



# Implémentation de l'approche 5S-KAIZEN-TQM dans un hôpital tunisien

## Implementation of the 5S-KAIZEN-TQM approach in a public hospital in Tunisia

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### ABSTRACT

**Introduction:** The 5S-Kaizen-TQM is a step-by-step approach, originally implemented in the Japanese industry as a continuous improvement strategy.

**Aim:** To underline the positive impact of its implementation in three pilot departments in Tunisia public hospital.

**Methods:** The 5S-KAIZEN-TQM introduced into three clinical departments lasted 6 months from February 2021 to July 2021. Firstly, we organized seminar to introduce this approach and training sessions on 5S and Kaizen activities to each department staff members. To collect data, we conduct satisfaction surveys, face to face interviews, meetings, and brainstorming sessions. To present these data, checklists, Analytic Hierarchy Process (AHP), Ishikawa chart, Value stream mapping (VSM) charts and visual management techniques were adopted. Then, with the participation of the staff members, we implemented the two steps of this approach and evaluated their performance by the identification of indicators related to each step and to each Department.

**Results:** The project had positive implications on employee and patient satisfaction. 5S step activities led to the reduction of the item research time and the releases of space. Improving the working environment increased staff satisfaction. Kaizen activities conducted to the reduction of process lead time and the error reductions which increased patient satisfaction.

**Conclusion:** This project, first in Tunisia, was undertaken by Tunisian National Health Evaluation and Accreditation Agency (INEAS) and partners as part of the program for the research on organizational innovation in health. The findings of this project can be disseminated and perpetuated the 5S-KAIZEN-TQM approach in the health sector in countrywide.

**Keywords:** Quality management healthcare, 5S-Kaizen-TQM approach, Tunisia, Public Hospital

### RÉSUMÉ

**Introduction :** 5S-Kaizen-TQM est une approche par étapes, initialement mise en œuvre dans l'industrie japonaise.

**Objectif :** Cet article vise à souligner l'impact positif de sa mise en œuvre dans trois départements pilotes d'un hôpital public tunisien.

**Méthodes :** L'introduction de cette approche dans trois départements a duré 6 mois, de février 2021 à juillet 2021. Nous avons organisé un séminaire pour présenter cette approche et des sessions de formation aux membres du personnel de chaque service. Pour recueillir des données, nous avons mené des enquêtes de satisfaction, des entretiens, des réunions et des séances de brainstorming. Pour présenter ces données, nous avons utilisé des checklists, le diagramme d'Ishikawa et les techniques de management visuel. Ensuite, avec la participation des membres du personnel, nous avons mis en œuvre les deux étapes de cette approche et évalué leur performance par l'identification d'indicateurs liés à chaque étape et à chaque département.

**Résultats :** Le projet a entraîné des répercussions positives sur la satisfaction des employés et des patients. Les activités de 5S ont permis de réduire le temps de recherche des articles et de libérer de l'espace. L'amélioration des conditions de travail a augmenté la satisfaction du personnel. Les activités Kaizen ont permis de réduire le délai des processus et ont diminué les erreurs, ce qui a augmenté la satisfaction des patients.

**Conclusion :** Ce projet, premier en Tunisie, a été entrepris par l'Agence Nationale d'Evaluation et d'Accréditation en Santé (INEAS) et ses partenaires dans le cadre du programme de recherche sur l'innovation organisationnelle en santé. Les résultats de ce projet sont prometteurs et pourront permettre de diffuser et de pérenniser l'approche 5S-KAIZEN-TQM dans le secteur de la santé à l'échelle nationale.

**Mots-clés :** Gestion de la qualité, approche 5S-Kaizen-TQM, Tunisie, Hôpital public

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## INTRODUCTION

Conventionally, the quality of medical services depended on the latest medical treatment and diagnosis at the highest level. However, despite on the high-level medical equipment in the developed countries, several serious medical accidents occurred in the 1990s and conducted to a severe dissatisfaction on the care services provided in developed countries. We thought that staff members were responsible and ought to not make errors. However, it is natural for humans to make mistakes and that it is important to create a system that reduces accidents (1). Besides, the quality-of-care services was be limited to clinical practice and did not consider organizational aspects such as waiting time to be served, time needed to find a document or equipment, etc. This led to a revision of the quality-of-care service and medical safety definition. According to (1), quality of care services must include quality management consisting of doing properly what is wanted by patients and naturally essential to patients.

International trends towards quality of health and medical care are now in the fourth Revolution of Medical Care, where we transfer to processes digitalization to optimize processes and reduce errors. The healthcare quality in Tunisia lags behind quality in developed countries. According to (2), the quality of the scanner examination at the Sahloul University Hospital in Sousse has been limited mainly by the excessive time required to carry it out and the non-conformity of the reports. According to (3), more than six hundred medications errors in 100 prescriptions were found throughout the drug circuit of an intensive care unit, due to environmental factors in 31% of cases. This is the case of many African countries.

In this context, the Japan International Cooperation Agency (JICA) has embarked on "Total Quality Management (TQM) for Better Hospital Services", which is a sub-program of the Asia-Africa Knowledge Co-creation Program (AAKCP) aiming to improve health services by implementing a Japanese-style quality management method called 5S-KAIZEN-TQM in 2007. The 5S-Kaizen-TQM is an approach of step-by-step quality promotion that was originally implemented in the Japanese industry (manufacturing enterprises mostly) as a continuous improvement strategy. This approach is low cost, but it gets visible changes within a reasonable short period of time which leads to satisfaction of the service providers along with the clients.

In Tunisia, this approach was not yet implemented. The studies that have been carried out in Tunisia are limited to certain health care services without defining yet a strategic framework for research on the implementation of organizational innovations in public health demonstrating quality and efficiency.

To fill this gap, the National Instance of Evaluation and Accreditation in healthcare (INEAS) launched a national project to set up an evaluative device for experimenting with new innovative projects for the health system. The 5S-Kaizen-TQM approach being the subject of a first national call for projects. To initiate this project in 2021, INEAS with the collaboration of National Engineering School of Carthage (Ecole Nationale d'Ingénieurs de Carthage ENICarthage) launched three end-of-study projects in three pilot services chosen by the MAMI hospital. From 2022,

on the sidelines of the 8th edition of the Tokyo International Conference on African Development (TICAD8) scheduled to be held in Tunisia, JICA experts will become partners for this project.

This project spanned 6 months from February 2021 to July 2021 and it is conducted as a change process on experimentation in health system to elaborate the first edition of a National Guide to Organizational Practices: Evaluation of experimentation in innovational organization in health - Experimentation of the 5S - Kaizen - TQM method implementation.

The aim of this study is to discover how the introduction and dissemination of the two steps 5S and KAIZEN can positively impact the Tunisian health sector and to determine the main factor for its success.

## METHODS

INEAS in collaboration with the Japan International Cooperation Agency (JICA) and the National Quality Program Management Unit (UGPQ) at the Ministry of Industry, Energy and Mines organized a webinar on Tuesday, December 15, 2020, on the introduction of the 5S- KAIZEN approach in the health sector in Tunisia. The participants in this webinar were hospital actors (technical services, medical/paramedical staff, executives), research professors in industrial engineering from engineering schools and executives from the Ministry of Industry. At the end of this webinar, ENICarthage proposed to participate in the implementation of the 5S-KAIZEN approach in a hospital. The Abderrahmen MAMI Hospital, a Public Health Establishment was proposed as a case study. Thus, INEAS launched the project to implement the approach in the MAMI hospital as part of the end-of-study projects of three Industrial Engineering students from ENICarthage. Three pilot services were chosen by the hospital: Medical resuscitation service (Departement A), Microbiology laboratory (Departement B) and Medical Imaging Department (Departement C).

In this section, we present the 5S-KAIZEN -TQM approach, the process of its implementation in the pilot public Tunisian hospital, data collected during this project and indicators defined to assess this project.

### 5S-Kaizen Approach

The 5S-Kaizen is an approach of step-by-step quality promotion that was originally implemented in the Japanese industry (manufacturing enterprises mostly) as a continuous improvement strategy. This approach is low cost, but it gets visible changes within a reasonable short period of time which leads to satisfaction of the service providers along with the clients. According to Hasegawa and Karandagoda, (4), 5S-KAZEN-TQM approach makes all hospitals "Value-Co-Creating Organizations" while creating three non-monetary values related to (1) hospital services (2) customer satisfaction and (3) employee satisfaction.

Two reasons to start with "5S": it is easy to understand by everybody and its achievement in terms of working improvement can be appreciated by everyone. This leads to positive mindset among the workers and incites them to participate to Kaizen

activities. 5S stands for the five Japanese words Seiri, Seiton, Seiso, Seiketsu and Shitsuke, translated in English to "Sort, Set, Shine, Standardize and Sustain". Sort items and remove unused ones from your workplace, Set in order to facilitate the access to items, Shine to work in clean workplaces with clean tools and equipment, Standardize to set up in every section of work place and Sustain 5S". For more details, please refer to appendix 1. Then proceeding to the Kaizen method which literally means "Better Change". KAIZEN is a method to solve problem and eliminate wastes. We begin by identifying the problem which is defined as the gap between ideal status and existing status. To fill the gap continuously, we adopt PDCA cycle: Plan to solve the problem, Do some actions to fill the gap, Check to measure the gap, still existing and "Act" to improve further.

Finishing with the Total Quality Management (TQM) is defined by ISO8402 (ISO: International Organization of Standardization) as "Management approach of an organization, centered on quality, based on the participation of all its members and aiming at long-term success through customer satisfaction, and benefits to all members of the organization and to society." Therefore, TQM in hospitals is viewed as a visionary and strategic leadership directing kaizen and 5S activities, conducted in respective work unit as a bottom-up managerial activities, to TQM, which must ensure horizontal links between the different Kaizen teams of the different departments by managing knowledges: best practices, risks and opportunities.

### Process of the pilot project

As visualized in Figure 1, the pilot project was carried out in four phases between February 2021 and July 2021: the field survey phase, the preparatory phase, the 5S implementation phase and the KAIZEN implementation phase.

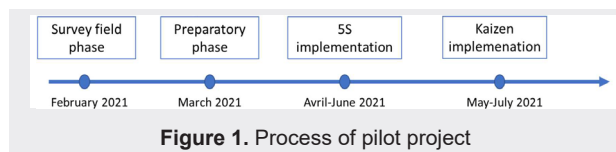


Figure 1. Process of pilot project

A field survey was carried out to identify not only the failures at three departments in terms of the working environment and health services provision but also the strengths to exploit them to attain objectives. We concluded that the physical working environment was inadequate, processes are not optimized but involvement of staff presented the unique strength of three departments. The diagnosis phase led to the production of a report summarizing the current situation. Given the nature of the approach, based essentially on group work and the positive spirit of the team, this phase is very important and decisive for the success of the approach and the achievement of the estimated objectives. In the preparatory phase, a training session and introduction to the 5S - Kaizen approach was organized for the heads of services of the hospital A and administration staff. 5S-Kaizen-TQM approach was presented in a simple and effective way, exhibiting the genesis of the approach, explaining the steps of implementation and the expected results by this project. This presentation was followed

by question/answer session. Then, a kick-off meeting with the staff of each pilot department was planned to disseminate the necessary information on the stages of the implementation of the 5S approach and to share the vision and the objectives to be achieved while insisting on the keys to success of the approach: positive spirit and group work. Then, a Quality Improvement Team (QIT) was restructured for each pilot service to ensure periodic monitoring of the application of 5S, to guarantee adequate training for all staff and to provide the necessary inputs for the 5S activities. In QIT team, all the profiles operating within the department were presented (head of department, quality manager, secretary, technician, hygiene and cleanliness manager, senior staff), the administration staff and the heads of the various departments. Finally, training sessions were carried out for each department.

5S implementation phase is composed of three steps: staff service training, selection of pilot zones and building Working Improvement Team (WIT) for each zone selected. In fact, given that the duration of project was limited to 6 months, the project team was not able to implement 5S in all zones of three pilot services. To define the pilot areas where the 5S will be carried out, a multi-criteria analysis was applied using the AHP "Analytical Hierarchical Process" method. For this reason, a meeting with the QIT team was organized to define the selection criteria, and the criteria comparison scale. For each zone, a WIT was structured to implement 5S.

Kaizen implementation phase is composed of three main steps. Firstly, the staff was trained in Kaizen approach. Then, QIT selected small and large Kaizen themes. Finally, QIT and team project practiced KAIZEN approach.

### Data collecting and assessment indicators

For the project data collection, we used face to face interviews, meetings, brainstorming sessions, and elaborated documents such as checklists, forms, and questionnaires.

To present these data, checklists, multicriteria analysis, AHP, Ishikawa charts, flowcharts, spaghetti charts, VSM charts, Pareto diagrams, matrix diagrams, tree diagrams and visual management techniques were adopted.

To assess the impact of 5S-Kaizen-TQM approach, indicators were identified for each department and each phase of 5S-Kaizen approach. As shown in table 1, three types of indicators were identified: impact indicators, monitoring indicators and staff involvement indicators to assess the 5S phase.

Table 1. Indicators identified

Impact indicators	Monitoring indicators	Staff involvement indicators
- staff satisfaction	- 5S Audit score AS	- number of QIT meetings
- tool search time		- number of WIT meetings
- document search time		- number of meetings between QIT and WIT
- space freed up after 5S		- Staff involvement rate

The indicators related to Kaizen phase depended on the theme chosen by each department. For department A, we search to reduce the number of medication errors and Average Medication recovery time, the frequency of non-conformities for department B and reduction lead time and transcription errors for department C.

## RESULTS

### Evaluation of the 5S activities

As we mentioned earlier, we define for each department pilot zones to carry out 5S approach. To identify these pilot zones, a multi-criteria analysis was applied using the AHP "Analytical Hierarchical Process" method. QIT team define selection criteria and comparison scale.

We present in the figure below the evolution of average 5S Audit Score (AS) department according to the date of each audit department. We can notice the increase of AS in each department.

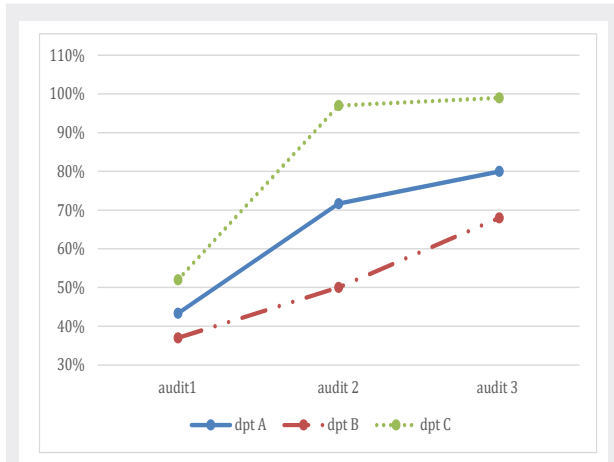


Figure 2. 5S score Audit per department

However, the increase rate depends on department: 37% department A, 31% department B and 47% department C. The difference in rate improvement of 5S score is explained by the involvement of leaders

of departments. As shown in figure below, the improvement rate of involvement of department B is lower than other departments.

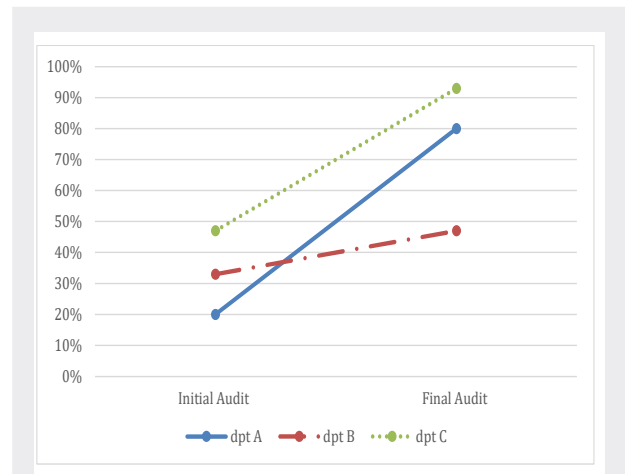


Figure 3. Involvement Rate of leaders' departments

Management involvement affects the performance of 5S activities, thus the 5S score. The 5S score reflects improvements in the working environment. This constantly influences the level of staff satisfaction. We notice that evolution of the satisfaction rates depends on department: the percentage of personal satisfied increases by 11 % in department A, 27% in department C. Whereas the rate decreases by 26% in department B. To evaluate how the 5S activities improve the environment workplace, we identified indicators for each department to consider their specificities (see figure below).

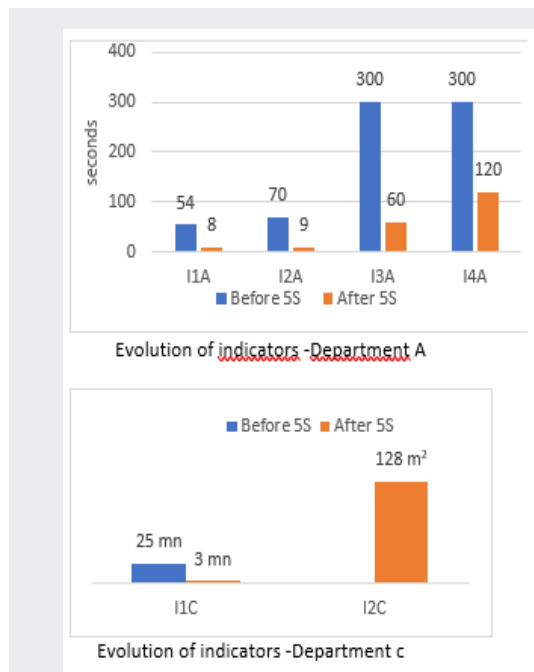
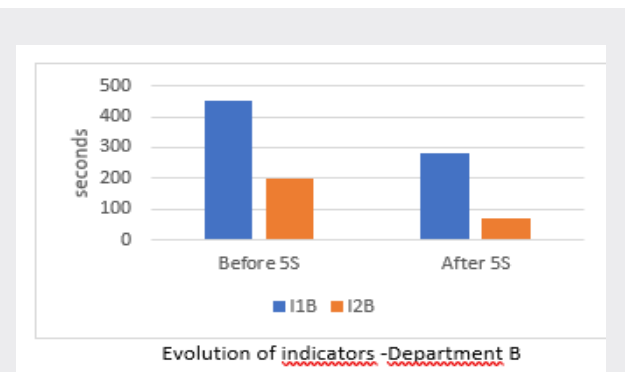


Figure 4. Evolution of Indicators



Department A	Departement B	Department C
-I1A: Access time to the emergency trolley	-I1B: Access time to work equipment:	I1C: Access time to documents
-I2A: Access time to consumable material	-I2B: Research time for tools	I2C: Freed space for documents
-I3A: Access time to documents		

We present in figure 5 some station works after implementing 5S in departments A, B and C. We have recourse to some tools: labels and signs, line Marking Painted for marking boundaries of work areas, as well as locations for pallets and marking of archive boxes to detect if any are missing or out of place.



Department A



Department B



Department C

Figure 5. 5S after photographs from pilot departments

To ensure communication with staff and to motivate them daily, a notice board was made available to display updates, progress of 5S implementation and project teams involved in this project.

**Progress of KAIZEN activities**

“KAIZEN” is a Japanese word composed of two terms: KAI and ZEN. KAI means “change” and ZEN means “Improvement”. In other words, KAIZEN means Change for the better. Kaizen is a problem-solving process for achieving a Total Quality Managed hospital. It is repetitive (continuous) possible changes on the way of working. We distinguish two types of problems: “Small problem” is simple composition and not complicated to analyze and resolve whereas “Large problem” is composed of several “contributing factors” and more complicated to resolve. In the table below, we exhibit a Chart presented at the KAIZEN Training of Trainers, 2015 given in the KAIZEN Facilitator’s Guide.

Table 2. Chart of Kaizen		
	Large KAIZEN (KAIZEN Process - QC story)	Small KAIZEN
<b>Target</b>	Large problem, Medium problem	Small problem
<b>Period of implementation</b>	Need certain time (One KAIZEN cycle is maximum 6 months)	Short time (Few minutes – less than one month)
<b>Process of implementation</b>	<ol style="list-style-type: none"> <li>1) Identify problems</li> <li>2) Collect baseline data</li> <li>3) Identify causes</li> <li>4) Come up with possible measures</li> <li>5) Implement measures... etc.</li> </ol>	<ol style="list-style-type: none"> <li>6) Identify problems</li> <li>7) Come up with the solutions</li> <li>8) Implement</li> </ol>
<b>Persons in charge</b>	All section staff	All section staff

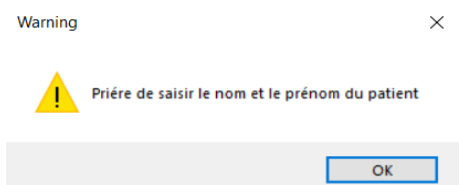
For each department, we have identified "small KAIZEN" activities needing fewer resources and time to solve problems and "large KAIZEN" requiring more resources and time.

*Small Kaizen*

Each department A, B and C treated 2 small Kaizen. We presented in table 3 the small problems and their solutions.

**Table 3.** Small Kaizen per department

Department A	
Small Problems	Solutions
Intra-team communication problems	Soft skills training plan. Team building. Discussion circles. Five (05) minute handover meeting.
Lack of visual management	Team organization chart with staff photos. Tracing the radio circuit to free up space for patients (beds or wheelchairs).
Department B	
Small Problems	Solutions
Intra-team communication problem	Draw a dynamic table for improvement proposals and problems encountered. Plan bi-monthly meetings to discuss the areas of improvement identified in the proposal chart.
Unsuitable transportation modes and conditions	A transport bin is provided with compartments large enough to hold the sample vials in their isolator bags.
Department C	
Small Problems	Solutions
Postponement of registrations due to lack of documents	Create a poster that outlines the documents needed for registration
«Examination Request» form not properly filled out	Automate the «examination request» form (figure 6).



**Figure 6.** "computerized "request for examination

*Large Kaizen*

Given the limited duration of the Kaizen phase in this project (2 months), each department dealt with only one "Large Kaizen". After a training session for the staff of each department, each department followed the approach proposed in the JICA document to solve the problems identified.

The theme treated are:

- Department A: "reduce errors in dispensing medications to patients".
- Department B: "Reduce Non-Conformities in the pre-analytical phase".
- Department C: "Reduce delays in the transmission of results"

We developed forms to record the frequency of occurrence of each type of error in department A over a period of 9 days before and after Kaizen. Before Kaizen, the number of Overstock disposal errors is 5. We have succeeded to eliminate this type of errors. For transcription errors, we have reduced 50% of errors. For the department B, we have reduced the non-conformities in the pre-analytical phase and increase the productivity.

**Table 4.** Indicators related to Large Kaizen of department B.

Indicators	Before	After Improvement
Number of blood cultures done per week	20	28 40%
Number of contaminated blood cultures per week	11	6 45%
Number of non-conformities per week	9	7 22%

For the department C, we have succeeded to reduce the average delay of the results transmission from 5.4 days to 3.6 days.

## DISCUSSION

The results indicate that 5S - KAIZEN approach improved the quality of services. While 5S method helped to improve the work environment and strengthen the teamwork, kaizen allowed us to optimize work process and reduce waste. Thanks to 5s method, we succeeded not to only improve the workplace but also to motivate and satisfy the staff members. It helped us to initiate the next approach "Kaizen". 5S-Kaizen approach was implemented in African, American and Asian countries. We note most of these countries were interested in the first phase of this approach: 5S. Kanamori et al., (7) published a literature review on the implementation of 5S in hospitals in Brazil, India, Jordan, Senegal, Sri Lanka, Tanzania, the United Kingdom (UK), and the United States of America (USA) with focus on: (a) the context of its application, (b) its impacts, and (c) its adoption as part of government initiatives. These countries considered 5S as the starting point for health-care quality improvement. 67% of studies conducted a study on the impact of 5S and emphasize the impact of 5S to three areas: safety, efficiency, and patient-centeredness. Efficiency was measured in (8-11) as the improvement to the work processes, potential cost reductions, and increases in physical space. Safety was measured as the percent of reduction in the post Caesarean infection rate and percent reduction in the stillbirth rate over the 2-year period resulting from the improvement of environment work in (12) and improved compliance with regulations in (10). To assess patient-centeredness measures, some indicators were be calculated such as: percent of increased time spent on direct patient care in (13) and reduction in waiting time for patients in (10). Authors noted that 5S was adopted as part of government quality improvement strategies in India, Senegal, Sri Lanka, and Tanzania.

Kanamori et al., (10) conducted a qualitative study to highlight the benefit of 5S one year after its implementation in the health center located in the Tambacounda region, which is 462 km away from Dakar, the capital of Senegal. He concluded that 5S had an impact on work environment, attitude and behavior of staff and patients. That 5S program has led the reduction in time searching of items, in waiting time for patients, the improvements in of labeling and directional indicators of service units and the release of space which facilitate to staff to move around the office.

In (16), authors conducted two implementation approaches: 5S Hybrid and 5S Traditional in three different hospitals' central warehouses at Ochsner Health System. The Hybrid 5S integrated traditional 5S with inventory management techniques and process improvement tools. Incorporating inventory management concepts with 5S approach, permits to identify quantity and frequency of delivery and then the space required for each product in the warehouse. Whereas, if a traditional 5S is carry out first and then inventory management concepts,

there is a missed opportunity for adjusting proper inventory levels and optimizing the storage space. The inventory turnover is increased within two approaches. However, the Hybrid 5S approach had additional improvements including 15.7% space saved and the least non-conformities to the 5S ideals.

In (17), authors mentioned that a successful 5S program necessitates top management involvement, a right organization such as a 5S Council and a detailed implementation plan. The 5S council can regroup 5S sponsors from all management levels, from the president down through the departments. Its roles are the delegation of duties concerning the 5S campaign, the formulation policies regarding various 5S activities, plans the 5S activity calendar, and identification of general implementation instructions. The 5S Promotion Council is a small team of 5S Council members who work out the details of planned 5S activities and provide explicit instructions and encouragement to make 5S implementation go more smoothly on the shop floor.

In (6), authors presented case study focused on sites pilots in five Egyptian public hospitals. To implement 5S-Kaizen approach, four phases were performed between January 2016 and February 2017: the preparatory phase, the introductory phase, the 5S implementation phase and the KAIZEN implementation phase. Preparatory phase consists of analyzing the current situation which need to be improved by the implementation of the 5S-Kaizen-TQM approach. The introductory phase consists of the introduction of 5S approach to hospital staff via organization of seminars. In the 5S implementation phase, hospitals conduct in-house trainings and implement the 5S activities at the pilot sites within four months. In the KAIZEN implementation phase, managers selected a KAIZEN theme and they practiced the KAIZEN approach. The expert team conducted two consultation visits: the first during 5S implementation phase, the second during Kaizen implementation phase. A score was calculated after each consultation visit. The authors concluded that the 5S scores of first consultations visits depends on the implementation time of QIT, the number of staff trained, and nature of services offered by the hospitals. Earlier the QIT team was implemented, higher was the score. More staff trained, higher is the score. This facilitates the implementation of 5S activities and lead to higher scores. Score for non-clinical services was higher than that for clinical services. Kaizen scores depends on the number of staff trained. In fact, high number of staff trained on Kaizen activities leads to a high number of Kaizen themes treated.

In (5), authors studied the 5S-KAIZEN-TQM approach in 28 regional level public hospitals in Tanzania to improve the management of healthcare waste. Hospitals used color codes and symbols for establishing self-explanatory system on proper segregation of waste. 25% of hospitals applied the KAIZEN process and reduced occurrences of improper waste segregation.

In (14), authors applied an Enhanced Kaizen Event (EKE) in the Sterile Processing Department (SPD) to reduce non-value-added activities. The EKE consisted of three successive Plan-Do-Check-Act (PDCA) cycles, which focused on improvements at the departmental level first, then at area level, and finally at the station level. The first PDCA cycle in the improvement ramp resulted in changes at the macro-level. It physically divided the SPD

into physical areas, according to each process: Decontamination, Prep and Pack, and Sterile Processing. During the second PDCA cycle, the KT focused on the Prep and Pack area (mid-level). The third cycle consisted of changes at the Prep and Pack workstation level. The EKE yielded an improved streamlined workflow and a new design for the SPD layout, one of its areas, and a workstation.

In (15), authors proposed a nine-step framework for evaluating Kaizen Projects. we no longer speak of a single Kaizen theme but of Kaizen projects that deal with a target system to be improved. The idea is the evaluation of the interactions within and between Kaizen Projects (KPs). These later should focus on the target system and be aligned to the organization's strategic planning or arise from problem. The system selected by authors in (15) is the process of preparation and administration of medications in a surgical ward. They choose five KPs carried out in d illustrates the use of the framework.

In our case, we have adopted 5S-Kaizen approach to Tunisian context: QIT for each service and indicators related to each service. The period of implementation of 5S- Kaizen was shorter compared with previous studies. Results obtained build on existing evidence of the impact of small changes. With simple ideas and little investments, we managed to achieve interesting results.

Implementing 5S-Kaizen approach in hospital allowed improving the performance of hospitals regarding personal satisfaction, patients' satisfaction, and process optimization. This approach combines bottom-up and top-down activities. In the bottom-up activities, staff members play a key role in the improvement of their work environment by eliminating the wastes and then optimizing process. Workers are integrated into top-down activities to determine the direction of the hospital and ensure the horizontal ties among different quality circles. In fact, the participation of workers whose are familiar with what happens on the down to develop a top-down strategy contributes to the success of this approach.

This project was implemented for the first time in Tunisia. We have been limited to bottom-up activities: 5S-Kaizen activities in three pilot services. 5S brings quick improvements in the workplace which motivates hospital staff to participate to Kaizen activities to optimize more processes by reducing mudas. Important and relevant results were recorded and thus, conclusions led to confirm the effectiveness of the 5S-Kaizen approach in the three (03) departments of hospital, even during the pandemic crisis. As this approach presented promising results, its implementation in all departments prevails as a first future direction. This work opens the way to various research perspectives. First, it is important to manage a change process to win to integrate the personnel who continue to resist to adopt 5S-Kaizen-TQM approach. That the most important key to sustain TQM is the staff. Second, we considered namely bottom-up activities. It will be interesting to develop top-down activities specifically the horizontal link between quality circles of departments to share issues and best practices. We have not to be limited to quality circle activities but to upgrade to TQM. Finally, the project evaluation must be done by the quality committee periodically to sustain

quality activities and to move to Hospital accreditation.

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## Appendix 1 5S educational sheet

### **5S definition: what is 5S**

5S is a systematic approach to workplace organization. It is developed by Hiroyuki Hirano for manufacturing companies in Japan.

5S refers to 5 five Japanese words:

1. Seiri (整理) translated to "Sort"
2. Seiton (整頓) translated to "Set in order"
3. Seisō (清掃) translated to "Shine"
4. Seiketsu (清潔) translated to "Standardize"
5. Shitsuke (躰) translated to "Sustain"

In some quarters, 5S has become 6S, the sixth element being safety (safe).

### **Importance of 5S: why**

The main objective of 5S is to create a clean, orderly environment where there is a place for useful items placed in their appropriate areas. This lead to reduce visible examples of waste such as time to search an item, time to locate an item. It also decreases the amount of workplace injuries. One of the ways to identify these benefits is to track specific metrics. For example, measure the time required to locate items in the workplace before 5S and then measure the time required after the workspace has been improved.

5S is easy to understand by everybody and its achievement in terms of working improvement can be appreciated by everyone. This leads to positive mindset among the workers and incites them to participate to other continuous improvement initiatives.

### **5S procedure: how to apply it**

As we mentioned earlier, 5S approach consists of 5 steps: sort, set in order, shine, standardize, and sustain.

#### **1. Step 1: Sort**

is the process of removing all the items not needed in the workspace. It is based on the rule: "If you do not use it on a daily basis, throw it out."

The goal of Sort is to eliminate all the unneeded tools and materials and create a space free of clutter. However, it is not easy to identify unneeded parts and tools. To do this, we can recourse to an effective tool in the sort process: red tags. If we have doubt that a tool is not needed. It can be identified by a red tag and placed in the Red Tag Holding Area where items are placed until we decide their value. For example, if we haven't use it for a month from now, we can safely assume it's not needed and remove it from the workplace. On the other hand, if we determine an item is still needed, we remove the red tag and find an appropriate location to store it.

Sort is the foundation of 5S and will help get rid of problems such as: Tools and materials blocking workflow, wasted time looking for parts, tools, and products, hoarding unnecessary and expensive inventory, Safety hazards resulting from clutter.

#### **2. Step 2: Set in Order**

Set in Order is the process of putting everything in a place that is easy to get to. All items should be clearly marked so anyone can easily find its proper home. To facilitate the access to tools:

- items used together, must be stored together,
- items frequently used, must be placed closest to the user
- Items should be placed in such a way that the user does not have to bend or twist very much to access them.

The goal of Set in Order is to create a standardized and consistent way to store and retrieve tools and materials. The user must develop this system based on how often the tools and materials are accessed and the process that uses them.

To accomplish the Set in Order step, we can recourse to several strategies:

- Labels and Signs: labeling is the simplest path to identify appropriate placement of tools, materials, and equipment quickly and visually.
- Line Marking Painted or taped lines are very useful for marking work areas, as well as locations for pallets, raw materials, finished goods, shipping, and other static locations. By marking the boundaries of these areas, you'll make it easier for employees and visitors to make sense of space
- Floor Marking Color Guidelines: each color has signification according to Occupational Safety and Health Administration' OSHA or American National Standards Institute (ANSI) codes. For example, red color presents Defect/Scrap Area; green color presents finished goods, blue presents raw materials.
- Shadow Board / Tool Outlining: the visual outline of tool permits to quickly return it to its proper home. This is done by placing painted or vinyl cutouts of tools behind those tools.

#### **3. Step 3: Shine**

Shine means removing all the dirt and grime and keeping the workplace clean on daily basis. In the 5S system, cleaning is everyone's responsibility. Tackle large jobs will be affected to janitorial staff, but the detailed cleaning will be done by employees. This should be a culture and dirt and chaos as will be viewed as an intolerable situation. To standardize cleaning program, we can utilize checklists and diagrams for consistency.

Shine step must also include inspection and routine maintenance. Employees should check tools and machinery for damage as well. This activity can be Included in the daily checklist with the cleaning daily program. Periodic routine maintenance should also be done at this time. Some examples are checking the oil level in machinery, tightening up belts, hoses, nuts, and bolts, or checking if tools need sharpening

#### **4. Step 4: Standardize**

Standardize creates a system of tasks and procedures that will ensure the principles of 5S are performed daily. It is an essential step to the success of 5S implementation. If staff continue to implement the first three steps of 5S, we can ensure long-term success and reap all of the rewards of 5S.

To ensure that each employee knows what he needs to do for each step of 5S on the same way, when he needs to

do it, and exactly how to do it, we utilize a set of schedules and checklists. In addition, we must:

- Make sure each employee knows their responsibilities. We should clearly write employee 'responsibilities on a checklist or a chart.
- Make it a part of their daily routine. They will execute the steps of 5S without even thinking about it.
- we can assess performance at regular intervals. This evaluation can be performed by a committee made up of employees from different departments or assign evaluation to department supervisors.

#### **5. Step 5: Sustain**

The aim of this step is to ensure the commitment and motivation of staff to follow each step. In fact, diligence is the key to long-term success of 5S

In literature, authors present some suggestions to Sustain 5S :

- designate the fifteen minutes before lunch and shift end as Shine time. During this time, their main focus is cleaning and organizing according to their checklists.
- Start from the top: If employees see that management is not following the steps, they don't continue to implement 5S.
- Create a reward system: Have friendly competitions between departments each month and reward the winner.
- Get everyone involved. Form a committee made up of employees and supervisors of different departments. Their job will be to oversee the implementation of 5S for a fixed period, maybe six months. Then you can rotate in new members. Let them see it. Posters, banners, and newsletters can be a constant reminder of the importance of 5S.