

Analysis of critical Success factors of Gemba Kaizen in Lean Manufacturing within SA Industries

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Abstract

Gemba Kaizen is used successfully by manufacturing organizations that supply Toyota South Africa (TSAM) with finished auto part. The paper seeks to establish how TSAM and its suppliers have used this Kaizen tool. The principle has been used in four stages namely going to Gemba where the manager physically goes to the production line floor. At the manufacturing floor the manager checks the whole process (machines, materials, tools, rejects), in order to identify for Muda and rejects. When the waste is identified, a temporary measure to stop the waste is quickly devised and installed to allow production to continue whilst a team of engineers is analysing ways of removing the root cause. When the solution is obtained they implement it and standardize the process establishing Standard Operating Procedures (SOPs). Gemba reduces the lead-time, rejects, and Muda in the production line whilst improving quality.

Key words

Mura, Muri, Muda, rejects, lead time.

1. Introduction

Lean Manufacturing (LM) is a philosophy of minimising the eight (8) waste whilst improving the quality of the product by adding only the value that the customer pays for, nothing less and nothing more in the manufacturing sector. The theory of LM emerged in the United States of America from where it was exported and adopted successfully to Japan by Edward Deming at the end of the Second World War. Its success in Japan is credited to the Japanese national and organisation culture that promotes unity in matters of development for self-sustenance. In other parts of the world LM has been less successful because of different challenges but nevertheless many manufacturing companies are striving to implement LM.

To implement LM many productivity improvement tools such Gemba, TPM, 5S, Jidoka, Poka Yoke, Heijunka JIT and so on have to be applied systematically in a well-structured manner. These tools can be applied in combination or as a stand-alone tool. Among the tools is Gemba Kaizen which is applied on existing plant to detect the problem, find the root a root cause, apply engineering principles to get a solution, standardise the solution and sustain the set standards.

There is evidence that Japanese companies in Singapore are less successful than in Japan. In SA the same can be true because of the culture of collective job action through the Motor industry Unions. The Union put all motor industries under one umbrella irrespective of the company philosophy. Members of the Union have the culture of sloganeering “Injure one injure all “which has been strongly adopted by many labour and non-labour unions and associations. This culture defeats the sense of ownership and belonging to the company like the Japanese counterparts. Some managers see it as abusive of power to circumvent the law. In Africa Gemba Kaizen may not be easily adopted due to environmental factors, culture of the nation and working ethics

The paper is investigating the CSF of Gemba Kaizen when applied to the SA scenario where Toyota South Africa Manufacturing (TSAM) is assembling automobiles from parts and components manufactured by TSAM and many supplies. The study uses data from TSAM and its suppliers and the literature from the world over. The literature identifies the generic CSF and investigate these factors’ success in the SA industries. These factors will be recommended for application by the companies that are at the preliminary stage of applying the LM philosophy.

2. Literature survey

The subsection seeks the literature that will establish the critical factors that makes Gemba successful and create a model that balances the factors and benefits derived by implementing Gemba Kaizen. A company with a reputation of making acceptable products or services at the customer price and meets customer time schedules fulfils customer needs, its employees remain loyal and pay heed to set SOPs, since the managers revisit the SOPs and establish the root cause of any problem that arise.

It is critical to be precise in our language, the good use of words in Gemba communication is key to achieve goals of the Gemba walk. Effective Communication improves Lean performance in determining standardized in a Takt time that is visible to everyone in the line. Managers should be humble and ask “What, Then, Why” to create a blame free culture that brings faithfulness, close all the gaps and develop people’s critical thinking skills. Managers show respect, involve staff and do what is manageable at a time. It should be noted that Gemba is not aimed at proving people wrong but to discover the cause of problems and generate amicable solutions as a team. The Gemba walk is done to identify and eliminate any forms of waste or any activity (Mura and Muri) that will result in waste. It aims at discovering the problem, designing and developing the solution then deploy or implement

(Dysko, 2012) hinted good mangers go for Gemba walk from time to time to identify problem areas. The constrains are then removed one after the other by applying other Lean tools such as 5S to organize the workplace and remove the constrains. Gemba creates addition floor area in the manufacturing plant. It reduces the lead time, WIP and improves job satisfaction to employees. The study by Dysko showed that productivity can improve by up to 20 % in small improvements when Gemba and 5S are linked. The work is standardised to improve the quality and the SMED is reduced for a multi-product plant.

(Omondi, 2013) stressed that management should go to Gemba when the problem start and check the machine, materials, defects and failures for Muda (waste), Mura (inconsistency) and Muri (physical strain). To avoid stopping production take a temporary measure then go to the drawing table and find the root cause of the problem. The solution is obtained and implemented then standardize the solution and sustain.

(Kisimbii, 2013) hinted that the success of the World Class Manufacturing (WCM) system depends on how much you reduce waste and what methods, standards and tools have you adopted in your plant. He recommended

going to the factory and identify the problems before prioritising them based on cost deployment. This is followed by an analysis of the problem and selection of the appropriate engineering principle to solve the problem. Implement the solution and evaluate the success.

(Kisalu, 2014) carried the Gemba Kaizen in the public service in Kenya by way issuing out questionnaires on how managers responded to the application of Gemba Kaizen in terms of results. Most responses showed that the Gemba model yielded positive results in the service delivery in Kenya. Workers and customers appreciated Gemba which improved efficiency by tapping employee knowledge and talents in improving service delivery and reducing taxes to the general public.

(Gupta, 2015) hinted on the challenges in implementing 5S and picked out the changing of sceptical people's mind as critical. The same would apply to Gemba, some workers will object at the beginning but through dedication of senior managers and training of workers the culture of the organization will eventually change. The die-hards gradually transform as senior management lead in the change and continue putting pressure throughout the organization. Leaders who are not dedicated normally make the initiative to collapse within 18 months. Senior managers need to acknowledge and put it clear that there is no turning back, but small improvements will make us get there. The theory of constraints (TOC) is applicable in the Gemba Kaizen so as to eliminate the one constrains after the other. The improvements can be named Gemba Kaizen 1 up to 5 using the 5why matrix, in which each why has a Kaizen.

(Lalisho, 2015) applied the five Golden Rules of Gemba management that summarize the activities of Gemba walks:

1. When a problem arises, go to the Gemba first. Do not hypothesize what is happening.
2. Assess the Gembutsu, or relevant object. For example, if a packing machine breaks down, the machine is the Gembutsu.
3. Take temporary counter measures on the spot.
4. Find the root cause. This can be often identified by asking, "Why?" Keep asking why until you drill down to the issue.
5. Standardize to prevent recurrence. Once the problem is solved, the solution needs to be standardized to facilitate a permanent solution.

Staying in close contact with and understanding the Gemba is the first step in managing a production site effectively.

The Critical Success Factors (CSF) that were obtained by (Lalisho, 2015) span from the organization culture to sustainability. The culture of the organization is significant and there is a new change concept that must be treated carefully and tactfully. The established culture of reporting to the desk was put in place by managers who played a role model on the shop floor and have support of most workers who were rewarded by the system. If not consulted and involved senior workers feel side-lined resulting in stiff resistance to change because their culture is neglected. Senior management must participate visibly in the new Gemba Kaizen culture by getting to the workstation. They have to be seen on the floor observing and making changes and decisions from the inputs from the shop-floor workers. The workers contribution must be visible and rewarded by recognition for them to realise the benefits of change.

(Lalisho, 2015) concluded that in Africa the initiatives to change lies in top managements who need to share the new concept with all employees at workplace. Workers' values and attitudes are likely change successfully when they undergo training at their workplace and results posted on notice boards.

An article about Kenya wildlife described Gemba as a tool that promotes discipline and standardization. It is based on the mathematical understanding and belief that the processes used for solving problems is more important than the solutions obtained. Gemba Kaizen embraces the skills of employees by rewarding successful contributions no matter how small the improvements. The concept focuses on achieving continuous improvement through small and cumulative improvements in the work floor activities.

(M. Abed, 2015) highlighted that Gemba walks are action of going to the manufacturing floor to study, understand the work, ask questions, mitigate and learn so that as a leader one would be able to pick up existing safety hazards, observe workers at work, see equipment conditions, gain and build relationships with employees and machines.

Gemba Walk aims to understand the value stream and its problems for improvement purpose only. Its dynamics overlaps into quality, TPM and Heijunka.

(Gurway, 2016) stressed that the success of Gemba Kaizen requires some motivating factors that brings sustainable development in the society. As such investor confidence, increase customer consciousness, need to bring effective manufacturing philosophies and techniques is built. These factors in cognisance of the need to exploit ethics and core values of the nation and community present a strong foundation for success in implementing Lean Manufacturing. A company can be successful in Japan but struggles to implement Gemba Kaizen in Africa, Europe or America due to the core values of that nation.

(Omotayo, 2017) carried a survey in Nigeria across many manufacturing companies using questionnaires and established that professionalism, honesty, integrity teamwork, innovation and client satisfaction. A Gemba walk in a manufacturing plant requires professional integrity among workers and Engineering managers. Teamwork in all Gemba innovation initiatives to meet customer needs is essential to get good responses from employees.

(Raut, 2017) in his study indicated that primary goal of Gemba walk is to find the root cause of a defect or problem by probing the question "Why?" 5 times for each defect or problem. It is effective beyond any doubt when responses are done by hands on workers in the process such as operators and artisans. The 5Whys are not only for troubleshooting tools in quality improvement and problem solving but are most effective when used to resolve simple or moderately difficult problems. Asking why's into the problem obtains reasons that caused the problem.

(Rao, Nallusamy and Rajaram Narayanan, 2017) applied the root cause analysis and the 5Whys probe in the Gemba walk to uproot the problems in manufacturing. In their study they superimposed Gemba to Lean other principles such as 5S, root cause analysis, VSM, line balancing and time study.

(Nath, 2018) and (Venkata, 2018) described Gemba as a "low-hanging fruit," or an easement tool which is quick to plan for and implement. It is solutions to a problem that can be undertaken quickly to add value to the services, while remaining painless to plan, execute, and implement. Managers who take a Gemba Walks observe and engage directly with employees, customers and suppliers working on improvements. Gemba is used to check the performance of the equipment after counter measures have been implemented. Gemba aid in continuous monitoring of the process to drive continuous improvement. Gemba, tool creates dramatic improvements in an organization through the application of the Go See and Ask Why principles. Be at the value adding place detect the problem, find the root cause, develop the solution, implement, set standards and sustain. By inviting all stake holders Gemba has the potential to tap all their experiences and creativity of employees, management, suppliers and customers to generate more improvement ideas.

Teamwork plays a significant role in the success of Gemba Kaizen. Each member is given a chance to express his views during the tea talk. This engagement puts everyone in a position to improve his/her workstation to the benefit of the company. Team leadership gets to the workplace to watch, observe and recommend for improvements. Team leaders are specialist with vast experience, talent and passion in the processes. Team leaders are good listeners and provide motivation to workers by rewards and recognition as well displaying their achievements on A3 pages on noticeboards to show the role, achievements, WIP and the target improvements.

3. Methodology

The research method used is quantitative with the use of interviews, questionnaires and statistical data.

- i) The study would first use questionnaires to obtain preliminary data from the responses by managers and workers from suppliers of TSAM and the Mechanical Engineering students who are doing Work integrated learning (WIL).
- ii) A tour of the manufacturing floor during the interview visit enables the researcher to access supporting statistical documents in the files and noticeboards where the results are displayed in the form of production charts per shift, day, week and month. The action taken is briefly explained by line managers and elaborated by the executor
- iii) The interview questions schedule is compiled from the questionnaire responses as a follow up and a 2-hour plant tour.

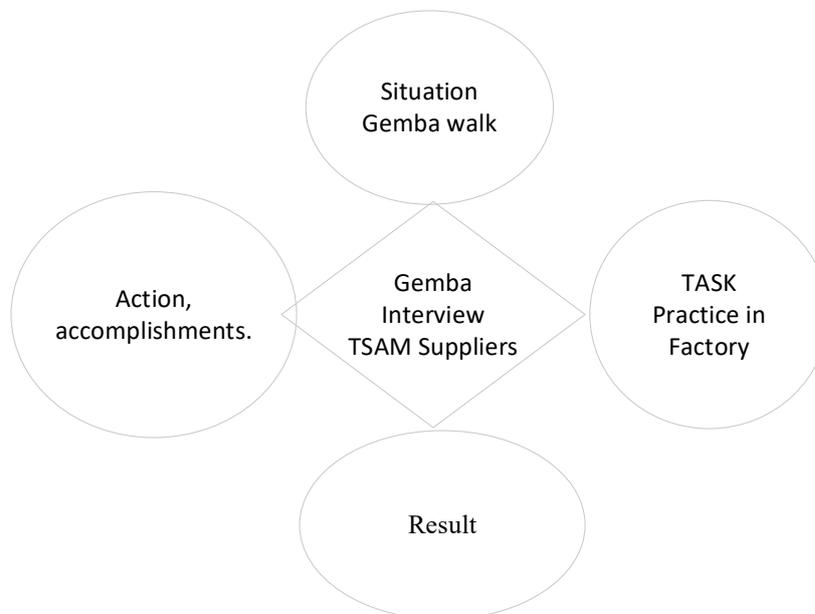
Criteria: The questionnaire schedule questions are compiled taking into consideration the 5Ws and How, the PDCA and the 5WHYs and send to the companies that supply TSAM.

In the study the respondents were not able to complete the questionnaires because they feared victimization by senior management, instead they preferred anonymous interviews. The interview schedule of questions was based on Gemba PDCA mitigation using the 5Whys.

Table 1. The PDCA and What? Who? Where? When? Why? How? Mitigation.	
PLAN Gemba policies and procedures Reflect	DO Train Activities
CHECK Confirm results Decide on urgent counter measures Find basic reasons	ACT Reflect Standardize Prevent recurrences

Figure 1 shows a model developed for collecting information using interviews. Two interviews were made with each respondent. The first was face to face on site and the second was by telephone to check the accuracy of information and the manufacturing trends.

Figure 1. Collecting data on Gemba Kaizen at Lean manufacturing companies by interviews



4. Data Collections

The study targeted the suppliers of TSAM in Durban, South Africa Piet Maritzburg and Ladysmith. The companies make automotive parts for TSAM, VW, Ford, Nissan and General Motors. I toured the plant obtained data through interviews from which we access some statistical information and records about manufacturing trends at these companies.

5. Results and discussions

The same attributes were checked at the four companies were that manufactures of the motor vehicle components had two trends that were observed before and during the pandemic. When a problem occurs, all companies first use a temporary solution (buffer) which is quickly developed and implemented to keep production running. On the other hand, a team will be mitigating the root cause and developing a long-time solution. One supplier's temporary measure was to carry out the stress relief process on the tubes before bending to final shape. All batches that were hard and brittle had to pass through the stress relief process. The long-term solution was to

collaborate with steel tubes supplier to stress relieve during the tube extrusion process to prevent cracking during bending.

5.1 Numerical

Data obtained from a production engineering company that supplies TSAM is shown in the table 3.

Table 2. Shift performance per day per model

Door levers					Wheel spanner						
Target	Actual	Rejects	Reworked	Delivered	PI	Tar	Act	Reject	Re	Del	PI
1500	1 520	2 / 3	8	1515	0.99	1000	1028	4/2	18	1020	0.99
1 500	1 493	0 / 1	3	1492	0.99	1000	1020	5/5	23	1010	0.99
1500	1 587	48 / 2	17	1537	0.99	1000	982	7/6	9	969	0.98
1500	1589	14/ 2	12	1573	0.99	1000	1015	11/ 1	26	1003	0.98

Table 2 shows the tabulated manufacturing data for door levers and the wheel spanner. It shows the production target, actual number produced, total rejects, pieces reworked, and products delivered to the client. TSAM and its suppliers never supply a defective product to the customer.

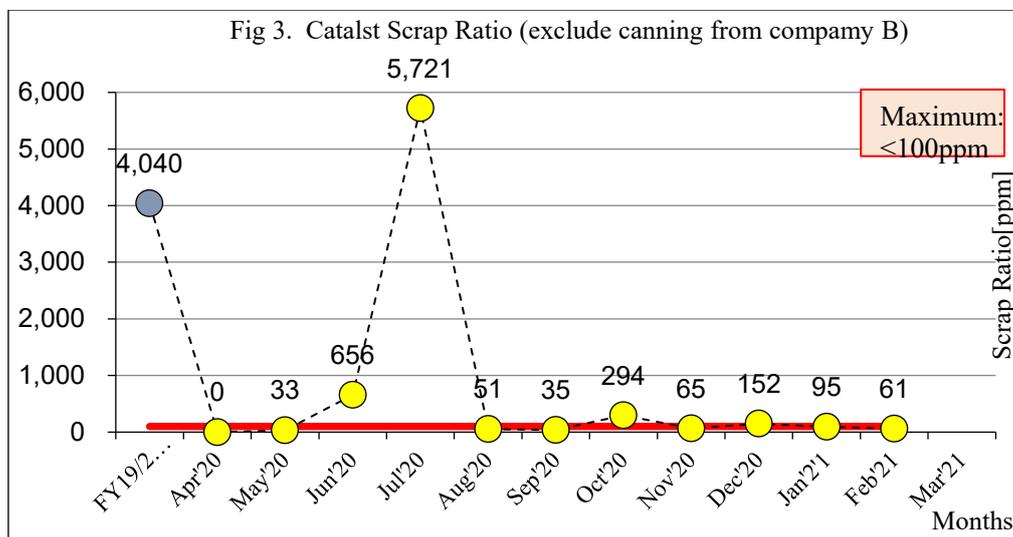
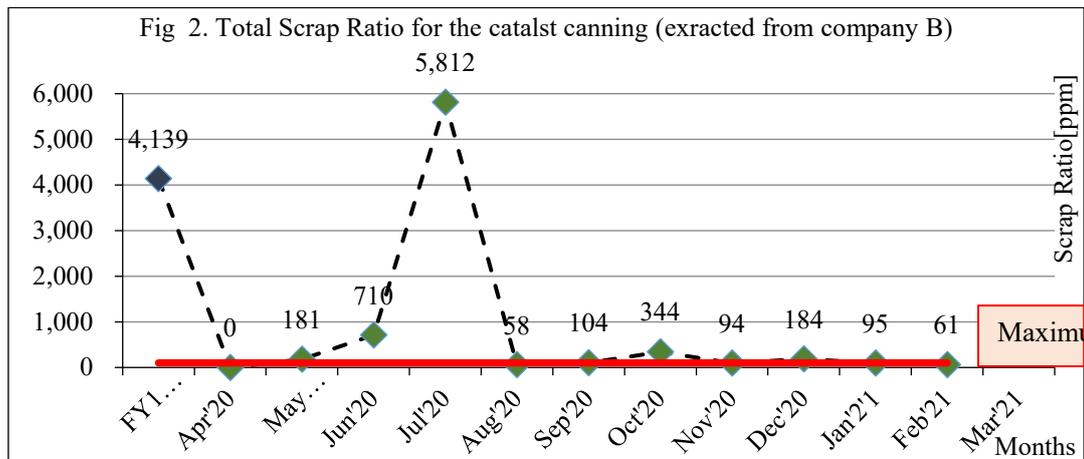
Table 3 shows the scrap or rejected material parts at the exhaust canning section. The first column shows the production for the year 2019 in green to 2020 and for 2020-2021 in orange. For the period 2019-2020 the production was higher than for 2020-2021 period because of the pandemic. Column 3 to 10 shows the specific defects that occur when making the catalyst cans. Rows 4 to 11 shows under column 3 to 10 shows the actual defects incurred for each production month.

Table 3. Production statistics on the Steel canning of exhaust catalyst.

1	Production Outputs per month			Scrap Target	gauge	Crack	Edge Chip	Side chip	Damaged	Skin peel	Oil	Marker	Total Defects	Year	
	Produced	Rework	rejects												
FY19/20	2438360	4139	10181	100	244	116	4	73	0	29	15	3	1	241	
FY20/21	1333271	859	1145	100	133	26	3	8	0	18	0	0	0	56	
April	0	0	0	100	0	0	0	0	0	0	0	0	0	0	2020
May	60894	181	11	100	6	9	0	0	0	0	0	0	0	9	
June	129548	710	92	100	13	2	0	2	3	0	0	0	0	7	
July	154163	5812	896	100	15	5	0	2	0	2	0	0	0	9	
Aug	156154	58	9	100	16	1	0	0	0	0	0	0	0	1	
Sept	172852	104	18	100	17	0	0	10	11	0	0	0	0	21	
Oct	20798	344	69	100	20	5	1	3	0	0	0	0	0	9	
Nov	170304	94	16	100	17	3	0	0	0	2	0	0	0	5	
Dec	92209	184	17	100	9	1	2	0	0	0	0	0	0	3	
Jan 21	147207	95	14	100	15	0	0	0	0	0	0	0	0	0	2021
Feb	491242	61	3	100	5	0	0	0	0	0	0	0	0	0	
March															
Overall	13333271	859	1145	100	133	26	3	8	0	18	0	0	0	56	

5.2 Graphical results

A supplier of TSAM provided the graph for scrap ratio from 2019 to March 2021, which showed the trend in fig 2 and 3. The maximum scrap parts are less than 100 parts per million (ppm) catalyst produced. In the last quarter of 2019, the scrap rate fell from 4139 to below a 100ppm and shot up in July 2020 shot up to 5812 ppm produced at the peak of the pandemic. By august the anomaly was resolved and the scrap rate came down to normal. These figures where obtained from the company as it is.



5.3 Proposed improvements

The study revealed that the initial step in Gemba Kaizen is to convince and influence top management so that they buy in Gemba Kaizen and start to go to the work centres periodically say weekly to see and evaluate the situation. Top management is trained first in order to be open-minded and promote open contribution from the workers for the strategy to be sustainable. CEO stick to their area of specialisation but be there in the first session of Gemba Kaizen representing the company. They establish an internal communication network to share training idea, applicability and performance rating to give job security and satisfaction to users.

The staff undergo on the job training in their department and the benefits are posted on the communique for employees to see on company televisions in company rest rooms, canteens, boardrooms, libraries and all convenient public rooms. During training in the department, each member gets the opportunity to identify improvement targets at their work centre and start to work on the improvement. The action taken is documented and displayed for transparency.

The success of Gemba Kaizen rest upon the company's dedication. Some companies gather and put in place all necessary resources needed in the implementation of the strategy for it to be sustainable, but others do not. It gives confidence to all workers if the CEO spends say a week in the factory with employees doing Kaizen. When managers go for a Gemba walk, they gather facts using the 5Ws and How. The 5Whys probing system is used where there is a problem to find the root cause. The Questioning should however not be a witch-hunt probe to give blame but be talent development and utilization procedure.

Identifying and respecting employee psychological, safety and financial needs instils the sense of belonging to the organisation. This gives job satisfaction to workers and gives them the pride of recognition and branding with the company. In Durban, employees from TSAM and its suppliers are identified by grey/ black/red coloured work suits brand.

Empowering employees in planning and decisions making procedures help to resolve quality and maintenance problems amicably. When the manager “GO ON GEMBA WALKS” around the plant and ask employees about improvements achieved that week, employees soon learn what is important and what they need to be working on. In a Gemba walk, an executive manager observes a selected process where there is a bottleneck such as material flow to help plant personnel see potential and high-priority areas for improvement. The executive observe and ask for opinions from team leaders, workers and after analysing and explaining the benefits of each proposed solution make a decision or use consensus.

In a Gemba walk, the manager seeks to review the plant’s performance boards to ensure that each area is meeting targets, SOPs and providing support for corrections when needed. These are not Gemba walks but review walks. TSAM and its suppliers have notice boards in every section or department where standard A3 sheets are posted. These show the SOPs, achievements, WIP and current continuous improvements targets. Gemba Boards typically guide employees on workplace safety, quality goals, material flow, delivery metrics, productivity efforts, and much more.

It is motivating and satisfying to employees if Management support employee initiatives and periodically review the action plans whilst recognizing achievements. Workers need to be trained on the benefits of Gemba Kaizen using standard operating procedures. Developing Cross-functional teams and job boundaries is beneficial in working collectively and sharing knowledge, ideas and initiatives for improvements.

- i. Reduction of inventory.
- ii. Machine Change overs increase per week.
- iii. Lead time drops.
- iv. Productivity increase to 150%.

Organizational objectives if aligned to Gemba Kaizen will fuel the adoption of the philosophy by top managers. This would stimulate top managers to gather resources required for implementing the ideology. Commitment and involvement of the suppliers in all training would make success possible for a company to transform to a Gemba Kaizen culture. Effective Communication will sell the strategy and its benefits to all employees in common rooms. Rewards and recognition would motivate the other workers to adopt Gemba Kaizen.

When the workers for both lead company and suppliers have adopted the philosophy the sustenance of the philosophy would call for standardisation of similar operations at both lead and supplier plants. Procedures for performance measurement and evaluation are formulated and implemented at both lead and suppliers. For instance, TSAM allows modifications on door parts by RAMSAY and TSAM designers at the development stage for ease of production using the machines and tools available at RAMSAY. Check the quality at all manufacturing stages to ensure zero waste and minimum rework. This applies to all its suppliers. The PDCA tool levels production for different volumes and part mix. The employee are motivated by periodic training strategies and recognition of rewards.

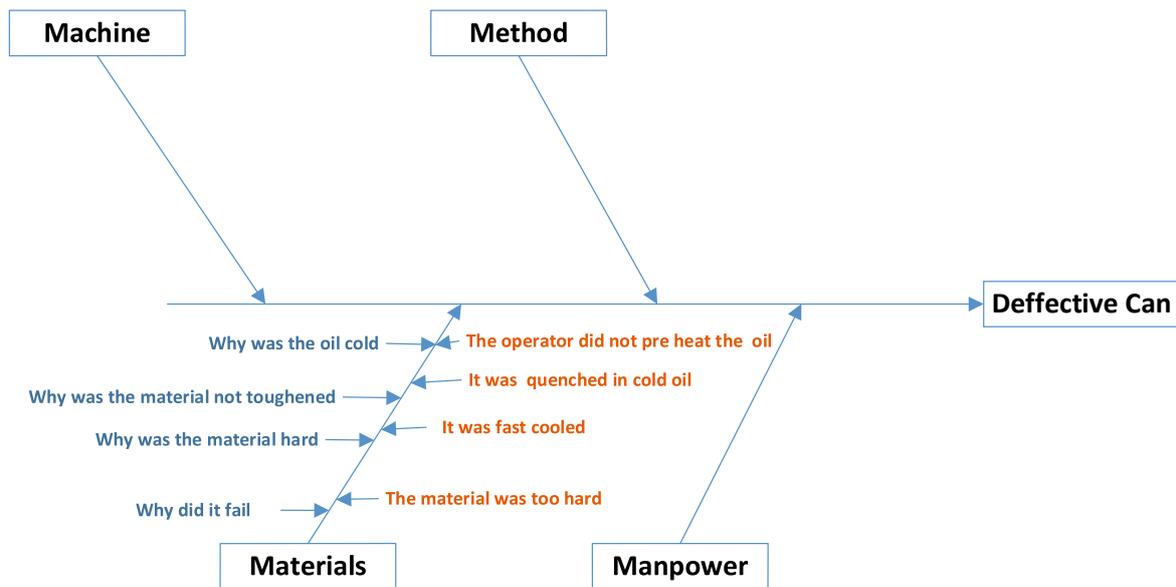
5.4 Validation

Table 4 shows a CAPA – Corrective action and Preventive action able that is used to mitigate and validate the problem in the plant. This form is standard and used in many manufacturing, assembly maintenance and service industry (hospital). The mitigation can be done whenever a problem exist to get to the root cause.

Gemba Kaizen event training for Workers motivate their expectancy, task value and beliefs. It is pertinent for management to support, document improvements and celebrate success to win the workers’ hearts, build confidence and beliefs in future problem-solving interventions through Gemba Kaizen. Work ethics and values such as honesty, job security, and respect for top management contribute a lot to the success.

Many articles have alluded that the success of Gemba Kaizen depended on the enabling factors. The availability of financial, material and human resources is a key factor. The employees culture has to be enthusiastic and open minded in order to change. Widespread communication of current performance and metrics plus the management’s proactive practice to counter any barriers to improvement and building of strong teams. The training and learning of employees does not stop but be ongoing whilst leaders show creative efforts to motivate and lead in Gemba Kaizen

Fig 4. Catalyst canning 5WHY analysis mitigation



6. Conclusion

The Gemba Kaizen improvements reduce the effort, shorten the process time, improve quality, reduce material input and above all bring job satisfaction to employees. TSAM and its suppliers have been so successful in LM because its employees are satisfied and interested in improving their performance and effectiveness. Job satisfaction help retain employees at one company but may migrate from one sister company to another for better rewards, upgrading and recognition.

Learning experiences in the Gemba are based on appreciation of fundamental human values, such a respect for humanity, commitment, determination, economy (sensible use of resources), cleanliness, and order. The best learning experience you can get is the one you gain through practicing, using your body, and learning by doing. Look, see, think and act hence implementing Gemba walk to see the anomaly, find and eliminate the root cause.

A Gemba walk is not an opportunity to find fault in others or a time to enforce policy adherence except for safety problems or gross violations. It requires a mutual respect and interest approach to workers and their tasks. If ideas or complaints arise, note them and make a follow up after the walk but do not quickly focus on the details before seeing the whole production line. If the walk is punitive, employees may close doors and resist any change. Gemba walk is not used solve problems and make changes immediately, but to observe, get inputs and reflect?

The study noticed that employees who leave TSAM go to its supplier as champions of Gemba or other Kaizens. A two-way migration of experienced personnel from the suppliers to TSAM and vice versa is prevalent. The migration happens mainly for promotion to fill senior management posts. TSAM and its suppliers does not dismiss employees but places the employee where he is best in the production line.

Gemba Kaizen is driven by Teamwork and cross-functional teams, quality planning and control, employee awareness and training- team autonomy, productivity improvement, management support, goal difficulty, work area routineness, goal clarity, affective commitment to change, internal processes, team Gemba Kaizen experience, action orientation, functional heterogeneity and team leader experience. All these are the drivers of productivity improvement through Gemba Kaizen.

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