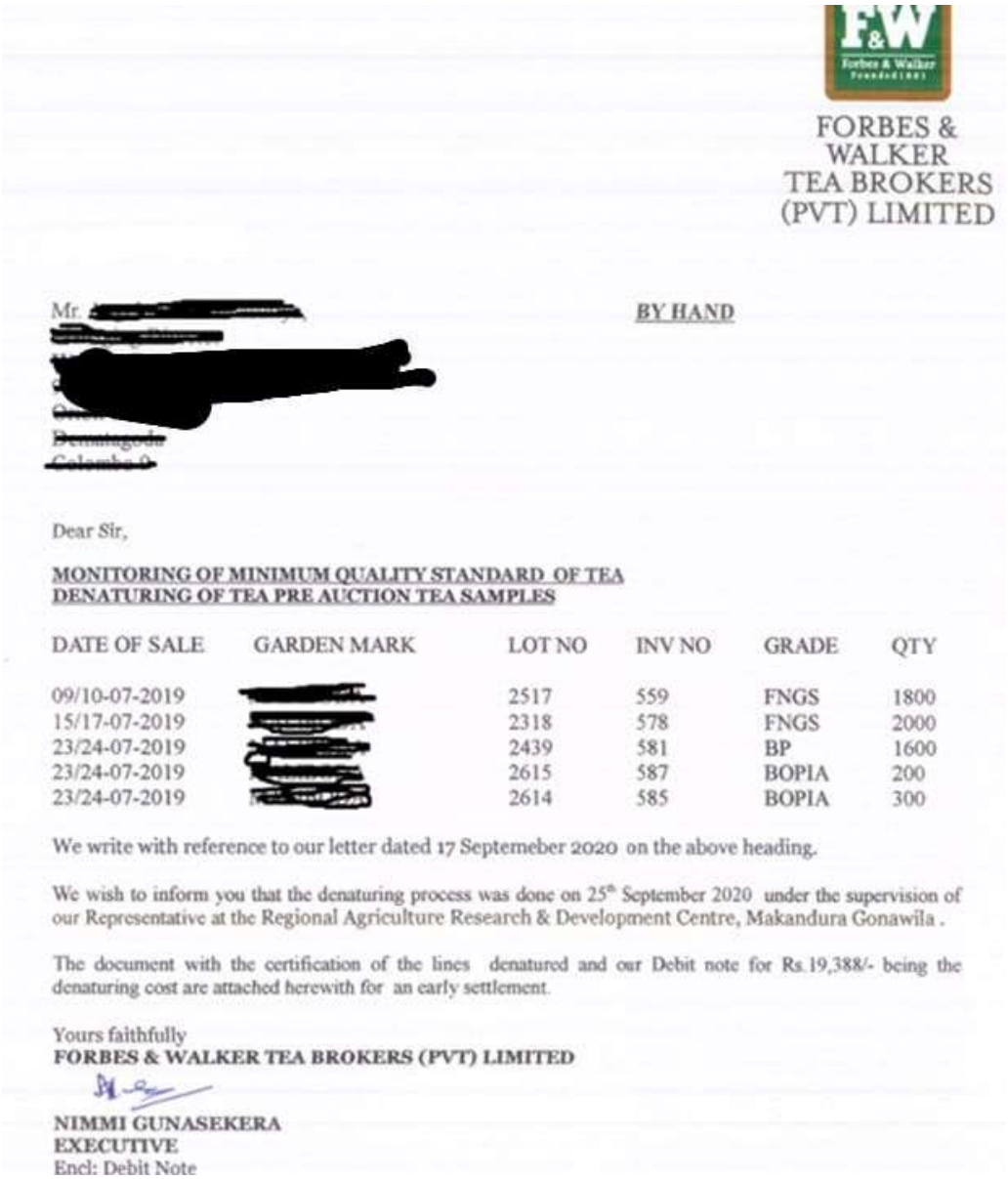
.....
.....

.....
Final Check & recommondations
Project Engineer

Appendix 12

COMPANY X tea invoices identified by SLTB as not suitable teas for sale in Sri Lanka



FORBES &
WALKER
TEA BROKERS
(PVT) LIMITED

Mr. [redacted]

BY HAND

[redacted]

Dear Sir,

MONITORING OF MINIMUM QUALITY STANDARD OF TEA
DENATURING OF TEA PRE AUCTION TEA SAMPLES

DATE OF SALE	GARDEN MARK	LOT NO	INV NO	GRADE	QTY
09/10-07-2019	[redacted]	2517	559	FNGS	1800
15/17-07-2019		2318	578	FNGS	2000
23/24-07-2019		2439	581	BP	1600
23/24-07-2019		2615	587	BOPIA	200
23/24-07-2019		2614	585	BOPIA	300

We write with reference to our letter dated 17 Septemeber 2020 on the above heading.

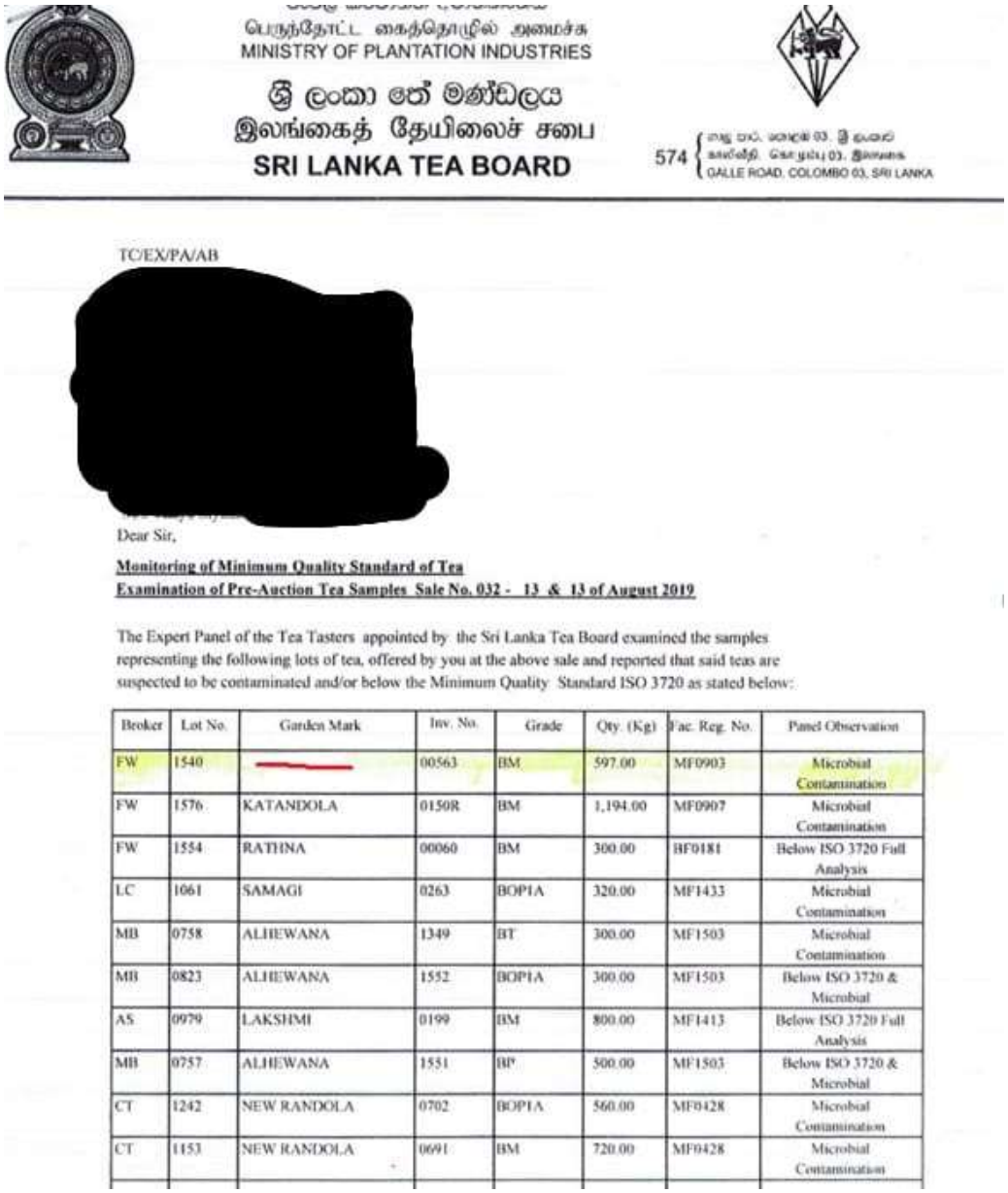
We wish to inform you that the denaturing process was done on 25th September 2020 under the supervision of our Representative at the Regional Agriculture Research & Development Centre, Makandura Gonawila .

The document with the certification of the lines denatured and our Debit note for Rs.19,388/- being the denaturing cost are attached herewith for an early settlement.

Yours faithfully
FORBES & WALKER TEA BROKERS (PVT) LIMITED

NIMMI GUNASEKERA
EXECUTIVE
Encl: Debit Note

Source: Company Data



பெருந்தோட்ட கைத்தொழில் அமைச்சு
MINISTRY OF PLANTATION INDUSTRIES
ශ්‍රී ලංකා තේ මණ්ඩලය
இலங்கைத் தேயிலைச் சபை
SRI LANKA TEA BOARD

574 GALLE ROAD, COLOMBO 03, SRI LANKA

TC/EX/PA/AB

[redacted]

Dear Sir,

Monitoring of Minimum Quality Standard of Tea
Examination of Pre-Auction Tea Samples Sale No. 032 - 13 & 13 of August 2019

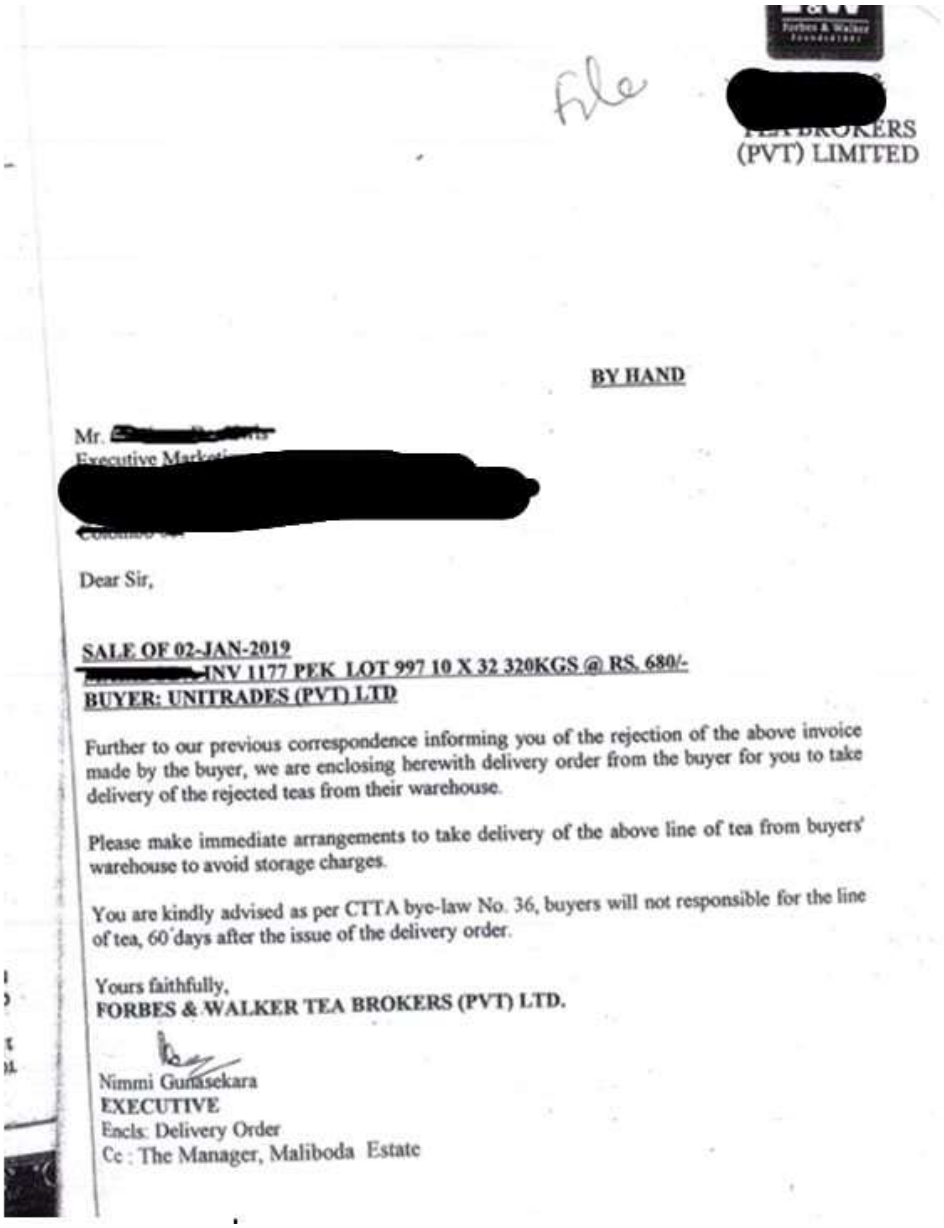
The Expert Panel of the Tea Tasters appointed by the Sri Lanka Tea Board examined the samples representing the following lots of tea, offered by you at the above sale and reported that said teas are suspected to be contaminated and/or below the Minimum Quality Standard ISO 3720 as stated below:

Broker	Lot No.	Garden Mark	Inv. No.	Grade	Qty. (Kg)	Fac. Reg. No.	Panel Observation
FW	1540	[redacted]	00563	BM	597.00	MF0903	Microbial Contamination
FW	1576	KATANDOLA	0150R	BM	1,194.00	MF0907	Microbial Contamination
FW	1554	RATHNA	00060	BM	300.00	BF0181	Below ISO 3720 Full Analysis
LC	1061	SAMAGI	0263	BOP1A	320.00	MF1433	Microbial Contamination
MB	0758	ALIHEWANA	1349	BT	300.00	MF1503	Microbial Contamination
MB	0823	ALIHEWANA	1552	BOP1A	300.00	MF1503	Below ISO 3720 & Microbial
AS	0979	LAKSHMI	0199	BM	800.00	MF1413	Below ISO 3720 Full Analysis
MB	0757	ALIHEWANA	1551	BP	500.00	MF1503	Below ISO 3720 & Microbial
CT	1242	NEW RANDOLA	0702	BOP1A	560.00	MF0428	Microbial Contamination
CT	1153	NEW RANDOLA	0691	BM	720.00	MF0428	Microbial Contamination

Source: Company Data

Appendix 13

COMPANY X tea invoices rejected by customers due to product quality issues



file

[redacted]
TEA BROKERS
(PVT) LIMITED

BY HAND

Mr. [redacted]
Executive Market[redacted]
[redacted]

Dear Sir,

SALE OF 02-JAN-2019
[redacted]INV 1177 PEK LOT 997 10 X 32 320KGS @ RS. 680/-
BUYER: UNITRADES (PVT) LTD

Further to our previous correspondence informing you of the rejection of the above invoice made by the buyer, we are enclosing herewith delivery order from the buyer for you to take delivery of the rejected teas from their warehouse.

Please make immediate arrangements to take delivery of the above line of tea from buyers' warehouse to avoid storage charges.

You are kindly advised as per CTTA bye-law No. 36, buyers will not responsible for the line of tea, 60 days after the issue of the delivery order.

Yours faithfully,
FORBES & WALKER TEA BROKERS (PVT) LTD.

Nimmi Gunasekara
EXECUTIVE
Encls: Delivery Order
Cc : The Manager, Maliboda Estate

Source: Company Data

Appendix 14

COMPANY X - ISO Certification Process Committee Appointment Form

COMPANY X (PVT) LTD

ISO Certification Process Committee

SN	Staff Name	Designation	Assigned Task
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

.....
Prepared By
Assistant to Project Engineer

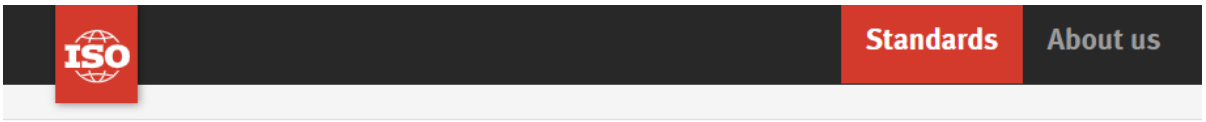
Recommondations

.....
.....
.....

.....
Recommondations & Appointment Approval By
Project Engineer

Appendix 15

ISO 9001 an ISO 22000 Certifications



WHY ISO 9001?

ISO 9001 sets out the criteria for a quality management system and is the only standard in the family that can be certified to (although this is not a requirement). It can be used by any organization, large or small, regardless of its field of activity. In fact, there are over one million companies and organizations in over 170 countries certified to ISO 9001.

This standard is based on a number of quality management principles including a strong customer focus, the motivation and implication of top management, the process approach and continual improvement. These principles are explained in more detail in ISO's quality management principles. Using ISO 9001 helps ensure that customers get consistent, good-quality products and services, which in turn brings many business benefits.

Source: International Organization for Standardization. (2022). Retrieved from https://www.iso.org/iso-9001-quality-management.html

Source: International Organization for Standardization. (2022). Retrieved fromhttps://www.iso.org/iso-22000-food-safety-management.html

Appendix 16

Cost of preparing “Good Leaf Count Test Sheets” for one year

	Factory - 1	Factory - 2	Total
Green Leaf per day - kg	8,050	8,050	16,100
Green Leaf per Month - kg	209,302	209,302	418,605
Number of supplier lorry loads per day	6	6	12
Number of supplier lorry loads per month	161	161	322
Number of supplier lorry loads per year	1,932	1,932	3,864
"Good Leaf Count Test Sheet" per year	1,932	1,932	3,864
Cost per "Good Leaf Count Test Sheet" - Rs	5	5	5
Total Cost per year - Rs	9,660	9,660	**19,320**

Appendix 17

Cost of preparing “Green Leaf Supplier Meeting Discussion Point Summary Sheet” for one year

	Factory - 1	Factory - 2	Total
Number of supplier visits per month	37	33	71
Number of supplier visits per year	446	401	847
"Supplier Meeting discussion point summary sheet" per year	446	401	847
Cost per sheet - Rs	5	5	
Total Cost per year - Rs	2,229	2,006	4,236

Appendix 18

Green leaf supplier meeting (Visit) cost for one year

Avg. Number of green leaf suppliers - Factory 1	124
Avg. Number of green leaf suppliers - Factory 2	111
Total	**235**

	Factory - 1	Factory - 2	Total
Avg. number of supplier visits per month (30% coverage)	37	33	71
Avg visit distance per 1 supplier visit - km	10	10	
Avg visits per month - km	372	334	706
Factory Manager Vehicle - No of km per 1 ltr of diesel	7	7	
No of ltrs of diesel required - per month	53	48	101
Cost per 1 ltr of diesel - Rs	121	121	
Avg running cost per month (Fuel) - Rs	6,422	5,780	12,203
Approx. Extra Expenses per visit - Rs	500	500	
Approx. Total Extra Expenses per month - Rs	18,577	16,719	35,297
Total Visit Expenses per month - Rs	25,000	22,500	47,499
Cost per visit - Rs	673	673	
Total Visit Expenses per year - Rs	299,994	269,995	569,989

Appendix 19

Good leaf suppliers selected to pay Incentive Payments for one year

	Factory - 1	Factory - 2	Total
Avg. number of green leaf supplier	124	111	235
Total Supply of Green Leaf per month - kg	209,302	209,302	418,605
Total Supply of Green Leaf per year - kg	2,511,628	2,511,628	5,023,256
Target selection of Grren Leaf per year to pay Incentives (20% coverage)	502,326	502,326	1,004,651
Target Approx. Incentive per kg - Rs	1.50	1.50	
Total Cost per year - Rs	753,488	753,488	1,506,977

Appendix 20

Signing an agreement with the selected ISO certification providing body – Three-year certificate validity period – Present Value of cost computed as at the year 1

Year	ISO 9001 / 22000 Certification Fees	Audit Fees	Net Cash Flows	DF 10%	Present Value
0	450,000	-	450,000	1.000	450,000
1	-	-	-	0.909	-
2	-	117,000	117,000	0.826	96,642
3	-	117,000	117,000	0.751	87,867
				Net Present Value	**634,509**

Appendix 21

Working Capital savings from expected reduction in Inventory Write-offs per year – Rs

	Year end 31st Dec 2020	Year end 31st Dec 2021	Year end 31st Dec 2022	Average for 3 years	Remarks
Inventory Value (Before write-off) - Rs	90,914,945	115,469,527	123,833,933	110,072,802	A
Inventory Written-off - Actuals - Current Level - Rs	13,249,622	11,747,830	12,850,760	12,616,071	B
Inventory Written-off as a % of Inventory	14.57%	10.17%	10.38%	11.46%	
Inventory Write-off - Annual Budget - Rs	3,500,000	4,500,000	6,500,000	4,833,333	C
Expected - Inventory write-offs per year - Rs (4% of the year end inventory value)				4,402,912	D = A * 4%
Working Capital savings from expected reduction in Inventory Write-offs per year - Rs				8,213,159	E = B - D
Working Capital savings from expected reduction in Inventory Write-offs per year - %				65%	F = (E / B) * 100

Appendix 22

Additional contribution from protected inventory

		Remarks
Expected inventory value to be protected - Rs	8,213,159	A
Approx. Average cost per kg	442	B
Expected inventory value to be protected - kg	18,582	C = A/ B
Approx. Average contrinution per kg	78	D
Additional contribution from inventory protection - Rs	1,449,381	E = D / C

Appendix 23

Additional contribution from annual production due to Product Certification

		Remarks
Approx. Annual Revenue - Rs	550,000,000	A
Approx. Annual Average Selling Price per kg	520	B
Approx. Annual Sales Quantity - kg	1,057,692	C = A / B
Expected Approx. Selling Price increase per kg		
due to Product Certification - Rs	5	D
Expected Annual Extra Contribution - Rs	5,288,462	E = C * D

Appendix 24

Interview Questions

1. Raw Material Quality
- What is the raw material selection procedure of the company?
- How do you measure the required quality level of the raw materials?
- What is the minimum raw material quality level / standard acceptable to the company and how do you measure that?
- What is the raw material supplier selection procedure of the company?
- How do you assess the raw material suppliers for quality aspects?
- What other criteria are you looking at when selecting the raw material suppliers?
- What are the procedures available to make sure the quality of the raw material taken in to the factory?
- How important is that to have quality raw material for production?
- Is there a separate team with relevant knowledge in your organization to make sure the raw material taken to the factory are in the expected quality level?
- How do you measure the raw material quality?
- What are the raw material quality related documentation available in the company?
- Etc.

2. Machine Maintenance
- What is the machinery selection criteria of the company?
- What is the machinery supplier selection criteria of the company?
- What aspects do you look at when selecting a machinery supplier in terms of machinery quality, after sales services and maintenance services?
- What is the machine maintenance procedure of the company?
- Is there a dedicated and knowledgeable team in the company to look at the machine maintenance?
- How do you see the importance of having a proper machine maintenance system in the organization?

3. End Product Quality
- How do you measure the required quality level of the end products of the company?
- What is the minimum end product quality level / standard acceptable to the company and how do you measure that?
- What are the procedures available to make sure the accepted quality of the company end products?
- How important is that to have quality end product?
- Is there a separate dedicated team with relevant knowledge in your organization to make sure, the end product quality?
- What are the end product quality related documentation maintained in the company.

Appendix 25

Company data summary table

Referred Information	Source Document
Inventory values before write-offs – Rs	Company management accounts extracts
Inventory write-offs actual – Rs	Company management accounts extracts
Inventory write-offs annual budget – Rs	Company financial Budget extracts
Green leaf expected good leaf quality %	Tea industry standard / norm
Green leaf actual good leaf quality %	Factory Tea Book Summary Report
Machine breakdown hours actual	Machine Breakdown Book Summary
Machine breakdown hours tolerance	Company financial Budget extracts
Product quality rejections actual	Product quality rejection book summary
Product quality rejections tolerance	Company financial Budget extracts

Appendix 26

Interview reduction Table

Ref	Interviewee Designation	Inventory	Information Extracted from
1	Factory manager, Tea factory officer, Tea factory supervisor, selected factory workers	Average inventory value (2020 to 2022) of the company is Rs. 110 million. Average inventory write-off value (2020 to 2022) is Rs.12 million. Average Inventory write-off values as a percentage of inventory values is 11 %.	Company management accounts.
2	Factory manager, Tea factory officer, Tea factory supervisor, selected factory workers	Expected good green leaf quality percentage level is 65%. Average actual good green leaf quality percentage level is 58 % (2020 to 2022) Average good leaf quality percentage negative variance is 7%. Current raw material selection procedure of the company: While accepting all the raw material lorry loads, select sample batches of raw material green leaf from random lorry loads to check the quality level percentage.	Tea industry norm and practice. Factory tea book summary reports.

Appendix 27

Resource Allocation

No	Study Component	Proposed Solutions	Reference (Appendix No)	Resources
1	Raw Material Quality	Agreeing the format and preparation of "Good Leaf Count Test Sheet"	Appendix II (b)	Tea Factory Officer Tea Factory Manager Operations Manager
		Completing a separate "Good Leaf Count Test sheet" for each lorry load of Raw Material Green Leaf intake by evaluating the samples raised. (Daily) Checking the accuracy of the sample evaluation and the data entries in the Good Leaf Count Test sheet. (Daily) Approval or rejection of the raw material green leaf lorry load. (Daily) Reviewing and commenting on the Good Leaf Count Test sheets. (weekly)		Assistant Tea Factory Officer Tea Factory Officer Tea Factory Manager Operations Manager

No	Study Component	Proposed Solutions	Reference (Appendix No)	Resources
		Agreeing the formats and preparation of "Green Leaf Supplier Monthly Meeting Plan" and "Green Leaf Supplier Meeting Discussion Point Summary Sheet"	Appendix II (c) Appendix II (d)	Tea Factory Manager
		Approval of "Green Leaf Supplier Monthly Meeting Plan" for execution.		Operations Manager
		Meeting the green leaf suppliers as per the approved meeting plan & obtaining the regular supplier feedbacks & updating the Green Leaf Supplier Meeting discussion point summary sheet.		Tea Factory Manager
		Reviewing and commenting on the "Green Leaf Supplier Meeting discussion point summary sheet".		Operations Manager

No	Study Component	Proposed Solutions	Reference (Appendix No)	Resources
		Agreeing the format and preparation of "List of good leaf suppliers eligible for Incentive Payments" and making payments. (Monthly Report to be prepared based on the records of Good Leaf Quality Test Sheets and Green Leaf Supplier Meeting discussion point summaries) Assessing the raw material quality & providing supplier wise approval or rejection to the list of good leaf suppliers to pay Incentive Payments (Monthly Report)	Appendix II (e)	Tea Factory Manager Operations Manager
2	Machine Maintenance	Agreeing the format and preparation of "Overall Equipment Effectiveness (OEE) Computation Sheets"	Appendix II (i)	Study Engineer Tea Factory Manager

No	Study Component	Proposed Solutions	Reference (Appendix No)	Resources
		Providing a training program to the Tea Factory Manager, Tea Factory Officer, Assistant Tea Factory Officer about OEE implementation, importance and need of proper machine maintenance and preparation of relevant documents.		Study Engineer
		Updating OEE documents on a timely basis. Checking OEE documents on a timely basis. Reviewing, commenting & signing off on OEE documents on a timely basis. Final Checking & Signing off the OEE documents on a timely basis and providing corrective action plans as necessary.		Assistant Tea Factory Officer Tea Factory Officer Factory Manager Study Engineer
3	End Product Quality	Appointing an "ISO Certification Process Committee" in the organization	Appendix II (l)	Study Engineer Assistant to Study Engineer

No	Study Component	Proposed Solutions	Reference (Appendix No)	Resources
		Evaluating and selecting a suitable ISO certification providing body		Study Engineer Assistant to Study Engineer
		Signing an agreement with the selected ISO certification providing body		Study Engineer Assistant to Study Engineer ISO Certification Body
		Providing ISO training sessions to "ISO Certification Process Committee" and the internal employees as necessary		Study Engineer Assistant to Study Engineer ISO Certification Body
		Assigning required tasks to be done to the members of the "ISO Certification Process Committee" as per the guidelines given by the ISO certification providing body.		Study Engineer Assistant to Study Engineer ISO Certification Body
		Obtaining the ISO 9001 and 22000 certifications and continuous follow up to make sure timely completion of required ISO process documentations and to make sure the prompt actioning to fulfill all the regulatory requirements of the ISO certification.	Appendix II (m)	Study Engineer Assistant to Study Engineer ISO Certification Process Committee

Appendix 28

Cost Estimates

Ref	Interviewee Designation	Inventory	Information Extracted from
3	Factory manager, Tea factory officer, Tea factory supervisor, selected factory workers	Tolerable machine breakdown hours of the companyare288 per year. Average actual machine breakdown hours are 614 per year (2020 to 2022) Negative variance in machine breakdown hour are 326 per year which is a 113% (2020 to 2022) There had not been a proper machine maintenance work plan in the company.	Company annual financial budget. Machine breakdown record summary book.
4	Factory manager, Tea factory officer, Tea factory supervisor, selected factory workers	Average tolerable end product quality rejections per year are 6,000 (2020 to 2022) Average actual end product quality rejections per year are 17,900 (2020 to 2022) Negative variance in annual average end product quality rejections are 11,900 per year which is a 199% (2020 to 2022) The company is not having a specifically defined system to make sure the quality of end product at the moment.	Company annual financial budget. Product quality rejection summary report.

No	Study Component	Proposed Solutions	Reference (Appendix No)	Cost LKR – (For 12 months)
1	Raw Material Quality	Agreeing the format and preparation of "Good Leaf Count Test Sheet"	Appendix II (n-1)	3,864 GLCT sheets per year * Rs 5 per sheet = Rs 19,320
		Completing a separate "Good Leaf Count Test sheet" for each lorry load of Raw Material Green Leaf intake by evaluating the samples raised. (Daily)		Nil
		Checking the accuracy of the sample evaluation and the data entries in the Good Leaf Count Test sheet. (Daily)		Nil
		Approval or rejection of the raw material green leaf lorry load. (Daily)		Nil
		Reviewing and commenting on the Good Leaf Count Test sheets. (weekly)		Nil

No	Study Component	Proposed Solutions	Reference (Appendix No)	Cost LKR – (For 12 months)
		Agreeing the formats and preparation of "Green Leaf Supplier Monthly Meeting Plan" and "Green Leaf Supplier Meeting Discussion Point Summary Sheet". Approval of "Green Leaf Supplier Meeting Plan" for execution.	Appendix II (n-2)	847 no of sheets * Rs 5 = Rs 4,236 Nil
		Meeting the green leaf suppliers as per the approved meeting plan & obtaining the regular supplier feedback & updating the Green Leaf Supplier Meeting discussion point summary sheet. Reviewing and commenting on the "Green Leaf Supplier Meeting discussion point summary sheet".	Appendix II (n-3)	Rs 569,989 Nil

No	Study Component	Proposed Solutions	Reference (Appendix No)	Cost LKR – (For 12 months)
		Agreeing the format and preparation of "List of good leaf suppliers" to pay Incentives. (This monthly Report to be prepared based on the records of Good Leaf Quality Test Sheets and Green Leaf Supplier Meeting discussion point summaries)		Nil
		Assessing the raw material quality & providing supplier wise approval or re-jection to the list of good leaf suppliers to pay Incentive Payments (Monthly Report)	Appendix II (n-4)	Rs. 1,506,977
2	Machine Mainte-nance	Agreeing the format and preparation of Overall Equipment Effectiveness (OEE) computation sheets		Nil
		Providing a training program to the Tea Factory Manager, Tea Factory Officer, Assistant Tea Factory Officer about OEE implementation, im-portance and need of proper machine maintenance and documentation.		Rs 35,000

No	Study Component	Proposed Solutions	Reference (Appendix No)	Cost LKR – (For 12 months)
		Updating OEE documents on a timely basis.		Nil
		Checking OEE documents on a timely basis.		Nil
		Reviewing, commenting & signing off on OEE documents on a timely basis.		Nil
		Final Checking & Signing off the OEE documents on a timely basis and providing corrective action plans as necessary.		Nil
3	End Product Quality	Appointing an "ISO Certification Process Committee" in the organization		Nil
		Evaluating and selecting a suitable ISO certification providing body		Nil
		Signing an agreement with the selected ISO certification providing body	Appendix II (n-5)	Rs 634,509
		Providing ISO training sessions to "ISO Certification Process Committee" and the internal employees as necessary		Rs. 45,000

No	Study Component	Proposed Solutions	Reference (Appendix No)	Cost LKR – (For 12 months)
		Assigning required tasks to be done to the members of the "ISO Certification Process Committee" as per the guidelines given by the ISO certification providing body.		Nil
		Obtaining the ISO 9001 and 22000 certifications and continuous follow up to make sure timely completion of re quired ISO process documentations and to make sure the prompt actions to fulfill all the regulatory requirements of the ISO certification.		Nil
	TOTAL COST			Rs 2,815,030

Appendix 29

Study benefits and Benefit cost analysis

Study Benefits

No	Benefit	Reference	Value LKR – 12 months
1	Direct Tangible Benefits		
1-a	Direct Benefit: Working Capital savings from expected reduction in Inventory Write-offs per year - Rs	Appendix 22	Rs. 8,213,159
1-b			
2	Indirect Tangible Benefits		
2-a	Additional contribution from protected inventory	Appendix 22	Rs. 1,449,381
2-b	Additional contribution from annual production due to Product Certification	Appendix 23	Rs. 5,288,462
	Total Tangible Benefits		Rs. 14,951,001
3	Intangible Benefits (Only if quantifiable)		
3-a	Intangible benefit-a		Nil
	Total Intangible benefits		Nil
	Total Benefits		Rs. 14,951,001

Benefit – Cost Analysis

Detail	Value LKR
Total Study Benefits (Table 4.10)	Rs. 14,951,001
Total Study Costs (Table 4.9)	Rs 2,815,030
Net Benefits of the Study	Rs. 12,135,971
Benefit / Cost Ratio	5.31

Appendix 30

Objective, Output and Outcome Summary

No	Study Component	Study Objectives	Output	Outcome
1	Excessive inventory write-offs of COMPANY X	To reduce the excessive inventory write-offs of COMPANY X from the current level of 11.46 % of the year-end inventory vale to 4% of the year-end inventory value.	Reducing the inventory write-offs in COMPANY X to 4% of the year-end inventory value.	Minimizing the inventory write-offs in the company. Manufacture of improved quality end product. The output of this study component will lead to increase the contribution(profitability) of the company. Lesser burden on cash investments in working capital of the company.
				Improving the customer trust and customer satisfaction by reducing customer product rejections. Generating additional revenue to the company.

No	Study Component	Study Objectives	Output	Outcomes
2	Raw Material Quality	To increase the raw material (green leaf) good leaf quality from the current level of 58% to 65% or more good leaf count percentage which is the Tea Industry Standard (This is accounting to a 7% increase).	Increasing the good leaf quality of raw material (green leaf) intakes to 65% level.	Improving the raw material quality to the best possible level which is the tea industry standard. Manufacturing a superior quality end product. Development of the supply chain. Supplier quality integration. Developing a proper procurement strategy in the company. Supplier development and involvement in business for a win-win situation. Development of supply chain partnership strategies. Business risk sharing between the manufacturer and the raw material suppliers.
				Development of collaboration with the suppliers. Developing incentive schemes to share the cost savings in the raw material buying process. Improving the company profitability.

No	Study Component	Study Objectives	Output	Outcomes
3	Machine Maintenance	To monitor and increase Overall Equipment Effectiveness and thereby to reduce the existing average annual machine breakdown MB) hours from 614 hours per year to 288 hours per year (This is a 113% reduction in MB Hrs.)	Reducing the machine breakdown hours by 113% from the current level to meet the company tolerated machine breakdown hours level.	Improving the machine maintenance effectively. Reducing machine breakdown hours. Improving the overall equipment effectiveness of the machinery. Making a quality end product. Reduction of avoidable expenses like overtime, etc. Leading to lean manufacturing practices. Improving food product quality. Improving customer faith about the products. Improving customer satisfaction. Improving the company profitability.

No	Study Component	Study Objectives	Output	Outcomes
4	End Product Quality	To reduce the annual average product quality rejections from 17,917 kg per year to 6,000 kg per year (This is a 199% decrease in product quality rejections). To increase customer satisfaction.	Reducing the product quality rejections by 199% from the current level to meet the company tolerated product quality rejection level. Increasing customer satisfaction.	Increasing the end product quality. Increased company profitability. Reduced inventory write-offs. Effective utilization of raw materials with better productivity. Increasing customer satisfaction. Generating solid cash inflows to the company. Increased business growth. Leading to TQM practices. Development in supply chain quality management. Minimizing of product quality defects. Establishing a well-recognized quality assurance certification system in the company.