

The Roadmap to Successful Implementation of 7S in the Automotive Industry in South Africa

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Abstract

The 7S Kaizen is critical in implementing Lean Manufacturing (LM) to increase productivity and reduce the 8 wastes in the Automotive Supply Chain (ASC) in South Africa (SA). The establishment of 7S champions, setting and maintaining 5S standards by management and staff was instrumental to the success of lean manufacturing in the ASC. Management commitment and engagement in setting Key performance areas (KPI) enabled the industry to reach the production targets. The operational Sort, set in order and shine champions who monitor their application in the plant all the times. Collaborative engagement to set sustainable standard operating procedures (SoPs) whilst the newly developed Safety and Security provided job safety in the Occupational Health and Safety Act (OSHAC) and retention benefits. The success of the 7S principle enabled other Lean techniques used to meet customer value at reduced costs, delivery times, and inventory.

Keywords

Integrity, engagement, involvement, standards, communication, and training

1. Introduction

The implementation of 7S and kaizen rules brings great changes in the organisation. Effectiveness and efficiency improve visibility of the process whilst increasing the morale and safety of the employees. The delays caused by searching for tools and materials consumes production time unnecessarily. Critical success factors are important to ensure the successful implementation of LM whilst preventing the risk of failing to control organization's resources, costs, time, and employee's effort. It is the organizational commitment and worker discipline in handling the 5S that alloys change without resistance by both staff and equipment.

2. Literature Review

The 7S technique in Lean Manufacturing (LM) is among the first steps in implementing LM. The best performance of the workstation is achieved when 7S standards of a clean working area are attained by the removal of anything that does not add value. The safety lines and signs are drawn for good housekeeping, increasing and improving space to add visibility in the work floor environment (Sukdeo, Ramdass, & Petja, 2020). The Implementing of 7S on existing systems, cultures and people of different attitudes and experiences require a complex change management strategic plan as compared to a new factory with new. It is critical to consider the cultural enablers, continuous improvement, enterprise alignment, and results as pillars for building a strong culture of excellence in LM. It becomes a core value of the organization that is shown on the mission statement (Bilinovics-Sipos & Reicher, 2023).

In the ASC, engagement and involvement of old and experienced workers is critical in the development of the strategy to implement the 7S to remove the temptation to slide back to their old ways and resist change. Management can put in place a long-term vision of 7S for the tool to yield desirable results. The financial support for on-the-job training to

provide knowledge and skills to apply 7S tool. Consultation only is not enough but real work can be done starting with the hot spot in the factory to resolve conflicts using 7S and other LM techniques.

Old factories are affected by organization culture, factory layout, experienced employees, policies, and procedures for any improvements. The traditional industry arranges tools and equipment using the First in First out (FIFO) or last in first out (LIFO) to save in time on delays in locating and retrieving materials and tools. The irregular storage of equipment and materials increase search activity unless you apply 7S in the stores and warehouses. Items are grouped based on size, characteristics, and similarity to make good usage of space in the installed storage racks and bays to minimize the search activity by full utilization of space (K. Mahlah, 2020).

The ASC needs to establish factory layouts that frees space in the stores, factory and warehouses to control the inventory. The construction of suitable shelves vertically creates space for storage within a small space. The modern housekeeping system has included the 6th "S" Safety which in ASC is embedded in Occupational Health and Safety Act (OSHAC) that create safe and better ergonomic conditions for workers. The OSHAC makes mandatory use of appropriate tools, protective equipment (overalls, gloves, goggles, masks, helmets, etc.) and keeping passageways free of unwanted items (Hamja, Maalouf, & Hasle, 2019).

The 6S enables continuous improvement in the work performance and efficiency of any industry. It provides a neat and clean, well-organized, safe working environment that improves the performance in the company (Cristina Ileana Pascu(B), 2023). The training of operators to do active maintenance activities in conjunction with 7S enables maximum equipment efficiency. A reduction in the downtime improves productivity whilst the safety and security of workers raises the morale and provides job satisfaction to employees. The overall effect is an increase in productivity (Fernández Carrera et al., 2021). The ASC need to reduce machine breakdowns by training on 7S to provide clear visibility to diagnose and repair before breakdowns occur. This enables good schedules to maintain the machines and improve the uptime and tool life.

According to (Rojasara*1, 2023) the vision to implement 7S, its benefits and importance to the environment, employees and organization must be clear to all participants for them to buy in. The implementing of 7S makes the workplace cleaner, safer, well-organized, and more pleasant by red tagging. Red tagging improves Floor space utilization by creating more space that allows a smoother and more systematic workflow with reduced nonvalue adding activities and time for searching tools and materials. The Red tagging generates income by auctioning of unwanted goods and scrap for recycling (Proto et al., 2020). The ASC is forced to train the employees on lean techniques at the workplace to see the immediate benefits derived. 7S free up space by red tagging the resources which are for immediate use. The organization generate income by selling unwanted old equipment and materials. The study (Fernández Carrera et al., 2021) singled out senior managers as the first hindrance to 7S implementation if the senior managers do not demonstrate a sound, visible leadership role to employees by putting posters, flyers and running television sessions in common rooms

The ASC must make a thorough diagnosis of the organization's administrative, operational, technological, and financial obstacles and developed methods that capacitate the employees when implementing 7S. Cultural issues are pivotal to knowledge and understanding of the organization core values through engagement and involvement of all staff is critical. Employees who have a long service in the organization tend to resist change in culture because normally they are not comfortable with the new performance measurement system. A balance of power to manage resources is critical and met through worker Union involvements. Generation of performance evaluation standards to involve all workers through unions, line and senior managers which provide immediate feedback (Tahasin, 2023). The optimum and collective application of available resources is rare to come by in traditional factories according to (Satria et al., 2022). In the ASC the effective and efficient utilization of resources by tangible skills and knowledge are a recipe for success.

The study on ethical psychological factors effect on 7S sighted the level of trust and cooperation between management and appropriate employees as critical in implementing the 7S principle. The organizations that provide financial, social and moral support (security) to employees obtain the desired results (Añazco-Alavedra & Quiroz-Flores, 2024). The ASC in SA is thriving to provide these motivating factors to divert the mindset that the job is not to organize or clean the work area and equipment but to focus only on production. Such attitudes are driven out of staff by training and providing the 7th S namely security to instil a sense of belonging and team spirit among the staff. It is imperative in the ASC to train the staff on Kaizen principles build good attitudes and stronger work ethic. Today the sixth and

seventh S (Safety & Security) is applied in Occupational Health and safety act. Safety improves operational security and performance at the Lean manufacturing workplace by removing hazards and practices that cause discontent. In the ASC in SA the safety is implemented, run, and audited by the Safety, Health, and Environmental quality officer (SHEQ)(Chikwanda & Ramnarain, 2024).

The barriers in the implementing of lean 7S are centred on poor cooperation on employee culture, resources, financial, knowledge, management, conflicts, top management, technical and experience (Hama Kareem & Hama Amin, 2017). If resources such Labour, capital communication resources are not availed the training of staff will not yield desired results in implementing the 7S tool. Organizations rely now use 7S and TPM techniques to maintain equipment at low cost to increase the effectiveness of the financial budget (Pawlak, 2024). The ASC must follow suit and establish cross function teams to eliminate challenges in the manufacturing floor. The manager subordinate relationship (autonomy), ethical training programs, and ethical instructions and commands are influential in 7S. The physiological factors include the motivational, morale, job security, workload, awareness, and responsibility.

The 7S framework enables the just-in-time (JIT) production systems to avoid delays problem in dispatching resources that spoils customer relations. The 7S methodology improved safety, productivity, efficiency, and housekeeping. Poor communication led to delays in receiving materials, restoring breakdowns, and delivery of the wrong items or quantities. Significant improvements in safety, productivity, efficiency, and housekeeping are noticed when 7S was implemented in plastic industries. The ASC will consider the application of 7S together with the E Kanban to improve communication and eliminate delays (Fernández Carrera et al., 2021).

The success of implementing 7S depends mainly on management, , resources, skills, expertise, and organization culture. If management engages and involves employees in the strategic planning and provide adequate training, the 7S will be a success (Añazco-Alavedra & Quiroz-Flores, 2024). In the ASC these factors are also critical in implementing any lean technique. A strong engagement and thorough employee motivation will help the employees to buy in the philosophy. Sufficient time for preparations and training to build competency and confidence must be allocated to instil a sense of belonging. It is imperative for the ASC to develop and establish a performance evaluation system through engagements and consultations with workers. This should link the link Lean six sigma to customers, 7S and the workers for total quality. The type rewards for outstanding performance should be proposed by teams and supported by management, however they should be realistic.

3. Methodology

The ASC industry globally has stiff competition that restricts disclosing of certain Engineering information. Most Engineering information and data used in the study was obtained after identifying it at the noticeboards then make a request. Noticeboards data is not confidential and was compiled by outstanding performers who helped answer interview questions to get a full explanation of the road to success. The literature survey, observation, the work study to obtain statistical data, pictures and interview workers was used to obtain data for the study.

3.1 Literature survey

The literature survey, observation, interviews and extracting data from the notice boards were used to collect data used to answer question. From the literature studied, the study developed a check list of questions to answer questions pertaining to 7S in the plant through observation, interviews and requesting data on noticeboards from the source. Books, Journals, and articles from renowned Mechanical, Industrial, Productivity improvement Engineering journal have been selected for use in the study from 2010 to date.

3.2 Work study at the ASC industries

Work studies were conducted in the different manufacturing plants in the ASC industries in SA to establish the factors that led to the level of success in implementing 7S. The work study considered the material searching duration, setting up of machine & tools, alignment of tool & work piece and the arrangement of the work centre. Data identified on the noticeboards was obtained from the source then used to analyse and interpret the success rate. The data consists of pictures in Figures 1 to 4 that shows the manufacturing floors and Red tag areas before and after implementing the 7S. The numerical data was used to plot graphs in Figures 5 to 7 to show the success rate and benefits of implementing 7S.

3.3 Interviews and observations

When the researcher conducted interviews at the respect work centres, he obtained graphs and pictures of improvements and achievements done by 7S. These picture and graphs are analysed and used in the discussions to interpret the success rate and factors.

3.4 Developing the implementing Model

After obtaining the factors that contribute to the success in implementing LM and the data from the work study was used to develop a model or framework Figure 8. The framework can be used by industry in the future as a guide to implementing 7S. The academics can also use the framework to teach and train the workers and students at learning institutions.

4. Results

The study on the literature, work study, literature survey revealed the critical factors that impede effective implementation of the 5S tool.

4.1 The literature survey

These barriers are overcome by involving stake holders in training and developing a strategy that eliminate or subordinate each barrier. The training of employees was critical in interlinking the 7S with all LM techniques in the manufacturing system.

A survey at the suppliers showed that the holistic benefits of the 7S are enjoyed when all the barriers are removed. The barriers are not eliminated at once but step by step and as they begin to manifest by continuous improvement motives of the motivated, inspired and determined work force. The support from management helps to sustain the implementation initiative by providing the resources.

In the production line production, teams elect or appoint team leaders and champions for the first 3Ss, Sort, Set in Order, and Shine based on passion and attributes of that S. If managers elect without consulting the team members, the exercise can be a flop. Team instead of individual rewards were identified after engaging and consulting the workers through their unions.

The availability, procedures and management of resources and plant layouts greatly devour the barriers. If 7S is not taken seriously, it leads to the 6D (delays, defects, dissatisfied customers, declining profits, and demoralized) phenomenon to the workers.

4.2 Work study results

The application of 7S create space, improves visibility, and reduces search time for items. Figure 1 shows the rework section at Ramsay Production an ASC company before applying 7S. The equipment is not arranged systematically, the floors, work benches are dirty and tools which are not in use are on the work benches. The work study has shown that most companies have successfully set up two red tag areas one in the Departmental Red Tag and one central for not in use and obsolete materials and equipment. This improved the flow of materials and tools saved in saved more than 2hrs per 12hour shift. The searching time of tools and materials was brought down to zero in the stores and warehouses since the position of the item is in real time when the order is placed. The work centres and floors became safe by removing any unwanted materials and placing them in the stores or red tag areas before cleaning the floors to meet the OSHAC act regulations. The 7S evolved the green technologies where obsolete materials generate income selling to recycling companies at auctioning old equipment.



Figure 1. The Rework area at Ramsay Production before Implementing 7S

Figure 2 shows the same Rework area after implementing 7S. The area is now clean both floor and work bench area is named and demarcated to guide the users and control traffic. Equipment not in use is placed in the Red tag area and tools are placed in the store room at respective shelves. Visibility has increased in the stores and the work floor.



Figure 2. Rework area at Ramsay Production after implementing 7S.

4.3 Interviews and observations

The observation and interviews help me obtain the pictures and the personnel who compiled some statistical data those who excelled in their championship portfolios. Some numerical data and graphs are displayed on the notice boards. Engraved medals for 7S champion awards are displayed at the common rooms such as canteens and noticeboards.

4.4 The Red tag Area

Figure 3 shows a workplace before red tagging the door hinge area. The door hinge blanks for different doors are mixed and a wrong P Kanban is picked defective hinges will be manufactured and scraped. If 7S is applied more space will be created to separate different hinges.

Figure 4 shows a clean and well-organized bench by sorting, setting in order and cleaning to improve visibility of defects in the parts. The design and use of racks and shelves would create more space when axles are stored in labelled racks. By applying 7S all materials not needed were removed and placed at the red tag area and remain with equipment required by the study. The needed equipment was set in order of the investigation method to prepare for the 5WHY interrogation to establish the root cause. The bench and equipment were thoroughly cleaned to remove dust, oils, and paint markings to increase visibility. This would allow visual inspection before assessing the metallographic structures at microscopic level.



Figure 3. The defective parts bench before implementing 7S (J. Zvidzayi 2024)



Figure 4. Before and after implementing 7S (J. Zvidzayi 2024)

4.5 Production time in the workshop value addition

The production times were recorded before and after 7S and graph plotted from the recordings per shift. After implementing 7S the durations were less than before. Through continuous improvement in other techniques, the durations finally became less than expected. For turning a shaft, the tool maker spent 118 minutes to finish a task with an expected time of 120 minutes before 7S, the time saving is appreciable. The production cycle time is reduced when the work area is sorted to remove unwanted material whilst the bench and cleaned and wanted material is set in order. The safety of machines and personnel is set according to the OSHAC act to create a safe working environment that gives a sense of security to all stake holders. Standard Operating Procedures are set for each process and champions for sustaining the standards are trained assigned to audit the standards from time to time. 7S enables the ASC to meet the customer quantity and quality demand Just in time (JIT). This help reduce the inventory at the manufacturing flow and waiting time for finished products by customers. The Lean Six sigma (LSS) is complimented by 7S to set and maintain the quality standards that meet the customer needs (Figure 5).

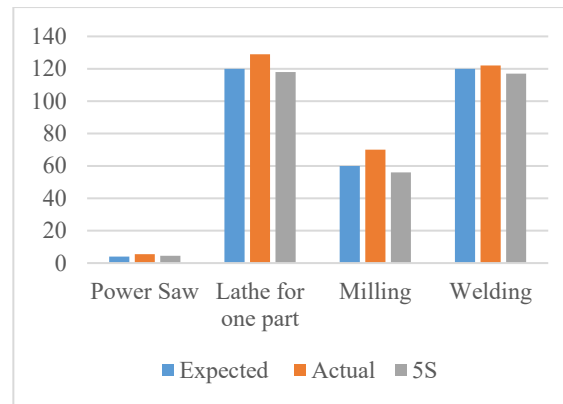


Figure 5. Process times in minutes before & after implementing 7S in the ASC in SA

4.6 The Complementary Non-Value adding tasks

An activity that does not add value to the customer needs is a waste to be eliminated if possible. If some non-value adding activities cannot be eliminated, then they must be streamlined to reduce costs and improve efficiency. Reducing Non-value adding processes improves quality and delivery times to meet customer needs.

The 7S tool reduced mistakes, training, searching time, inventory, unnecessary human motion, and transportation of goods from place to place. The workplace cleanliness conditions improved, and machine uptime increased. The workspace utilization, employee safety and morale were improved and boosted. Improved quality and delivery times boosted the morale and confidence of the customers. Standards Operating Procedures were developed and set for each organization and department. For instance, the Safety Health and environment Quality (SHEQ) department set safe work standards enforced by the SHEQ officer (Figure 6).

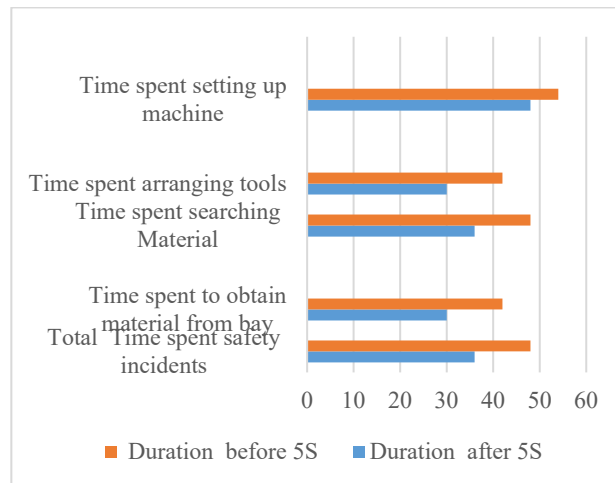


Figure 6. Average duration before and after implementing 7S in the ASC in SA

The job security improved benefits such as staff dependant education, housing and medical subsidies to reduce brain drain. Accident, retirement insurances and annual bonuses attracted the attention of employees to curd brain drain because they felt belonging to the company.

5. Discussions

Figure 7 shows the success factors of the 7S principle which is cheaper and generates income when sorting and placing items at the right place to create extra space. This has a big impact on the success of other lean techniques such as

Poka yoke (PY), Total Productive Maintenance (TPM) Jidoka, and the Overall Equipment Efficiency (OEE) which are preceded by 7S.

Workers must be involved in planning and developing the strategy of implementing 7S and participate in decision-making to minimize resistance to change. Externally and internally training is important to share knowledge and experiences from other industries and help comply with the 7S methodologies and benefits.

The 7S principle requires regular maintenance of equipment, review, and compliancy with quality ISO 9000 and ISO 2000 for Total quality. The 7S organizations must provide adequate resources for training skills and engagements for developing champions. The 1S, 2S and 3S champions are nominated by team members must be developed and given responsibility for the Sort, set in order and shine. Champions combine training at the shop floor, motivation by visual rewards and application in the processes to yield good results. The champions make frequent audits to check for unnecessary items, dirty and compliancy to Standard Operating Procedures (SoP) culture at the work centres.

Clumsiness of resources, and invisibility of the working space is prevented by these champions. The setting in order champion enables the SoPs in the planning and compilation of job cards to identify and place resources in the correct sequence of usage. The smart champion checks and reminds other workers to remove any dirt at the workstation, and walkways as per procedures set. The SHEQ officer maintains a safe working environment for workers and machines. The line managers set the SoPs and sustain the standards by generating the job cards all the tasks.

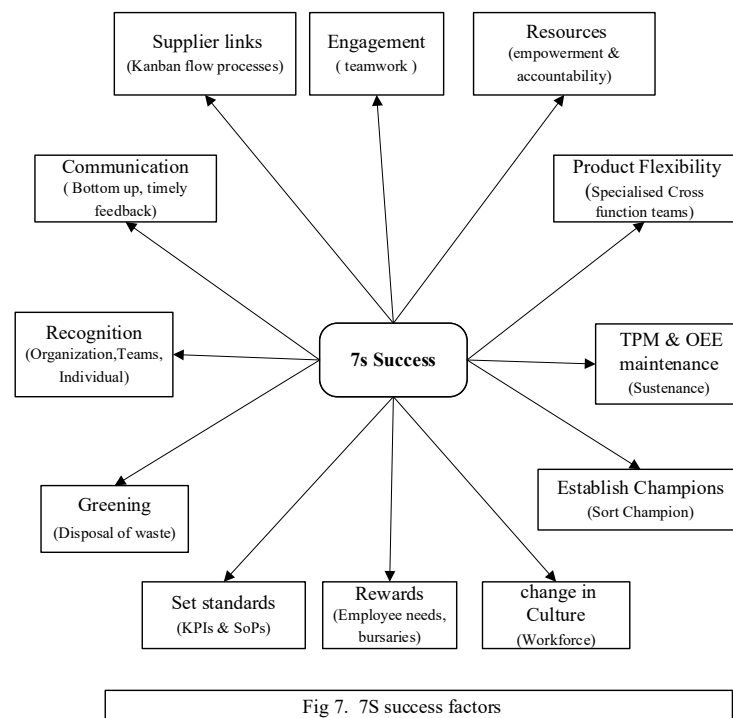


Figure 7. 7S success factors

The culture of providing feedback and update on the expected outcomes in the reflection meetings, newsletters, graphs, and charts on noticeboards keeps employees informed. Recording and displaying the successful achievements periodically using graphs, charts, flow charts and tables motivate the employees to implement 7S. The principle improves the quality, productivity, performance, and efficiency of the organization. Use of green materials from suppliers improved safety and generated income when obsolete materials and equipment were auctioned. Greening led to the establishment of downstream industries that provided employment opportunities and income to the community.

5. Proposed improvements

The success of implementing the 7S rest upon respect for people, integrity, trust, honesty, accountability, and open communication. Good communication platforms, engagements, and involvement of employees overcome the barriers in implementing Lean. Value Stream mapping survey identifies the strengths and weaknesses to establish the way forward. The SWOT analysis and Theory of Constrains (TOC) is used to thwart er any barrier. The 7S principle improves prosperity and sustainability to achieve zero wastes, injuries, and complaints in the production line.

Figure 8 shows the proposed framework for implementing 7S in the Automotive industry in South Africa. The situational analysis, perseverance, knowledge, belief, acceptability, commitment, and support of top management is critical in overcoming the barriers. The holistic benefits of the 7S are enjoyed in LM when all the barriers associated with implementation of the technique are removed and other LM techniques are linked to 7S.

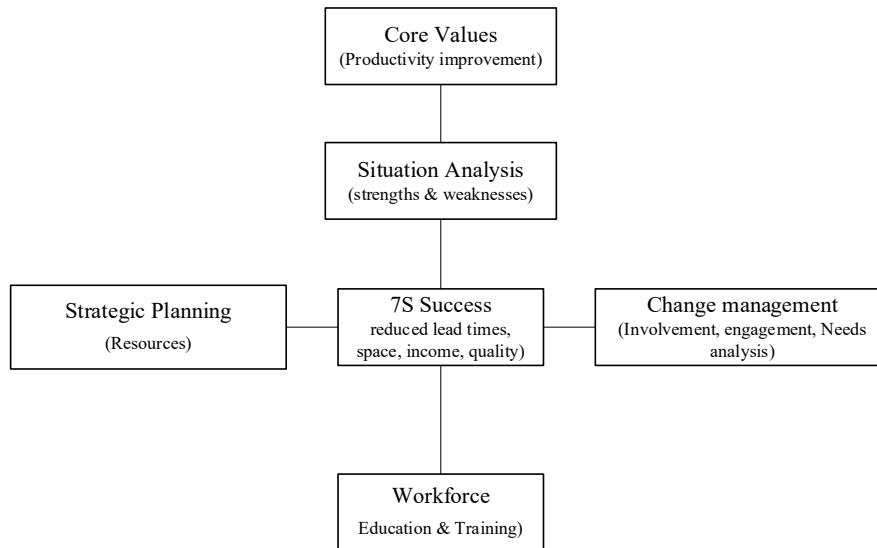


Figure 8. The framework for implementing 7S

Figure 8. The framework for implementing 7S

6. Conclusions

The 7S principle thrives in an open communication environment that allows brainstorming during problem solving to integrate ethical decision making and give security to all workers. Delegating responsibilities and the power of decision making to staff guarantee a strong impact on successful completion of each task. It gives security and employee motivation.

The education and training, availability of resources, respect for people, engagements with all stake holders and meeting customer vale is critical for implementing 7S. The leadership's ability to foster integrity as a core value to employees is the cornerstone for building trustworthiness, moral uprightness, transparency, and job satisfaction when implementing 7S.

The study merged the 7S pillar of productivity with the 5Ps of Organization transformation. The workforce is treated with respect to identify their passion and engaged in all decision made and recognition. The workforce is engaged from start to understand the purpose of 7S otherwise some will mistake it with a retrenchment tool.

Motivation, training, and the provision of the 6th S (safety) and 7th S (security) is used in the automotive industry to flush out resistance to change. The provision of transport, dependants' education and housing subsidy to permanent workers on a sliding motivates the workforce.

Developing the Standard Operation Procedures (SoPs) instils a culture of accountability and openness among the workers. It enables the employees to take ownership of the results of the manufacturing activities. Teamwork and

team rewards unites the workforce and build champions and specialists within the team. Safety and security prevent brain drain and promotes continuous improvement in the manufacturing plant.

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