Low Cost Approach to Manufacturing Problem Solving

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Abstract—For today’s organization, much like the past, successful problem solving translates into enhanced productivity and increased profit. The more efficiently, effectively, and quickly problems get resolved the greater the propensity for improved product quality, enhanced production capabilities and realization of fewer dollars wasted on flow line maintenance. Achieving successful problem resolution remained an important endeavour in manufacturing for decades. Manufacturing problems are more likely a technical disturbance occurred in production line for which in current flexible manufacturing systems vast technical equipment are used which cost comparatively more. However the skill based human interaction with machine helps to procure the cause and depth of problem on temporary countermeasures with a low cost approach and result into successful problem resolution. To achieve this low cost approach to problem solving the best tool is to enhance the Man-Machine relation which simultaneously results into a quality production and enhanced inter relation between Process Measures and Results.

Index Terms—inventory inspection techniques, man and machine relation, process development, worker’s attitude and ethics

I. INTRODUCTION

Introduction to Problem Solver initiated to his insight towards calibrations of problem and the situation. Successful problem solvers recognize the value of structurally controlled problem-solving methods to promote discipline of processes and increase the productivity [1]. Problems must first be defined before an investigation of the causes can begin. Calibrating and implementing the solutions are the next phases of the process. Naturally, self describing the problem accurately and communicating the problem clearly to the defined measures is critical in successful problem solving methodology but practice and skill of accuracy emphasis it perfectly. The key to efficient and successful problem resolution is approaching the process with a systematic and logical methodology and accomplishing this through positive interpersonal interaction in manufacturing. This paper proposed results-oriented approach to problem solving through a straightforward and impactful model as follows in Fig. 1:

Figure 1. Process measures and results of the manufacturing system must be potentially interred connected. The combination of any to element gives the third one as precise and ideal output.

Process is accordingly sustain through the defined measures of appropriate and efficient working strategies and the desire output as increased productivity results through it [2]. So adhering to the standardized measures the improved results can be obtain from the sophisticated and well deliberate process. As this tri-pin is applicable to bring out desired results it also used as an inspection tool. The spruce contact of processes with the measures and standards always helps to inspect the functions and working of the processes, and thus the probable disruptions and defects easily detected. Likewise; continues accordance of Measures and Standards to the manufacturing process on account of every newly produced product enormously increases the quality assurance and reduce future large investment in highly advanced inspection technocrat. In so far Process and Measures plays a vital role in manufacturing problem solving, results that obtain also contribute an important factor as feedback at every level of process check, product check, quality check, flow check, etc. and hence the cycle cannot regulate properly without considering the outputs or results at large [3]. Thus this tri-pin conducts the three major purposes (as mentioned in application) of Productive Maintenance in manufacturing industries and adds value on test bench.

II. NEXT IS THE CUSTOMER

In every Mechanical Industry mainly in Manufacturing and Processing Industry the final product gone through the various sub workplaces or a process counters, where the final product is manifested in various parts and continued to the finalization and perfection over the production line. All work is a series of processes, and each process has its supplier as well as its customer [4]. A material or piece of information provided by a process A (Supplier) is worked on and improved in process B and then sent on to process C. The next process should

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always be regarded as a customer. This Axiom—the next process is the customer—refers to two types of Customers: internal (within the company) and External (Out in the Market).

Most people working in an organization deal with internal customer. This realization should lead to commitment never to pass on defective parts or inaccurate pieces of information to those in the next process. This axiom regulates the trend within a workshop to obtain precise products at each level of sub works or sub part manufacturing, and thus the accuracy and preciseness regulated through the production line from planning of product to the actual product in inventory which bounded to the perfection. When everybody in the organization practices this axiom, the external customer the market receives a high quality product or a service as result. While concentrating on a process series functions within the company or industry the external customer i.e. the receiver out in the market automatically move toward the satisfaction and quality assurance of the product. A real quality assurance systems means that everybody in the organization subscribes to and practices this axiom.

III. PROCESS CHECK ANALYSIS ACT (PCAA)

When in the organization internal customer axiom recruits; the Process Check Analyses Act subsequently must be practiced. It’s a four step cycle, primarily based on the temporary countermeasures. This cycle fully functioned through the TRI-PIN principle. Throughout the methodology we can observe that the relation between Process Measures and Results is well established and it always contribute to acquire positive results.

A. Process

Process must be in flow and small disruption must be calculated and resolve by the worker himself [5]. Process must be well regulated and rapidity of checking the process must do after the one forth regulation of 1 cycle. If in a batch there are 100 products, process must be checked after 25 products. This ratio apparently depends on several aspects like inline fluctuations, waste formation, take timing of product. According to the bulge of process the ratio must be checked and this can be decided virtually looking to the need of Man and Machine. For example: while working on a particular machine if the waste is saturating on a conveyer or on the belt of engine then the speed of machine-working get disrupted and productivity reduces, thus this disruption must easily get noticed by the worker and waste must be removed by simple leg-shake or any kind of stroke to that belt i.e. this quite simple problem must get solved by fine Process Check rather than certainly facing the machine stop and high technical problem solving decisions like production line stop.

B. Check

As the process is well regulated and most perfect in one batch after regular Process Check; every product must go under the ‘Improve by Comparing’ strategy. Which on certain compares the produced product to the previously produced product by simply holding it in your hand, touching it, feeling the subsequently generated properties of material like heated surface, texture etc., closely examining it, looking to the appearance [6]. This inspection can be taken through different measures like Texture of produced product, heat generated on machining surface, colour of the product after production, etc. These measures also called as ‘On Day Standards’. These standards may be change batch-wise or working day-wise or worker-wise, so these are not the fix measures and standards but definitely establish the immense similarity on instant working processes in group. This is the concept rise through the group technology. And this inspection method also called as ‘Reverse Check’. And only worker can fully utilise it on opt of precise working. This is the low cost approach to maintain the quality of product while working. But the major disruption in assembly line can create the bottleneck and continues production of defective pieces can occur. To avoid this; temporary countermeasure must be elevated to certain sophisticated calibrations like checking by ‘Comparing to Main Prototype’. Comparing to Main Prototype strategy can be utilise as Process Check in a certain ratio by calibrating relevance of procuring product to the desire one. This is instant tests practice in which there is no need of highly equipped technology. For Example: if the procured product found to have certain different material surface properties than the ‘On day Standard’ of previously all produced product the next low cost approach must be taken to have comparison with the main prototype available with the worker.

C. Analysis

The Process Check and ‘Continues Reverse Product Check’ collectively bring the desire product as output. But if in case the uncertain disruption occurred in manufacturing or in dimensions or in machining the suspected product must came to ‘Sight Lock’. Sight Lock is the strategy to ‘Quantify the Gap’ and analyzes the defect. It also called as detecting Gembutsu (in Japanese means something Physical or tangible). In this method the suspected piece is taken in consideration and bring apart from inventory. While working on another part the defective product is analyze simultaneously on an exact where it has gone defective and make concentration on the present product on machine with exact timing and process where the defective product goes wrong in manufacturing. In sight lock it may happen that the defective part had gone wrong at very first step of manufacturing process but this must be recognize the machine and measure holder himself. Likewise the phase of accuracy and perfection must be developed in worker through training. Except manufacturing defects dimensional defect and process disruption can cause the defective product. But according to discussed strategy of Next is the Customer and Process Check; manufacturing defect and process disruption will never be occurred.

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D. Act

After this fine analysis the defect get recognize if any. If the procured defect in previous product seems to rising in present product on machine also, process must be stop and one more sight lock must be done on about two defective products i.e. one in hand and one on machine. Now the sophisticated inspection must be carried out and exact cause of defect must be overcome. After using the strategies like Next is Customer and Process Check most probable reason of defect will be the machining defects, irregular work motion, inline fluctuation, worker’s own strategic irregularities, etc. which can inspected and overcome on instant. For more complex reasons the problem can be move to more elegant problem solving strategy involving Highly Equipped Technology. On other hand if defect does not rise in the product on machine. The process must be continued. And sight lock for defect must be done on next even and odd turn from the defective product to ensures that process and methods are not going wrong.

The process development through Process Check Analysis Act adds the outstanding values in problem resolution according to case study of OMMR 2013, Maharashtra.

IV. LOW COST APPROACH TO INVENTORY INSPECTION

If due to certain disruptions mentioned above production is on defective edge then the ‘REPORT DO’ strategy is used. This is the inventory base low cost approach which is conducted as soon the call from production line came to inventory inspection panel about having defective products as final output. This strategy onwards slightly moves towards sophisticated inspection process by using tools, but till it can be opt as low cost approach. Rather can say its methodology or a path arranged to have inspection on defects. The ‘Report Do’ strategy stands as follows:

A. Revise

Revise the product or process according to its specified measures or prototype. For this technique worker must be skilled and his accuracy level must well polished to detect problems by sight lock. Revising the procured product is the relative term, since the measures for comparing is received through the ‘On Day Standards’ which may be batch wise, worker wise or day wise. Thus the well liberated attitude must be developed in worker to have this accuracy level or skill.

B. Eliminate

After revising the process or product; eliminate the paradox or detect the defect with simple manual approach like gauging or scaling to standards. This is simple manual base inspection techniques in which no need of electronic inspection media is needed. In short develop the worker’s skill and attitude in such a way that the simple manual inspection techniques results as a highly equipped inspection output.

C. Pick Aside

After elimination of defective products, it must be pick aside in different working panel or inspection panel. There must be a record of no. of defective products from the sub-inventory is moving to re-functioning and this must be done in a comparative ratio.

D. Organize or Orient

By using group technology method under manual handling approach products must be classified according to the type of defect into different families. Although range of types of defect is very low in semi-automated and fully automated production line or machining line, defect must be classified significantly in different families for next operation. On regular production line there is an inspection department at certain. But adding the or obtaining the one another panel of inspection through the embedded inspectors of regular inspection department at various level, like Receiving Level Inspection Department, Laboratory Level Inspection department, Manufacturing Level Inspection department, and Dispatch level Inspection Department but be came together to inspect the defect and grouped it in various families of defects.

E. Research

Research on defect occurred must be done on various procured families of defective pieces. For this reason a communal of representative or actual skilled worker or expertise of various departments like from Research and Development Department, Process planning department, Designing Department, Production line Maintainer, Manufacturing Base Worker forms a team to have research on various families of products which are defective in case. It is the need of research on defective product but if this legislate as the rule of organization then there will not be excuse from any department to not to come for research as the defect not belong to his department. In short this representative must kept the basic knowledge of each department and the relation of other department with his own.

F. Transfer

All the researches done on the defective part families are implemented and likewise process plans are obtain to have the re-functioning of the defective products. Although the process plan for these defective products does not have the same attribute as the process plan for actual product, the separate timing for correction or separate worker batch must be employed in free time of production line or by knowing the exact defect these defective products must introduce to the regular production line. But both of these approaches have disadvantages as by the working on machines even in a free time of production line, the maintenance of machine can be disrupted and if the defective products are introduce in main regular production line the regular flow of production may be get blocked. So it is always a better option to have different machines on different manufacturing floor for correction in defective production [7].
This method is called ‘Re-Measure Implementation’. In this methods where the product gone defective, department wise work is done and desired changes are bring in Production line or in Production Methods. In so far the case is of defective production, sometime it may be happen that the defect cannot be removed and the product only can have scrap value. In such a case a representative from the marketing and managerial department must try hard and obtain a plan to save the defective product from total scrap and try to gain all possible utility from defective product in any other manufacturing need, this can be known as ‘Utility Transfer’. Else they must work toward the as possible much favorable scrap value for this product.

G. Develop

In this step the obtain measures from ‘Re-Measure Implementation’ is implemented on product in actual. As discussed above on different machine line or on regular machine line if there is assurance of no blockage in regular production and machine maintenance is well liberated.

H. Obtain

In this step the defect less product is obtain. These products have about 80% to 90% of Quality scale relative to regular precise procured product. But still these obtain corrected products are kept separate from regular batch of product. According to marketing ethics these slightly defective products are brought before the 100% quality scaled product or after the 100% quality scaled products in market [8]. Sometimes for more tactical marketing this semi quality scaled and fully quality scaled products are mixed together and bring in market. But it’s a matter of fact that there is no range of 100% quality scaled product.

V. MAN MACHINE RELATION

In highly automated era of manufacturing the man machine relation is indeed an important fact of consideration. Development of modern machines and production equipment, supported by advanced control systems, based on recent achievements of computer and software technology is necessary to fulfill client’s requirements. Significant number of manufacturing systems can work automatically with limited contribution of employees. However even in the advanced manufacturing systems still one of the most important factors is human being [9]. Usually the whole system performance depends on human decisions; the significance of them is higher than in the past, because of more complex and costly production systems. In such a situation, the importance of efficient utilization of manufacturing equipment by proper man-machine relation is necessary.

Today flexible manufacturing systems and computer integrated manufacturing systems has the successful collaboration of Human Intelligence and Non Human Intelligence i.e. machine intelligence. Still some little part of these systems worried about the devaluation of human creativity and correspondingly a human value in manufacturing field. At some level it may be true since we can find some supportive fact to this worry like increasing labor cost. While doing the interaction with labors among various industries under the survey MMR 2013, we came to the complex mode of man-machine relation where some said that the reason behind automation is increased labor cost while many thinks because of the automation labor cost is increased. This shows that still in many industrial areas the human intelligence and machine intelligence not going parallel.

Full automation of control functions in production appears to be impossible without losing flexibility and malfunctions’ resistance, what is the consequence of the complexity of present manufacturing systems. High performance, products quality, systems flexibility required from one side and complex problems solving, experience based learning from the other side require strict co-operation of the machine and human factor. The human and machine intelligence co-operation is strongly dependent on behavior of a man and control system. Human operator has very unique natural abilities that decide about his or her important role in manufacturing. The most important are: experience based self-learning, adaptation to new situations, high abilities of manual manipulation, very efficient sense feedback (eyesight, hearing, etc.), and possibility of innovative solution application. Those features decide about very strong advantages of man in automation. Automation is used to develop non human knowledge which contributed as non human intelligence [10]. The non human intelligence provides the dominant tool as control system to the automated production like accuracy, speed, complexity, deliberate control on time and efficiency. In today’s organizations this non human intelligence is common which in past sourced through human. So at some level automation reduces the human interfere in manufacturing but when it raise to the level where the mutant of this non human knowledge or intelligent doesn’t carry even a fraction of human intelligence it produce the new trend or new branch which requires more labor work. A very common and usual examples are social network, a non human intelligence of Internet bring the more human intelligent requiring software like facebook, twitter, and their many applications. On the opt to having the whole computerization systems in Banking Sector of India many union stands for worker welfare but today when banking sector is highly computerized many products coming which require more human interaction. So the Human and machine relation is strongly interconnected in every fraternity even and more emphatically in manufacturing. In manufacturing systems proper co-operation of human intelligence and Machine Intelligence can significantly improve whole production performance. In advanced manufacturing systems human factor plays even more important role than in the past, in spite of predictions from seventies that in fully automated production, operators would no longer be needed.

VI. TO DEVELOP A LOW COST APPROACH
This low cost approach for the manufacturing problem solving on actual working floor is systematically arranged for the primary solution manifestation in productions however the intensity of strategic precautions and use of highly maintained technology is a safer part. But Decision making skill and supervision accuracy always conducted by the worker always plays a vital role in the manufacturing. The strategy elaborated in the paper is oriented to the workers skill, knowledge and experience. So the only cost approach for the implication of it is a skilled worker and correspondent Industrial Trainings. The manufacturing problem solving through industrial training model was developed during a time when the environment within which work was performed was static and when workers were responsible for only small, routine job tasks, consistent with the scientific management approach to work. Problems encountered on the job were solved by supervision and were most often well-structured and predictable. The current manufacturing environment, however, is quite the opposite. The environment in which work is currently performed is dynamic and complex, with tasks which are relatively unstructured and undefined and that involve novel and changing demands. In fact, many of today’s manufacturing jobs require complex cognitive skills to deal with more highly technical and sophisticated manufacturing and customer service systems as well as the interpersonal skills necessary to function effectively in work teams. The historic conclusions suggests that linear problem solving models fail to account for everyday problem solving because they are ill-suited to the dynamic and generally chaotic conditions of the workplace. Current research supports problem solving as a situational and context-bound process that depends on the deep structures of knowledge and experience. Open skills, such as problem solving and decision-making may proceed through the use of contextual cues that interface with tacit knowledge rather than through the systematic application of explicit steps in the problem solving stage models [11]. Such a training models and working session must be carried out with the implicit regular working training to the labors and workers. Experience breeds the worker more mature at strategic level and on accuracy quotient. This low cost approach contributes tremendously in productive rate of the manufacturing floor or service consultancy desk. The only limitation in using this approach is that the entire strategy is human centered thus all human weaknesses directly affect the results.

VII. LIMITATIONS

The Major disruption can probably occur in the use of this approach is the unconscious working and low will power of the manufacturing worker.

The slight ignorance of manual working inspection methods can cause the imperial slot of defective products. One can be expertise in using this Method only by having experience on actual manufacturing floor.

Practice workshops and increasing Skilled approach for using this cycle is the major sector of Industrial training which can cause cost in case.

VIII. CONCLUSIONS

Equally important of having a set of process empowered and inspired through the standards and measures are critical to problem solving success. Without positive inter-personal interaction, problem solving is usually fruitless.

In today’s era the humanization of machines helped to access to the complete non-human intelligence likewise the mechanization of human will also help in accessing complete creativity, imagination and perpetual interaction of human. Together, high-performing measures and an effective process combine to create a problem-solving environment that produces the results prefect and spruce as desired in process plan. Simultaneously we can expect the Man contributory culture in manufacturing which emphasis the skills, inter-personal capabilities and creativity of human, which now a days has been limited to switching on and off of the main machine switch, and driving the transportation cab only.

REFERENCES


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