



بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ



Sudan University of Science and Technology

College of Graduate studies

Deanship of Development & Quality

Title

**The impact of implementation of 5S Methodology as
tool for continuous improvement to the quality
operations in industrial sector**

Case Study:

**COLDAIR Engineering Company for manufacturing and
assembling**

**اثر تطبيق منهجية التاءات الخمسة كاداة للتحسين المستمر لجودة
العمليات في القطاع الصناعي**

دراسة حالة : شركة كولدير الهندسية للتصنيع والتجميع

بحث تكميلي مقدم لنيل درجة الماجستير في إدارة الجودة الشاملة و الامتياز

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Nov 2018

الله يستهلل

قال الله تعالى :

فَبِمَا رَحْمَةٍ مِنَ اللَّهِ لِنْتَ لَهُمْ وَلَوْ كُنْتَ فَظًّا غَلِيظَ الْقَلْبِ
لَانْفَضُّوا مِنْ حَوْلِكَ فَاعْفُ عَنْهُمْ وَاسْتَغْفِرْ لَهُمْ وَشَاوِرْهُمْ فِي الْأَمْرِ
فَإِذَا عَزَمْتَ فَتَوَكَّلْ عَلَى اللَّهِ إِنَّ اللَّهَ يُحِبُّ الْمُتَوَكِّلِينَ

صدق الله العظيم

سورة آل عمران الآية (159)

DEDICATION

This study is wholeheartedly dedicated to my beloved parents, who have been my source of inspiration and gave me strength when we thought of giving up, who continually provide their moral, spiritual, emotional, and financial support.

To my brothers, relatives, mentor, friends, and classmates who shared their words of advice and encouragement to finish this study.

ACKNOWLEDGEMENT

First and foremost, I thank Allah for letting me live to see this thesis.

My sincere thanks also go to my supervisor:

DR. ABDELMUTALAB IBRAHIM ABDELRASUL

For his encouragement and patience through this process. I can never pay him back for all the help he had provided me, experience I had gained and the precious time he spent making sure my thesis is always on track.

Thank you so much!

I would like to give special thanks to those who supported me in the mechanics of producing this thesis.

COLDAIR ENGINEERING COMPANY

Mr.Hasssan Omer

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ABSTRACT

The study aimed to identify the impact of implementing **5S** methodology as a tool for continuous improvement of the quality of operations in the industrial sector in Sudan. The study was followed by the descriptive analytical method. The questionnaire was used as a data collection tool.

The study population was represented by Coldair Engineering Company which is a company for the manufacturing and assembly of refrigerators and air conditioners. A random sample of 40 employees was selected (SPSS).The study concluded that the implementation of the concept of the **5S** helps in the process of continuous improvement and also contributes effectively to improve the quality and effectiveness of the operations. The study also concluded that the implementation of the concept of the **5S** clearly helps to reduce the time of completion of operations.

The study recommended increasing the interest of companies and factories in the industrial sector in particular in the implementation of the concept of the **5S** or similar concepts and increasing awareness of the employees in this concept and methods of application. The study also recommended more studies focusing on the concept of the **5S**, its methods and the benefits of its application, this concept is in all sectors in Sudan whether it is industrial, medical or service sector.

مستخلص البحث

هدفت هذه الدراسة الي التعرف علي أثر تطبيق منهجية التاءات الخمسة كأداة للتحسين المستمر لجودة العمليات في القطاع الصناعي في السودان ، وإتبعت هذه الدراسة المنهج الوصفي التحليلي ، كما استخدم الباحث الإستبانة كأداة لجمع البيانات ، وتمثل مجتمع الدراسة في شركة كولدير الهندسية المتمثلة في مصنع كولدير لتصنيع وتجميع المبردات والمكيفات ، حيث اختيرت عينة عشوائية مكونة من (40) موظف وتم تحليل البيانات باستخدام برنامج الحزم الإحصائية للعلوم الإجتماعية (SPSS).

وتوصلت الدراسة الي أن تطبيق مفهوم التاءات الخمسة يساعد في عملية التحسين المستمر وكذلك يسهم بشكل فعال في تحسين جودة وفعالية العمليات وكذلك توصلت الدراسة الي ان تطبيق مفهوم التاءات الخمسة يساعد بشكل واضح في تقليل زمن انجاز العمليات.

واوصت الدراسة بزيادة إهتمام شركات ومصانع القطاع الصناعي بشكل خاص في تطبيق مفهوم التاءات الخمس او المفاهيم المشابهة لها وزيادة توعية العاملين بهذا المفهوم وطرق تطبيقه ، وكذلك اوصت الدراسة بالمزيد من الدراسات التي تركز علي مفهوم التاءات الخمس (5S) وطرق استخدامه وفوائد تطبيقه وكذلك اوصت بمحاولة تعميم هذا المفهوم في جميع القطاعات في السودان سواء كان القطاع الصناعي او الطبي او الخدمي .

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Chapter One

Introduction

1.1 Background:

In recent years, the practice of 5S is commonly used among the Japanese firms in order to enhance human capability and productivity. Since it was introduced by Takashi Osadaz in the early 1980s, it is believed that applying the 5S techniques could considerably raise the environmental performance in production line including housekeeping, health, safety and more.

Modern management in the company is not only the quality management system based on the ISO series 9000:2000 standards, but pursuit to the continuous improvement, so this is the philosophy of the Total Quality Management.

In the frames of implementation of the Total Quality Management on the operating level more and more popular becomes the idea called 5S. The 5S method begins each programmed of improvement. It is the tool for helping the analysis of processes running on the workplace.

5 S is an approach to organize, order, clean, standardize and continuously improve a work area. 5S is not just about housekeeping, It is one of the efficiently working tools of Lean Manufacturing. The program gets its name from five activities beginning with the letter S, which were derived from five Japanese words. The words are (Seiri, Seiton, Seiso, Seiketsu and Shitsuke), which when translated mean Sort, Set in Order, Shining, Standardize and Sustain, respectively.

Sort helps to remove all unneeded items: only what is needed stays. **Set** establishes locations and quantities needed for efficient operation. **Shine** represent cleaning through inspection. **Standardize** implements visual displays and controls. **Sustain** helps to keep the organization effort in place through training and total employee involvement.

1.2 The Statement of the Problem

The problem of the study in the question is whether there is a clear effect on the improvement and quality of operations when using the method of 5s cause , Most of the manufacturing companies have difficulty in meeting customers' demands because of time consuming, and non-efficient process flow and tools and components are set without being categorized.

The result is personnel have poor workplace surroundings and this makes the company experience lower efficiency and makes it hard to reach their customers' demand.

In the leading company, much time was wasted in set up than machining time and material and equipment handling time. So to increase the productivity, it was necessary to reduce the nonproductive time on production line and tool handling time.

In the sense of increasing the thinking of increasing the productivity of the process, the improvement and quality of its operation should be considered through the use of different quality methods to reduce the process time which represents a 5s approach in the industrial section.

1.3 The question of the study:

1. How the implementation of 5s can guarantee continuous improvement?
2. How the implementation of 5s will increase the efficient of the operations.
3. How the usage of 5S can reduce time of completion of operations?

1.4 Objectives of the study:

The objectives of this study are:

1. To examine the concept of 5s and continuous improvement.
2. To Identify the effect of implementing 5S in improving the quality and efficient of the operations.
3. To study how to use the 5S tool to reduce the time of completion of operations.

1.5 Hypotheses:

1. There is relation between implementation of 5s and continuous improvement
2. There is relation between implementation of 5s and Efficient operations.
3. There is relation between implementation of 5s and Time of completion of operations.

1.6 The Significant of the study:

A questionnaires was used to describe the role of the axes, and the questionnaires asked about the existence, effectiveness and application of the axis. After the formulation of the questionnaire, three professors were satisfied with the degree to be judged and modified to achieve the study objective. The names of the arbitrators in the last study are Arabic and English.

Following problems occurred before implementation of „5S“ in the organization:

1. Improper utilization of storage space for raw material, bins and finished products.
2. Wastage of time in searching the raw material due to non-permanent location for storage of raw material.
3. Low productivity due to the time wastage in searching for tools, materials due to improper workplace management.
4. Presence of unwanted materials at the workplace which affects the moral of the worker while working.
5. Useful storage space being acquired by the unwanted materials.
6. More time and cost required for the inventory process of unwanted stored materials in raw material stores.
7. No well-defined space for storing the unwanted or rejected material.
8. Unequal participation of officers and workers in workplace management due to non-standardization.

1.7 The limits of the study

Spatial limits: Sudan / State of Khartoum / COLDIR Company.Ltd

Temporal limits: from Feb 2018 to Nov 2018.

Human limits: Employees of **COLDIR** Company.Ltd

This study was done for organizations that are willing to solve the problems which are similar to Wan Cheng manufacturing company and intends to help these companies to enhance the profits by using 5S.

Chapter Two

Literature review and Previous Studies

2.1 Introduction:

Section One briefly explained the research background and described the research objectives. This section reviews the relevant literature, which underpins this research and describes how this research relates to existing works on continuous improvement. According to Saunders et al, the literature review is required for each project. At first, the preliminary search helps the author to generate and refine his other research ideas. Secondly, project assessment criteria usually require the author to demonstrate awareness of the current state of knowledge in the subject, its limitations, and how the research fits in this wider context. (Saunders et al. 2009, p. 58) The purpose of this section is to get an understanding and definition of quality management, in particular the continuous improvement. Basically there will be explored definitions of continuous improvements, historical background, development and existing approaches to quality management. Ultimately we should get theoretical frameworks for this study.

2.2 Continuous improvement

Despite the fact that in literature there are many definitions of continuous improvement, historically it is associated with Japanese method Kaizen. Kaizen can be roughly translated from Japanese to mean "good change". This philosophy assumes according to Imai that "our way of life – be it our working life, our social life or our home life – deserves to be constantly improved." (Imai, 1997, p1).

Kaizen is a long-term approach to work that systematically seeks to achieve small, incremental changes in processes in order to improve efficiency and quality. One of the core principles of Kaizen is self-reflection of processes, which is also known as "Feedback". The purpose of CI is the identification, reduction, and elimination of suboptimal processes, in other words is to become efficient. Kaizen can be applied to any kind of work, but it is perhaps best known for being used in lean manufacturing and lean programming.

In literature readers can come across the term "Continual" instead of "Continuous". These terms are frequently used interchangeably, but some quality authors make distinction. Hammer and Champy define continuous improvement as subset of continual improvement, with a more specific focus on linear, incremental improvement within an existing process. Some practitioners also associate continuous improvement more closely with techniques of statistical process control (Hammer & Champy 1993, p.46). W. Edwards Deming, a guru in the quality field, determines Continual Improvement broader in scope than continuous improvement. He refers this term to general processes of improvement and encompassing "discontinuous" improvements—that is, many different approaches, covering different areas (American Society for Quality). In other words, continual improvement speaks to the PROCESS of improvement (always and forever (continually) ongoing, in all of its forms and in all areas) rather than the NATURE of the improvements. "Continuous improvement" is common usage among business management, to explain both meanings. It is merely the way the word has been conventionally used in this context, in a common understanding that existed regardless of prescriptive preferences. However, ISO (International Organization for Standardization) has chosen the more careful usage Continual Improvement Process (CIP) for its standards including ISO 9000 and ISO 14000 (ISO). Research of CI has been mainly focused on defining the nature, its tools, organizational issues required to support these initiatives, its applicability to various types of organizations, implementation issues, and critical success factors (Bhuiyan & Baghel 2005, p. 769). So they allocate two models of behavior on continuous improvement initiatives. There are revolutionary and evolutionary models.

2.3 Historical background and development

To better understand the existing approaches of continuous improvement, it is necessary to trace the development of these initiatives. The initial attempts to apply the quality management approaches were taken in the 1800s by several companies, which encouraged any improvements carried out staff in order to achieve better results. And in the late 1800s early 1900s some companies already used scientific approaches to

standardize certain processes, such as the development of norms of piecework wages (Bhuiyan&Baghel 2005, p. 762).

In that time Taylor, an American engineer, founder of the scientific organization of labor and management, suggested doing work tangible and measurable through analyzing manufacturing processes and separating them into a set of tasks, which could be standardized and repeated. His techniques became the basis of scientific management (Rath&Strongs\Management Consulting 2003, p. 5). In 1913 Henry Ford adopted these ideas to his the first moving assembly line used for large-scale manufacturing. It was the first model, which became later famous as Just-in-Time model and Lean Manufacturing (Rath &Strongs\Management Consulting 2003, p. 6). In the 1920s Walter Shewhart was involved in project at Western Electric Corporation in Rochester, New York where he was investigating ways of improving the economics of the electromechanical relay manufacturing lines at Western Electric. Shewhart started using the emerging science of applied statistics to see if issues causing process variations might be identified and fixed before leading to the production of defective parts. As a result of this work, he founded theory and approach to continuous improvement, which became the foundational work for the Statistical Quality Control (SQC) movement, the Total Quality Management (TQM) movement.

The next stage in the development of quality management refers to Japan. It covers period from 1947 to the end of the 1970s.

At this particular time were laid down the basics of what we today call TQM, which are often linked to people like Edwards W. Deming, Joseph M. Juran and Kaoru Ishikawa. Japanese companies developed their own approaches based on works of these people (Bergquist, Garvare, &Klefsjö 2007, p.256). Much of the Japanese success was based on the three fundamental tenets of Juran(Klefsjö, Bergquist&Edgeman 2006, p.164). He developed numerous quality theories, two concepts in particular serve as the basis for establishing a traditional quality system and to support strategic quality management – Juran’s Quality Trilogy for managing quality (quality planning, quality control and quality improvement) and his Quality Planning Roadmap (Juran& Godfrey 1998, pp.2.5-2.7). As a result of these efforts, we can say that the economic growth and manufacturing dominance of Japanese industries in the 1980s can be

attributed to the successful application of TQM in Japan (Klefsjö, Bergquist&Edgeman 2006, p.165).

The quality revolution in the West began as a backlash to the Japanese success. Total quality management (TQM) became the centre of these drives in most cases since 1980s (Martínez-Lorente, Dewhurst & Dale 1998, p. 379). TQM has developed in many countries into holistic frameworks, aimed at helping organizations achieve excellent performance, particularly in customer and business results. In Europe, a widely adopted framework is the so-called “Business Excellence” or “Excellence” Model, promoted by the European Foundation for Quality Management (EFQM), in the UK by the British Quality Foundation (BQF) in the US the Malcolm Baldrige National Quality Award created by an Act of Congress (Fisher & Nair 2009, p.11). These programs focus on pre-production activities and rely on quality standards or instructions to assist with the reduction of the risk of failures and mistakes in the processes used to produce a product or service (Bergquist, Garvare&Klefsjö 2007, p.254). Despite the large number of such programs ISO standards have become the most internationally recognized (Thawesaengskulthai 2007, p. 18). ISO is a series of quality management systems (QMS) standards created by the International Organization for Standardization, a federation of 132 national standards bodies. The ISO 9000 QMS standards are not specific to products or services, but apply to the processes that create them. The standards are generic in nature so that they can be used by manufacturing and service industries any- where in the world (ISO 2014).

As we see throughout the history there have been several stages in the development of the quality movement. Although in literature a lot of definitions of quality management, mostly authors agreed that we could divide whole development into four eras. According to Dale et al. (see Figure 2.1.) there are Inspection, Quality Control (QC), Quality Assurance (QA) and Total Quality Control (TQM). However, some researcher's say that we can now distinguish the fifth era is continuous improvement, which tends to overlap with issues such as sustainable business development, the environment and interest groups (Bergquist et.al. 2012, p.12; Thawesaengskulthai 2007, p.14). Other researchers

believe that further development of quality management will lie in the field of innovation and technology.

2.4 The 5S and Kaizen concept for overall improvement of the organization

2.4.1 Introduction of Kaizen

Kaizen: the concept of kaizen was introduced in Japan in 1950 when the government and management had a feeling that there was a problem in their current management system and a pending labor shortage. The problem was solved with the help of some workforce (Brunet, 2000). Kaizen has become an important part of Japanese manufacturing system and has lent some useful contribution to the manufacturing success (Ashmore, 2001).

A kaizen study is structured and focused improvement project using a team which is cross functional to improve a targeted work area in an accelerated timeframe (Farris, 2006). In many Western companies the word kaizen has become more common as it indicates a process of continuous improvement (Chen et al., 2000). The word kaizen is a compound word which involves two concepts, Kai (change) and Zen (good) for better (Palmer, 2001). Kaizen needs attaching great value to the details and common sense to make every employee cleverer in the organization (Asada et al., 2000; Imai, 1986; Imai, 2008). Kaizen calls for an effort for improvement involving everyone in the industry. Kaizen successful implementation results in healthy atmosphere where everyone in the organization is aware of key goals, objectives and measure of success. Kaizen is considered to be more than just a continuous improvement process as it represents daily struggle occurring in the workplace and the manner in which these struggles can be overcome (Malik and YeZhuang, 2006). Models and theories of change such as theory of structure are being integrated with improvements (Pettigrew, 1990). Initial success of kaizen does not guarantee sustainability, some researchers come with an idea that kaizen events should not be done unless they can do with right intent and activities necessary to sustain results (Friedli, 1999).

2.4.2 Kaizen

The Kaizen Method has been particularly distinguished as the best methods of performance improvement within companies since the implementation costs were minimal. It is nowadays more than ever that

the relationship between manager and employee is crucial and the Kaizen technique has a major contribution to the reinforcement of this relationship since the achievements of a company are the results of the mixed efforts of each employee. These methods bring together all the employees of the company ensuring the improvement of the communication process and the reinforcement of the feeling of membership. The companies that want to have a performance must keep their leader position on market by increasing the quality level of services provided, reducing costs and last but not least motivating the whole staff in order to implement the concept of performance oriented organization.

Many industries can benefit from kaizen events because it results in increase of the productivity in the company and also it helps in producing high quality products. Benefits from kaizen activities can be achieved with minimum efforts (Deniels, 1996; Reid, 2006).

Kaizen is a term which is widely practiced in quality circles and manufacturing sector. It relates to continuous improvement process and idea is to make a process which has no end to make process better. Concept of kaizen is not only limited to manufacturing sector, it has widened its scope to all aspects of business including software and service industry (Suzaki, 1987; Cheser, 1998). Success of kaizen activities performed highly depends upon the contribution of teamwork. Every member's role and responsibility has been described by taking an example of Nissan Motor Plant in UK. Direct contact and communication between the employee and boss is key for successful implementation of kaizen activities in the organisation(Wickens, 1990). Understanding of management philosophy of kaizen is must to sustain in constantly changing environment (Deming, 1995). Kaizen activities can be best performed by the operators because they are experts of shop floor and once they know there is some problem they are the ones who will make an effort to solve the problem. All they need is some sort of right direction to solve the problem (Deniels, 1995). Studying the impact of kaizen activities on human resources is must. There are some variables like attitude towards kaizen events, understanding need of kaizen, skills gained from kaizen event participation which are quite useful to measure 26 *S. Gupta and S.K. Jain* kaizen impact (Doolen et al., 2003). A framework as a design and assessment tool has been made to make the kaizen programmer more effective; framework includes assigning roles

for kaizen events, measuring results and sharing lessons learned in the areas of the Organization outside the work processes targeted by kaizen programmers (Eileen et al., 2010). There is need to understand target costing and kaizen costing concept. Target costing is a process of making profit by selling the products at a cheaper rate.

Target costing and kaizen costing act as basis for the total life cost management and managing cost throughout the product life cycle (Williamson, 1997). Kaizen event effectiveness is important to measure and there are wide numbers of case studies available which are important means to check its effectiveness. Kaizen benefits include improved quality, reduced cost, improved safety, faster deliveries, increased productivity etc. (Powel, 1999). Kaizen technique has been applied to small sized custom made furniture industry. Brainstorming with employee has been done to identify the various problems. Problems include absence of appropriate methodology to assure quality, disorganized workplace lack of training and poor quality of raw material. Suggestions are made to these problems. The main objective of brainstorming is to develop the product with high quality, high productivity and lower cost (Radharamanan et al., 1996). Kaizen events have been applied to Allied Signal Inc., jet engine manufacturing industry. The main problems found are low production rates and large floor space requirements.

Implementation of kaizen activities results in 89% improvement in work in process 88.5% increase in productivity and saved floor space area up to 2000 sq ft. (Sheridan, 1997). Poka yoke a kaizen tool has been applied in fuel fitter assembly. Problem of lower production rate and problem of errors at large scale are noticed. After implementing kaizen activities a fall from 50% to 1% has been seen in error rate and also production increase about 50% is noticed (Erlandson et al., 1998). A study has been conducted at Nicholas Foods Manufacturing food products. Problems found in organization are lack of standard operating procedures, forces and structure. Kaizen events purposed in the organization improved the work environment by raising the company values. Now there are less quality rejections, there is increase in manufacturing efficiencies and reduction in change over times (Lee, 2000). The Gemba-Kaizen approach has been used in the multinational food company of Mexico to enhance their manufacturing performance (Suárez-Barraza et al., 2012). New

united motor manufacturing Inc. (NUMMI) in Fremont, California successfully implemented kaizen approach in terms of its organizational design and knowledge management preconditioners (Watanabe, 2011).

Two Mexican small family businesses improved their sales, customer and market share by using the Japanese approach for kaizen (Suárez-Barraza, 2011). Implementing personal kaizen in our daily life can bring incremental change which is very helpful for person to improve their quality of life and health (Bingham, 2011). Individual kaizen were implemented by three persons in their personal life and as a result their quality of life improved up to a great extent (Suárez-Barraza et al., 2013). A study has been conducted in Chinese construction companies, 27 Chinese building professionals from 16 companies were interviewed and it has been found out that different types of activities associated with kaizen have been adopted by Chinese construction firms at the project level (Gao and Low, 2013). Doing survey is very effective means to determine the performance of kaizen practices. In Australian SME's survey has been conducted. Survey highlights some critical success factors which include creating an effective structure, promoting a corporate culture and developing flexibility and speed of response (Gibb and Davies, 1990). CI and innovation practices have been performed in French SME's. Short and long term goals, nature of innovative management and the sounds of innovation fall in survey parameters in French SME's (Soderquist, 1996). In a small scale manufacturing company, a survey has been conducted which suggest that ideal situation of CI strategy is its integration with the corporate culture (Irane and Sharp 1997). A survey has been conducted in Chinese companies. Survey conducted has to check whether CI helps in getting desired results or not. Survey results suggest that there is great extent of effect on the companies as they achieve all the desired results (Hongming et al., 2000). A comparative survey has been conducted between two countries China and Pakistan.

Investigation has been done to check how they are deploying CI practices. Eighteen sets of question have been prepared which were related to organization in both countries.

Survey findings clears that both countries are deploying CI practices but with different proportions (Malik et al., 2007).

Application process of kaizen event basically consists of (Asada et al., 2000; Imai, 2008; Imai, 1996; Kraszewski, 2005; Suzuki, 1993):

1. Definition of the area to be improved
2. Key problem analysis and selection
3. Identification of cause of improvement
4. Improving project implementation
5. Measuring, analyzing and comparison of the results
6. Standardize systems.

Kaizen covers many techniques which include kanban, total productive maintenance, and six-sigma, automation, just in time, suggestion system, productivity improvement and 5S (Imai, 1986).

2.4.3 Introduction of 5S

The 5S is the acronym of five Japanese words which stands for Seiri (sorting), Seiton (set in order), Seiso (sweep), Seiketsu (standardize), Shitsuke (sustain) (Ho et al., 1995; Ho, 1997; Vasudevan, 1998). In the mid-1950s, 5S was first used in Japan in the manufacturing sector (Korkut et al., 2009). 5S is the first step to the continuous improvement. 5S implementation ensures continuous improvement in housekeeping and results in better environment and safety standards (Ho, 1999a; Mente, 1994).

There is need of developing a common language that is understood by all, so that humans can communicate with each other in the company (Sethi and Pal, 1995). However 5S is a practice which can't be implemented without a self-discipline (Pheng, 2001). Many problems can be solved by organizing the 5S team (Ho, 1999b, Ho, 1999c). Organizing 5S team will result in maintaining a quality environment in the firm (Hough, 1998; Mente, 1994; Sethi and Pal, 1995).

Quality environment includes both order and cleanliness (Pheng and Khoo, 2001; Saraph, 1989). 5S becomes more effective when it is integrated to management system (Sevim, 2005). Support from management level is vital to have potential benefits from 5S implementation (Narasimhan, 2009). Homes, schools, communities and workplaces all of them can be improved by 5S activities (Gapp et al., 2008). A small company in Taiwan underwent 5S activities and improved

their overall productivity. Implementing 5S brought the plant to a neat and organized state (Gunasekran and Lyu, 1997).

5S is not only a system for housekeeping; it is an integrated approach for productivity improvement. 5S is a whole a culture which increases production, improves quality, reduces cost, makes delivery on time, improves safety and improves morale. This leads employees to waste time and motivation searching, waiting, reworking or just plain giving up. A 5S a visual workplace eliminates questions, generating significant improvements in productivity, quality, customer satisfaction, safety and more the TQM of company. The primary objective of 5S is to create a clean, orderly environment- an environment where there is a place for everything and everything is in its place. Beyond this, many companies begin their lean transformation with 5S because it exposes some of the most visible examples of waste. It also helps establish the framework and discipline required to successfully pursue other continuous improvement initiatives.

2.4.4 History of 5S

5S was developed in Japan. It was first heard of as one of the techniques that enabled what was then termed 'Just in Time Manufacturing'. The Massachusetts Institute of Technology's 5- year study into the future of the automobile in the late 1980s identified that the term was inappropriate since the Japanese success was built upon far more than components arriving only at the time of requirement. John Krafcik, a researcher on the project, ascribed Leanto the 10 collective techniques being used in Japanese automobile manufacturing; it reflected the focus on waste in all its forms that was central to the Japanese approach. Minimised inventory was only one aspect of performance levels in companies such as Toyota and in itself only arose from progress in fields such as quality assurance and Andonboards to highlight problems for immediate action.

5S was developed by Hiroyuki Hirano within his overall approach to production systems. Many Western managers coming across the approach for the first time found the experience one of enlightenment. They had perhaps always known the role of housekeeping within optimised manufacturing performance and had always known the elements of best practice.

However, Hirano provided a structure for improvement programs. He pointed out a series of identifiable steps, each building on its predecessor. Western managers, for example, had always recognized the need to decide upon locations for materials and tools and upon flow of work through a work area; central to this (but perhaps implicit) is the principle that items not essential to the process should be removed – stored elsewhere or eliminated completely. By differentiating between Seiri and Seiton, Hirano made the distinction explicit. He taught his audience that any effort to consider layout and flow before the removal of the unnecessary items was likely to lead to a sub-optimal solution. Equally the Seiso, or cleanliness, phase is a distinct element of the change program that can transform a process area. Hirano's view is that the definition of a cleaning methodology (Seiso) is a discrete activity, not to be confused with the organisation of the workplace, and this helps to structure any improvement program. It has to be recognised, however, that there is inevitably an overlap between Seiton and Seiso.

Western managers understood that the opportunities for various cleanliness methodologies vary with the layout and storage mechanisms adopted. However, breaking down the improvement activity in this way clarifies that the requirements for the cleanliness regime must be understood as a factor in the design aspect of Seiton. As noted by John Bicheno, Toyota's adoption of the Hirano approach is '4S', with Seiton and Seiso combined – presumably for this very reason. The improvement team must avoid the trap of designing the work area and then considering the cleanliness or tidiness mechanism.

Hirano also reminded the world of the Hawthorne effect. We can all introduce change and while people in the business consider the change program to be under management focus the benefits of the change will continue, but when this focus has moved (as is inevitably the case) performance once more slips. Western managers, in particular, may have benefited from the distinction between the procedural or mechanical elements, Seiketsu, of keeping these matters in focus and the culture change, Shitsuke, which is a distinct approach to bringing about a new way of working. A number of publications on the subject in the West have questioned whether this culture can really be tackled as part of an exercise of relatively limited scope.

The broader kaizen, or continuous improvement, approach is built, among other things, upon the company's valuation of all members of the workforce. If employees don't feel valued within the overall company culture, perhaps the change required falls outside the limits of a housekeeping improvement describes that there were four activities in the Japanese system. These activities, each beginning with the letter S, were:

1. Seiri(**sort**)
2. Seiton(**set in order or Stabilize**)
3. Seiso(**shine**)
4. Seiketsu (**standardize**)
5. Shitsuke(**sustain**)

Figure 5S Circle modified

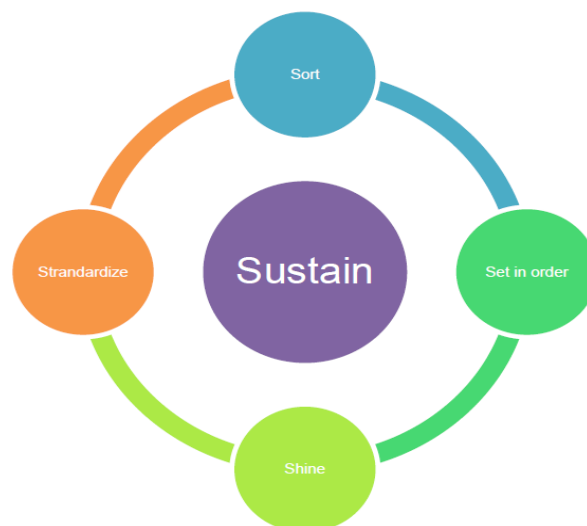


Figure (2-1). 5S Circle modified from David Visco's book 5S Made Easy

Phase one Sort

The first phase is called Sort. Main point in this first phase is simply to sort everything. Every tool, object and instrument is looked through and every one of those will be recognized and the demands of those are evaluated. This phase includes also a task where criterions are created. These criteria define the difference between useful and useless products. Removable products will be sorted and after that, disposed of. Also useful products will be sorted and new places must be created after sorting. (Teknologiaateollisuusry 16/2001, 8-9; Tuominen 2010, 25-27.)

Mostly used method in sorting-phase is "Red-tag"-program. In there the removable or somewhere else storable products are marked with a red tag (Figure 1). That tag tells for example name of the inspector, date, demand, reason of the tag, storage place and disposition date. Jigs,

moulds, junk and work-in process are often accumulated all over the stations and the purpose is to get rid of all these. First, those tagged products are moved in-to the red tag-area and after that, either positioned again or removed for good. (Teknologiategollisuusry 16/2001, 8-9; Tuominen 2010, 25-27.)

The image shows two red 'RED TAG' forms. The top form is partially obscured. The bottom form is a standard red tag with the following fields and options:

RED TAG

55today.com

Date: _____ Tagged by: _____

Item Name: _____ Tag ID# _____

Location: _____

Reason: _____

Scrap

Not Needed

Defect

Old/Obsolete

Extra

Other _____

Action to take: _____

Discard Shred

Recycle

Move to Red Tag Holding Area

Move to _____

Return to _____

Other _____

Figure (2-2) Red Tag (Creative safety supply. n.d.)

Removing useless items clarifies working environment and gives more space to act. Sorting helps everybody to keep places clean and in good order. Moving and safety at work gets better, it saves and increases space, clarifies processes and gives a chance to save up in cleaning. (Tuominen 2010, 25.)

Phase Two Stabilize or Set

The main purpose of stabilization is to find practical depository for every requisite instrument and those depositories should be marked properly. Every single item, which is necessary in working, will be organized in a way that those can be found easily when needed. Setting in order assures that it is a snap for everyone to find, take in use and put away the needed item. Target of all these actions is to eliminate pointless searching, improve safety at work and make working environment better. Places of the equipment's are not the only things which are marked. It is advisable to mark tools itself for example with colored cable ties. Marking off the floor and dividing it into stations is a wise thing to do. That creates passages and clarifies movements in the production areas. When pulling

the lines, it is useful to mark places for pallets, pallet jacks and garbage cans at the same time. Color-codes and signs are used to prevent equipment's getting mixed-up. (Teknologiategollisuusry 16/2001, 10-11; Tuominen 2010, 35-38).

“Taking an object to its own place takes one minute but finding it might last an hour, at the worst” (Teknologiategollisuusry 16/2001, 10). Time used into taking something to its own place or getting it, is pointless when thinking from works point of view. Because of that, pointing places is critical. Belongings needed rarely are moved beyond and equipment's needed daily are staying near the stations. (Tuominen 2010, 35, 40-41.)

Phase three Shine

It is not enough if phases one and two alone are implemented. Those remove problems in relation to space but one problem is hiding around the corner. Dirt wear down machines and makes quality worse. Third phase, Shine, is created for these problems. Everything will be cleaned up when operation model reaches this point. Floors, tools, tool racks, devices and especially machines. Engine life increases and everything is ready for instant use when those are cleaned. This leads automatically into situation where everything is kept in top condition. That creates user maintenance and whit user maintenance is easier to notice possible errors and deviations. (Kouri 2009, 27; Tuominen 2010, 49)

Clean environment creates optimal offset for working. Everybody watches out mistakes and from the other hand, even the smallest mistakes are easier to register. It is self-evident that oily and dirty floors can cause slips and objects in wrong places can be fatal if something drops from high or someone stumbles over. This all can be discounted if 5S-model is carried out properly. Some kind of manual or instructions should be created in touch with cleaning. There can be a kind of sorting into daily, weekly and monthly actions. Those instructions define precept for how to keep environment clean. (Tuominen 2010, 51-54)

Phase four Standardization

“Carrying out a 5S-campaign once in a cell or work station is a pushover. Without daily discipline and clear follow-up and operation routines it is too easy to return into old habits. That is why the management level should set annual 5S-goals for every station and employee.” (Teknologiategollisuusry 16/2001, 13.) Fourth phase is Standardization. This stage is destined to create procedures and routines. Those should be guiding three earlier phases into continuous and developing course of actions. Purpose is to take in use and maintain all that, which is created earlier in sorting, stabilizing and shining. Target is to change constant

methods into standards which employees are expected to obey. Mundane tasks are established and those are followed precisely. Instructions should be so crystal clear that almost everyone could check the station with the help of those. (Tuominen 2010, 61-64.)

Actions are being supervised and followed by persons proposed. Everyone should know what to do and which are each one's responsibilities. Check lists are created in standardization phase and on by a way of those the level of operation model is monitored. (Teknologiateollisuusry 16/2001, 13; Tuominen 2010, 64-67)

Phase five Sustain

Last phase is sustaining the level which is reached with four earlier phases. Brought standards and balanced workplace are maintained and followed all the time. Methods are under adoption and those are improved continuously. Improvement has to be one part of sustain because the environment should be improved with the help of results from follow-up. Internal audit lists should be created in the phase five, and audits should be made at regular intervals. The results from the audits should be gathered and put on to bulletin boards so that everyone can see and follow up the development of 5S-actions. Evaluation should include happened changes and comparison to earlier months. Audit is essential tool in progress of pushing cleanliness and sustaining a creditable level of order. (Teknologiateollisuusry 16/2001, 15; Tuominen 2010, 75-77.)

Sustaining should create a situation where each and every operational principle and applied method becomes a natural part of daily actions and development. Creating some kind of competition between cells in implementation phase is not a bad idea. It pushes developing in the next level if stakes step forward. Another option is a bonus system. Suitable prize motivates employees and by that way gives better results. (Tuominen 2010, 77-78.) Economic situation of course determinates rewards. It can be for example clear productivity bonus or just a dinner financed by employer.

2.5 Implementation of 5S

The implementation of 5S requires the understanding of all the employees, supervisors and managers related. The program might seem simple, but it requires a lot of planning, even though it is not considered as project, since project has a beginning and ending, whereas 5S is a program for continuous improvement.

The planning phase is important when considering the success of 5S implementation. First of all, the entire implementation begins with choosing a proper project leader. The project leader should have a thorough understanding of 5S and experience of leading such a project and managing personnel. After choosing the project leader, a 5S champion should be chosen. This person is the one, who is responsible of the area, in which 5S is implemented. The 5S champion is the person, who provides guidance and instructions to the project team. In some situations, there might be more than one 5S champion, depending on the size of the area. As 5S is part of lean, employee involvement plays a significant role in the implementation. The team members should be a mix of employees that work in the area, performing different tasks (Tuominen 2010: 18-20).

After choosing the team, it is extremely important to train the team, in order for the 5S program to fully succeed. The training should also be kept for all employees and other staff working in the area, where the implementation takes place. The project leader has the responsibility of educating the employees and to make sure each and every one truly understands the meaning of the 5S program. A good way of presenting the idea of 5S is to use the What, Why, Where, When and How strategy. Simply presenting what 5S is about and what does the five “s” mean. Why is the program implemented, high-lighting the benefits it brings? Where is it implemented, mentioning the area chosen to be worked in. When, answers to the question, which implementation plan has been chosen, whether the facility is shut down for a certain time or a little bit is done two to three times a week. Finally, how, answers the question how is it implemented, this is when you show the project plan and explain there will be short training sessions, but most of learning is done by doing. For the training, a well prepared Power Point presentation and different 5S games, should be enough, ensuring there is suitable time for answers and questions (Visco 2016: 13-14).

The size of the area is crucial. Some consider that the implementation of 5S can be done at once into a big area, let’s say a huge warehouse. This is clearly not the right way. The area should be divided into different sub-projects, to be efficient in the entire area. This brings us into scheduling. The timeframe the project is implemented can be executed in two ways. The first way is to close down the facility and do everything at once. Unfortunately, in logistics this cannot be done executed, since all orders have to be delivered. The second way is to work on 5S implementation a few hours on daily or weekly basis, which is more suitable for logistics (Visco 2016: 7-9).

2.6 Benefits of the 5S

5S-operation model brings a lot of benefits. Some of those are economical and some improves human capital. Results can be seen in staff, environment, quality, production and offices. It can be said that the main benefits are:

1. Upgrade of productivity and the quality of actions.
2. Reduce of work in-processes and shorten lead-times.
3. Better working circumstances and rising comfort.
4. Decreasing searching times and costs.
5. Rising company image.

5S gives a better starting point to notice problematic and deviations before major troubles and every complication should be putted in record. If in auditions turns up several times a note from same machine or station, should that ring a bell. There should be conversation even about the smallest blips. Roots of every problem should be traced and eliminated. (Teknologiategollisuusry 16/2001, 22; Tuominen 2010, 83-87)

5S certainly brings numerous benefits for the organizations that choose to use the program. Once it is implemented and planned carefully by following all the steps, the benefits surely will affect the organizations overall cleanliness, safety and quality.

All the different phases of 5S offer different benefits. When the sort and set in order phase is well implemented and developed, more space for working is ensured, which then positively affects the safety measure of the organization. Also the fact that employees are been involved with the decision making and the actual implementation increases the employee satisfaction. The quality is more likely to increase, as these phases are implemented, when each article has its own place and work is standardized. This also leads to customer satisfaction, since no more time is wasted in searching for missing articles (Tuominen 2010: 85-86).

5S offers the organizations a foundation for continuous improvement. It also frees up floor space, which once again leads to increased safety among the employees. The work ergonomics is improved, when part of stretching, bending and reaching has been eliminated. Re-locating tools and reserve articles also reduces the amount of walking, which leads into more efficient work flow and saves money as each article has its own place and inventory is easily executed. Employees are given more responsibility, which enables easier and more dynamic cross-training (Visco 2016:18-23).

2.7 Previous Studies

2.7.1 Foreign Studies: -

1. Abhishek Jain, Rajbir Bhatti, et al, (2014)

Productivity Improvement through 5S Implementation in Indian Manufacturing Industries

The results of this research obtained from a comparative measurement of organizational performance before and after 5S implementation. The results show that 5S is an effective tool for improvement of organizational performance, work culture, productivity, etc. Consequently, 5S techniques would strongly support the objectives of organization to achieve continuous improvement and also in implementation of total productive maintenance (TPM).

5S is a systematic technique used by organizations, and this comes from five Japanese words: seiri (sort), seiton (set in order), seiso (shine), seiketsu (standardize), and shitsuke (sustain). This system helps to organize a workplace for increasing efficiency and decrease wasting and optimize quality and productivity via monitoring an organized environment. There is a real need for the studies in field of new management systems and their impact on company's performance. Aim of this paper is to determine the impact of 5S in industrial organizations and identifying the effectiveness of 5S implementation on organizational performance as well. The target organization (Medium size organization) is chosen for implementation.

2. Mariano Jimenez a, Luis Romero, (2015) 5S methodology implementation in the laboratories of an industrial Engineering university school

This article examines the experience in 5S methodology implementation in order to optimize the work and safety of the university engineering laboratories, in such a way that the results obtained can be extended to other, similar centers. The research project developed has created an organization culture of all resources in the practice laboratories. A working model was defined to create a 5S structure and an implementation process has been established. With the 5S methodology implementation, the school

Laboratories have become industrial laboratories; they have been adapted to the conditions of security and organization that are usually found in the metalworking industry. Learning, control and maintenance of the resources and activities involved are performed in less time and with a considerable reduction of cost. There is also an increase in available space available for the location of the resources. 2015 Elsevier Ltd. All rights reserved.

3. HarshaLingareddy, G.Sahitya Reddy, et al., (2013). 5s as a tool and strategy for improvising the work place

The study aimed to clarify how we can use 5s as tool and strategy to improve workplace. We provided some vast literature on the implementation of 5S in any industry. This strategy involves the study and change in the work place of a manufacturing industry post implementation of 5S. This strategy helps in minimizing the time of manufacturing and also increases the area of work place. Thus, the solution found by our approach solely minimizes several kinds of wastes in the production process and which finally helps in the development of the organization. An Inspection process has been executed on the basis of 5S check lists and the results analyzed to confirm great changes like increasing efficiency in production and quality, improves safety.

4. Richa Sharma, Jagtar Singh, (2010) Impact of Implementing Japanese 5S Practices on Total Productive Maintenance

5S is a systematic technique used by organizations comes from five Japanese words; Seiri (sort), Seiton (set in order), Seiso (shine), Seiketsu (standardize) and shitsuke (sustain). This system helps to organize a work place for efficiency and decrease wasting and optimize quality and productivity via monitoring an organized environment. 5S is the pre- step of Total Productive Maintenance (TPM), is a systematic approach providing the contribution of all personnel in the cleaning regime of the company. 5S execution is an essential prerequisite of implementation of Total Productive Maintenance (TPM). In this paper relations between 5S and pillars of TPM are explicated. The objective of this study is to identify the effectiveness of 5S practices on the TPM implemented organization performance. The result of this study confirms that all 5S principles affect TPM directly or indirectly. Consequently, 5S is an effective tool which strongly supports the objectives of TPM implemented organization to achieve continuous improvement and higher performance.

**5. José H. Ablanedo-Rosas, Bahram Alidaee , et al (2009) Urbina
Quality improvement supported by the 5S, an empirical case study
of Mexican organisations**

Global markets are continuously changing and demanding customized, low cost, and high quality products and services; organizations that offer these products and services are dealing with these issues on a daily basis to stay competitive. Among the quality tools used to achieve competitive advantage, the 5S practice plays an important role facilitating the introduction and development of other quality and continuous improvement methods and techniques. We present results of an empirical study applied to some Mexican organizations with the aim of understanding their implementation experience, empirical relationships, and ongoing challenges associated with the 5S practice.

**6. Carmen Jaca, Elisabeth Viles, et al, (2013) learning 5S principles
from Japanese best practitioners: case studies of five
manufacturing companies**

The 5S methodology is a very appropriate way to initiate and achieve the process of continuous improvement. This paper studies management practices in successful Japanese companies in order to determine what 5S principles are behind them. After visiting and conducting interviews at five different plants, a multi-case study analysis was developed to identify the key aspects of the success of the implementation of 5S in Japan. Although each of the companies studied is different, there are commonalities that provide for interesting learning. As a result, best managerial practices based on 5S principles are explained, and the most important principles associated with the success of the 5S method are described and discussed.

**7. Eileen Julieth Hernandez Lamprea1mm, et al, (2014) Impact of
5S on productivity, quality, organizational climate and industrial
safety in Caucho Metal Ltda.**

This paper describes a first approach of 5S impact on the study factors of quality, productivity, industrial security and organizational climate in the manufacturing area of Small and Medium Enterprises (SMEs) in Colombia, through a case study carried out in a small company located in

Bogotá, in order to evaluate whether the 5S methodology could be considered as an effective tool to improve manufacturing companies. A visual diagnosis was chosen to identify the area that presented the greater amount of clutter and dirt. Once the location was identified, surveys, performance measures and a risk landscape were performed, focusing on the study factors, in order to understand the initial situation of the area. Subsequently, the implementation of 5S was carried out and then three measurements were taken to monitor the performance of the study factors, so as to know if they followed a trend during the measuring period. The results show the existence of a positive relationship between the study factors and the implementation of the 5S methodology, since an increase of productivity and quality was evidenced, based on the performance measures as well as an improvement of the organizational climate and a decrease of the risks identified in the workshop.

8. NoniHartikaBintiJuhari, NorridzwanAbidin, et al.,(2011)

Factors influencing employees' motivation in implementing 5s system

This study attempts to examine the relationship between the variables (communication for 5S System, training for 5S System, reward and recognition for 5S System and top management role for 5S System) with the employees' motivation in implementing 5S System. The sample size of respondents is 150 and all of them are the employees from NibongTebal Paper Mill Sdn. Bhd (NTPM) and Muda Paper Mill Sdn. Bhd. This present study focused on manufacturing firms that are situated in northern area (Penang) and both are manufacturing paper based products. All the respondents are given the questionnaire and their responses are analyzed. In the findings of this present study shows that communication for 5S System and training for 5S System were found to have a positive significant relationship with the employees' motivation in implementing 5S System while not for the other two variables (reward and recognition for 5S System and top management role for 5S System).

9. Prof. S. B. Khedkar, Prof. R. D. Thakre, et al, (2012) Study of implementing 5S Techniques in Plastic Molding.

5S is a basic foundation of Lean manufacturing systems. It is a tool for cleaning, sorting, organizing and providing the necessary groundwork for workplace improvement. This research effort dealt with the implementation of 5S methodology in the S.P. Plastic Industry MIDC,

Hingna Road, Nagpur 16. A detailed application of the 5S system is given. It will impact the instructors and workman of Industry that work within the selected place. By following the 5S methodology, this research effort may show significant improvements to safety, productivity, efficiency, and housekeeping. The research documents improvements by using before and after pictures. It also intends to build a stronger work ethic within the workman and engineer who would be expected to continue the good practices.

2.7.2 Arabic studies: -

1. HosseinHojjati, Seyed Mohammad, (2011) IMPLEMENTING 5S SYSTEM IN PERSIA NOOR FACTORY.

Among the eighteen members of Asian Productivity Organization, Iran is the seventeenth. The reason is the lack of properly usage of the great resources present in this country. Five S system is a methodology as basement for better usage of the resources in an organization, it is used to establish and maintain a quality environment that help in reducing waste and maintain a high degree of cleanliness and orderliness in the work place. Five S are five Japanese words start with S and stand for: Seiri(Sort), Seiton (Set in order), Seiso (Shine), Seiketsu (Standardize), and Shitsuke (Sustain). This paper shows how five S technique is used in Persia noor of Shiraz factory in Iran. Decisions which are made, actions which are done, and the results which are gained, are presented in this paper.

2. MohdNizamAbRahman, Noor KamalianaKhamis, et al, (2010)

Implementation of 5S Practices in the Manufacturing Companies

5S practice is one of the techniques to improve quality environment, health and safety at the workplace. Evaluation of 5S practice can be done through implementation of 5S audit at each division in the company. Approach: Through 5S audit, it enables each company to identify the potential level of quality improvement and at the same time can analyze their ability and weakness of each division in the company. Therefore, in order to assess the implementation of 5S practice, two manufacturing companies were involved in this study. Results: The study started with understanding background of the company, recognizing divisions to be assessed in the company and come out with the complete 5S checklist for

each division for auditing process. Based on the result, both companies basically perform an excellent 5S practice, but there are a few weaknesses that still need to be considered such as arrangement of the documents, tool and equipment. Conclusion/Recommendations: Moreover, both companies agreed that the 5S practice is seen as an effective technique that can improve housekeeping, environmental performance, health and safety standards in their workplace. However, effort and participation from top management is a key factor that determines the success of the 5S practice.

3. Khamis, M. N. AbRahman, et al, (2009).

Development of 5S Practice Checklist for Manufacturing Industry

This paper explores the practical use of the 5S Checklist for environment, housekeeping and health, as well as safety improvement purposes at two manufacturing organizations. The main objective of this study is to assess the implementation of 5S and development of the 5S Activity Checklist in manufacturing companies. The scope for this study covers the following areas: identifying problems, looking into critical success factors, their outcomes and recommendations. In addition, factors that may act as constraints to the implementation of the 5S activity and possible solutions for the industries are also identified through observation and evaluation of the improved environmental performance. The study is conducted using a systematic approach with specific software in order to get the most accurate results. In conclusion, effective implementation of the 5S activity depends on the commitment of the top level management, total involvement of the staff at all levels within the company, function and background of the business, publicity given to the 5S activity and finally the training conducted for the organisation in implementing the 5S practices.

4. Jamal Ahmed Hama Kareem, Noraini Abu Talib, Role of Ethical Factor in 5S and Implementation: Study of Kurdish Cement Industry,

The present study attempts to investigate the role of ethical factors in the implementation of 5S and TPM. The results of the study reveal that manager-subordinate relationship (empowerment) is having insignificant influence on the implementation of 5S and TPM; while ethical training and ethical instructions and commands are found to be influential in the

implementation of these techniques. The study provides limitations and future directions for researchers interested in the area.

Organizations pursue policies and strategies to gain competitive advantage against their competitors. To overcome cost issues and production quality issues, many organizations adopt lean manufacturing techniques such as 5S and TPM.

However, many of these organizations especially in developing countries face problems in effective and successful implementation of these techniques 5S and TPM. This is mainly due to lack of employee related factors that are not considered when organizations adopt these techniques.

2.7.3 Local studies: -

1. LubabaAbdalaziem,(2017) The Impact of implementing 5S Methodology on Improving Health Facilities Performance in Omdurman Maternity Hospital Khartoum state

The quality systems have become one of the fundamentals of any health facility management system, actually to make sure that they are efficient, a lot of studies should be done. The purpose of this qualitative study is to figure out the impacts of implementing the 5S Approach as one of the most important and simplest lean methodologies, additionally to study the effect of these impacts to the 5S Methodologies implementation ,moreover which one is more correlated . Factually, questionnaire is distributed randomly to 30% of employees in Omdurman maternity hospital, so they contain six aspects implementing 5S methodology; operational cost reduction, customer satisfaction, Continuous Improvement, employee satisfaction and rewarding and recognition. the data analyzed using SPSS. The result of this study showed that there is significant difference between implementing 5S methodology & the five impacts (cost reduction, customer satisfaction, Continuous Improvement, employee satisfaction and rewarding and recognition). The more correlated factor to implementing 5S is employee satisfaction. so its recommended for any health facility to build its quality system basically by adopting 5S approach and other complementary quality system that focus certainly on documentation.

2. Salma GaisAbadi (2017) The Application of Kaizen and 5s in Manufacturing field to Improving and measurement work environment and Increase Benefit to owner and Customers

Research title is (Benefits of application kaizen and 5s method in industrial field to develop work environment) aims to give complete view about Kaizen and 5S method and are roles to develop work environment. Researches problems abstract that most factories did not implement Kaizen and 7S methods in work which give negative impact for work environment, continues improvement and eliminate waste. Researcher took samples from Sur military and civil clothing factory to verify research hypothesizes, research total population was one thousand and two hundred employers and workers, she took fourteen random samples to do research analysis and took results. After analysis results: there is positive relation between implementing quality policy and developing work in manufacturing field, there is positive relation between implementing kaizen and eliminate waste in manufacturing field, there is positive relation between implementing kaizen and continues improvement in manufacturing field and there is positive relation between implementing 5S (sort- set in order -shine-sustain-standardize) in work place to keep improvement in work place. The researcher concluded that all fields, whether industrial or otherwise, are in urgent need to apply these methodologies to develop work, to discover points of improvement in a scientific way and to try to improve them and to reduce waste in the workplace.

2.7.4 Differences and similarities

There are many points of similarities between the previous studies and this study that the whole studies handling the 5S concept focusing and targeting 5s in different aspects, to initiate and achieve the process of continuous improvement.

The differences show below –

In the findings of this present study shows that communication for 5S System and training for 5S System were found to have a positive significant relationship with the employees' motivation in implementing 5S System while not for the other two variables

(reward and recognition for 5S System and top management role for 5S System).

The studies aspect is to investigate the role of ethical factors in the implementation of 5S and TPM, effective implementation of the 5S activity depends on the commitment of the top level management, total involvement of the staff at all levels within the company, function and background of the business.

2.8 Case Study: COLDAIR FACTORY

2.8.1 History

COLDAIR Engineering Company has represented one of the key pillars of Sudanese industry, since its inception in 1960. As the first company in this category, COLDAIR was able to capture top-of-mind awareness from the outset.

Today the COLDAIR brand remains one of the most respected brands in the Sudanese market, viewed as a symbol of pride and heritage. **COLDAIR's** products combine a high level of functionality with quality and affordability across a variety of sizes and designs made to meet current and evolving customer needs. Currently the company produces single and double door refrigerators in 3 sizes, 10, 12 and 14 cubic feet, chest freezers equipped with direct cooling thermodynamic technology in 4 sizes, 9,12,14 and 18 cubic feet, and 2 sizes of double door refrigerators which use no-frost thermodynamic technology.

COLDAIR have a loyal and structured workforce, and their teams of fully qualified technicians and engineers are consistently inspired to develop the brand's product portfolio to encompass the entire spectrum of modern household appliances.

HHC acquired COLDAIR Engineering Company (CEC) in 2001; today's industry leader in domestically produced home appliances.

COLDAIR works through authorized dealers and distributors spread across the country and supported by service centers to ensure product availability and service support. COLDAIR prides itself on its product quality and durability, offering 5 year guarantees as standard. COLDAIR

believes in quality management systems and best practices in manufacturing as core parts of its strategy.

2.8.2 Vision: COLDIR range of products and services, for each and every business and home in Sudan.

2.8.3 Mission: Coldair's mission is to provide business and homes with exceptional and innovative products and services in the home appliances sector, that deliver superior, quantifiable value to all stakeholders in **COLDIR** Engineering Company.

Chapter Three

Methodology

3.1 Introduction

This chapter explains in detail the methodology used in gathering the information necessary in this study. It highlights the sources of data used and the survey design, which includes the sampling plan and data analysis method employed. The methodology developed in the research is largely driven by research objectives of the thesis.

3.2 The methodology

Having reached identifying from the literature of the attributes and preliminary structure of the **COLDIR** Company and 5S implementation program.

In this research descriptive method was used, the questionnaire was used as a data collection tool.

3.3 Population of the study

The population of this study is collection of units within which the survey will be conducted (samadel et al, 2007, p.747) argued that there is two different type of population:

3. The target population: consist of the group of units about which information is ideally wanted.
4. The survey population: the units that we are able to survey.
5. The target population of this study is the employees of **COLDAIR** Company, whereby the number of employees are 40 which they have been selected to participate in the study are the survey population.

3.4 Sample of study

Sampling is the process of selecting 40 employees (managers, supervisors, workers) from the population of interest, sample size must be

large enough to give a good representation of the population , but small enough to manageable .

The two main types of sampling techniques in quantitative research are random sampling and non-random sampling.

3.5 Determining the sample size:

An important consideration in sample design is the choice of sample size, larger sample provide greater precision but are costlier to undertake.

A common approach is to choosing the sample size is to specify the precision desired and then determine the optimal sample size providing the precision. Roscoe (1975, p. 57) propose that the appropriate sample sizes for most research be greater than 30 and less than 500. Taking into consideration these guidelines we decided to choose 50employees as our sample.

3.6 Questionnaire design:

The aim of questionnaire design is to translate the research objective into specific questions. The answers to these questions should provide data for answering all or some of the research questions. planning and designing the questionnaire is one of the most critical stages in surveys development process, and from the literature review it seems that most problems with questionnaire data can be traced back to the design phase of the project.

The questionnaire consists of **two parts:**

Part 1: Demographic information about testing .

Part 2:5S questions (statements).

CHAPTER FOUR

DATA ANALYSIS AND DISCUSSION

4.1 Descriptive of the Variables Study

The first topic

Field study procedures

This course deals with the field study procedures under the following sections

First: population and sample of the study

Table (4-1) illustrates the frequency and percentage for the sex

sex	Frequencies	Percentage
Male	27	67.5%
Female	13	32.5%
Total	40	100.0%

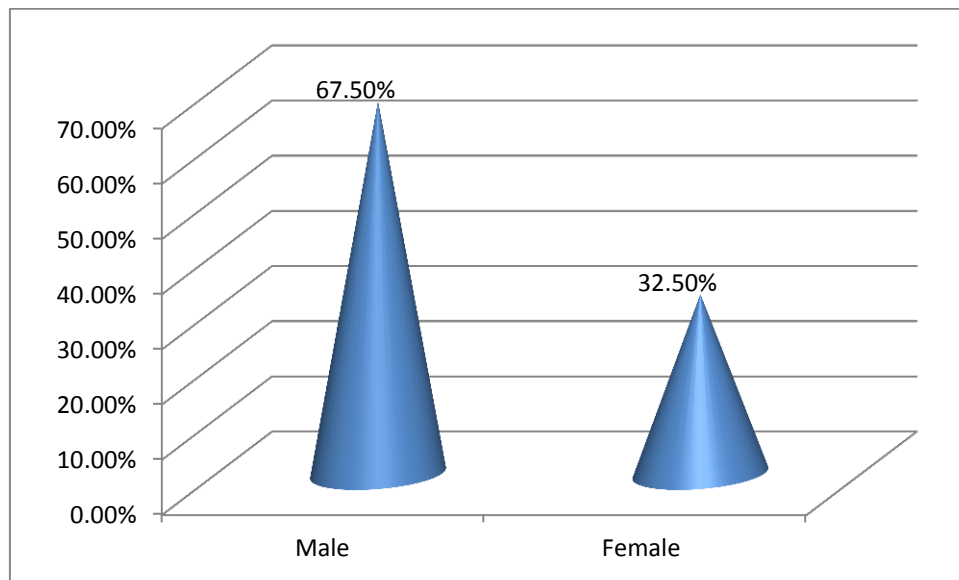


Figure (4-1) illustrates the frequency and percentage for the sex

Table (4-1) illustrates the views of the distribution of the sex sample by male by (%67.5) and female by (%32.5).

Table (4-2) illustrates the frequency and percentage for the Age

Value	Frequencies	Percentage
Less than 30	15	37.5%
30 – 40 year	13	32.5%
41 – 50 year	11	27.5%
51 – 60 year	1	2.5%
More than 60 year	0	0.0%
Total	40	100.0%

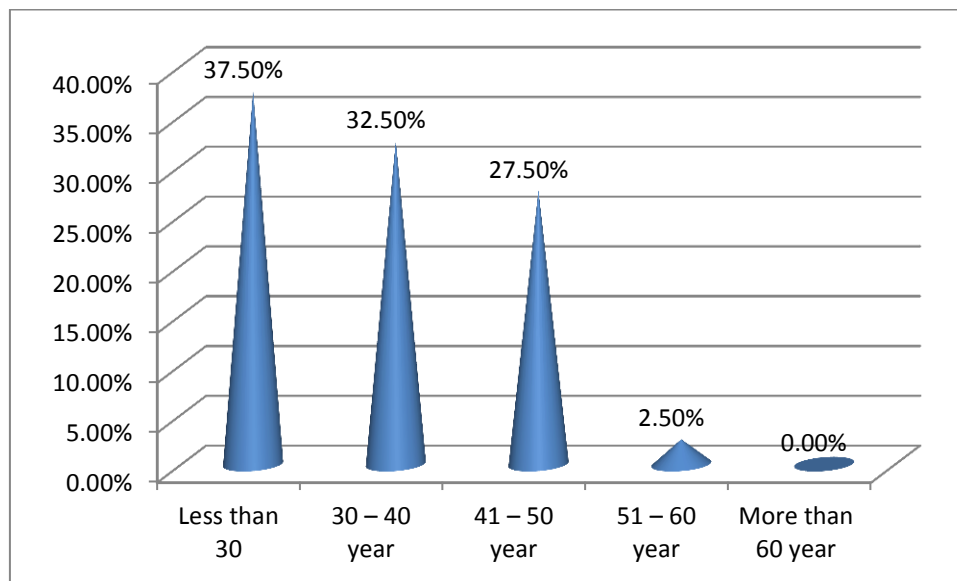


Figure (4-2) illustrates the frequency and percentage for the Age

Table (4-2) illustrates the views of the distribution of the age sample by Less than 30 years by (%37.5) and 30-40 year by (%32.5) and 41-50 year by (%27.5) and 51-60 year by (%2.5) and More than 60 years by (%0.0).

Table (4-3) illustrates the frequency and percentage for the Qualification

Value	Frequencies	Percentage
Diploma	5	12.5%
Bachelor	11	27.5%
High Diploma	2	5.0%
Master	18	45.0%
PHD	4	10.0%
Total	40	100.0%

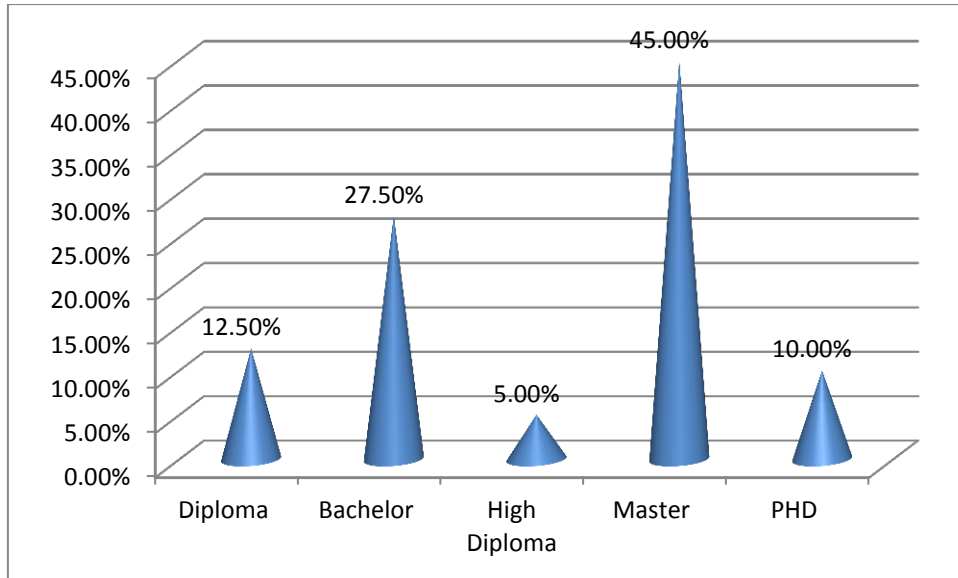


Figure (4-3) illustrates the frequency and percentage for the Qualification

Table (4-3) illustrates the views of the distribution of the Qualification sample by Diploma by (%12.5) and Bachelor by (%27.5) and High Diploma by (%5.0) and Master by (%45.0) and PHD by (%10.0)

Table (4-4) illustrates the frequency and percentage for the Scientific Specialization

Value	Frequencies	Percentage
Accounting and Finance	4	10.0%
Business Administration	6	15.0%
Economics	2	5.0%
Administrative Costs and Accounting	27	67.5%
Other	1	2.5%
Total	40	100.0%

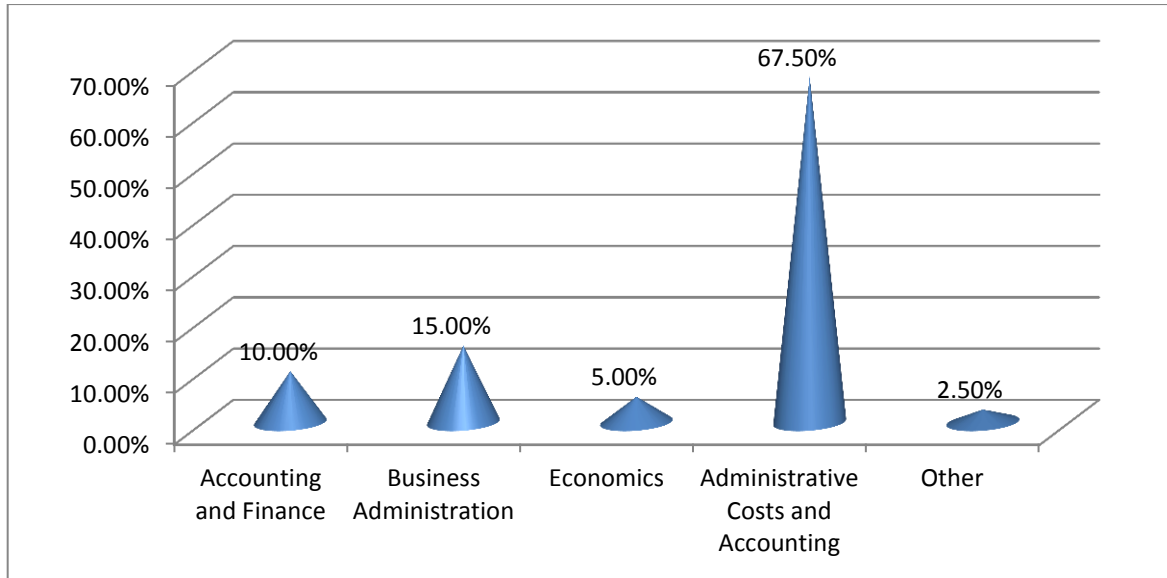


figure (4-4) illustrates the frequency and percentage for the Scientific Specialization

Table (4-4) illustrates the views of the distribution of the Scientific Specialization Sample by Engineering by Accounting and Finance (%10.0) and Business Administration by (%15.0) and Economics by (%5.0) and Administrative Costs and Accounting by (%67.5) and other by (2.5%).

Table (4-5) illustrates the frequency and percentage for the Job title

Value	Frequencies	Percentage
Accountant	2	5.0%
Head of Quality	6	15.0%
Internal Auditor	2	5.0%
Manager	5	12.5%
External Auditor	25	62.5%
Other	0	0.0%
Total	40	100.0%

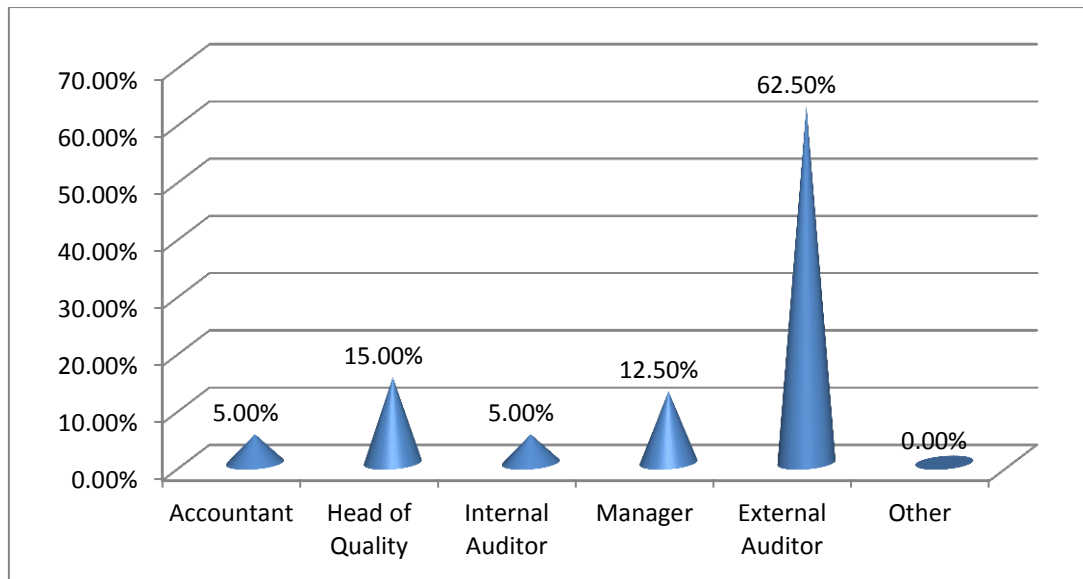


Figure (4-5) illustrates the frequency and percentage for the Job title

Table (4-5) illustrates the views of the distribution of the Scientific Specialization Sample by Accountant by (%5.0) and Head of Quality by (%15.0) and Internal Auditor by (%5.0) and Manager by (%12.5) and External Auditor by (%62.5) and other by (%0.0).

Table (4-6) illustrates the frequency and percentage for experience

Value	Frequencies	Percentage
Less than 5 years	16	40.0%
6 - 10 years	10	25.0%
11 - 15 years	5	12.5%
16 - 20 years	8	20.0%
21 - 25 years	1	2.5%
More than 25 years	0	0.0%
Total	40	100.0%

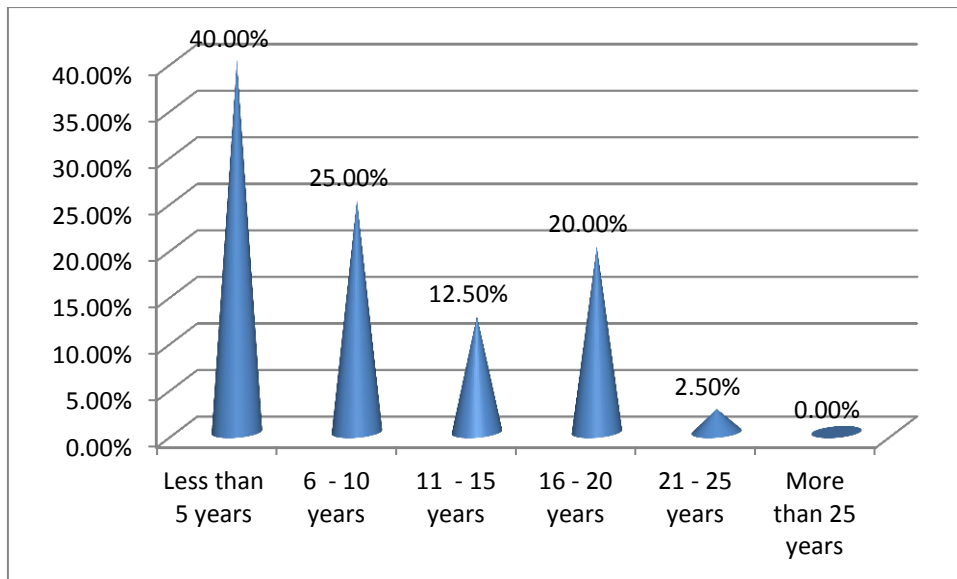


Figure (4-6) illustrates the frequency and percentage for experience

Table (4-6) illustrates the views of the distribution of the How long have you worked in this organization sample by Less than 5 years by (%40.0) and 5 - 10 years by (%25.0) and 11 - 15 years by (%12.5) and 16 - 20 years by (%20.0) and 21 - 25 years by (%2.5) and More than 25 by (0.0%).

Second: reliability and validity

Cranach's alpha method: -

Where reliability was calculated using Cranach's alpha equation shown below:

$$\text{Reliability coefficient} = \frac{n}{N-1} * \frac{1 - \text{Total variations questions}}{\text{variation college grades}}$$

$$\text{Validity} = \sqrt{\frac{n}{N-1} * \frac{1 - \text{Total variations questions}}{\text{variation college grades}}}$$

Cranach alpha coefficient = (0.95), a reliability coefficient is high and it indicates the stability of the scale and the validity of the study

Validity coefficient is the square of the islands so reliability coefficient is (0.97), and this shows that there is a high sincerity of the scale and that the benefit of the study.

Table (4-7) Cranach’s alpha method

No	Value	reliability	Validity
1	Sort	0.85	0.92
2	Set in Order	0.83	0.91
3	Shine	0.71	0.84
4	Standardize	0.75	0.87
5	Sustain	0.84	0.92
6	Continuous improvement of processes	0.64	0.80
7	Efficiency of Operations	0.84	0.92
8	Reduce the Processing time	0.81	0.90
Total		0.95	0.97

The second subject

4.3 View and analyze data

Following table explain illustrates the frequency and percentage for Sort

Table (4-8) illustrates the frequency and percentage for Sort

No	Items	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1	Equipment is distributed in the workplace (effectively) and free of randomly scattered objects	12	13	4	9	2
		30.0	32.5	10.0	22.5	50.0
2	Things are sorted by priority for a certain period (using a red color card)	5	5	15	12	3
		12.5	12.5	37.5	30.0	7.5
3	Tools and equipment (many use) are placed in clear and close places of users	13	15	2	9	1
		32.5	37.5	5.0	22.5	2.5
4	Equipment and documents are maintained	15	11	8	5	1
		37.5	27.5	20.0	12.5	2.5
5	Labels, paintings, and tags were used	15	14	3	7	1
		37.5	35.0	7.5	17.5	2.5

From the above table result shows:

Equipment is distributed in the workplace (effectively) and free of randomly scattered objects by the strongly agree (%30.0) and agree by (%32.5) and neutral by (%10.0) and disagree by (%22.5) and strongly disagree by (%5.0).

Things are sorted by priority for a certain period (using a red color card) by the strongly agree (%12.5) and agree by (%12.5) and neutral by (%37.5) and disagree by (%30.0) and strongly disagree by (%7.5).

Tools and equipment (many use) are placed in clear and close places of users by the strongly agree (%32.5) and agree by (%37.5) and neutral by (%5.0) and disagree by (%22.5) and strongly disagree by (%2.5).

Equipment and documents are maintained by the strongly agree (%37.5) and agree by (%27.5) and neutral by (%20.0) and disagree by (%12.5) and strongly disagree by (%2.5).

Labels, paintings, and tags were used by the strongly agree (%37.5) and agree by (%35.0) and neutral by (%7.5) and disagree by (%17.5) and strongly disagree by (%2.5).

Table (4-9) illustrates chi-square test results for respondents answer about the Sort

No	Phrases	Chi-square value	df	Sig.	Median	Interpretation
1	Equipment is distributed in the workplace (effectively) and free of randomly scattered objects	11.750	4	0.000	4.00	agree
2	Things are sorted by priority for a certain period (using a red color card)	13.500	4	0.000	3.00	neutral
3	Tools and equipment (many use) are placed in clear and close places of users	20.000	4	0.000	4.00	agree
4	Equipment and documents are maintained	14.500	4	0.000	4.00	agree
5	Labels, paintings, and tags were used	20.000	4	0.000	4.00	agree

The results of table (4-9) Interpreted as follows:

1. The value of chi – square calculated to signify the differences between the numbers of individuals of the study for the Equipment is distributed in the workplace (effectively) and free of randomly scattered objects was (11.750) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
2. The value of chi – square calculated to signify the differences between the numbers of individuals of the study for the Things are sorted by priority for a certain period (using a red color card) was (13.500) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
3. The value of chi – square calculated to signify the differences between the numbers of individuals of the study for the Tools and equipment (many use) are placed in clear and close places of users was (20.000) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
4. The value of chi – square calculated to signify the differences between the numbers of individuals of the study for the Equipment and documents are maintained was (14.500) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
5. The value of chi – square calculated to signify the differences between the numbers of individuals of the study for the Labels, paintings, and tags were used was (20.000) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.

Table (4-10) illustrates the frequency and percentage for Set in Order

No	Items	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1	The tools and files are obtained quickly and in a short time	9	14	7	8	2
		22.5	35.0	17.5	20.0	5.0
2	Files and tools are returned to their specified location after use	12	12	6	7	3
		30.0	30.0	15.0	17.5	7.5
3	The order of the place needs a short time	9	11	8	9	3
		22.5	27.5	20.0	22.5	7.5
4	The level of safety in the work environment has increased	15	11	10	3	1
		37.5	27.5	25.0	7.5	2.5

From the above table result shows:

The tools and files are obtained quickly and in a short time by the strongly agree (%22.5) and agree by (%35.0) and neutral by (%17.5) and disagree by (%20.0) and strongly disagree by (%5.0).

Files and tools are returned to their specified location after use by the strongly agree (%30.0) and agree by (%30.0) and neutral by (%15.0) and disagree by (%17.5) and strongly disagree by (%7.5).

The order of the place needs a short time by the strongly agree (%22.5) and agree by (%27.5) and neutral by (%20.0) and disagree by (%22.5) and strongly disagree by (%7.5).

The level of safety in the work environment has increased by the strongly agree (%37.5) and agree by (%27.5) and neutral by (%25.0) and disagree by (%7.5) and strongly disagree by (%2.5).

Table (4-11) illustrates chi-square test results for respondents answer about the Set in Order

No	Phrases	Chi-square value	df	Sig.	Median	Interpretation
1	The tools and files are obtained quickly and in a short time	9.250	4	0.000	4.00	agree
2	Files and tools are returned to their specified location after use	7.750	4	0.000	4.00	agree
3	The order of the place needs a short time	4.500	4	0.000	4.00	agree
4	The level of safety in the work environment has increased	17.000	4	0.000	3.50	agree

The results of table (4-11) Interpreted as follows:

1. The value of chi – square calculated to signify the differences between the numbers of individuals of the study for the tools and files are obtained quickly and in a short time was (9.250) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
2. The value of chi – square calculated to signify the differences between the numbers of individuals of the study for the Files and tools are returned to their specified location after use was (7.750) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
3. The value of chi – square calculated to signify the differences between the numbers of individuals of the study for the order of the place needs a short time was (4.500) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
4. The value of chi – square calculated to signify the differences between the numbers of individuals of the study for the level of safety in the work environment has increased was (17.000) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.

Table (4-12) illustrates the frequency and percentage for Shine

No	Items	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1	Work environment (furniture, equipment and files) clean	10	17	10	2	1
		25.0	42.5	25.0	5	2.5
2	Work environment (furniture, equipment and files) safe in which the causes of accidents and injuries	11	12	13	3	1
		27.5	30.0	32.5	7.5	2.5
3	It is easy to observe faults and check them during cleaning (preventive maintenance)	16	8	12	4	0
		40.0	20.0	30.0	10.0	0.0
4	Minimize the causes of faults with auditing and continuous cleaning	8	18	12	2	0
		20.0	45.0	30.0	5.0	0.0

From the above table result shows:

Work environment (furniture, equipment and files) clean by the strongly agree (%25.0) and agree by (%42.5) and neutral by (%25.0) and disagree by (%5.0) and strongly disagree by (%2.5).

Work environment (furniture, equipment and files) safe in which the causes of accidents and injuries by the strongly agree (%27.5) and agree by (%30.0) and neutral by (%32.5) and disagree by (%7.5) and strongly disagree by (%2.5).

It is easy to observe faults and check them during cleaning (preventive maintenance) by the strongly agree (%40.0) and agree by (%20.0) and neutral by (%30.0) and disagree by (%10.0) and strongly disagree by (%0.0).

Minimize the causes of faults with auditing and continuous cleaning by the strongly agree (%20.0) and agree by (%45.0) and neutral by (%30.0) and disagree by (%5.0) and strongly disagree by (%0.0).

Table (4-13) illustrates chi-square test results for respondents answer about the Shine

No	Phrases	Chi-square value	df	Sig.	Median	Interpretation
1	Work environment (furniture, equipment and files) clean	21.750	4	0.000	4.00	agree
2	Work environment (furniture, equipment and files) safe in which the causes of accidents and injuries	15.500	4	0.000	4.00	agree
3	It is easy to observe faults and check them during cleaning (preventive maintenance)	8.000	3	0.000	4.00	agree
4	Minimize the causes of faults with auditing and continuous cleaning	13.600	3	0.000	4.00	agree

The results of table (4-13) Interpreted as follows:

1. The value of chi – square calculated to signify the differences between the numbers of individuals of the study for the Work environment (furniture, equipment and files) clean was (21.750) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
2. The value of chi – square calculated to signify the differences between the numbers of individuals of the study for the Work environment (furniture, equipment and files) safe in which the causes of accidents and injuries was (15.500) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
3. The value of chi – square calculated to signify the differences between the numbers of individuals of the study for the It is easy to observe faults and check them during cleaning (preventive maintenance) was (8.000) with P-value (0.000) which is lower than

the level of significant value (5%) These refer to the existence of differences statistically.

- The value of chi – square calculated to signify the differences between the numbers of individuals of the study for the Minimize the causes of faults with auditing and continuous cleaning was (13.600) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.

Table (4-14) illustrates the frequency and percentage for Standardize

No	Items	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1	There are clear and written steps for each process	11	25	3	1	0
		27.5	62.5	7.5	2.5	0.0
2	Written steps are followed for each process	8	17	10	2	3
		20.0	42.5	25.0	5.0	7.5
3	Work is conducted with discipline	13	15	8	3	1
		32.5	37.5	20.0	7.5	2.5
4	The information (archive) will be disposed of after a specified period	5	19	15	0	1
		12.5	47.5	37.5	0.0	2.5

From the above table result shows:

There are clear and written steps for each process by the strongly agree (%27.5) and agree by (%62.5) and neutral by (%7.5) and disagree by (%2.5) and strongly disagree by (%0.0).

Written steps are followed for each process by the strongly agree (%20.0) and agree by (%42.5) and neutral by (%25.0) and disagree by (%5.0) and strongly disagree by (%7.5).

Work is conducted with discipline by the strongly agree (%32.5) and agree by (%37.5) and neutral by (%20.0) and disagree by (%7.5) and strongly disagree by (%2.5).

The information (archive) will be disposed of after a specified period by the strongly agree (%12.5) and agree by (%47.5) and neutral by (%37.5) and disagree by (%2.5) and strongly disagree by (%0.0).

Table (4-15) illustrates chi-square test results for respondents answer about the Standardize

No	Phrases	Chi-square value	df	Sig.	Median	Interpretation
1	There are clear and written steps for each process	35.600	3	0.000	4.00	agree
2	Written steps are followed for each process	18.250	4	0.000	4.00	agree
3	Work is conducted with discipline	18.500	4	0.000	4.00	agree
4	The information (archive) will be disposed of after a specified period	21.200	3	0.000	4.00	agree

The results of table (4-15) Interpreted as follows:

1. The value of chi – square calculated to signify the differences between the numbers of individuals of the study for There are clear and written steps for each process was (35.600) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
2. The value of chi – square calculated to signify the differences between the numbers of individuals of the study for the Written steps are followed for each process was (18.250) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
3. The value of chi – square calculated to signify the differences between the numbers of individuals of the study for the Work is conducted with discipline was (18.500) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.

4. The value of chi – square calculated to signify the differences between the numbers of individuals of the study for the information (archive) will be disposed of after a specified period was (21.200) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.

Table (4-16) illustrates the frequency and percentage for Sustain

No	Items	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1	The sections are inspected to observe compliance with the system	6	15	4	11	4
		15.0	37.5	10.0	27.5	10.0
2	There is a stimulus for the sections that apply the five (5s) successfully	3	10	9	15	3
		7.5	25.0	22.5	37.5	7.5
3	There is communication between staff in the department and other departments	12	12	5	9	2
		30.0	30.0	12.5	22.5	5.0
4	There is a check list for each audit phase	10	14	1	12	3
		25.0	35.0	2.5	30.0	7.5
5	The number of errors produced unintentionally decreases	14	9	11	5	1
		35.0	22.5	27.5	12.5	2.5

From the above table result shows:

The sections are inspected to observe compliance with the system by the strongly agree (%15.0) and agree by (%37.5) and neutral by (%10.0) and disagree by (%27.5) and strongly disagree by (%10.0).

There is a stimulus for the sections that apply the five (5s) successfully by the strongly agree (%7.5) and agree by (%25.0) and neutral by (%22.5) and disagree by (%37.5) and strongly disagree by (%7.5).

There is communication between staff in the department and other departments by the strongly agree (%30.0) and agree by (%30.0) and neutral by (%12.5) and disagree by (%22.5) and strongly disagree by (%5.0).

There is a check list for each audit phase by the strongly agree (%25.0) and agree by (%35.0) and neutral by (%2.5) and disagree by (%30.0) and strongly disagree by (%7.5).

The number of errors produced unintentionally decreases by the strongly agree (%35.0) and agree by (%22.5) and neutral by (%27.5) and disagree by (%12.5) and strongly disagree by (%2.5).

Table (4-17) illustrates chi-square test results for respondents answer about the Sustain

No	Phrases	Chi-square value	df	Sig.	Median	Interpretation
1	The sections are inspected to observe compliance with the system	11.750	4	0.000	4.00	agree
2	There is a stimulus for the sections that apply the five (5s) successfully	13.000	4	0.000	4.00	agree
3	There is communication between staff in the department and other departments	9.750	4	0.000	4.00	agree
4	There is a check list for each audit phase	16.250	4	0.000	4.00	agree
5	The number of errors produced unintentionally decreases	13.000	4	0.000	4.00	agree

The results of table (4-17) Interpreted as follows:

1. The value of chi – square calculated to signify the differences between the numbers of individuals of the study for the sections are inspected to observe compliance with the system was (11.750) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
2. The value of chi – square calculated to signify the differences between the numbers of individuals of the study for the There is a stimulus for the sections that apply the five (5s) successfully was (13.000) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.

3. The value of chi – square calculated to signify the differences between the numbers of individuals of the study for There is communication between staff in the department and other departments was (9.750) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
4. The value of chi – square calculated to signify the differences between the numbers of individuals of the study for the There is a check list for each audit phase was (16.250) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
5. The value of chi – square calculated to signify the differences between the numbers of individuals of the study for the number of errors produced unintentionally decreases was (13.000) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.

Table (4-18) illustrates the frequency and percentage for Continuous improvement of processes

No	Items	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1	Implementation of the 5S stimulates procedure process and task improvements	10	24	6	0	0
		25.0	60.0	15.0	0.0	0.0
2	Modifications were made to the method of completing some tasks or processes after applying the methodology of the five (5S)	7	19	10	4	0
		17.5	47.5	25.0	10.0	0.0
3	Improved performance of the department after the implementation of the methodology of the five (5S)	8	20	12	0	0
		20.0	50.0	30.0	0.0	0.0
4	Implementation of the 5S methodology increases individual discipline and responsibility	11	19	10	0	0
		27.5	47.5	25.0	0.0	0.0

From the above table result shows:

Implementation of the 5S stimulates procedure process and task improvements by the strongly agree (%25.0) and agree by (%60.0) and neutral by (%15.0) and disagree by (%0.0) and strongly disagree by (%0.0).

Modifications were made to the method of completing some tasks or processes after applying the methodology of the five (5S) by the strongly agree (17.5%) and agree by (%47.5) and neutral by (%25.0) and disagree by (%10.0) and strongly disagree by (%0.0).

Improved performance of the department after the implementation of the methodology of the five (5S) by the strongly agree (%20.0) and agree by (%50.0) and neutral by (%30.0) and disagree by (%0.0) and strongly disagree by (%0.0).

Implementation of the 5S methodology increases individual discipline and responsibility by the strongly agree (%27.5) and agree by (%47.5) and neutral by (%25.0) and disagree by (%0.0) and strongly disagree by (%0.0).

Table (4-19) illustrates chi-square test results for respondents answer about the Continuous improvement of processes

No	Phrases	Chi-square value	df	Sig.	Median	Interpretation
1	Implementation of the 5S stimulates procedure process and task improvements	13.400	2	0.000	4.00	agree
2	Modifications were made to the method of completing some tasks or processes after applying the methodology of the five (5S)	12.600	3	0.000	4.00	agree
3	Improved performance of the department after the implementation of the methodology of the five (5S)	5.600	2	0.000	4.00	agree
4	Implementation of the 5S methodology increases individual discipline and responsibility	3.650	2	0.000	4.00	agree

The results of table (4-19) Interpreted as follows:

1. The value of chi – square calculated to signify the differences between the numbers of individuals of the study for the Implementation of the 5S stimulates procedure process and task improvements was (13.400) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
2. The value of chi – square calculated to signify the differences between the numbers of individuals of the study for the Modifications were made to the method of completing some tasks or processes after applying the methodology of the five (5S) was (12.600) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
3. The value of chi – square calculated to signify the differences between the numbers of individuals of the study for the Improved performance of the department after the implementation of the methodology of the five (5S) was (5.600) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
4. The value of chi – square calculated to signify the differences between the numbers of individuals of the study for the Implementation of the 5S methodology increases individual discipline and responsibility was (3.650) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.

Table (4-20) illustrates the frequency and percentage for efficiency of Operations

No	Items	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1	The implementation of the 5S methodology will lead to the completion of correct operations as well as their proper completion	13	23	4	0	0
		32.5	57.5	10.0	0.0	0.0
2	The application of the 5S methodology will use and coordinate the materials used in each process to achieve the objectives of the processes	12	22	6	0	0
		30.0	55.0	15.0	0.0	0.0
3	The implementation of the 5S methodology reduces the quantity of inputs and increases the quantity of outputs, i.e., reduces the amount of materials used in the processes and increases the output.	12	18	7	3	0
		30.0	45.0	17.5	7.5	0.0

From the above table result shows:

The implementation of the 5S methodology will lead to the completion of correct operations as well as their proper completion by the strongly agree (%32.5) and agree by (%57.5) and neutral by (%10.0) and disagree by (%0.0) and strongly disagree by (%0.0).

The application of the 5S methodology will use and coordinate the materials used in each process to achieve the objectives of the processes by the strongly agree (%30.0) and agree by (%55.0) and neutral by (%15.0) and disagree by (%0.0) and strongly disagree by (%0.0).

The implementation of the 5S methodology reduces the quantity of inputs and increases the quantity of outputs, ie, reduces the amount of materials used in the processes and increases the output.by the strongly agree (%30.0) and agree by (%45.0) and neutral by (%17.5) and disagree by (%7.5) and strongly disagree by (%0.0).

Table (4-21) illustrates chi-square test results for respondents answer about the efficiency of Operations

No	Phrases	Chi-square value	df	Sig.	Median	Interpretation
1	The implementation of the 5S methodology will lead to the completion of correct operations as well as their proper completion	13.550	2	0.000	4.00	agree
2	The application of the 5S methodology will use and coordinate the materials used in each process to achieve the objectives of the processes	9.800	2	0.000	4.00	agree
3	The implementation of the 5S methodology reduces the quantity of inputs and increases the quantity of outputs, ie, reduces the amount of materials used in the processes and increases the output.	12.600	3	0.000	4.00	agree

The results of table (4-21) Interpreted as follows:

1. The value of chi – square calculated to signify the differences between the numbers of individuals of the study for the implementation of the 5S methodology will lead to the completion of correct operations as well as their proper completion was (13.550) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
2. The value of chi – square calculated to signify the differences between the numbers of individuals of the study for the application of the 5S methodology will use and coordinate the materials used in each process to achieve the objectives of the processes was (9.800) with P-value (0.000) which is lower than the level of

significant value (5%) These refer to the existence of differences statistically.

3. The value of chi – square calculated to signify the differences between the numbers of individuals of the study for the implementation of the 5S methodology reduces the quantity of inputs and increases the quantity of outputs, ie, reduces the amount of materials used in the processes and increases the output was (12.600) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.

Table (4-22) illustrates the frequency and percentage for Reduce the Processing time

No	Items	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1	Implementation of the 5S methodology will lead to the discontinuation of production lines in operations.	8	21	4	7	0
		20.0	52.5	10.0	17.5	0.0
2	Implementation of the 5S methodology leads to streamlining processes, thus reducing working hours.	7	21	7	4	1
		17.5	52.5	117.5	10.0	2.5
3	Implementation of the 5S methodology will reduce the time of arrival of production inputs.	9	21	8	1	1
		22.5	52.5	20.0	2.5	2.5
4	Application 5S accelerates the collection and classification of process outputs	12	22	5	1	0
		30.0	55.0	12.5	2.5	0.0

From the above table result shows:

Implementation of the 5S methodology will lead to the discontinuation of production lines in operations by the strongly agree (%20.0) and agree by (%52.5) and neutral by (%10.0) and disagree by (%17.5) and strongly disagree by (%0.0).

Implementation of the 5S methodology leads to streamlining processes, thus reducing working hours by the strongly agree (%17.5) and agree by (%52.5) and neutral by (%17.5) and disagree by (%10.0) and strongly disagree by (%2.5).

Implementation of the 5S methodology will reduce the time of arrival of production inputs by the strongly agree (%22.5) and agree by (%52.5) and neutral by (%20.0) and disagree by (%2.5) and strongly disagree by (%2.5).

Application 5S accelerates the collection and classification of process outputs by the strongly agree (%30.0) and agree by (%55.0) and neutral by (%12.5) and disagree by (%2.5) and strongly disagree by (%0.0).

Table (4-23) illustrates chi-square test results for respondents answer about the Reduce the Processing time

No	Phrases	Chi-square value	df	Sig.	Median	Interpretation
1	Implementation of the 5S methodology will lead to the discontinuation of production lines in operations	17.000	3	0.000	4.00	agree
2	Implementation of the 5S methodology leads to streamlining processes, thus reducing working hours	29.500	4	0.000	4.00	agree
3	Implementation of the 5S methodology will reduce the time of arrival of production inputs.	33.500	4	0.000	4.00	agree
4	Application 5S accelerates the collection and classification of process outputs	25.400	3	0.000	4.00	agree

The results of table (4-23) Interpreted as follows:

1. The value of chi – square calculated to signify the differences between the numbers of individuals of the study for the Implementation of the 5S methodology will lead to the discontinuation of production lines in operations was (17.000) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
2. The value of chi – square calculated to signify the differences between the numbers of individuals of the study for the Implementation of the 5S methodology leads to streamlining processes, thus reducing working hours was (29.500) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
3. The value of chi – square calculated to signify the differences between the numbers of individuals of the study for the Implementation of the 5S methodology will reduce the time of arrival of production inputs was (33.500) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
4. The value of chi – square calculated to signify the differences between the numbers of individuals of the study for the Application 5S accelerates the collection and classification of process outputs was (25.400) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.

4.4 Testing Hypotheses:-

1. There is a statically significance between implementation of 5s and continuous improvement

Table (4-24)

No	Chi-square	Df	Sig.	Median	Scale	Statistical significant
40	25.26	3	0.00	4.0	Agree	Significant

Table (4-24) shows that the value of the Chi-square test (25.26) by significant value (0.00) it's less than the probability value (0.05) this means that there is statically significance between implementation of 5s and continuous improvement

2. There is a statically significance between implementation of 5s and Efficient operations.

Table (4-25)

No	Chi-square	Df	Sig.	Median	Scale	Statistical significant
40	32.01	2	0.00	4.0	Agree	Significant

Table (4-25) shows that the value of the Chi-square test (32.01) by significant value (0.00) it's less than the probability value (0.05) this means that there is statically significance between implementation of 5s and Efficient operations.

3. There is a statically significance between implementation of 5s and Time of completion of operations.

Table (4-26)

No	Chi-square	Df	Sig.	Median	Scale	Statistical significant
40	28.145	3	0.00	4.0	Agree	Significant

Table (4-26) shows that the value of the Chi-square test (28.145) by significant value (0.00) it's less than the probability value (0.05) this means that there is statically significance between implementation of 5s and Time of completion of operations.

DISCUSSION:

Analysis of data showed:

- There was great presence of males in quality and manufacturing fields.
- Gender is not significant variables in implementing 5S concept.
- 70% of Employees were young, their age less than 40 years old, which consider as competitive advantages for the company because Innovation and creativity are generating from this group, and they are low resistant to new change in work environment than those who above 40 years old, age is not a significant variable in implementing 5S concept.
- There are about 45% has Master degree that mean they has ability to understand implementing new concepts
- Academic certificates are not a significant variable in implementing 5S concept.
- Employees with Different Years of Experiences in one department, the mix between old and new candidates could give a wide board to exchange knowledge and experiences, years of Experiences is significant variables in implementing 5S concept.

Hypotheses 1: Analysis show that there is relation between implementation of 5S and continuous improvement .

Hypotheses 2: results showThethat the Implementing of 5S have a positive role on the efficient of the operations.

Hypotheses 3: Analysis show that There is effective relation of the implementation of 5s and Time of completion of operations.

Chapter Five

CONCLUSION AND RECOMMENDATIONS

1- INTRODUCTION:

This chapter shows the results of the study after analysis, the recommendation and support suggestions for future research.

2- CONCLUSION:

The purpose of the research has been achieved by answering the following hypotheses.

The results of the study showed that: -

1. There is relation between implementation of 5s and continuous improvement .
2. Implementing of 5S have a positive role on the efficient of the operations.
3. There is effective relation of the implementation of 5s and Time of completion of operations.

3- RECOMMENDATIONS:

From the results above there are some recommendations, that we recommend companies to focus on continuous improvement

- 1- Increase the level of the employee's awareness of the 5S methodology.
- 2- The company has to train, motivate and support the employees to implement 5S technic.
- 3- The quality research and training centers has to encourage studies that integrate of 5S methodology with the other quality management system.
- 4- increasing the interest of companies and factories in the industrial sector in particular in the implementation of the concept of 5S or similar concepts

- 5- recommended more studies focusing on the concept of the 5S, its methods and the benefits of its application, this concept is in all sectors in Sudan whether it is industrial, medical or service sector.

4- SUGGESTION OF FUTURE RESARCHES:

- 1- suggest more studies focusing on the concept of the 5S,
- 2- suggest to procedure methods and the benefits of its implementing 5S concept is in all sectors in Sudan whether it is industrial, medical or service sector.
- 3- Make more research discuss the difference between 5S concept and lean manufacturing and six sigma concepts
- 4- Impact of implementing of 5S with(ISO 18001/ 45001) to achieve the continuous improvement.
- 5- The Role of 5S usage to reduce the quality cost.
- 6- Study the impact of the 5S methodology between two companies on of them it applies the concept and the other not.

REFERENCES:

Sources

القران الكريم
الحديث الشريف

References in English language:

1. Abhishek jainemail authorrajbir bhattiharwinder singh Conference paper First Online: 29 April 2014
2. Asada, T., Bailes, J.C. and Suzuki, K. (2000) Implementing ABM with Hoshin Management, Institute of Management Accountants Publ., New Jersey.
3. Ashmore, C. (2001) 'Kaizen and the art of motorcycle manufacture', Manufacturing Engineer, Vol. 80, No. 5, pp.220–222.
4. Bhuiyan, N., & Baghel, A. (2005). An overview of continuous improvement: from the past to the present. Management Decision, 43(5), pp. 761-771.
5. Bingham, B. (2011) The Kaizen Method to Living a Healthy Lifestyle: Easy Steps to Better Eating and Exercise Habits to Help You Lose Weight and Feel Great, E-Kindle, Amazon.
6. Brunet, P. (2000) 'Kaizen in Japan', Understanding to Action, Vol. 1, No. 35, pp.1–10, IEE (Institute of Electrical Engineers) Seminar, Kaizen, London, UK.
7. Chen, J.C., Dugger, J. and Hammer, B. (2000) 'A kaizen based approach for cellular manufacturing design: a case study', Journal of Technology Studies, Vol. 27, No. 2, pp.19–27.
8. Cheser, R.N. (1998) 'The effect of Japanese Kaizen on employee motivation in US manufacturing', International Journal of Organizational Analysis, Vol. 6, No. 3, pp.197–212.

9. Deming, W.E. (1995) *the New Economics for Industry Government and Education*, 2nd ed., MIT Press, Cambridge, MA.
10. Deniels, R.C. (1996) 'Profit-related pay and continuous improvement: the odd couple', *Engineering Management Journal*, Vol. 6, No. 6, pp.233–236
11. Dinesh B. Shinde, Prashant N. Shinde, 2014, "Improvement of plant layout by using 5s technique-an industrial case study", *International Journal of Modern Engineering Research (IJMER)*, Vol. 4(2), pp. 141-146.
12. Doolen, T.L., June, W.Q., Akan, V., Eileen, M. and Farris, J.A. (2003) 'Development of an assessment approach for Kaizen events', *Proceedings of the 2003 Industrial Engineering and Research Conference*, CD-ROM.
13. Eileen Julieth Hernández Lamprea, Zulieth Melissa Camargo Carreño, Paloma María Teresa Martínez Sánchez Implementing 5s system in persia noor factory. *ingeniare. Revista chilena de ingeniería*, vol. 23 n° 1, 2015, pp. 107-117
14. Erlandson, R.F., Noblett, M.J. and Phelps, J.A. (1998) 'Impact of Poka-Yoke device on job performance of individuals with cognitive impairments', *IEEE Transactions on Rehabilitation Engineering*, Vol. 6, No. 3, pp.269–276.
15. Farris, J.A. (2006) *An Empirical Investigation of Kaizen Event Effectiveness Outcomes and Critical Success Factors*, PhD dissertation, Virginia Polytechnic Institute and State University.
16. Friedli, D. (1999) 'UK firms may suffer from kamikaze kaizen strategy', *The Engineer*.
17. Gao, S. and Low, S.P. (2013) 'Understanding the application of Kaizen methods in construction firms in China', *Journal of Technology Management in China*, Vol. 8, No. 1, pp.18–33.

18. Gapp, R., Fisher, R. and Kobayashi, K. (2008) 'Implementing 5S within a Japanese context: an integrated management system', *Management Decision*, Vol. 46, No. 4, pp.565–579.
19. Gibb, A. and Davies, L. (1990) 'In pursuit of frameworks for the development of growth models of the small business', *International Small Business Journal*, Vol. 9, No. 1, pp.15–31.
20. Gunasekran, A. and Lyu, J. (1997) 'Implementation of just in time in a small company', *Production Planning and Control*, Vol. 8, No. 4, pp.406–412.
21. Harsha lingareddy, g.sahitya reddy, k.jagadeshwar *lingareddy* , 5s as a tool and strategy for improvising the work place, address for correspondence mechanical engineering department, k l university, guntur, andhra pradesh, international journal of advanced engineering technology e-issn 0976-3945, india IJAET/Vol. IV/ Issue II/April-June, 2013/28-30
22. Ho, S.K., Cicmil, S. and Fung, C.K. (1995) 'The Japanese 5-S practice and TQM training', *Training for Quality*, Vol. 3, No. 4, pp.19–24.
23. Ho, S.K.M. (1997) 'Workplace learning: the 5S way', *J. Workplace Learn*, Vol. 19, No. 6, pp.185–191.
24. Ho, S.K.M. (1999a) '5s practice: the first step towards total quality management', *Total Quality Management*, Vol. 10, No. 3, pp.345–356.
25. Hongming, H., Sun, H. and Xu, Y. (2000) 'An empirical study on quality management practices in Shinghai manufacturing industries', *Total Quality Management*, Vol. 11, No. 8, pp.1111–1122.
26. Hossein Hojjati, Seyed Mohammad, Implementing 5s system in persia noor factory *International Journal of Industrial Engineering*. 2011, Vol. 18 Issue 8, p425-431. 7p. 3 Diagrams, 2 Charts.

27. Imai, 1997, p1 Imai, M. (2008) Gemba Kaizen. A Commonsense, Low-Cost, Approach to Management, Kaizen Institute, Warsaw.
28. Irane, Z. and Sharp, J.M. (1997) ‘Integrating continuous improvement and innovation into a corporate culture: a case study’, *Technovation*, Vol. 17, No. 4, pp.225–226.
29. José H. Ablanedo-Rosas, Bahram Alidaee Juan Carlos Moreno & Javier Urbina Quality improvement supported by the 5S, an empirical case study of Mexican Organizations Pages 7063-7087 | Received 24 Mar 2009, Accepted 29 Sep 2009, Published online: 21 Jan 2010
30. Juran, J. & Blanton Godfrey, B. 1998. JURAN’S QUALITY HANDBOOK. 5TH ED., MCGRAW-HILL.
31. Khamis, M. N. Ab Rahman, K.R. Jamaludin, A.R. Ismail, J.A. Ghani, R. Zulkifli, Development of 5S Practice Checklist for Manufacturing Industry, Proceedings of the World Congress on Engineering 2009 Vol I WCE 2009, July 1 - 3, 2009, London, U.K.
32. Klefsjö, B., Bergquist, B. & Edgeman, R. 2006. Six Sigma and Total Quality Management: Different Day, Same Soup? *INTERNATIONAL JOURNAL OF SIX SIGMA AND COMPETITIVE ADVANTAGE*, 2(2), pp.162-178
33. Korkut, D.S., Cackicier, N., Erdinler, E.S., Ulay, G. and Dogan, A.M. (2009) ‘5s activities and its application in a sample company’, *African Journal of Biotechnology*, Vol. 8, No. 8, pp.1720–1728.
34. Learning 5S principles from Japanese best practitioners: case studies of five manufacturing companies Pages 4574-4586 | Received 20 Jun 2012, Accepted 18 Dec 2013, Published online: 31 Jan 2014
35. Lee, M. (2000) ‘Customer service excellence through people motivation and Kaizen’, *IEE Seminar, ‘Kaizen: from Understanding to Action’*, Vol. 5, No. 35, pp.1–21.
36. Malik, S.A. and YeZhuang, T. (2006) ‘Execution of continuous improvement practices in Spanish and Pakistani industry: a

comparative analysis', IEEE International Conference on Management of Innovation and Technology, Vol. 2, pp.761–765, Singapore.

37. Malik, S.A., Li-Bin, L., YeZhuang, T. and Xiao-Lin, S. (2007) 'Continuous improvement practices in Asian developing countries: a comparative analysis between Chinese and Pakistani manufacturing industry', 14th International Conference on Management Science and Engineering, pp.692–697, Harbin, China.
38. Martínez-Lorente, Dewhurst & Dale 1998, p. 379
39. mariano jiménez, luis romero manuel domínguez, mara del mar espinosa A department of mechanical engineering, technical school of engineering – icai, universidad de comillas, madrid, spain B design engineering area – universidad nacional de educación a distancia (uned), madrid, spain 27 april 2015.
40. Mente, D. (1994) Japanese Etiquette & Ethics in Business, NTC Business Books, Lincolnwood, IL.
41. Mohd Nizam Ab Rahman, Nor Kamaliana Khamis, Rosmaizura Mohd Zain, Baba Md Deros and Wan Hasrulnizzam Wan Mahmood, Implementation of 5S Practices in the Manufacturing Companies: A Case Study Department of Mechanical and Materials Engineering, Faculty of Engineering and Built Environment, University Kebangsaan Malaysia, 43600 Bangi, Selangor, Malaysia, American Journal of Applied Sciences 7 (8): 1182-1189, 2010 ISSN 1546-9239 2010 Science Publications
42. Narasimhan, G. (2009) 'Strategic handling to changes in small manufacturing organizations in India', International Journal of Business and Management, Vol. 4, No. 1, pp.141–148.
43. Noni Hartika Binti Juhari, Norridzwan Abidin, Maznah Wan Omar Factors influencing employees' motivation in implementing 5s system, Elixir Hum. Res. Mgmt, Universiti Sains Malaysia 11800,

Pulau Pinang, Malaysi Universiti Teknologi MARA, Kedah P.O.Box 187, 08400, 28 September 2011, Merbok, Kedah, Malaysia.

44. Palmer, V.S. (2001) 'Inventory management kaizen', Proceedings of 2nd International Workshop on Engineering Management for Applied Technology, pp.55–56, Austin, USA.
45. Pettigrew, A.M. (1990) 'Longitudinal field research: theory and practice', Organization Science, Vol. 1, No. 3, pp.267–292.
46. Pheng, S.L. and Khoo, S.D. (2001) 'Team performance management: enhancement through Japanese 5-S principles', Team Performance Management: An International Journal, Vol. 7, Nos. 7/8, pp.105–111.
47. Powel, J.A. (1999) 'Action learning for continuous improvement and enhanced innovation in construction', Proceedings of IGLC-7, pp.433–444, University of California, USA.
48. Prof. S. B. Khedkar, Prof. R. D. Thakre, Prof. Y. V. Mahantare, Mr. Ravi Gondne, Study of Implementing 5S Techniques in Plastic Moulding, Mechanical Engg Department, B. D. College of Engg Sevagram, India, International Journal of Modern Engineering Research (IJMER) www.ijmer.com Vol.2, Issue.5, Sep.-Oct. 2012 pp-3653-3656 ISSN: 2249-6645 www.ijmer.com 3653 | Page
49. Radharamanan, R., Godoy, L.P. and Watanabe, K.I. (1996) 'Quality and productivity improvement in a custom-made furniture industry using kaizen', Computer and Industrial Engineering, Vol. 31, Nos. 1/2, pp.471–474.
50. Richa Sharma and Jagtar Singh Impact of Implementing Japanese 5S Practices on Total Productive Maintenance, Department of Mechanical Engineering, SLIET Longowal-148106, Distt. Sangrur, Punjab, India March 2015, Available online 25 March 2015, Vol.5, No.2 (April 2015)

51. Saraph, J., Benson, G. and Schroeder, R. (1989) 'An instrument for measuring the critical factors of quality management', *Decision Sciences*, Vol. 20, No. 4, pp.457–478.

52. Saunders, M., Lewis, P. & Thornhill, A. 2009. *Research methods for business students. FIFTH EDITION, PRENTICE HALL, FINANCIAL TIMES.*

53. Sethi, G. and Pal, P. (1995) *Energy Efficiency in Small Scale Industry – An Indian Perspective*, 64p, TERI (Tata Energy Research Institute), New Delhi, India.

54. Sheridan, J.H. (1997) 'Kaizen Blitz', *Industry Week*, Vol. 246, No. 16, pp.18–27.

55. Soderquist, 1996 Soderquist, K. (1996) 'Managing innovation in SMES: a comparison of companies in UK, France and Portugal', *International Journal of Technology Management*, Vol. 12, No. 3, pp.291–305.(BOOK)

56. Sevim, 2005 Sevim, K.D. (2005) *Total Maintenance Management and Application in a Forest Products Enterprise*, PhD thesis, Istanbul University, Institute of Science, Istanbul, Turkey.

57. Suzaki, K. (1987) *The New Manufacturing Challenge-Techniques of Manufacturing Systems*, John Wiley and Sons, Inc., New York.

58. Suárez-Barraza et al., 2012 *An exploratory study of 5S: a multiple case study of multinational organizations in Mexico*

59. Teknologiateollisuus ry. 16/2001. 5S. Helsinki: Teknologiateollisuus Teknova Oy.

60. Thawesaengskulthai 2007, p. 18 Thawesaengskulthai, Natcha (2007) *Selecting quality management and improvement initiatives: case studies of industries in Thailand*. PhD thesis, University of Nottingham

61. Tuominen, K. 2010. LEAN-Tehoa ja laatua siisteyden ja järjestyksen kehittämiseen-5S. Jyväskylä: WS Bookwell Oy.
62. Vasudevan, A. (1998) 'Perspective of the role of small scale industries in India's economic development', Reserve Bank of India Bulletin, Vol. 3, No. 10, pp.8–28.
63. Watanabe, R.M. (2011) 'Getting ready for kaizen: organizational and knowledge management enablers', VINE, Vol. 41, No. 4, pp.428–448.
64. Wickens, P.D. (1990) 'Production management: Japanese and British approaches', IEE Proceedings Science, Measurement and Technology, Vol. 137, No. 1, pp.52–54.
65. Williamson, A. (1997) 'Target and kaizen costing', Manufacturing Engineer, Vol. 76, No. 1, pp.22–24.

Web sites:

1. www.googletranslate.com
2. <https://scholar.google.com/>

APPENDIXESI

Questionnaire

College of Graduate studies

Deanship of Development & Quality

Master of Total Quality Management and Excellence

Dear Sir/ Madam

Greetings

I submit to you a questionnaire for the purpose of scientific research, the topic is **The impact of implementing 5S Methodology as tool for continuous improvement of the quality of operations in the industrial sector**

I would kindly appreciate your cooperation by answering all the phrases in the questionnaire.

I would like to thank you for putting the sign in front of the phrase that suits you:

-1. Type:

Male () Female ()

-2. Age:

30 years old and less () 40-31 years () 41-50 years ()

51- 60 years () more than 60 years ()

3. Academic Qualifications: -

Diploma Master () Bachelor () Higher Diploma ()

Master () PhD ()

4. Scientific specialization:-

Accounting and Finance () Business Administration () Economics ()

Administrative Costs and Accounting () Other ()

5.Job title:-

Accountant () Head of Quality() Internal Auditor()
Manager() External Auditor() Other()

6.Scientific experience:-

5 years and less () 6-10 years () 11-15 years () 16-
20- years() 21-25 years() more than 25 years ()

The first axis: the reality of the implementation of the methodology of the five (5S) at the Coldair Company.

Phrases	S. Agree	Agree	Not Applicable	Disagree	S. Disagree
S1: Sort					
1. Equipment is distributed in the workplace (effectively) and free of randomly scattered objects.					
2. Things are sorted by priority for a certain period (using a red color card) .					
3. Tools and equipment (many use) are placed in clear and close places of users					
4. Equipment and documents are maintained					
5. Labels, paintings, and tags were used					
S2: Set in Order					
1. The tools and files are obtained quickly and in a short time					
2. Files and tools are returned to their specified location after use					
3. The order of the place needs a short time					
4. The level of safety in the work environment has increased					
S3: Shine					

1. Work environment (furniture, equipment and files) clean					
2. Work environment (furniture, equipment and files) safe in which the causes of accidents and injuries					
3. It is easy to observe faults and check them during cleaning (preventive maintenance)					
4. Minimize the causes of faults with auditing and continuous cleaning.					
S4: Standardize					
1. There are clear and written steps for each process					
2. Written steps are followed for each process					
3. Work is conducted with discipline					
4. The information (archive) will be disposed of after a specified period					
S5: Sustain					
1. The sections are inspected to observe compliance with the system					
2. There is a stimulus for the sections that apply the five (5s) successfully					
3. There is communication between staff in the department and other departments					
4. There is a check list for each audit phase					
5. The number of errors produced unintentionally decreases					

The Second axis: The impact of the implementation of the methodology of the five (5 S) on the quality of operations at the COLDAIR Company: (continuous improvement of operations, increase the effectiveness and efficiency of operations, reduce the time of completion of operations)

Phrases	Strongly Agree	Agree	Not Applicable	Disagree	Strongly Disagree
Continuous improvement of processes					
1. Implementation of the 5S stimulates procedure process and task improvements					
2. Modifications were made to the method of completing some tasks or processes after applying the methodology of the five (5S)					
3. Improved performance of the department after the implementation of the methodology of the five (5S)					
4. Implementation of the 5S methodology increases individual discipline and responsibility					
Efficiency of Operations					
1. The					

<p>implementation of the 5S methodology will lead to the completion of correct operations as well as their proper completion</p>					
<p>2. The application of the 5S methodology will use and coordinate the materials used in each process to achieve the objectives of the processes</p>					
<p>3. The implementation of the 5S methodology reduces the quantity of inputs and increases the quantity of outputs, ie, reduces the amount of materials used in the processes and increases the output.</p>					
<p>Reduce the Processing time</p>					
<p>1. Implementation of the 5S methodology will lead to the discontinuation of production lines in</p>					

operations.					
2. Implementation of the 5S methodology leads to streamlining processes, thus reducing working hours.					
3. Implementation of the 5S methodology will reduce the time of arrival of production inputs.					
4. Application 5S accelerates the collection and classification of process outputs					

السلام عليكم ورحمة الله وبركاته

إن هذا الاستبيان معد لغرض الحصول على البيانات التي تتعلق بالجانب الميداني للبحث (التكميلي) لنيل درجة الماجستير في إدارة الجودة الشاملة والامتياز
بعنوان:

اثر تطبيق منهجية التاءات الخمسة (5S) كأداة للتحسين المستمر علي جودة العمليات في القطاع الصناعي

أرجو من كريم سيادتكم ملء الاستبيان المرفق علما بأن هذه البيانات تستخدم لغرض البحث العلمي فقط.

ولكم جزيل الشكر

الباحث : ساره عبدالرازق محمد ساتي

APPENDIXES II

البيانات الأولية:

أرجو شاكراً وضع علامة (√) أمام العبارة التي تلائمكم:

1- النوع :

ذكر () انثي ()

2-العمر:

30 سنة فأقل () 40 - 31 سنة () 50 - 41 سنة ()
60 - 51 سنة () أكثر من 60 سنة ()

3-المؤهل العلمي:

دبلوم وسيط () بكالوريوس () دبلوم عالي ()
ماجستير () دكتورة ()

4-التخصص العلمي:

محاسبة وتمويل () إدارة أعمال () اقتصاد ()
تكاليف ومحاسبة إدارية ()

أخرى ()

5-المسمى الوظيفي:

محاسب () رئيس قسم الجودة () مراجع داخلي ()
مدير () مراجع خارجي () أخرى ()

6-الخبرة العلمية

5 سنوات فأقل () 10 - 6 سنوات () 15 - 11 سنة ()
20 - 16 سنة () 25-21 سنة () أكثر من 25 سنة ()

المحور الاول: واقع تطبيق منهجية التاءات الخمسة (5S) بمصنع كوالدير.

غير موافق بشدة	غير موافق	محايد	موافق	موافق بشدة	العبارات
ت1: التصنيف					
					1. يتم توزيع المعدات في مكان العمل (بصورة فعالة) وخلص من الأشياء المبعثرة عشوائياً.
					2. يتم فرز الأشياء حسب الأولوية لفترة معينة (باستخدام بطاقة اللون الاحمر)
					3. توضع الادوات والمعدات (كثيرة الاستخدام) في أماكن واضحة وقريبة من المستخدمين
					4. يتم المحافظة علي المعدات والوثائق
					5. تم استخدام العلامات واللوحات والوسم
ت2: الترتيب					
					1. يتم الحصول على الادوات والملفات المهمة بسرعة وفي زمن قصي
					2. يتم ارجاع الملفات والادوات الى مكانها المحدد
					3. يحتاج ترتيب المكان الى زمن قصير
					4. ارتفع مستوى السلامة في بيئة العمل
ت3: التنظيف					
					1. بيئة العمل (الاثاث والمعدات والملفات) نظيفة
					2. بيئة العمل (الاثاث والمعدات والملفات) امنه تقل فيها مسببات الحوادث والاصابات
					3. يسهل ملاحظة الاعطال وفحصها اثناء

					التنظيف (الصيانة الوقائية)
					4. تقل مسببات الاعطال مع مراجعته والتنظيف المستمر.
ت4: التمييز ط					
					1. توجد خطوات واضحة ومكتوبة لكل عملية او إجراء
					2. يتم الالتزام بالخطوات المكتوبة لكل عملية
					3. يسير العمل بانضباط
					4. يتم التخلص من المعلومات (الارشيف (بعد فترة محدد
ت5: التثبيت					
					1. يتم المرور على الاقسام لملاحظة الالتزام بتطبيق النظام
					2. يوجد تحفيز للاقسام التي تطبق التاءات الخمسة (s5) بنجاح
					3. يوجد تواصل بين العاملين في القسم والاقسام الاخرى
					4. توجد قائمة تفتيش (check list) لكل مرحلة تدقيق
					5. تقل عدد الاخطاء الناتجة بدون قصد

المحور الثاني: أثر تطبيق منهجية التاءات الخمسة (5S) على جودة العمليات بمصنع كولدير:(التحسين المستمر للعمليات، رفع فعالية وكفاءة العمليات، تقليل زمن انجاز العمليات)

غير موافق بشدة	غير موافق	محايد	موافق	موافق بشدة	العبارات
التحسين المستمر للعمليات					
					1. تطبيق التاءات الخمسة (5S) يحفز الاجراء التحسينات على العمليات والمهام
					2. تم اجراءت عديلات على طريقة انجاز بعض المهام او العمليات بعد تطبيق منهجية التاءات الخمسة (5S)
					3. تحسن اداء القسم بعد تطبيق منهجية التاءات الخمسة (5S)
					4. يؤدي تطبيق منهجية التاءات الخمسة (5S) الى زيادة الانضباط والمسؤولية الفردية
فعالية كفاءة العمليات					
					1. يؤدي تطبيق منهجية التاءات الخمسة (5S) الي إنجاز العمليات الصحيحة وكذلك إنجازها بشكل صحيح
					2. يؤدي تطبيق منهجية التاءات الخمسة (5S) الي استخدام وتنسيق المواد المستخدمة في كل عملية بصورة مثلي من أجل تحقيق أهداف العمليات
					3. يؤدي تطبيق منهجية التاءات الخمسة (5S) الي تقليل كمية المدخلات وزيادة كمية المخرجات، أي أنها تقلل كمية المواد المستخدمة في العمليات وزيادة النتاج المنجز منها.
تقليل زمن انجاز العمليات					
					1. يؤدي تطبيق منهجية التاءات الخمسة (5S) الي عدم توقف خطوط الانتاج في العمليات.

					2. يؤدي تطبيق منهجية التاءات الخمسة (5S) الي تبسيط العمليات مما ادي ذلك لتقليل ساعات العمل.
					3. يؤدي تطبيق منهجية التاءات الخمسة (5S) الي تقليل زمن الوصول لمدخلات عمليات الانتاج .
					4. يؤدي تطبيق (5S) الي تسريع جمع وتصنيف مخرجات العمليات

Appendixes III

List of Arbitrators: -

Name	Scientific Degree	Institute
Dr.Ashraf Hassan Idrees	Assistant Professor Statistics and information Centre	Statistics and information Centre Sudan University of Science and Technology
Dr.Mohaned Hassan Ismail	Assistant Professor Education -Education Technology - Quality	Sudan University of Science and Technology
Dr. Huda Hashim Obaied	Head of Self-Assessment Section Deanship of Development and Quality	Sudan University of Science and Technology