Journal of Tea Science Research. 2015, Vol. 5, No. 6, 1-14
http://jtsr.biopublisher.ca

Research Report Open Access

Effectiveness of 5S Application in Tea Industry and Synchronization of 5S into ISO 22000:2005

Lokunarangodage C.V.K. ✉, Wickramasinghe I., Ranaweera K.K.D.S.
Department of Food Science and Technology, Faculty of Applied Sciences, University of Sri Jayewardenepura, Gangodawila, Nugegoda, Sri Lanka
✉ Corresponding author email: vindikal@gmail.com
Journal of Tea Science Research, 2015, Vol.5, No.6 doi: 10.5376/jtsr.2015.05.0006
Received: 30 Sep., 2015
Accepted: 18 Oct., 2015
Published: 20 Nov., 2015

Preferred citation for this article:
Lokunarangodage C.V.K., Wickramasinghe I. and Ranaweera K.K.D.S., 2015, Effectiveness of 5S Application in Tea Industry and Synchronization of 5S into ISO 22000:2005, Journal of Tea Science Research, 5(6), 1-14 (doi: 10.5376/jtsr.2015.05.0006)

Abstract A study was conducted to develop an ISO 22000 generic model for tea industry in synchronization with 5S while considering changes in currently adapted systems, processes, practices and adaptation to design synergetic technical solutions. Thus all stakeholders in tea manufacturing process were interviewed and requested to use the developed documents as a user innovation strategy and incorporated progressive changes in design until both document management and user's requirements were satisfied. The documents were prepared in local language and 5S work instructions were enriched with food hygiene requirements instead of developing new set of instructions where harmonization, modification and adaptation was very effective. Work instructions, cleaning and housekeeping were further integrated while enriching with relevant standards to be met after cleaning as well as relevant records and references. Consequently, work instructions, preventive maintenance, general housekeeping, training and standardization were properly synchronized where it was used from existing 5S systems with modifications to harmonize and comply with ISO 22000 as well as 5S requirements which reduced the time spent for recordings on two systems. Synchronization reduced the number of documents used in the food safety management system up to a great extent and frequency of recording while improving the effectiveness of recording.
Keywords ISO 22000; 5S; Synchronization; Work Instructions; Tea Manufacturing; Orthodox Black Tea

Introduction

As a medicinal crop tea has been grown in China over five thousand years, to become a USD 4 billion industry today (Fair-trade foundation, 2010) which has employed more than 15 million people around the world to serve over four billion tea cups a day. The scotch man James Taylor was became the first commercial tea planter in Sri Lanka, who planted approximately 8 ha of tea on Loolecondera at Hewaheta in Kandy district in 1867, which is still in production (Fuches, 1989; Boyle, 2012).

Sri Lanka is one of the oldest tea producing countries in the world. Commercial tea plantation and production in Sri Lanka commenced almost 148 years. Sri Lankan tea was branded and known as Ceylon Tea which is ranked one of the superior teas among the teas available in the international trade and over the years the word Ceylon has become synonymous with quality tea (Mohamed and Zoysa, 2006). The major product of the country is orthodox black tea which accounts for 95% of the total production with the balance being cut, tear and curl (CTC) that was mainly utilized for tea bags. The instant tea and green tea productions were very minimal compared to the orthodox black tea manufactured in the country (Mohamed and Zoysa, 2008).

Sri Lankan tea industry annually produced around 320 million kilograms of made tea according to the current statistics available. Out of the given production output, country has manufactured approximately 95% orthodox black tea annually which basically intended for export representing 32% of the global demand on orthodox black tea (Ministry of Plantation Industries, 2013). The CTC and green tea represents only 5% of the total production and country manufacture tea throughout the year. The growing areas were distributed differently and

mainly concentrated in the central highlands and southern inland areas of the country which can be broadly categorized according to elevations, with high grown lands ranging from 1200 m upwards, medium grown tea fields covering between 600 m to 1200 m and low grown tea fields from sea level up to 600 m (Williges, 2004).

The major problem encountered in the improvement was production and development of infrastructure, because cost of production (COP) was being highest among tea producing countries, whereas the profitability is comparatively less. The corporate sector has the highest COP which basically depends on the cost of green leaves and which in turn is dependent on the productivity of the field, wages, plucker intake, cost of other inputs such as weeding, fertilizing and transportation costs. The current rate of a green leaf 1kg was found to be around LKR 75.00 – 80.00 and plucking cost was about LKR 25.00 per 1kg. Accordingly, the total gross cost of the green leaf per 1kg was about LKR 60.00 where corporate sector has lower profitability rates due to the many other overheads accumulated while manufacturing process up to the auction. On the other hand, smallholder sector operates in different models where household labour is mostly utilized in many of the crop management and plucking operations as well as transport.

Nonetheless, consumer awareness on product safety is stronger. World food crises that prevailed in the past decades resulted doubts in the consumer's mind thereby causing lack of trust and confidence in products placed on the market. Fortunately, most of the companies have already given special attention on the product quality and consumer safety. A lot of good practices have been developed and implemented on a voluntary basis by manufacturers. These practices ensure achieving product safety satisfactorily (The Traceability Blue Book, 2004). Companies continuously challenge their internal quality systems and work on continuous improvement, thanks to new technologies and ways of working.

Considering these food safety problems and trade issues generated over the time, the International Standard Organization developed the ISO 22000 Food Safety Management System (FSMS) to harmonize the requirements of various food safety standards into integrated system while eliminating lots of trade issues faced on exports. The new standard ensures the complete food safety of entire food supply chain while satisfying global food safety statutory and regulatory requirements.

ISO 22000 is a quality assurance system introduced by ISO, to ensure consumer safety through food safety while eliminating trade issues, which is a further development of hazard analysis critical control point (HACCP) and other available food safety/quality assurance systems that ensures the food safety of entire food supply chain from farm to fork. ISO 22000 is a federative standard which harmonized the most of the food safety requirements set by different global standards and compatible with any food safety regulation worldwide.

ISO 22000 has been developed basically merging good manufacturing practices (GMP), HACCP and ISO 9001. Here the foundation layer is consist of GMP/GHP/GAP, Codex General Principles of Food Hygiene and Prerequisite programs which altogether creates very sound infrastructure and physical requirements to implement food safety requirements inside the plant focusing on basic food hygiene standards.

The total food safety is achieved through HACCP system of Codex Alimentarius using its seven principles to identify hazards and to control them under strict management plan. This includes the hazard analysis, identification of critical control points, establishment of critical control limits, monitoring procedures, corrective actions, record keeping and verification activities. However, these requirements are applied through mandatory food safety procedures. In addition, same procedures and activities are applied to the prerequisite programs and operational prerequisite programs identified according to the risk levels of the product manufactured.

The most effective food safety systems are established, operated and updated within the framework of a

structured management system and incorporated into overall management activities of the organization concerned which provide the maximum benefits for interested parties. The standard integrates the HACCP system and application steps developed by Codex Alimentarius Commission. By means of auditable requirements, it combines the HACCP plan with (PRPs) perquisite programs (ISO 22000, 2005). The ISO 22000 FSMS has been developed based on risk based management model focusing the entire food supply chain through harmonization.

While improving the tea industry, Sri Lanka Tea board, Tea Research Institute and Plantation owners had committed greatly where various new technologies, improvements, polices and regulations introduced over the time and adapted. Some of these introductions were diminished over the time and some of them were survived while few of them were greatly adapted and adsorbed by governing and regulatory organizations as well as plantation or factory owners and their subordinates. One of such introductions was Japanese 5S method which has helped tea industry to improve its productivity and organization of work place into a more productive system. Nevertheless, tea industry also adapted ISO 22000, HACCP, ISO 9001, UTC, Ethical Tea Partnership and many other different standards relating to buyer requirements or the company's individual preferences.

5S was initially originated in Japan which dates back to the post developments of World War II (Osada, 1991), where it was used to improve the overall productivity of manufacturing through focusing cleanliness, orderliness and discipline with continuous improvements. The concept was first developed by Hiroyuki Hirano (Patel and Thakkar, 2014) and it was further developed by Takashi Osada around 1980's which was commonly adapted by Japanese firms to enhance human capabilities while improving the productivity (Kumar et al., 2007; Daud et al., 2006). 5S has five words begin with "S" where it got its name and they are Seiri, Seiton, Seiso, Seiketsu and Shitsuke, in Japanese language which means Sort, Set in order, Shine, Standardize and Sustain in English. The five words can be explains as follows in literature.

Seiri – Sort: it is the first step of 5S and stress to remove all unnecessary or surplus objects from the workplace that has no immediate requirement for ongoing operations (Hough, 2008).

Seiton – Set in Order: The second word which requests to keep all the sorted items in right places where they are frequently required for the smoothness of operation. The users must be motivated to place objects in right places where it belongs or at its point of use which help improve the visual management of work place (Van, 2006).

Siso – Shine: After the removal of unnecessary items away from the work station while re-placing the necessary objects in right places according to the utility, it was necessary to set the sanitizing or cleaning standards (Howell, 2009) where a cross-functional team should decide on the required cleaning standards (Samuels, 2009) for the operation.

Seiketsu – Standardize: The maintenance of the work place was mandatory after organizing and cleaning of the place, thus standardizing is required (Cooper et al., 2007) for the continuation of previous achievements (Samuels, 2009).

Shitsuke – Sustain: The success of a 5S implementation is basically depends on the sustainability of the program where benefits of above 4S were easily measurable and visually observed. But without self-discipline which was the element of sustainability, can be momentary and transform back to the initial messy workstation (Maggie, 2006).

According Goetsch and Davis (2010), continuous cost reduction and improvements of quality were critical requirements for any organization to stay on business in any competitive marketplace. Since 5S was very popular around the world today as a total quality management tool (TQM), it has absorbed into many industries as well as service organizations which was further associated with other major TQM tools such as Kaizen, Continuous Improvement, Six Sigma, Just-in-Time (JIT) (Wakhlu, 2007) as well as Lean Management. Thus 5S was helping many

industries to reduce the waste while optimizing the productivity through maintaining an orderly workplace with the use of visual cues to accomplish highly consistent operational outputs (Janakiraman and Gopal, 2007; Parrie, 2007; Gapp et al., 2008). Nevertheless, some of the empirical analysis had demonstrated that the successful implementation of 5S significantly improve the organization's financial and operational performance (Salaheldin, 2009).

The Sri Lankan tea industry has adapted various quality tools to improve productivity, efficiency, customer satisfaction, food safety as well as environmental sustainability and social wellbeing. However, these systems were operated separately where it generated additional costs to the operation while making it is complex as well as not properly operated according to the requirements. Due to that fact, most of the adapted systems were abandoned, weakly operated or virtually existed only for auditing dates. In contrast, 5S implementations which were initially promoted by the Sri Lanka Tea Board had gained the significance where it was drifted in to the all existing tea factories up to a certain extent while some of the factories were operating at extraordinary conditions. Most of the employees were also aware about 5S and they practiced it in their workplaces. The research was further intended to study and select the basic areas of interventions compatible with ISO 22000:2005; which could be merged to ISO 22000 FSMS with or without modifications to its original implementation objectives while designin -g relevant document formats.

Thus study was focus to understand effectiveness and efficiency of 5S applications in the orthodox black tea manufacturing process and apply the 5S methodology in synchronization with ISO 22000: 2005 to develop a hybrid generic model which can be customized according to the factory requirements. The research further intended to identify highly compatible areas and adaptable interventions in tea industry with ISO 22000 while developing necessary formats to use in food safety generic model. The findings of the work were incorporated into ISO 22000 generic model which will help tea manufacturing facilities to easily adapt ISO 22000 FSMS while amending their existing 5S systems to match with relevant regulations.

Materials & Methods

The study was designed to evaluate the major food safety violations in tea supply chain with a special attention to tea manufacturing process. Current food safety applications, their efficiency and constraints to implement proper food safety management systems in tea industry as well as to find out reliable solutions with minimizing or eliminating the existing complications was the main objective of the study. The sampling plan was stratified random sampling, with the use of Factory Information.xls provided by the Sri Lanka Tea Board. The excel sheet contained contact information and addresses of the tea factories which was used to select tea factories from the low grown orthodox black tea manufacturing industries based on whether they had a food safety certification or not and then 30 factories from each group. The following areas were selected due to the easy access as well as shorter distances between factories where concentration of factories was high. The most prominent area was the Southern province due to the fact that law grown tea manufacturing was prominent throughout the province while Galle, Matara and Rathnapura districts were set as major target areas for the project execution considering the objective of analyzing low grown orthodox black tea manufacturing industry.

The project has two phases for execution and sample size for each phase was 30 factories and cumulative target was to evaluate 60 low grown orthodox black tea manufacturers where phase II was focused on the factories which have ISO 22000/ISO 9001/HACCP systems or Good Manufacturing Practices with Japanese 5S implementations. However, there were number of tea factories which had abandoned the implemented food safety management systems due to various reasons, where additional priority was given to understand the problems they faced, that led to abandoning as well as to find out the remaining practices and their efficacy.

In-depth site analysis were carried out factories were evaluated based on the visual observations, documentary evidences, in-depth structured interviews and unstructured discussions for all the 45 factories audited where stage I gap analysis was based on GMP compliance at the time of evaluation, while stage II internal audits were focus on the compliance of GMP with HACCP or ISO 22000 system requirements. The unstructured interviews were mostly used to gain additional insights of the organizations and their role in the industry as well as anecdotal information about real food safety practices. All the factories were evaluated against GMP since it is the basic level of registering a food manufacturing facility in the country as stipulated by the Sri Lanka Food Act no 26 of 1980. The compliance to GMP was weighted averaged to consider the real impact on each and every component of the GMP can provide for the basic food hygiene to be met by food manufacturers.

According to the evaluation of first stage and second stage results, the 5S implementation in tea industry and practices were very identical and sustaining where additional focus was given to understand best practices as well as to capture them over the auditing activities. Bearing in mind the importance of 5S in tea industry, the system development was focused to absorb 5S into ISO 22000 food safety system development work. Thus existing 5S systems and practices were thoroughly studied and best practices were captured with a digital camera. 5S related literature was collected and analyzed to develop 5S based ground level documents which workers easily understands, where published literature was very important.

The system development initiative was based on the human involvement, processes, tools and technology. Thus development process focused on integrated requirements of both ISO 22000 and 5S while considering changes in the currently adapted systems, processes, practices, and adaptation to design synergetic technical solutions. Incorporation of designed changes to improve the documentation system had to be defined with the comparison of design elements and management requirements while discussing with management as well as the operators to validate the application by changing design to match with user requirements. The policies and procedures as well as available literature related to food safety management system were reviewed to improve the functionality of the food safety management systems in the organization. The new changes required adaptation, where training required as well as responsibilities were also considered. The information available as well as existing ISO 22000 and 5S document management systems were analyzed for the identification of gaps between the requirements of the organization (in terms of document management) and the functionalities of its existing systems. Further considerations were given to the duplication of information as well as the document management strengths that can be used to promote the proper management of documents through the analysis of context of organization with regards to the activities and transactions of the organization in the business processes.

Results and Discussion

In pursuit of finding best practices of the tea industry to develop of a ISO 22000:2005 generic model to utilize in tea manufacturing process; the research found most of the tea factories evaluated for the objective has implemented Japanese 5S (Figure 1) to cut down the waste and to improve the productivity. On the other hand, over 75% of the workers interviewed from the factory floor levels had basic understanding of the 5S methodology while they had participated for implementation of the 5S system in their working place or in a previous working place. According to the figure 01, over 50% of them had some kind of 5S training in their working environments as they explained to the question of what kind of trainings they had. The activity was greatly influenced by the Sri Lanka Tea Board's star factory grading system which was abandoned after very successful implementation of few years, where the 1st star was given for very successful implementation of 5S methodologies. Although the implemented systems were mostly concentrated on visual representation of various kinds of sign boards, instructions and praises; efficient auditable systems were seen in very few

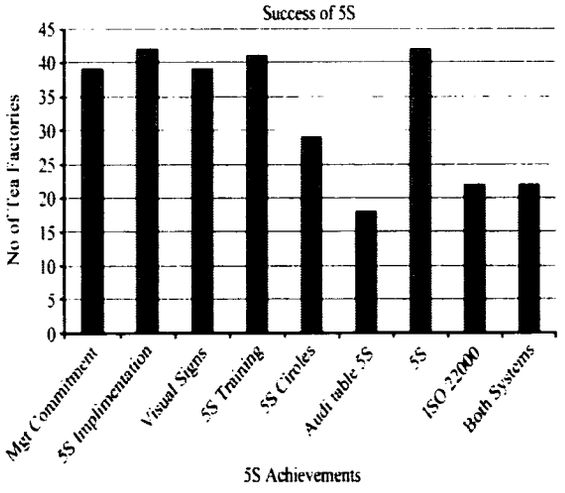

Figure 1: 5S Adaptation in Tea Industry and Success

factories due to the fact that 5S systems were not developed up to the sustaining stages.

In current context, most organizations are look forward to find ways of reducing the cost, improve the quality while increasing the productivity in order to be more competitive and maintain the organization's excellent performance (Hirata, 2001). While considering ISO 22000 FSMS in contrast to Japanese 5S, it also has same areas of interventions which had more alike features where it was better to consider utilizing adapted systems instead of developing a completely new system.

Thus ISO 22000:2005 can be further harmonize with existing 5S systems in tea industry, where features like work instruction, preventive maintenance, general housekeeping, training and standardizing can be used from existing 5S systems with little modifications to synchronize and right wording to comply with ISO 22000 and 5S requirements. This will reduce the time spent for recordings on two systems. Nevertheless, previous research findings supported that implementation of 5S in workplace was substantially correlated to the achievement of quality assurance certifications like ISO certifications (Piros, 2013). As a rule of thumb, obtaining such quality certifications could help increase the customer perception on company's reputation and performances (Elfenbein et al., 2013) where Chemmanur and Peaglis (2004) explained that who has successfully implemented 5S/any other quality assurance programs were critical about the implementation of continuous improvement at their internal operations.

At the same time, it was very important to decide the most appropriate policies, practices, standards, tools and other tactics the organization should take to remedy the weaknesses identified. As a rule of thumb, the nature of the organization, type of activities carried out, as well as its human resources, tools and technology, has to be aligned to the company culture while considering external socio-political constraints. User innovation was very vital factor in any successful development and implementation of a document management system where user requirements and user involvement was considered as an essential part of the development process. Thus tea factory officers, managers, operators and labourers were interviewed, requested to use the developed documents and asked for the elements that affect them and incorporated progressive changes in design until both document management and user's requirements are satisfied.

Nonetheless, most of the previous researches on total quality management (TQM) had proved that, it was always linked to organizational performance and excellence (Prajogo and Sohal, 2006; Irani et al., 2004; Janakiraman and Gopal, 2007; Vijande and Gonzalez, 2007) which was gaining significance as a tool of enhancing organizational performance. However, the success of implementation of TQM as well as 5S also depends on the development of the complete and consistent programs (Kaluarachchi, 2009; Hirata, 2001). Empirical studies has shown that most successful implementations of 5S were greatly influenced by management leadership, continuous improvements, supplier quality assurance, improvement tools and techniques, measurement and feedback, human resource development, systems and processes, resources, education and training, as well as work environment and culture (Rafikul and Reeduan, 2008). The organizational culture was a key to the preliminary development and successful implementation of 5S concept where it has been identified that conducive cultural characteristics

such as employee involvement, management support and continuous focus element, within organization have a greater impact to quality management development and implementation (Fredendall et al., 2006). Thus organizations with objective of implementing 5S in their workplaces must have a culture of considering learning as a fundamental requirement of survival of an organization (Pool, 2000; Nikolic and Nastasic, 2010).

Furthermore, concept of quality circle approach had a great influence to 5S applications in tea industry; in which workers banded as small teams working in specific areas for the betterment and smoothness of operation where cleaning, organizing and managing workplace was more efficient with them. According to Swinton (2004) and Isoeasy (2006), the formation of quality teams within the organizations had helped to carryout quality assurance process while contributing to the continual sustainability of the organization's performance over long run. Designing a properly documented management system was not an easy task, because it has to consider various aspects before finalizing a given set of instructions or preparing a record for evidencing the systematic approach as well as following the exact system guidelines. On the other hand, designing was the key activity in transforming key strategies, requirements and techniques selected for the system where digital or paper based systems have to draft all the manuals, policies, objectives, scope, procedures, prerequisite programs, work instructions, standard operating procedures, records, reports and checklists etc. considering the ISO 22000 FSMS and tea manufacturing. It was mandatory to prepare food safety procedures, prerequisite programs, HACCP plans and OPRP plans with work instructions for various operational requirements as well as records for the evidence which was necessary for auditing purposes; were systematically evaluated.

The documentation pyramid was considered as the cornerstone for the documentation developments, where the first tire (Figure 02) was consist of ISO 22000 policy statement, scope, objectives and the manual (manual is optional) . The second tire was

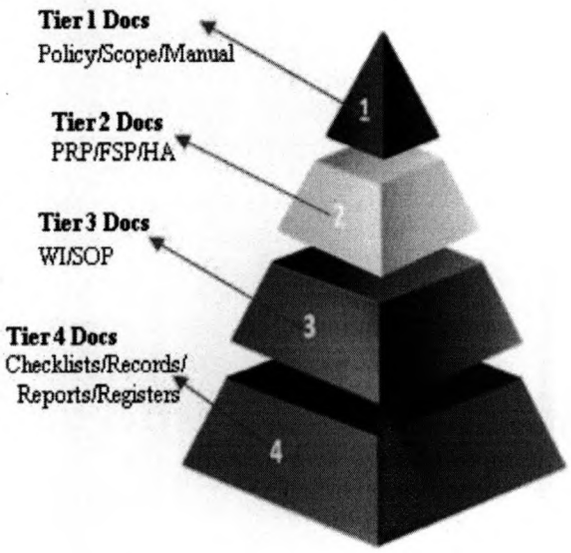

Figure 2 Documentation Pyramid

consisted of food safety procedures and prerequisite programs where hazard analysis also came under same layer. However, the 3rd layer was basically used for work instruction where ISO 22000 and 5S requirements were consolidated in to single set of instructions while considering to use available 5S practices with alignment to ISO 22000 requirements. The 4th layer of the documentation pyramid normally consisted of records, reports, checklists and any kind of evidencing documents which were basically keep for the auditing purposes and for the traceability requirements.

Considering the given requirements, work instructions were written in following order, where it was basically to educate operators or labourers in case of they don't know what is tea manufacturing or a specific operation. In such situations, the work instruction booklets are given to relevant person for reading in order to raise his/her knowledge on the specific process and then he may be start the work under the supervision of the relevant supervisor or another senior worker. However, the work instruction has great deal of information on the exact work where employee will have the opportunity of understanding standard operating procedure of a given operation, its cleaning requirements, specific methods of cleaning and the way it must be visible

after the work and cleaning was over. Thus work instructions were very important in tea industry because of the lower education of the factory workers as well as lower awareness on food safety, personnel hygiene and sanitation of the factory environment.

Typical work instruction documentation shall include following areas for the complete understanding of the assigned work which can be written as:

1. Subject

The subject of work instruction which can be a process or activity to be performed in most instances

2. Objectives

Objectives of writing and letting someone read the given work instruction

3. Responsibility

Who: the position or person is responsible for what activity

4. Instructions/Activities

What/How: any activity or process has systematic way of doing and sequence for operating for a given task, which has to be explained in a manner that the relevant operator can easily understand and act without very much guidance and supervision.

When/Frequency: it is also necessary to instruct how often the "Who" does the "What".

i.e. Starting a machine required to be verified for, if it fits for the operation first, then it is necessary to power on and check for if the indicators are okay and then it is the time to push the start button.

5. Subject Area Cleaning

It was mandatory to mention following areas of any cleaning schedule for the complete understanding of the work as well as relevant requirements.

a. *Time of cleaning*
b. *Required number of workers*
c. *Objects and equipment meant for cleaning*
d. *Equipments and materials required for cleaning*
e. *Method of cleaning*
f. *Frequency of cleaning for specific objects or equipment*

6. Standards to be maintained or audited after cleaning for verification

This is actually the last step of 5S and it is mandatory to maintain sustainability of the ongoing work as well as its continuous improvements.

7. Records

Evidence of the relevant works carried out and the cleaning checklists that are mandatory to find out the reasons for deviations as well as to prove that all the planned activities were followed in the systematic way to comply with system requirements.

8. References (if any)

References and guidelines as well as records/reports related to the work instruction

Cleaning and housekeeping was another synergetic area of 5S and ISO 22000 where it can be used separately or in combination of work instructions. In pursuit of excellence and to reduce the number of documents to be used in the production floor as well as to make it more relevant and easily understandable; cleaning and housekeeping was also merged into the work instructions where it was really belonged. It was mentioned in the given format above under the section 5, subject area cleaning. However, it was also enriched with relevant standards to be observed by the supervisor after cleaning as well as records and references relevant to the work in progress or to the work instruction; was also given in the same book let. On the other hand, these documents have to be prepared in the local language or the mother tongue of the workers to let them understand easily. The cleaning check list of the relevant area (i.e. figure 03) also added to the work instruction booklet which was further simplify the understanding of the reader who intern understand what is the duty to perform and how to perform and the way of cleaning of the workstation as well as records to be completed after completion of the given job function.

A typical example of a prepared Work Instruction translated to English which was initially developed in Sinhala was given below.

1.0 Subject – Withering

2.0 Objectives

Preparation of leaf for rolling by removing the water and changing the physical state of the leaf.

Control of temperature to minimize the breakdown chemical compounds inside the leaf.

Extend the minimum time required up to 8 hours before chemical degradation starts inside the leaf.

3.0 ***Responsibility*** *– Withering Operator*

4.0 ***Instructions***

4.1 Clean yourself and wash your hands before entering the production facility and then wear appropriate uniforms, gloves, mask and cap.

4.2 Clean the utensils, equipment and withering area within first 15 minutes.

4.3 Check the hygrometers for appropriate levels of water and add water if necessary.

4.4 Green leave are weighted and sorted by the appointed personnel, but leaf needs to be tested and verified for matured leaves (B – 60 Leaf Grading/Randahlu Verification) as well as presence of high moisture.

4.5 Check for the presence of impurities, biological or physical hazards in green leaf.

4.6 Remove impurities, none tea leaves, insects or dead insects if rarely presence.

4.7 If the impurities concentration is considerable, reject the relevant amount with the approval of relevant officer working in the withering area.

4.8 Stack the withering trough loosely up to the top level of the trough without compressing the leaves.

4.9 Fix the name/code tag on trough relevant to the Supplier/Area/Vehicle from the starting end of the specific green leaf quantity.

4.10 Start the withering fans after completion of loading the withering troughs.

4.11 Control the hygrometer difference around 4F – 6F (6F – 8F on a raining day) and supply dry heated air.

4.12 Observe withering time. Initial withering will take place at the bottom layer which has to be check time to time.

4.13 Stop the fans when the bottom layer is withered completely and turning and mixing has to be carryout time to time and re-stack before re-starting the fan.

4.14 Start releasing properly withered green leaves to the rolling room after approval of the relevant officer

4.15 The leaves have to be weight according the roll size before releasing to the rolling operation and release when request is made by the rolling section.

4.16 Always release leaves from a single withering trough and start a new trough once the entire trough is emptied properly.

4.17 Record the start and end timings, turning and mixing times as well as hygrometer readings appropriately on the given recording formats.

4.18 Clean the withering area, withering troughs and equipments properly (Follow the instructions given below).

4.19 Prevent any cross contamination from biological, chemical or physical hazards at all stages of withering.

4.20 Inform the relevant officer or technician, if there is any breakdown, technical failures or mechanical issues found on machinery or equipments.

5.0 Cleaning of Withering Area

5.1 Cleaning Time

7.30 am – 7.45 am

4.45 pm – 5.00 pm

5.2 Required Number of Workers

Daily	*– 05*
Weekly	*– 05*
Monthly	*– 02*

5.3 Equipments to be Cleaned

Staircase, Floor and Deck
Through Nets
Trough Fan Blades
Trough Fan Nets
Trough Fan Louvers

Cobwebs on walls and Ceiling
Windows, Nets and walls/Surfaces
Internal Fixtures and Floor of the Trough
Sign boards on Troughs and Equipments

Following Items to be leaned Under Supervision of an Officer

Trough Fan Blades
Trough Fan Nets
Trough Fan Louvers

5.4 Utensils Required for Cleaning

Brooms	*– 08*
Hand Ekel Brooms	*– 04*
Ekel Brooms	*– 10*
Cobweb Brush	*– 01*
Sponges	*– 06*
Cleaning Cloths	*– 20*

5.4.1 Method of Cleaning

5.4.1.1 Daily

Sweep and clean the Deck, Staircase and the Floor properly.

Sweep and clean inside fittings and internal floor of the trough using the hand ekel broom while removing all the leaf particles retaining there.

Sweep and clean trough nets using the hand ekel broom properly.

5.4.1.2 Weekly

Clean trough fan blades with a wet cloth properly.

Clean trough fan louvers with a wet cloth properly.

Clean the windows, nets and walls of the loft with brush and broom.

Remove the cobwebs on the ceiling and walls with a cobweb brush.

5.4.1.3 Monthly

Wash and clean all the nets on the windows of the loft.

6.0 Visual Standards after Cleaning

There shall be no any remaining dirt or dust on the loft.

There shall be no any remaining leaf particles inside the trough or on the nets.

There shall be no any remaining dust or dirt on trough fan, fan blades or louvers.

There shall be no any remaining cobwebs on ceilings or on the walls.

There shall be no any remaining withered leaves in plastic creates.

There shall be a clean and tidy nice environment.

7.0 Records

Withering Area Cleaning Checklist – FSMS 04/PRP/11/RP/01 (**Figure 03**)

Hygrometer Temperature record – FSMS 04/PRP/05/RC/01

Withering Record – FSMS 04/PRP/05/RC/02

8.0 Reference

Control of Monitoring and Measuring of Equipments and Methods - FSMS 02/PRP/04

Storing Handling and Transportation of Materials - FSMS 02/PRP/05

Control of Monitoring and Measuring equipment and methods FSMS 02/PRP/11

Preventive maintenance was one of the major areas to consider while implementing food safety since ISO 22000:2005 is based on preventive action for elimination of hazard occurrences in food manufacturing operations. Thus it was mandatory to keep all the machinery and utensils in appropriate conditions where preventive maintenance was one of the key areas to consider. On the other hand, 5S applications also consider preventive maintenance as a key function as well as lean manufacturing operations. ISO 22000:2005 focus to keep records on preventive maintenance of all the machineries where it was also applicable to 5S too, because conducting preventive maintenance has been identified as the best long term strategy to maintain equipment where preventive maintenance strategy and scheduling were major key options to reduce work-in-process inventory while

XYZ TEA FACTORY — Black Tea
ISO 22000 - PREREQUISITE PROGRAMME — D. Ref: FSMS 03/WI/WA/01
WORK INSTRUCTION - WITHERING AREA

Withering Area Cleaning Record

Month: | 2015 | D.Ref: FSMS 04/PRP/11/RP/01 | Loft No:

Date	All units are free of unnecessary utensils & Dirt	staircase of 1st/2nd floor is cleaned	Floor of the 1st/2nd floor is cleaned	All Trough Fans are Cleaned	No cobwebs or Dust on 1st/2nd Floor	Inside, outside & all units of troughs are cleaned	No cobwebs or dust on doors, windows & ceiling	Window nets of 1st/2nd floor are cleaned	All Light bulbs and equipments are Cleaned	Leaf releasing Hoppers are Cleaned	hygrometers are Maintained	dustbins are daily Cleaned	Reasons for Not Doing	Carry out Later	Withering Operator for the Day	Checked By(A F O - Withering)	FSTL's Comments
01																	
02																	
03																	
04																	
05																	
06																	
07																	
08																	
09																	
10																	
11																	
12																	
13																	
14																	
15																	
16																	
17																	
18																	
19																	
20																	
21																	
22																	
23																	
24																	
25																	
26																	
27																	
28																	
29																	
30																	
31																	

Tick the Relevant Cage with ☑ or ☒

Prepared : FSTL
Reviewed : C - FSMS
Approved : D/GM

Revision : 00
Date : 01-03-2015
Page : 1 of 1

Figure 3: Example cleaning checklist

maximizing output (Smith et al., 2004).

Thus both system requirements were aligned to achieve single objective where ISO 22000 preventive maintenance templates were designed based on the available 5S document models with some modifications to improve the efficiency with the reduction of documentation frequencies because some of the existing 5S preventive maintenance records in tea industry requires checking the machine every day and record it. It was observed that, this practice was a rare

circumstance and most of the tea factories employed one technician who has many different functions to attend daily than checking each and every machine inside the factory where large number of different machines as well as similar machines was employed based on the capacity. However, the real practice observed was that quality assurance officers or someone carrying out documentation works tick the checklist even without looking at the machines. Thus it was appropriate to setup new recording checklist which requires running once a month preventive maintenance check and verification by the technician together with quality officer. However, each and every machine was checked for the running conditions everyday by operators and if there is any repair or maintenance to be carried out, it will be recorded in specific machine's recording sheet with relevant data. In addition to that checklist indicates replacements required as well as planed dates for execution of the planned replacements.

Furthermore to the above, training programs were enriched with additional 5S lessons which followed by red tagging exercises and implementation of 5S as well as standardization of the factory for 5S practices had shown number of benefits to the organization.

The developed system was implemented in one of the tea factories which had abandoned recertifying for ISO 22000, after the development of 5S synchronized ISO 22000:2005 generic model as a trail, where 5S were also implemented and both documentation systems were in operation. As to the results, the factory had 85 files in operation for records which was cutoff to 45 files that was related to both systems. On the other hand, most of the documents were belong to preventive maintenance of the machineries where each documents had to be filled everyday by the quality assurance (QA) personnel. However, these documents requested to check each and every machine for certain technical functionalities which was beyond the QA officer's expertise and it was more in line with technician's job description. Thus it was never practiced actually and they tick it and signed even without looking at the machine where it was changed to once month complete examination by the technician with the verification of QA Officer. In addition, all the routine maintenance and breakdowns were recorded in the recording sheet while stating the ongoing condition of the machine or equipment as well as repairs or replacements required and the planned dates to avoid any disturbances to the ongoing production. The changes in the mode of recording on preventive maintenance reduce the huge time required for unnecessary data entries while saving the time of the recording person to attend other works too.

Nevertheless, cleanliness and orderliness of machines as well as equipments and utensils were added to the cleaning checklist instead of mentioning areas without proper specifications which gave an additional advantage of verifying the individual hygiene and cleaning of each machine in the factory. The cleaning work instructions were further enriched with individual standards for each and every work carried out where it was easier for the QA officer to verify the cleaning and sanitation program on visual observation and verify it or rectify any errors or mistakes spotted.

Conclusion

Tea industry has adapted 5S as an important concept in improving productivity, quality and neatness of the organization while cutting down the waste. This was further influenced by Sri Lanka Tea Board and it was disseminated into almost all the factories were used for the study where all the factories had some kind of 5S implementation. Over 75% of the employees interviewed had some kind of 5S training in their past where it was easier for educating factory workers to implement cleaning and sanitation programs through 5S.

ISO 22000:2005 can be harmonize with existing 5S systems in tea industry, where work instruction, preventive maintenance, general housekeeping, training and standardizing were synchronizing where it was used from existing 5S systems with modifications to synchronize and comply with ISO 22000 as well

as 5S requirements which reduced the time spent for recordings on two systems. Synchronization further reduced the number of documents used in the system up to a great extent as well as frequency of recording while improving the effectiveness of recording. Nevertheless, work instructions were written based on 5S work instructions developed in tea industry because there were no extraordinary differences in writing work instruction for a given work since it was the instructions provided for a specific operation. Thus 5S work instructions were enriched with food hygiene requirements instead of developing new set of instructions where harmonization and modification was much easier than any other areas of ISO 22000:2005.

Cleaning and housekeeping were also added to the work instruction which further enhance the utility of the work instruction since cleaning schedules were also a set of instruction for a specific cleaning operation amalgamate to the relevant machinery, equipment and processing area. All the cleaning schedule requirements were properly synchronized with ISO 22000 as well as 5S. The evidences or records were also greatly adapted to the given requirements in specific places where checklists were easily understandable and applicable to the specific locations.

Concept of quality circle approach had a great influence to 5S applications in tea industry; in which workers banded as small teams working in specific areas for the betterment and smoothness of operation where cleaning, organizing and managing workplace was more efficient with them.

The changes in the mode of recording in preventive maintenance reduce the huge time required for unnecessary data entries while improving the actual application of the record. Nevertheless, cleanliness and orderliness of machines as well as equipments and utensils were added to the cleaning checklist instead of mentioning areas without proper specifications which gave an additional advantage of verifying the individual hygiene and cleaning of each machine in the factory. The cleaning work instructions were further enriched with individual standards for each and every work carried out where it was easier for the QA officer to verify the cleaning and sanitation program on visual observation and verify it or rectify any errors or mistakes spotted.

References

Piros Audrey A., 2013, The Effectiveness of 5S Practices towards Organizational Performance: Studies in Federal and State Agencies in Sarawak.(https://www.academia.edu/7871934/)

Chemmanur T.J., and Paeglis I., 2004, Management Quality, Certification and Initial Public Offerings. Journal of Financial Economics, 00 1-40

Cooper K., Keif M.G., and Macro K.L., 2007. Lean printing: pathway to success. PIAIGATF Press, Sewickly, PA.

Daud Khairul and Wan Rosmanira., 2006, An Empirical Study on the Effects of Service Quality Towards Organizational Performance in Malaysian Local Authorities. (http://www.jgbm.org/page/8%20Talib.pdf)

Elfenbein D.W., Fisman R., and McManus B., 2013, March, Market Structure, Reputation and the Value of Quality Certification. (http://www.bus.umich.edu/Academics/Departments/Strategy/pdf/ElfenbeinFismanMcManus%20Quality%20Certification%2020130313.pdf)

Smith E., Scott Couzens., and Scott Hiroshige., 2004, Preventive Maintenance Principles SPL 7. (http://ocw.mit.edu/courses/engineering-systems-division/esd-60-lean-six-sigma-processes-summer-2004/lectur-notes/7_2prevent_main.pdf.)

Fredendall L.D., Robins T.L., and Zu Z., 2006, Organizational Culture and Quality Practices in Six Sigma, (http://om.aomonline.org/dyn/award/Best%20paper%202006.pdf)

Gapp R., Fisher R., and Kobayashi K., 2008, Implementing 5S within a Japanese Context: An Integrated Management System. Management Decision, 565-579 http://dx.doi.org/10.1108/00251740810865067

Goetsch D.L., and Davis S., 2010, Quality Management for Organizational Excellence: Introduction to Total Quality. United States of America: Pearson, Prentice Hall

Hirata R., 2001, Implementation of 5S in Mexico. (http://www.keisen.com/documentos/Implementation%205S-in-Mexico.PDF)

Hough R., 2008, 5S Implementation methodology, Management Services, 35(5), 44-45

Howell V.W., 2009,). 5S for success, Ceramic IndusflY, August-September

ISO 22000:2005 Standard.

Isoeasy., 2006, Ishikawa Fishbone Diagram, Management Inc. (http://pdca.wordpress.com/2006/05/09/ishikawa-fishbonecause-and-effect-diagram/)

Janakiraman R., and Gopal R.K., 2007, Total Quality Management: Text and Cases. New Delhi: Prentice-Hall of India.

Kumar., Sudhahar., and Dickson., 2007, Performance Analysis of 5-S Teams Using Quality Circle Financial Accounting System. The TQM Magazine , 483-496

Maggie L.Y., 2006, Library as place: implementation of 5S system. Journal of East Asian Libraries, 139, 57-67

Nikolic V., and Nastasic A., 2010, Organizational Culture as Significant Factor in Implementation of TQM – Experience Serbian Economy. International Journal for Quality research, 59-69.

Osada T., 1991, The 5S's: five keys to a total quality environment. Minato-ku: Asian Productivity Organization.

Parrie J., 2007, Minimize Waste With The 5S System. Spring, 30-35

Pool S., 2000, The Learning Organization: Motivating Employees by Integrating TQM Philosophy in a Supportive Organizational Culture. Leadership and Organization Development Journal, 373-378 http://dx.doi.org/10.1108/01437730010379276

Prajogo D.I., and Sohal A., 2006, The Relationship between

Organization Strategy, Total Quality Management (TQM), and Organization Performance-The Mediating Role of TQM. European Journal of Operational Research, 35-50 http://dx.doi.org/10.1016/j.ejor.2004.03.033

Richard Boyle., 2012, Loolecondera, The Birth Place of Ceylon Tea, (http://www.serendib.btoptions.lk/article.php?issue=30&id=764)

Salaheldin I., 2009, Critical Success Factors for TQM Implementation and Their Impact on Performance of SMEs. International Journal of Productivity and Performance Management, 58/03, 215-237 http://dx.doi.org/10.1108/17410400910938832

Samuels G., 2009, 5S (Sort/Set/Shine/Standardize/Sustainability). Converting Magazine, 27/12, pp. 25-26

Statistical Information on Plantation Crops – 2012; Ministry of Plantation Industries, Colombo, 2013, p 1 - 68. (http://www.plantationindustries.gov.lk/dwnlds/plantation/2012%20-%20Statistical%20Information%20on%20Plantation%20Crops.pdf.)

Stirring Up the Tea Trade Can We Build a Better Future for Tea Producers? A Fair-trade Foundation Briefing Paper, 2010, (http://www.beveragestandardsassociation.co.uk/PDF/FTrade_Stirring_up_the_tea_trade(Jan10).pdf)

Swinton L., 2004, Dr. Kaoru Ishikawa. Management for The Rest of Us.Com: (http://www.mftrou.com/kaoru-ishikawa.html)

The Traceability Blue Book., 2004,-Using Traceability in the Supply Chain to meet Consumer Safety Expectations, (http://www.gs1belu.org/sites/default/files/publications/files/2004_traceability_blue_book.pdf)

Ute Williges., 2004, Status of organic agriculture in Sri Lanka with special emphasis on tea production systems (Camellia sinensis (L.) O. Kuntze), PhD Thesis, Faculty of Plant Production, Justus- Liebig-University of Giessen (http://geb.uni-giessen.de/geb/volltexte/2005/2315/pdf/WilligesUte-2005-02-10.pdf)

Van Patten., 2006, A second look at 5S. Quality Progress, 39/10, pp. 55-59

Patel V.C., and Thakkar H., 2014, Review on Implementation of 5S in Various Organization, International Journal of Engineering Research and Applications, 4(3-1) pp.774-779

Wakhlu B., 2007, Total Quality: Excellence through Organization-Wide Transformation. New Delhi: S. Chand and Company Ltd.

Ziyad Mohamed M.T., and A.K.N. Zoysa., 2006, Current Status and Future Research Focus of Tea in Sri Lanka (http://www.sab.ac.lk/journal_agri/papers/agri_vol2_2_2006/agri_vol2_2_2006_artical4.pdf)

Ziyad Mohamed M.T., and Zoysa A.K.N., 2008, Chapter 2: An Overview of Tea Industry in Sri Lanka. : "Hand Book on Tea", pp 4-9