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Quality Shop Floor Management Based on Abnormality Management

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Abstract

In the fast growing and highly competitive industrial world, it requires an appropriate way of collaborating with all strategic component suppliers in improving quality management capabilities to control the level of defective products outflow to customers. The basic principle of production is not to make a defective product, but if it produces a defective product, the product may not pass to the customer. The strategy of developing Quality Shop-Floor Management (QSFM) based on abnormality management taken by automotive manufacture where the author works, is the right step in building sustainable quality shop floor management based on a deep understanding the concept of strong industrial foundation, by using standard of Plant Management Requirements (PMR) . The purpose of QSFM is to improve the ability to identify abnormalities, solve problems quickly and understand accordingly in carrying out shop-floor daily management tasks. The results of research and development with the method described in this paper of 31 automotive part's suppliers, showed a very significant improvement in performance preventing the outflow of defective part to customers sustain in than 1 year. There are 3 important keys in conducting shop-floor management development, are: Management, Knowledge and motivation, which are very demanding high commitment in carrying out the regulation and control of daily production. This research gives the benefit for Manufacture manager and fresh graduate to get knowledge and knowhow to develop Quality Shop Floor Management by using standardized Plant Management requirement from best practice in ineternational scale automotive manufacture.

Keywords: Quality Shop Floor Management, Abnormality Management, Plant Management Requirements

1. INTRODUCTION

Rapid change in the business and economic environment of advanced industrial societies is an important stimulus for alternative forms of work organization. Long-term arrangements with approved suppliers are being implemented in an integrated manner by providing supplier training and improvement programs [1]. Collaboration provides many benefits that are very meaningful. The impact of collaboration, among others, is that companies restructure relationships with suppliers by engaging them into strategic suppliers. Improving suppliers and providing continuous improvement support is crucial for managing the organization and supply chain. Supplier evaluation helps to make decisions about supplier selection and development [2].

In addition, supplier performance evaluation is an important part of production planning and control. This causes many manufacturing organizations, 60% of production costs are procurement costs, so that suppliers are needed who not only contribute to the product but also support an effective production process [3]. Through the supplier evaluation process will be identified corrective measures, so that supplier performance will be obtained that can help improve organizational competitiveness [4]. Based on previous research and preliminary studies on the company, the main problem in this research is: how to design an appropriate decision-making framework for evaluating and developing strategic suppliers by considering sustainability criteria. As written by Park. Et al. [5] that there are many studies on topics related to supplier relationship management (SRM), namely purchasing strategies, supplier selection and development, and collaboration with suppliers. The research papers are very good in providing approaches to how to evaluate performance, but do not explain the methods and steps of the real and detailed development steps.

The problem is a need to make collaborative framework for conducting proper evaluations and followed by actions to develop shop floor management, to get a significat impact for quality, delivery and productivity performance of strategic suppliers by considering sustainability criteria. What is an appropriate and holistic evaluation item that if used to improve shop floor management can significantly and significantly improve the quality, delivery and productivity of supplier factories and sustainably?

Every time we launch a new vehicle model, there is a high fluctuation in the flow of product defects into the customer factory (see figure.1)

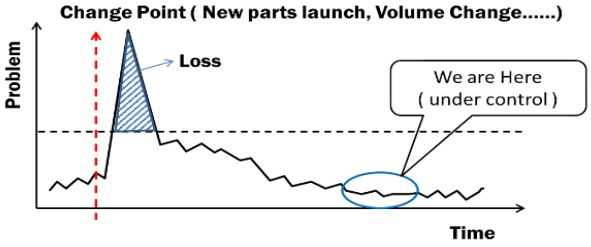


Figure 1. Fluctuation problems when launching new models, volume change

The author limits the research in quality improvement especially in reducing the out flow of defective products to

customers. Because it can lead to critical problems, such as:

1. Mitigation costs for defective products reaching the ATPM factory
2. Very large handling costs associated with components that are exported, especially if it has been assembled into a vehicle that has reached the purchaser of the vehicle (both domestic and export)
3. The brand image of the vehicle that will decrease is related to the speed of the handling as well as the frequency of problems that flow to the vehicle buyers

2. LITERATURE REVIEW

2.1. Toyota – Quality Shop Floor Management (QSFM) Manual and Guide Book [6]

Quality Shop Floor Management is a development guidance for developing Manufacture's floor management in Quality process, by set up basic mandatory Plant management's requirement standard and proceeding method manual.

Why QSFM is needed in quality management:

- To ensure that fundamental quality control process points are still "under good control"
- For identification of abnormalities/points of weakness and improvement by suppliers before causing accidents, defects of product or late delivery.
- Most of the quality control actions in the market lately are caused by the weakness of the very basic Shop-Floor management

Play a role in the Shop-Floor arrangement (see figure 2 below) are:

Each function has a different role in carrying out SFM responsible task.

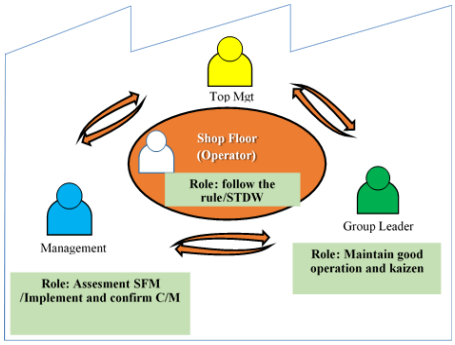


Figure 2. Role in Shop Floor Management

2.2. Fundamental Concept of Toyota – Group Leader Role Guidance [7]

Background from Toyota - Guidance Group Leader is to support the understanding of roles that must be agreed by each member using their knowledge and expertise. The purpose of the promotion of understanding this role is to develop the ability of work leaders who can (1) clarify and (2) complete (3) tasks expected for themselves (4) based on the workplace.

The ideal situation of the Group Leader (GL): GL has full understanding of Standardized work and Fundamental Skill groups themselves and organizes his groups through Abnormality Management based on *Genchi-Genbutsu*

The thinking framework of the two theoretical foundations explained in chapters 2.1 and 2.2 above is as follows

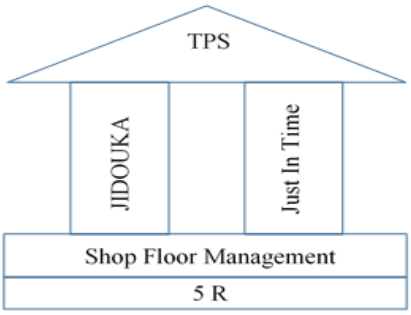


Figure 3. Foundation and Pillar of manufacture production system

Figure 3 above explain the basic principles that must be understood by every manufacturing manager in general, and manufacturing vehicle components in particular, is the production system which has 2 main pillars, are:

- Jidouka (*Ninben no Tsuita Jidouka*/automation that includes the human element in it)
- Just in Time

The difference in Management that is commonly applied in many / almost all manufacturing is the foundation of the two pillars. Where is the shop floor management includes 5S / 5R as a condition that should have been well organized at the beginning before making improvements and developing shop floor management.

In the QSFM (Quality Shop Floor Management) focus, the meaning is floor management for quality inspection work. Two Performance indicator that will be proven in this research are:

- Process KPI: Performance Indications of the production process line in the component factory (supplier)
- Result KPI: An indication of monthly quality outflow performance from component suppliers (the number of defects in defective products to customer's plant). The KPI process will be stated in scores from categories A, B, C and D, as shown in Figure 4 above.

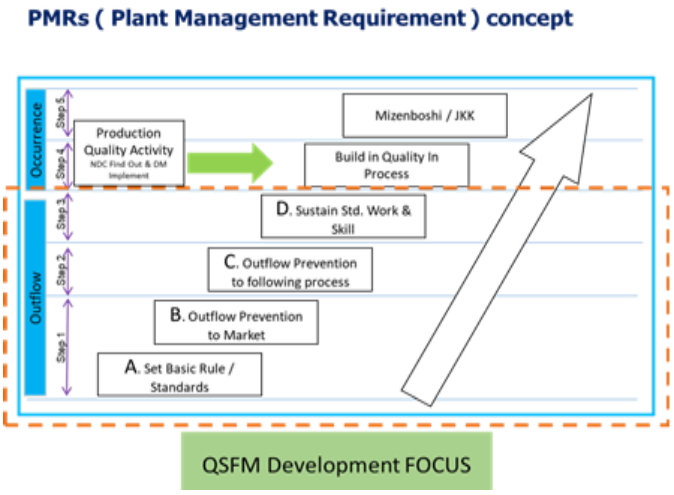


Figure 4. Concept of Management

3 basic principles that must be understood and implemented, are:

1. Three (3) Essential Keys

The intended methodology is related to the integration of 3 essential keys: Knowledge, Management and Motivation, which must be fulfilled when implementing QSFM development in the factory (as shown in figure 5 Below)

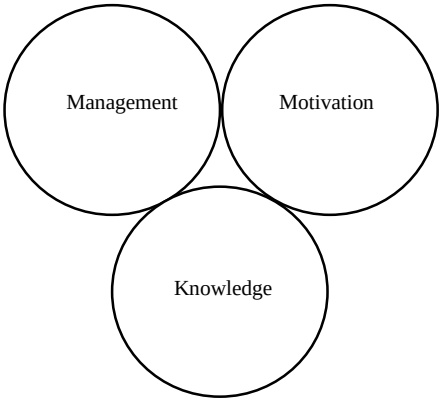


Figure 5. Essential Keys in Floor Management

2. Knowledge of quality management needs in manufacturing

The concept of Plant Management Requirement (PMR) for QSFM development will focus to Outflow defect performance which are divided become 3 step (4 kategori: A, B, C, D) (see table 1 below):

Table 1. QSFM Evaluation Item and Check Point

Category A. Set Basic Rules

No.	Evaluation Item	Check Point / Data Source
1	Quality management organization, policy & improvement activity plan	-Organization with enough man power to conduct activity -Quality Policy, improvement activity plan with achievement status - Genba
2	Quality target vs result information sharing of: - After market claim - Customer claim	Visualization problem with analyze & progress C/M updating (Include measure effective of C/M & YOKOTEN) - Genba
3	Frequency and effectiveness of sampling audit by QC/QA	Audit record from QA/QC with evidence comparison with problem recurrence result - Genba
4	Completion of inspection items as Drawing, PIS & QCPC requirement	Inspection Std./method include frequency & time is updating and cover all TOYOTA's requirement - Genba
5	Confirm that the production meet the regulation as Drawing and PIS require	Regulation part control list & confirmation method of regulation part - Genba
6	Operator skill management	Skill matrix sheet with clear evaluate/judgment criteria & refreshment training plan - Genba
7	Operator skill management	Check operator working follow Std. - Genba
8	Work Instruction (WI), include low frequency job	WI implementation & Complete Level#3 : Clear quality key point & effect if not follow - Genba
9	Stop-Call-Wait rule following	Procedure, Rule, Record and actual operation - Genba

Category B. Establish a structure for preventing defect outflow to the market

10	Critical part management	Control list with clear confirmation method and visualization of critical process (Critical process map, layout) - Document check
11	Capability to control critical part/process and frequency of critical part/process confirmation	TOYOTA certify result : SSA5 / CPPP -Frequency of self confirmation (PS53, SSA5, CPPP,...) - QD/PN record and document check
12	Identification & separation of abnormal/NG part	Visualization & record with clear operation procedure - Genba
13	Repairing skill evaluation method	Clear identify repair man skill and evaluation method with comparing with defect from repairing result - Genba
14	PCR and ECI management	Visualization of PCR / ECI implementation with clear operation plan & procedure - Monthly Feedback from QC

Category C. Establish a structure for preventing defect outflow to following process

15	Quality assurance level	Effectiveness of problem occurrence & outflow prevention - QA net work / P-FMEA/____ - Document & Genba check
16	Pokayoke management	Frequency of confirmation & visualization of POKAYOKE (map, layout) - Genba
17	Boundary Sample or NG sample or part key point	Visualization & update - Genba
18	Measurement tools control / Parameter confirmation / MC maintenance or Daily check	Checking frequency & recording - Genba
19	Identification of NG or suspect NG part	Clearly identify & visualization by tag and Red/Yellow box with record - Genba
20	FIFO System	Visualization of WIP, complete part and materials - Genba
21	Incoming part/component inspection	Checking method & frequency - Genba
22	Conduct Evaluation system & Status monitoring for sub-supplier	Evaluation criteria and visualization of result & action plan - Genba

Category D. Sustain Standardized Work and skills

23	Quality information sharing system	Conduct Asakai meeting to share concern quality info./activity to all employee - Genba
24	Investigation sheet submission	Apply QC tools (e-QIS : PIRR & Defect claim) - Refer record in e-QIS / from QC
25	Traceability	Visualization & record with clear operation procedure - Genba
26	Inspector skill refreshment	Clarify the skill that need to refresh, set up refreshment training plan and update result by visualization - Genba
27	Confirm work operation of supervisors in order to keep STDW	Visualization & updating - all document that concern with STDW maintain (Training record of OP, tool storage layout,..) - Genba
28	4M change control (Man, M/C, Method, Material)	Visualization & updating - Clear record with action - Genba

3. Abnormality Management Concept

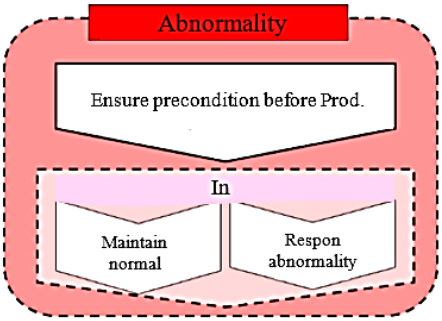


Figure 6. Basic concept of abnormality management

Figure 6 above explained that in applying the management of abnormalities as the basis of quality and production management, it must start from ensuring the initial conditions before production begins and subsequently carried out activities to maintain normal conditions and respond quickly to any abnormalities during production.

Source of quality data need to be controlled, as explained in figure 7 below

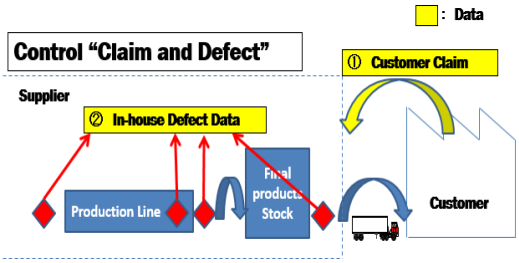


Figure 7. Quality data source for claim and defect control

Claim and defect data are defined as abnormality, will be starting point to understand actual quality condition.

3. METHODOLOGY

3.1 QSFM Development Tools

3 Tools needed in this research are as follows:

a. Guide book for proceeding QSFM development

This guide book explains to the leaders in the factory about the objectives, the concept of quality management and in detail explains each item of Quality Management Requirements enriched with visual examples.

b. QSFM check sheet (see table 3.1)

c. Control Board

Control of visualized data and the speed of action on problems. There are two types of control boards that are used in the implementation of building quality management, are:

c.1. GL (Group Leader) Board

This board is used by the leader of the work group/group leader are work leaders who control several production lines. The control board for the leader of this work group is divided into 2 types:

- Changing Point Board (see example in figure 8). This control board contains all changing condition in shop floor which should be under control from initial condition until end of production time

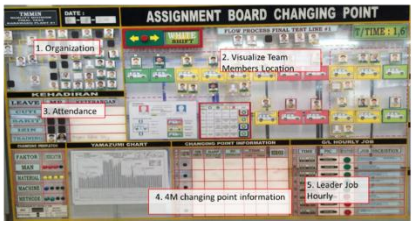


Figure 8. Changing point Control board at shop floor

- Mission Board (see example in figure 9)

Figure 9. Mission Control board at shop floor

This mission control board contains all achievements of required KPI in production line led by GL.

c.2. Management Board

Figure 10. Management Control board for Quality

This control board is used by managers up to the director to control information (data) that is accurately connected to the GL control board. (see figure 10).

3.2. QSFM Development Method in Shop Floor

The development method in this study is builds a quality management system that is carried out holistically from material/component acceptance posts until final checkpoints based on the PDCA cycle (Plan, Do, Check, Action)

1. Plan

Explain the background, objectives and quality management needs of a manufacturer to all of management levels, Selecting a model line for assessment and Improvement plans for the model line

2. Do

The stage of making improvements based on the weaknesses obtained from the assessment / assessment

3. Check

The Stages of checking activity by the work leader, both from the supplier factory top management and from the customer top management

4. Action

This stage is to provide feedback on the next steps taken to improve the entire production line at the plant.

These steps for developing QSFM are explained in the flow chart below (see figure 11)

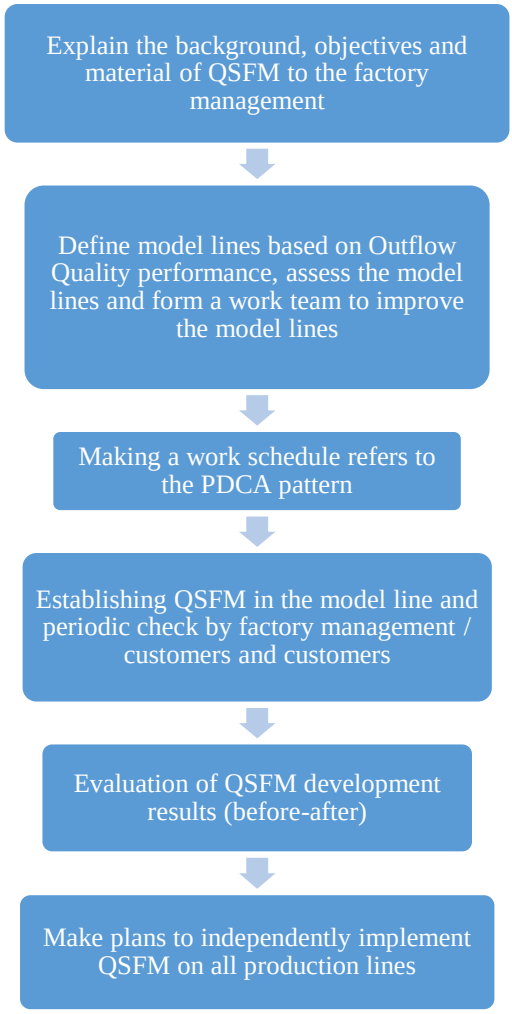


Figure 11. Flowchart of the steps in the QSFM development process in the field

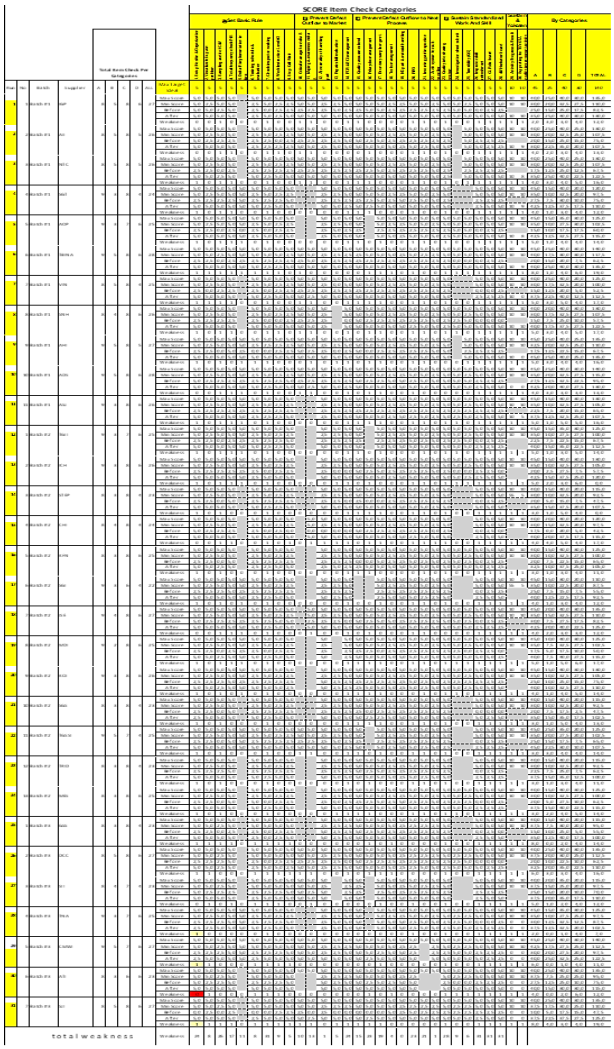
4. RESULT AND DISCUSSION

4.1 Results of QSFM Development

This Research study 31 suppliers selected based on the priority level of quality outflow. Evaluation the results of QSFM development method will be presented in 2 assessment criteria, are: Process KPI (by using QSFM Score) and Result KPI (quantity of defects in defective products). KPI Process evaluation criteria is the results of the assessment before and after the improvement (at actual Shop Floor conditions) by using QSFM check sheet and guidance. Result KPI evaluation criteria is the actual outflow data of defective products at the customer receiving area.

A. Evaluate the Process KPI criteria from 31 developed suppliers before and after development (see table 2)

Table 2. Model line assessment result from 31 suppliers (before and after development)



Based on the data of total assesment results after development, we could have achieved the required level of shop floor management for model line. Furthermore, implementation the similar action of the model line to the other production lines is independently carried out by the supplier's management.

B. Evaluate the KPI Result criteria

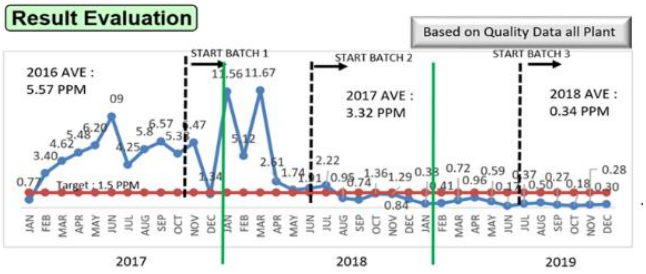


Figure 12. Result Evaluation of defect outflow after QSFM development

Figure 12 shows performance from total of 138 suppliers before and after development. The implementation of QSFM Development is divided into 3 Batches (Batch 1 ~ Batch 3), it can be seen that the level of total defect outflow performance has significntly improved. By building QSFM by the priorities 31 selected suppliers, the results of the achievement can achieve < 1.5 PPM for more than one year.

4.2. Discussion of Research Results

From the 31 suppliers which had been developed in Shop Floor Management, the main weaknesses in each assessment category were as follows:

- Category A – Set Basic Rules
  - Point no. 9: Follow Stop-Call-Wait Rules (20%)
  - Point no. 8: Work Instruction (include low frequency job) (18%)
  - Point no. 7: Check operator working follow standard (16%)
  - Point no. 6: Operator skill management (13%)
- Category B – Prevent defect outflow to market
  - Point no.14: Process Change Request and Engineering Change request management (23%)
  - Point no.13: Repairing skill evaluation method (22%)
  - Point no. 12: Identification and separation of abnormal/NG part (20%)
  - Point no.11: Capability to control critical part/process and frequency of critical part/process confirmation (18%)
  - Point no.10: Critical part management (10%)
- Category C - Establish a structure for preventing defect outflow to following process
  - Point no. 22: Conduct evaluation system and status monitoring for sub supplier (15%)
  - Poimt no. 21: Incoming part/component inspection (14%)
  - Point no. 20: FIFO system (14%)
- Category D – Sustainable standardized work and skill
  - Point no. 28: 4M change control (Man, Machine, Method, Material) (18%)
  - Point no. 27: Confirm work operation of supervisors in order to keep STDW (standardized work) (18%)
  - Point no.26: Inspector skill refreshment (17%)
  - Point no. 25: Traceability (16%)
  - Point no. 24: Investigation sheet submission (16%)
  - Point no. 23: Quality information sharing system (15%)

5. CONCLUSION

5.1. Conclusion of the Research

Important things to consider in developing this QSFM, as a holistic method used by the authors are as follows:

1. 3 Essential Keys (see figure 5)
2. Communication between Management - Work Leaders - Members who each have a role in running QSFM (see figure 2)
3. The concept of Plant Quality Management Requirements (see figure 4) and check sheets (see table 1) are used to guide development each level
4. QSFM is an abnormality management and it must become a habit for every person working in the production flow to play a role in detecting abnormalities and returning them to normal condition

The conclusion from this research is the importance of making improvements of shop-floor quality management based on proper standardized Plant Management Requirement in abnormality management (as explained above about the holistic method in developing QSFM) to be able to significantly improve the performance of preventing defective product outflow to customers.

5.2 Suggestion

The author suggests to continue the next development step is: QSFM Experties Development. The basic concept of QSFM Experties Development is training for each QSFM Leader in 31 component suppliers who have done their QSFM development so far, to become experts who can develop next QSFM experties for all other component suppliers in collaboration strategy with the existing manufacturing community at customer. The pattern of follow-up for skills development can be seen in Figure 13

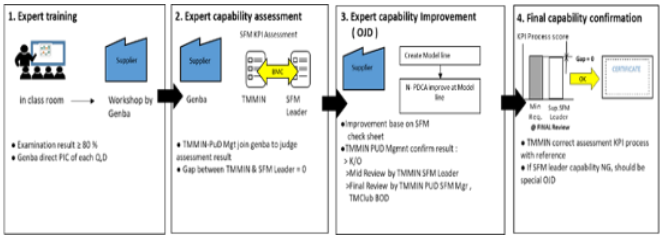


Figure 13. Follow-up pattern for the development of QSFM expertise for all component suppliers

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