

STRUCTURED SKILL DEVELOPMENT IN INDIAN AUTOMOTIVE INDUSTRY – A CSR ENDEAVOR TOWARD ENHANCING EMPLOYABILITY

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Abstract *Owing to several competitive advantages, India is fast evolving as a major global manufacturing hub by attracting investors across the globe due to the abundance of inexpensive labor and other favorable investing environments. Particularly within the sectors of mass manufacturing, the Indian automotive sector has already established itself as one of the prime sectors in employing a skilled workforce. But, the major challenge the sector faces is the availability of rightly skilled resources. Apart from the availability of the right skill, there is another key challenge that the Indian industry faces is the inconstancy in human skills, which leads to quality inconstancy. This poses a serious threat to the Indian manufacturing industry toward emerging as a global manufacturing hub. Here lies the importance of up-skilling in a structured manner on which this research paper focuses to identify various underlying factors in this aspect and develops a structured solution to negate the possibilities of inconsistency in product quality due to human skill. Structured up-skilling to provide a holistic understanding of the overall manufacturing in terms of technology, quality, process engineering, safety, etc., to handle the process complexity in a better manner along with standardized workstation-level training, robust evaluation, and deployment process is needed to bridge the vast skill gap that is prevailing in the Indian automotive industry.*

Keywords: *Structured Skill Development, CSR, Employability, Productivity, Process Consistency, Skill Gap, Customer Satisfaction*

INTRODUCTION

India's economy has surpassed China in terms of growth rate and has emerged as the fastest-growing among the major economies of the world. As per the estimate by Goldman Sachs, India would become the third-largest economy in the world by 2035¹. Due to several competitive advantages, India is fast evolving as a major manufacturing hub. India is set to become one of the youngest nations in the world by 2020 with an average age of Indian workforce below 30 years, which is considerably lower than another manufacturing behemoth, China, and even further lower than Europe, the US, and Japan (Economic Survey 2011–12, Government of India). In the second-most populous country of the world, the abundance of human resources provides a distinct competitive advantage to attract investments in the manufacturing sector. Particularly within the sectors of mass manufacturing, the Indian automotive sector has already established itself as one of the leading sectors in employing a skilled workforce.

An estimated 291 million skilled workers are needed by the year 2022, if India wants to become a globally leading manufacturing economy (Mehrotra et al., 2013). It is estimated that by 2022, direct and indirect employment through the Indian automotive sector itself would reach 38 million (KPMG Sector Skill Gap Study 2013–17, 2017–22). On the contrary, India is among the countries with the lowest proportion of trained youth in the world, high unemployment among the youth in combination with low skill availability of the workforce to meet the industry requirement. Most of the existing demand of the industry in terms of skilled workforce is met by the government institutes, which are in most instances not effectively run to provide an industry-fit skilled workforce. Moreover, the courses are not updated along with the technological advancement and as implemented at the manufacturing plants. In recent times, a huge number of private engineering colleges came up across India. With almost non-existing entry screening barriers and doubtful quality of education standards, most of those institutes are just churning out engineers who are not fit for the industry. Although there is a burgeoning number of privately run engineering institutes, the number of private institutes providing skill-based education in Diploma/ITI is limited.

¹ <https://www.focus-economics.com/blog/the-largest-economies-in-the-world>

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To offset the fast-changing business environment, it has become imperative for every organization to strive to achieve higher productivity, develop superior products/services to remain sustainable in the intensely competitive global market. Indian manufacturers have widely adopted the strategy of continuous quality improvement to remain competitive. Continuous focus toward the development of skills and ownership of workforces toward continuous improvement are imperative elements toward achieving the goal of higher productivity and superior quality. With growing complexities, the workforces have to acclimatize them in the shift from a highly structured, largely predictable work environment to a flexible workflow system where the swift reaction to conditions and quick decision-making are the requirement. It is not easy to adapt to such a radically new method of working, and here lies the importance of education & skill training. A structured skill development methodology to groom an agile workforce is the key to achieve the objective of superior product quality. The challenge in the Indian context is even higher as although India has abundant and young workforce, a vast skill gap prevails in the Indian labor market.

Moreover, there is a huge gap in terms of the availability of the right skill. Often, the inconstancy in human skills leads to minor product irritants which ultimately affect customer satisfaction, negatively impact perception on product quality and the brand image. India will not be able to reap the benefits of the demographic dividend unless this increasing skill gap is bridged. Here lies the importance of up-skilling in a structured manner on which this applied research paper highlights.

The practitioner-oriented paper explores the causes of minor inconsistency/imperfections in the product due to human factors, validates the factors statistically and then develops the solutions to tackle the problem of inconsistency in the collaborative way involving all the stakeholders. A structured and dynamic skill development process evolved out of this operational research and ultimately helped the organization to ease out the minor irritants in the product and achieve higher customer satisfaction.

The organization on which this study been performed was facing the perennial problem of a high number of one-off issues/minor irritants in the final product. Apart from experienced permanent & fixed-term operators with Diploma Engineering or ITI background, the organization engaged a substantial number of trainees in the assembly process who were undergoing vocational education in Technical Training schools. This CSR endeavor was intended to provide opportunities to those trainees to learn and acquire practical skills that are relevant to the industry and thereby increase their employability. Under this CSR program, the trainees from technical training schools were provided an opportunity to undergo on-the-job training and get industry knowledge,

skills for maintaining the required service standards and customer satisfaction level, and also learn various lean tools like Just-In-Time, Kanban, Heijunka and principals of Total Productive Maintenance. This in-depth exposure with contemporary manufacturing practices and principals increases the employability of those trainees and make them industry-fit. Moreover, apart from the opportunities in the mainstream automotive industry, it also increases indirect employment opportunities in the service and sales networks of the automotive sector. Moreover, an in-depth exposure in technical knowledge about vehicles opens opportunities for self-employment in terms of starting a service workshop.

LITERATURE REVIEW

Growing as a major manufacturing base and export hub, the Indian auto industry is one of the poorest-performing auto industries globally in terms of labor productivity. The major challenge the Indian auto industry faces presently is the availability of rightly skilled manpower. There is an urgent need to improve the quality of skilled and semi-skilled manpower working in the auto industry. This would require focus and structured endeavor from all concerned stakeholders – Industry, Academia and the Government (Geetika Malik, A. Venkatraman, 2017).

The government has taken skill development as one of the key focus areas. Skill development is essential to securing employment in the organized sector and enhancing productivity in the informal economy toward reducing poverty and the risk of underemployment (Sanghi & Srijia, 2015). The National Policy on Skill Development aims at training about 104.62 million people afresh and an additional 460 million are to be reskilled, up-skilled and skilled by 2022². In India, a vast majority of the population have limited access to education and training and are either inactive or engaged in low-skilled work in the informal economy. If the labor market is not made more inclusive through a balanced approach to human capital development, the consequences could be grave (Afroz, 2018).

Bridge the skill gap companies are making a huge investment in training to prepare employees for future needs. As mentioned by Armstrong (2001), “Training is systematic development of the knowledge, skills, and attitudes required by an individual to perform adequately a given task or job.” The researchers and practitioners have constantly emphasized the importance of training due to its role and investment (Tan, Hall & Boyce, 2003).

Updating of the technical vocational training curriculum along with technological advancement and as implemented at the industry is a key to develop an industry-fit workforce.

² National Policy for Skill Development and Entrepreneurship, 2015.

Bates & Davis (2010) emphasized that the use of a training program is likely only when the trainee can practice the theoretical aspects learned in training in an actual work environment. They stressed the use of role-playing, cases, simulation. Isyaku (2000) mentioned that the process of training and development is a continuous one. It is an avenue to acquire more and new knowledge and develop further the skills and techniques to function effectively. Training and development aim at developing competencies such as technical, human, conceptual and managerial for the furtherance of individual and organization growth (Oribabor, 2000).

Skill development is a key driver to address poverty reduction by improving employability, productivity and thereby facilitating sustainable enterprise development and inclusive growth. Lack of industry-specific skills is the most severe in employment creating sectors such as manufacturing, software, and automobiles (Mehrotra et al., 2014). A multi-stakeholder partnership involving the public and private sectors, community and other stakeholders is needed. There is a need for the Technical and Vocational Education Training (TVET) Act to support the technical and vocational training system and open new pathways for implementation to generate employment (Majumdar, 2016).

Skilled workers are in short supply in India; major investment in employee development pays off because it helps ensure the quality of the workforce (Cappelli et al., 2010). Several Indian automotive companies and bigger Tier-1 auto component suppliers have their training setup and they provide specialized training to the recruits as well as refresher courses to the existing workforce to stay productive. But for small- and medium-scale ancillaries of auto sectors, investing heavily in internal skill development infrastructure remains a challenge. Hence, the existing vocational educational institutions have to be upgraded and additional ones should be started and industry should come forward in collaborating in a meaningful way toward supporting the academia in bridging the skill divide. This would also contribute to the long-term sustainability of the Industry in terms of getting the rightly skilled manpower in adequate numbers. Though India's corporate sector has also been contributing to skill training through its Corporate Social Responsibility (CSR) initiative, the efforts have

been few and far between (Sadasivan, 2018). As there is a growing recognition of the need to address the concerns of a wider range of stakeholders, scholars argue that the CSR is becoming increasingly important to competitive success (Porter & Kramer, 2006). The CSR can be integrated into the workplace and leave substantial impacts on the employee's attitudes and behavior that ultimately foster the performance of the organization (Peng, 2014).

Organizations can incorporate skill training framework in its CSR strategy and involve employees through volunteering opportunities to provide real-life training opportunities for the community. Apart from promoting the brand, providing essential vocational training and skills development to the local community can ensure a competent labor supply for the future (Sadasivan, 2018). Deployment of resources through the CSR has a strong potential for funding the education and skill of the rural population (Ghuman & Sharma, 2014).

The CSR should be implemented in the concrete practice of human resources management for promoting employment (Ding, 2010) on which this research paper focuses on through structured skill development.

APPROACH AND METHOD

Though the numbers of major flaws in the final product were very less, those minor irritants which were often one-off were causing much botheration for the product service team and the dealers. Those small but nagging issues were eventually denting product perception among the customers. In the yearly strategy review meeting, a directive been given to the plant operations function to identify and analyze the underlying factors which were leading to those minor flaws in the final product. A six-member cross-functional team has been formed with members from Manufacturing, Business Excellence and Human Resource functions.

The first pass yield, that is, the percentage of OK products at the end of the assembly line was hovering around 93% when the project was taken. The Pareto analysis of the defects did not helped in providing a direction as the nature of the Pareto curve was almost flat in nature. This was due to the substantial number of issues that were appearing once or twice only during the data capture period.

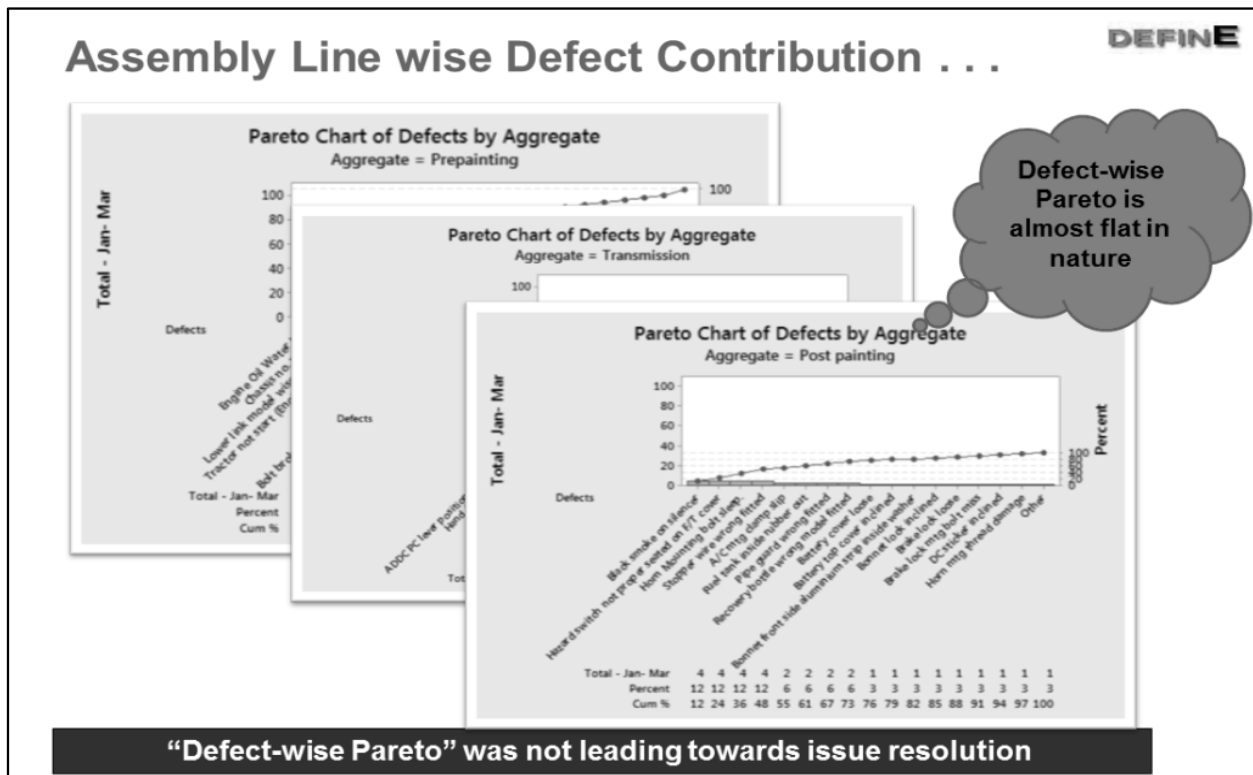


Fig. 1: Defect Wise Pareto Analysis of Three Assembly Lines

Further analysis was done with the count of the unique type of issues were done. This revealed that 77% of issues were of 1 or 2 frequency in the last 3 months. Month-on-month analysis revealed that only 30% of the defects are common in three months. This indicated that the variability of the defects is very high.

It was inferred that the spread of assembly error issues is very high, defects with the frequency of 1 or 2 are a major concern. Those varieties of stray issues accumulate to almost 80% of total assembly issues.

Approach: For resolving the product quality issues in mass manufacturing, generally, one of the following two

approaches are adopted in the industry:

- Issues which are repeatedly appearing are addressed through deployment of Engineering Improvements as identified through Root Cause Analysis (Traditional Approach).
- For low frequency but creating spread as a whole, calls for an in-depth analysis and deployment of common action to address this common cause variation.

In this case, the second approach was adopted as the defects were of low frequency and multiple. The solution approach was taken to identify the issues leading to common cause variation and applying a blanket solution of common action.

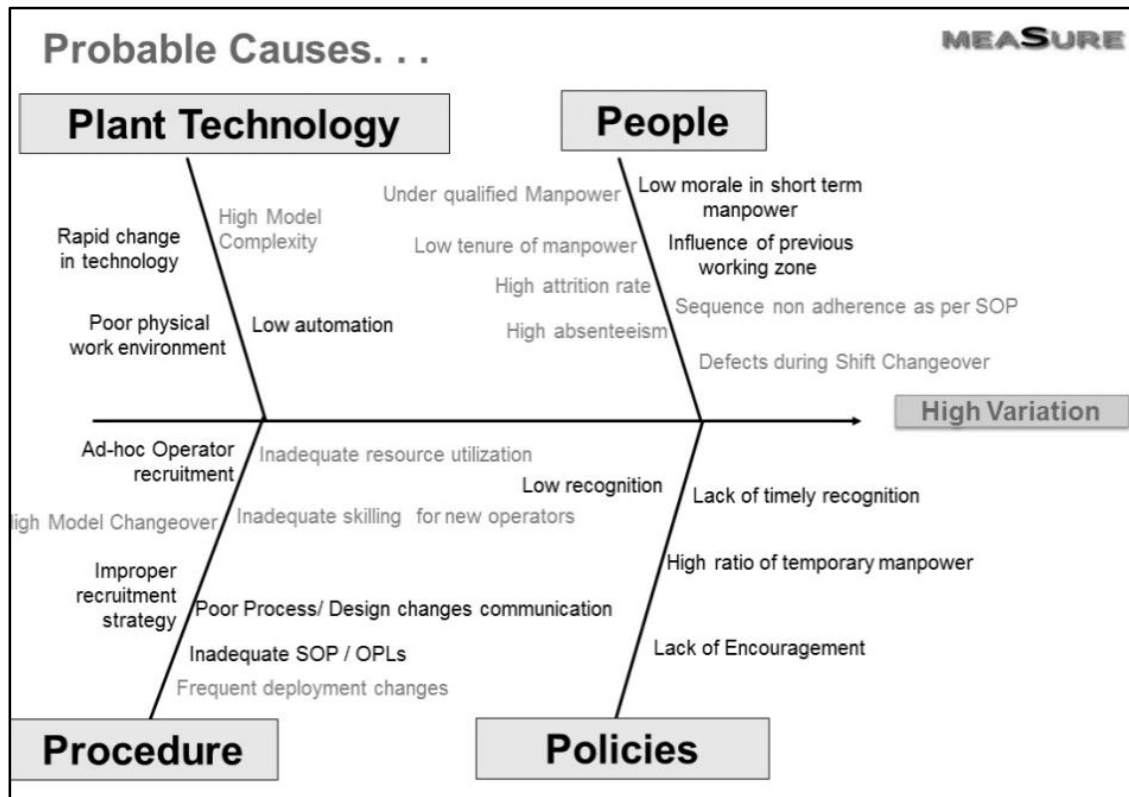


Fig. 2: Cause and Effect Analysis

Through brainstorming at multiple levels involving the operators, supervisors and line managers, a cause-and-effect analysis was done. The identified causes were further

prioritized through Cause & Effect (CE) Matrix to derive causes as highlighted in grey in the fish-bone diagram. But, the causes identified were too generic in nature to take action upon.

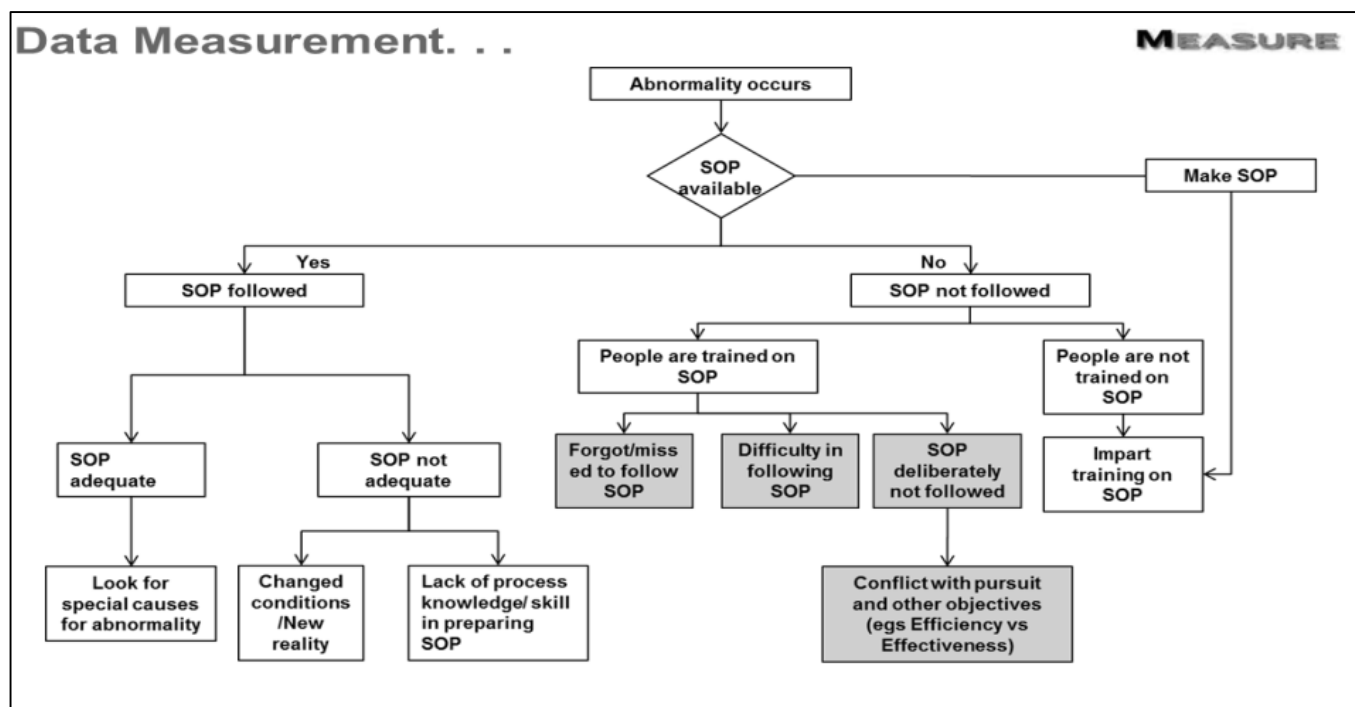


Fig. 3: Real-Time Monitoring of 4M Conditions

The team decided to collect real-time data to understand inputs. Real-time monitoring of 4M conditions, i.e., Man, Machine, Method and Materials, were done and workers were interviewed at once when the defect occurs. Analysis of the responses pointed out four aspects that the operators were facing at a particular instance when the defect occurs. Those are as follows:

- 1) Forgot to follow Standard Operating Procedure (SOP);
- 2) Difficulty in following SOP; 3) SOP deliberately not followed; and 4) Lack of knowledge and skills.

The real-time monitoring of 4M conditions and interviewing the operators immediately after generation of defects revealed that assembly error is just a tip of the iceberg and there are many inherent challenges the process is throwing at the operator like operation sequence, model to model configuration, model identification, part selection, model changeover, etc. In this way, 11 probable causes were identified. Each of the causes was analyzed statistically through the Chi² test, and four of them were found to be significant.

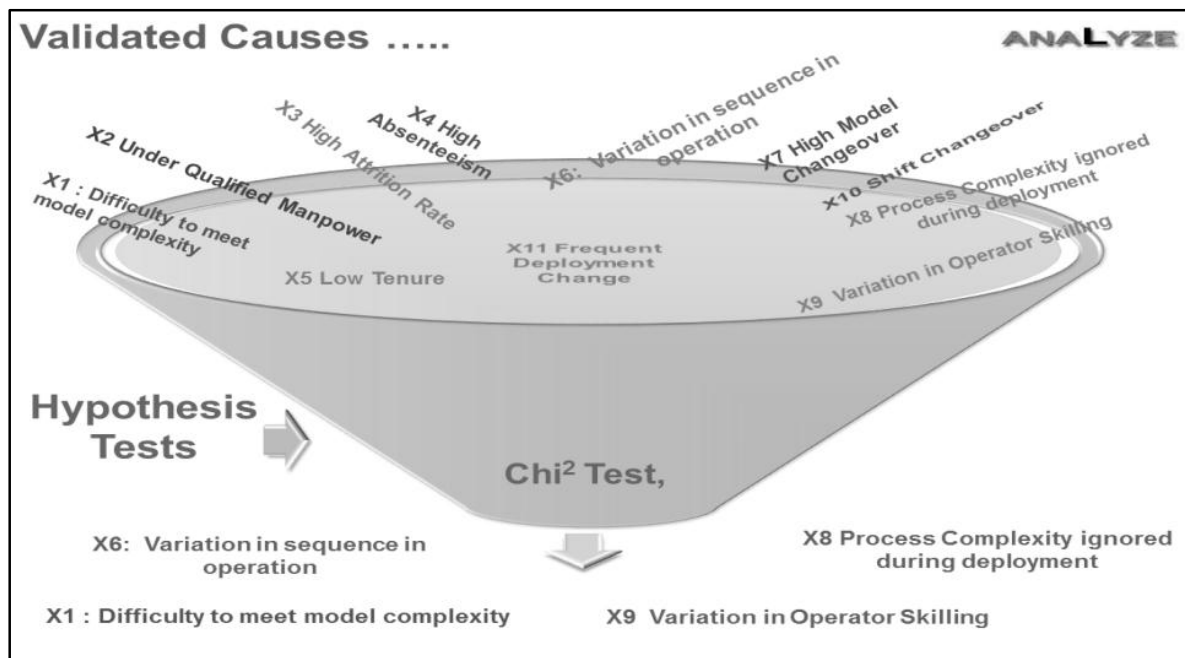


Fig. 4: Probable Cause to Root Cause

The four validated causes were as follows:

- X1: Difficulty to meet model complexity.
- X6: Variation in sequence in operation.
- X8: Process complexity ignored during deployment.
- X9: Variations in Operator Skilling.

Three categories of fully trained operators were taken for the test and deployed in critical stations where skill requirement and process criticality are high. The three categories were Category A: Experienced Diploma Engineers, Category B: Experienced ITI, Category C: Non ITI (Trainees-Undergoing Course). The test was conducted for assembling 50 units' two models for the product. It was found that the

Category, experienced diploma engineers and operators produced much fewer defects than statistically estimated. Even the experienced ITI operators generated slightly lesser defects than estimated whereas the Category C Non-ITI Trainee operators generated much higher defects than estimated even though they were fully trained in those workstations. Whereas when the same three categories of operators were deployed in non-critical stations, there was no significant difference in the defects generated by them. This clearly indicated that the defect rate is dependent on the variation in deployment of different categories of operators at critical stations and even though all three categories were fully trained, the higher qualified operators could handle the manufacturing process complexities in a better way and generated much fewer defects.

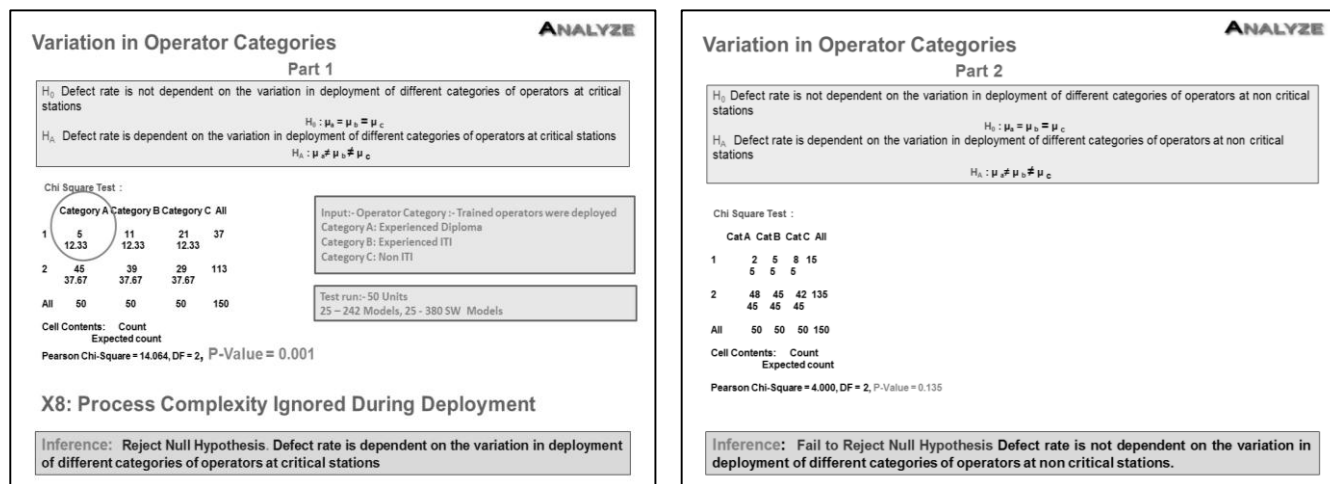


Fig. 5: Hypothesis Testing – Variation in Operator Category

The second revelation was that defect generated by the operators are dependent on the Trainers also who trained the operators. There lies the importance of standardizing the training process so that there is no variation in trainer to trainer. Variation in the sequence was also found to

pose challenge to operators. It was observed that at certain workstations, there is variation in the sequence of operations followed by different operators in different shifts or one operator himself at different times. In those stations, the defect generations were higher.

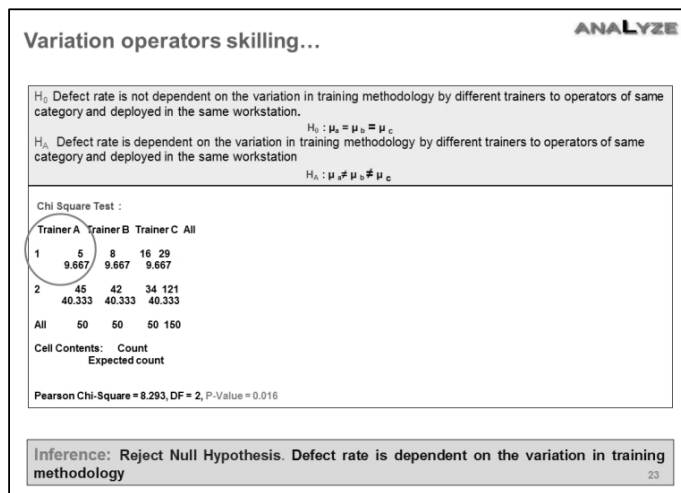


Fig. 6: Hypothesis Testing – Variation in Skilling

Solution Development Approach: From four identified root causes, concern areas were identified and three solution areas were derived such as: 1) Operator deployment strategy, 2) Comprehensive skill development, and 3) Improve process robustness. In the action area of operator deployment strategy development, the following four-step approach was followed. Workstation-wise, each activity was studied and the inherent skill element in that activity was identified,

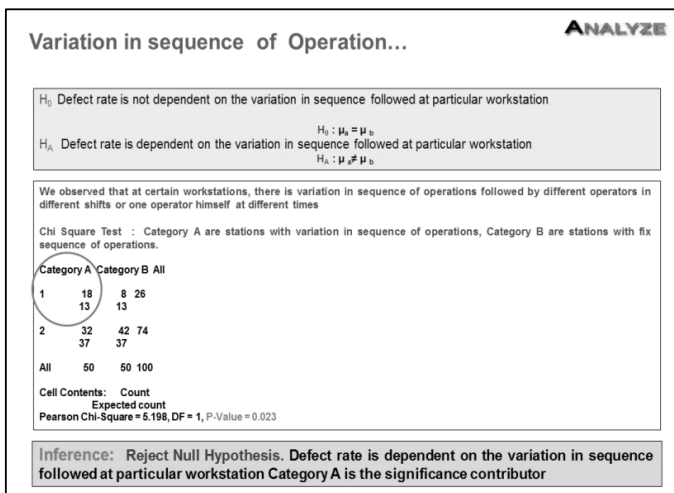


Fig. 7: Hypothesis Testing – Variation in Sequence

e.g., “Part Selection”, Setting Likewise 60 odd skills were identified and categorized in four quadrants in terms of 1) easy to learn and easy to perform, 2) easy to perform but hard to perform, 3) hard to perform but easy to learn and 4) hard to perform and hard to learn. Then, each of the skills in those four categories in an increasing gradient of complexity level was marked. The workstations were categorized in terms of the highest skill identified within the set of activities performed in the workstation.

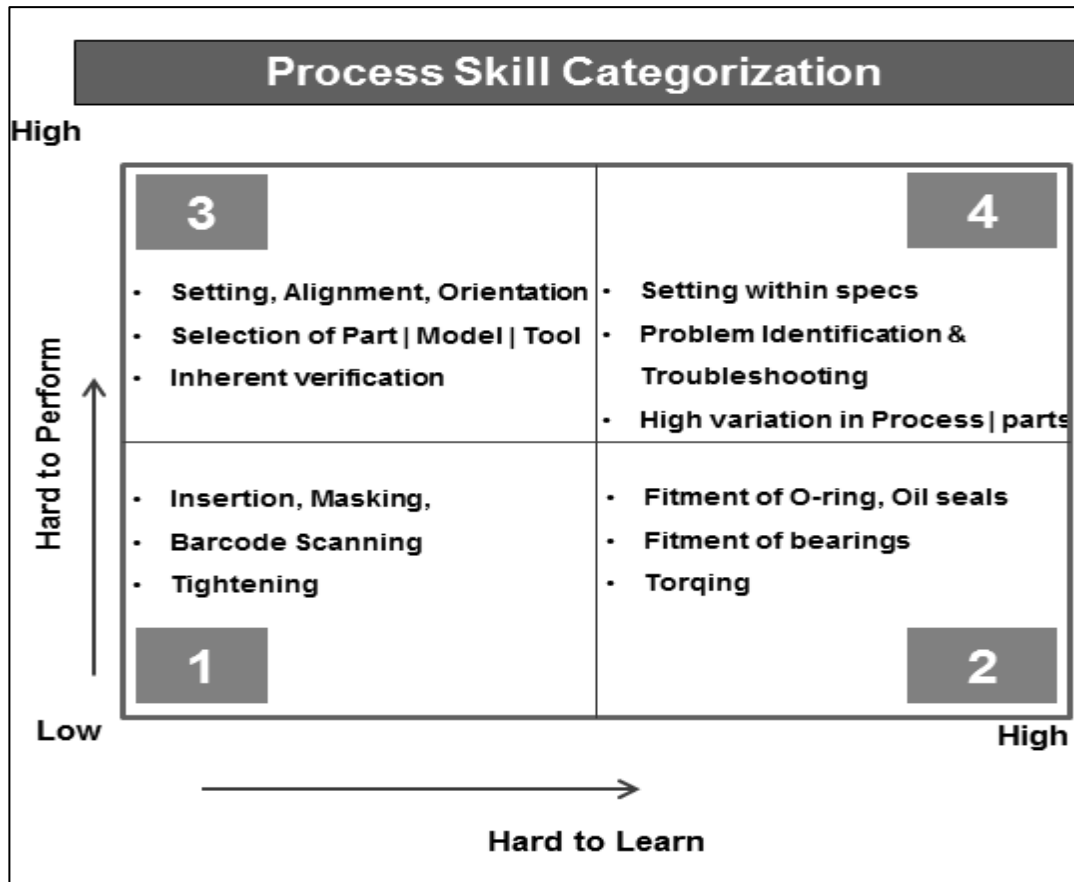


Fig. 8: Process Skill Categorization

Solution 1: Revamped Operator Deployment Strategy: Earlier work stations were classified by w.r.t Quality requirements. Workstation classification was done on only two categories – critical and non-critical. Deployment of operators was done based on training, evaluation and skill matrix and deployment was based on a push system. Based on the study findings, workstations were categorized in four categories in increasing order of process criticality - Level 1, Level 2, Level 3 and Level 4 workstations. Similarly, Operators were categorized in four categories based on qualification and experience. Instead of push type deployment, pull type deployment was mandated, i.e., if a vacancy occurs in a Level 4 station, deployment would be from category 4 operators who are having higher qualifications and experience and are better equipped to handle the process complexities, apart from training on the specific workstation. This approach minimized the deployment error which was earlier dependent on the supervisor’s experience and skill matrix.

Solution 2: Standardized workstation-level training: In the hypothesis testing, one of the revelations was that trainer to trainer the training delivery varies and ultimately it affects the product quality. Hence, a standardization of the delivery of training was needed. For Standardized on Job Training,

Station-specific training kits were prepared comprising of 1) Model wise configuration, 2) Operations sequence, 3) Part/Model identification, 4) Tools, 5) Safety aspects and Critical to Quality (CTQ) Points. Train the Trainer workshop and trainer certification process was also calibrated and standardized training videos were prepared to minimize the chance of variation in the On the Job Training process.

Solution 3: Robust evaluation process: Stage-wise evaluation of operators on all significant parameters, i.e., ability to tackle model complexity, ability to identify parts/ model, awareness of CTQ points, autonomous maintenance activities, handling of tools and equipment, Takt time and defect rate. Evaluation has been done at each stages and operators were qualified based on a qualifying criterion.

Solution 4: SMART Manufacturing training: In order to provide the operators a holistic understanding of the overall manufacturing in terms of technology, quality, process engineering, safety, etc., the Category 4 and Category 3 operators were provided a 48 hours training on eight modules. The objective was to equip them to handle the process complexity in a better manner.

RESULTS

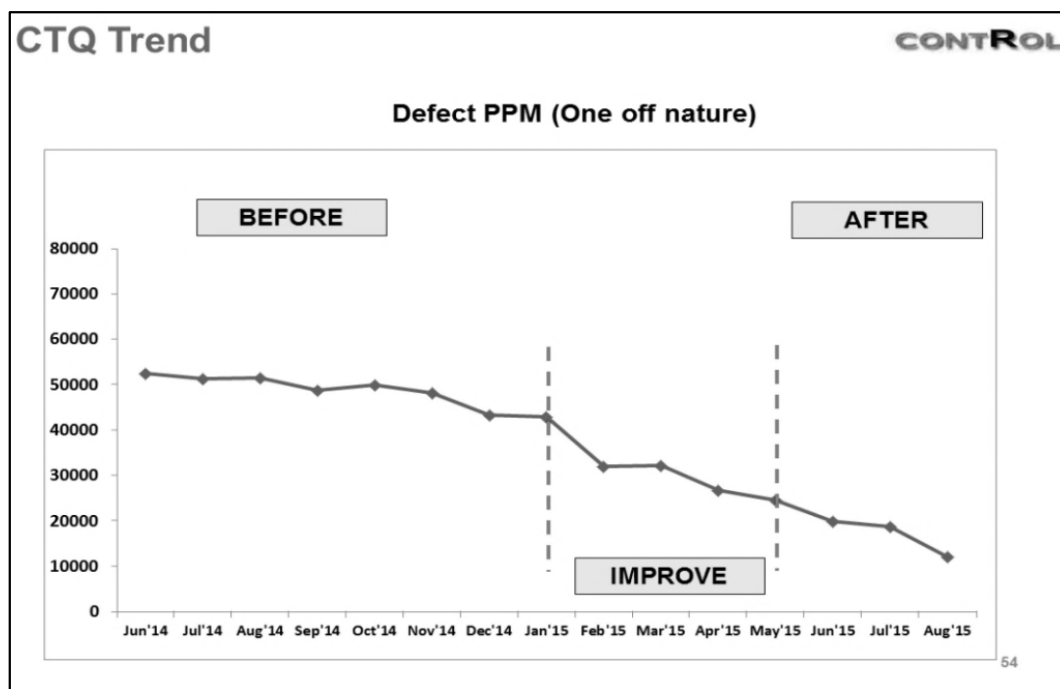


Fig. 9: Critical to Quality Trend (Defect PPM)

The in-depth analysis of the factors which led to sporadic errors and course correction from traditional training process yielded positive results. The critical to quality trend for one-off errors improved from around 50000 ppm at the beginning of the project to around 12000 ppm. The encouraging trend

also reflected on the improvements in the first-pass yield. Before the improvement, the first-pass yield was hovering around 93% and after the actions were put in place, the first-pass improved to more than 97%. The morale of the operators and shop floor supervisors also boosted.

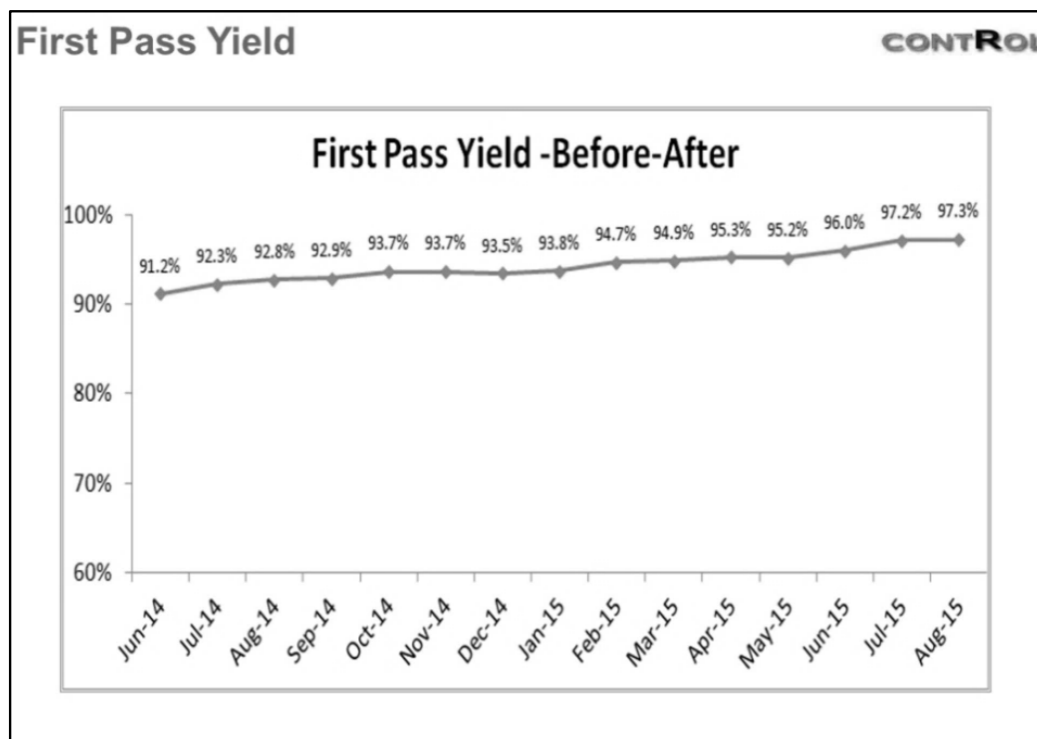


Fig. 10: First Pass Yield Trend

CONCLUSION

The sporadic defects or the one-off defects are minor irritants and can be resolved very easily under warranty clause but those are detrimental to the reliability of the brand and ultimately affect customer satisfaction. The optimum consistency in product quality is imperative to be in the marketplace today. This is very important for a country like India that has lots of potential in mass manufacturing. The government of India is giving a major thrust to make-in-India. Many global manufacturers have opened their manufacturing setup here; similarly, in the sector of automotive, India is fast evolving as an export hub. But, at the same time, there are lots of challenges. The productivity of an average Indian worker is much lower than his counterpart in China or even Thailand.

After the devastation of WWII, the Japanese manufacturing industry took the lead role to rebuild the economy. But at that time, the Japanese goods were globally perceived as “Cheap” and “low in Quality”. It was that time when Dr. Deming taught Japanese engineers and top management statistical methods and how to view production as a system that included suppliers and consumers and Dr. Juran delivered lectures in Japan about managing for quality. By adaptation of principles of TQM and shop-floor improvement tools like TPM and TPS, Japanese manufacturing industry has travelled a long journey toward excellence. Today, made-in-Japan goods are globally perceived as the best in terms of quality.

The Indian manufacturing industry is fast embracing the principles of TQM and World Class Manufacturing. In a country like India with a huge workforce, employment and job creation are the topmost focus areas of the government. We have a relatively young workforce and there lies a great opportunity. But, the vast skill gap is prevailing in the Indian labor market and there is a dearth of human intellectual capital in India. To bridge this gap, the need is for a comprehensive skill development policy, industry-relevant curriculum, active collaboration between academia and industry, and willingness of industries to provide opportunities to bridge the skill gap and thereby helping the maximum number of the students becoming employable and Industry-fit. Although India’s corporate sector has been contributing to skill training through its CSR initiative, it needs to be more widespread and inclusive.

LIMITATIONS

The study is conducted in a mass manufacturing setup and for resolving the persistent issue of one-off issues. Through structured up-skilling and by developing a pull-based operator deployment approach, the sporadic issues due to operator mistakes were contained. For discrete

manufacturing and in service sectors, the same might not be applicable.

FUTURE DIRECTIONS

The operator generator errors are a common phenomenon in a mass manufacturing industry. Moreover, when a post-mortem is done, often there is a tendency to assign the defect in the category of “man” while doing a 4M analysis. But rarely, it is inquired what sort of challenge an operator has faced. If the complexity in the assembling process can be envisaged at the product design stage and can be addressed at the design stage only, the chance of minor one-off issues can be minimized. Usage of virtual reality tools like the virtual design for assembly can be very useful in this context. Deploying process and design Poke-Yoke at every possible stage and use of visual signals for helping the operators for following the right process are to fall in place.

Globally, the manufacturing industry is moving toward deskilling. The usage of automation and robots is growing exponentially. But in a hugely populous country like India where generating employment is a foremost national issue, there should be a judicious combination of utilization of operator skill as well as the deployment of the right tools for preventing mistakes in mass manufacturing to meet the global quality.

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