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PRODUCTIVITY IMPROVEMENT IN AN AUTOMOTIVE INDUSTRY USING BEST IN CLASS (BIC) TECHNIQUES

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Abstract

In the realm of economic globalization, industries grapple with numerous obstacles, including global economic downturns, suboptimal production efficiency, competitive pressures, and more. Addressing these challenges necessitates the implementation of effective operational tools. Mismanagement and inefficient utilization of manufacturing resources result in heightened production costs, diminished product quality, and extended delivery timelines. To mitigate these issues, the introduction of advanced business excellence strategies proves invaluable, with "Best In Class" (BIC) being one such approach. Enhancing productivity stands as a crucial determinant for a firm's survival and breakthroughs. Within the automobile industry's production domain, certain non-value-added activities (NVAs) consume extra time and effort, amplifying product costs and worker fatigue. Consequently, the industry's productivity suffers. This endeavor seeks to bolster production processes within the sector, thereby augmenting overall productivity by identifying and resolving pertinent issues through the application of BIC techniques. The influence of BIC extends to manufacturing procedures, corporate culture, employee well-being, and job satisfaction. By adopting the BIC methodology, a notable boost in productivity (approximately 105%) is achieved through cycle time reduction and optimized manpower employment in the wiring harness assembly line. Furthermore, this approach contributes to improved working conditions, enhanced workplace safety, superior product quality, streamlined shopfloor space, minimized waste, and energy conservation.

Keywords: Best In Class (BIC), Productivity, Automotive Industry, Wiring Harness Assembly.

1. INTRODUCTION

The Indian economy greatly benefits from the automotive sector, a key industry closely intertwined with manufacturing and services. Initially centered around vehicle imports, India's automotive sector has evolved to encompass assembly operations and the growth of automotive component manufacturing. This industry is at the forefront of productivity enhancement, quality assurance, cost-effective production, continuous improvement, supply chain development, and technological adaptation. Notably, World Class Manufacturing (WCM) leverages its manufacturing capabilities strategically, offering top-tier performance in productivity, quality, safety, environment, delivery, morale, flexibility, and cost to attain a global competitive edge. In the realm of contemporary manufacturing, organizational success hinges on the synergy of effective and efficient business practices. One avenue for enhancing operational and business performance is the adoption and refinement of a Best In Class (BIC) strategy. BIC, rooted in Japanese philosophy, has been honed through productive concepts and methodologies. It introduces an innovative paradigm striving for zero losses, abnormalities, breakdowns, accidents, and defects. BIC entails astute and strategic business management planning, directly influencing efficiency and effectiveness within the manufacturing organization. This comprehensive BIC approach encompasses nine facets: MOTO, MPPS, PLE, NYS, TPM, 3G, BEKIDO, VFM, and DIGITALIZATION. Consequently, BIC stands as a pivotal driver of productivity within businesses. It's not merely an unprofitable endeavor; on the contrary, its implementation holds the potential for long-term profitability.

2. BEST IN CLASS (BIC) PILLARS

Best In Class (BIC) is well structured & systematic approach that improves plant performance at a faster rate. It has nine pillars. The pillars of BIC are shown in the following fig. 1.

Fig.1 Pillars of BIC

2.1 MOTO

This is the activity to build the basis (foundation) of 'Monodukuri' (The act of making something) by looking back at origin in order to reestablish basics and standards. The main objective of the MOTO is to stabilize quality and improve productivity. Also, i) Visualization of the production site's condition and control. ii) Create a habit of keeping the rules. iii) Create a habit of 'continuous Kaizen' (up to target condition).

It consists the three pillars of the activity:

2.1.1 *5S Standardization:* This is the basic of all production control. It aims: i) Make a process to visualize abnormality. ii) Make an environment to follow the rules.

2.1.2 *License System for Operators:* Implementing basic training and approval system for operators. It aims assign worker who follow the standardized work and speed.

2.1.3 *Change Point Management:* It means reviewing the control standard. It aims Clarify the action for change points and maintain good product conditions. Whatever changes (4M) happens, These 3 Stable Pillars are necessary to support the Roof (Quality) through people with motivation.

The benefits of MOTO are; i) To improve overall discipline of the employee. ii) To improve 5'S of the factory. iii) To improve productivity of the factory.

2.2 MPPS (Manufacturing Process Plan Sheet):

Manufacturing Process Plan Sheet/ QC Process Sheet is abbreviated and called as MPPS. The main objective of MPPS is to maintain the product quality. Its benefit is to achieve zero defects.

2.3 PLE (Process Level Evaluation)

PLE stands for process level evaluation. There is standard check sheet for PLE. In this evaluation of process accuracy done with respect to PLE check sheet. The main objective is to strengthen the process. Its benefit is to improve productivity.

2.4 NYS Shikumi: Shikumi signifies a system; more specifically a holistic system, composed of elements and aspects. Its objective is strategic design and multi-objective optimization of distribution.

2.5 TPM: TPM means Total Productive Maintenance. It's objective is to increase OEE (Overall Equipment Effectiveness).

T	Total	Must involve all employees at all levels of the organization
P	Productive	Effective utilization of all resources
M	Maintenance	Keeping the Man- Machine- Material system in optimum condition

TPM consists nine pillars- i) KK- Kobetsu Kaizen ii) JH- Jishu Hozen iii) PM- Planned Maintenance iv) QM- Quality Maintenance v) DM- Development Management vi) E&T- Education & Training vii) OTPM- Office TPM viii) SHE- Safety, Health & Environment ix) VI- Vendor Improvement. The effectiveness of TPM is to improve PQCDSME (Productivity, Quality, Cost, Delivery, Safety, Morale, and Environment).

2.6)3'G*:* Gemba- Go to the actual workplace ii) Genjitsu- Know the actual situation iii) Gendustu- Give realistic solution. Its objective is to solve any type of problem that occurred on the shop floor. Its benefit is to improve productivity, quality, delivery, safety, etc.

2.7 BEKIDO: Bekido is the japanese consepts, it represents the optimal designed cycle time. It aims to create energy-efficient machine tools with low rates of downtime. This system helps manufacturers reduce waste and save time and money by improving the production throughput rate.

2.8 VFM (Visual Factory Management)*:* It is a systematic approach in manufacturing processes based on visual information throughout the workplace. The goal of visual management is to translate shop floor processes and production statuses into easy-to-understand visual overviews. The benefits of VFM are; i) Makes it easy to understand information quickly. ii) Keeps things running as designed. iii) It prevents mistakes or improves safety. iv) It reduces miscommunication. v) Improvements in the employees involvement and morale.

2.9 Digitalization*:* Digitization is the process of converting information into a digital form. Its objective is to protect original records by reducing frequent handling during reference use or reproduction through digitization. The benefits of digitalization are; i) Increased accuracy and speed. ii) Transparency- everybody gets access to the same real-time data. iii) Traceability- every step of the process can be tracked easily. iv) Manual document work eliminated means no waste of time.

3. METHODOLOGY

The methodology is nothing but a systematic way, in which theoretical analysis of the methods is applied to almost every field of study, or it is the theoretical analysis of the body of methods associated with a branch of knowledge. The concepts are generally classified into paradigms, theoretical models, phases and quantitative or qualitative techniques. A methodology is not providing a solution but is used to solve a problem theoretically, which is called "best practice". The detailed methodology is explained below:

3.1 Select*:* This phase selects or defines the improvement in the projects. It identifies critical requirements of customer & organization targets and links them to business needs. It also defines the business processes to be undertaken for continuous improvement by Kaizen way.

3.2 Measure*:* This phase involves selecting characteristics mapping the respective process, making respective measurements and recording the results of the process.

3.3 Analyze*:* In this phase, an action plan is created to close the gap between how things currently work and how the organization would like them to work in order to meet the goals for a particular product.

3.4 Improve*:* This phase involves improving processes or product performance characteristics to achieve the desired results or goals. This phase involves the application of scientific tools and techniques for making tangible improvements in productivity, performance, profitability as well as customer satisfaction.

3.5 Control: This process involves the process conditions to be properly documented and monitored. This phase requires institutionalizing SMAIC into day to day working of the organization. In this phase, the gains derived by certain specific projects are applied to the other projects as well for optimum results.

The person may require planning, communication, engineering, statistical and teamwork skills for applying the SMAIC method. Moreover, the right people and the right environment are crucial for effective applications of SMAIC methods for tackling process and product quality problems. The participation & commitment of top management is also necessary for successful implementations.

4. RESULT & DISCUSSIONS

4.1 Jig Board Modification

4.1.1 Statement of The Problem: This problem pertains to the trough fitment. In engine wiring harness (W/H) assembly line at trough fitment station during upper trough fitment, there is 6.38 minutes cycle time required which is bottleneck station due to four branches travel from single node where excess wires create a bulge in trough during upper cover fitment. Also, the wires get trap and cut/pinch. There is no inbuilt fool proof process.

Following pictures shows the excess wires create bulge in the trough during upper cover fitment.

Fig.2 Bulge in trough

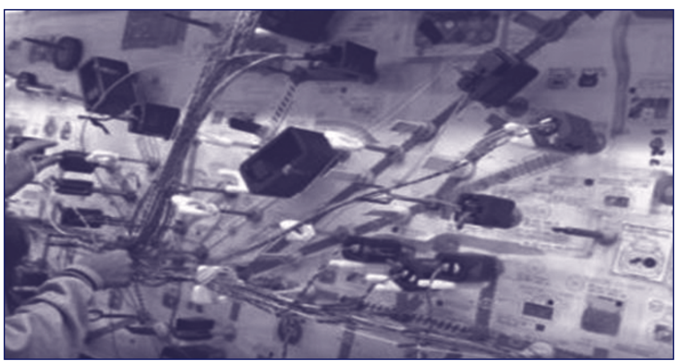


Fig.3 Jig board without modification

4.1.2 Input Data/ Structure/ Questionnaire:

i) Possibility of short circuit.

ii) Engine of vehicle will not work.

4.1.3 Analysis/ Solution/ Description:

This problem has been analyzed using the why-why analysis tool.

Why-why analysis:

Why1: Bulge in trough?

Answer: Excess wire length & jig board not as per the lower trough.

Why2: Excess wire length & jig board not as per the lower trough?

Answer: No wire length optimization & no modification in jig board as per lower trough.

Root Cause: No wire length optimization & no modification in jig board as per lower trough.

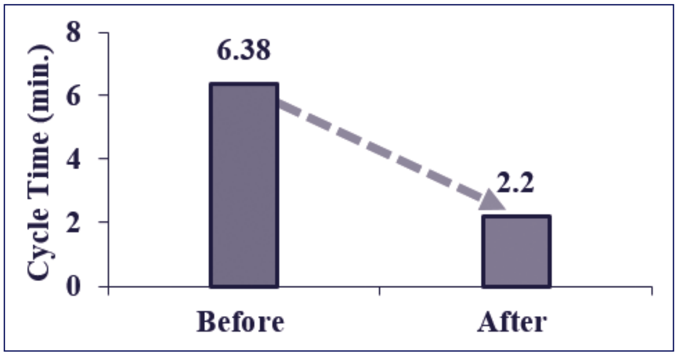
Following pictures shows the wire length optimized & jig board modified as per lower trough:

Fig.4 Upper trough fitment

Fig.5 Jig board with modification

4.1.4 Final Result: Cycle time reduced by 4.18 min. Following graph shows the results:

Fig.6 Result of cycle time reduction



4.1.5 Conclusion/ Benefits:

i) Cost saving of 17000 Rs./ month by optimizing wire length.
ii) Wire cut/ pinch eliminated.
iii) JPH increased by 19 nos./shift. iv) Increased production capacity of the assembly line.

4.1.6 Scope of Future Study:

i) Possibility of horizontal deployment on other line.

4.2 Line Balancing/ Appropriate Work Distribution of Cap Fitment

4.2.1 Statement of The Problem: In engine harness assembly line, there is low productivity due to separate workstation & one manpower for 16 nos. cap fitment due to no appropriate work distribution & line balancing.

Following pictures shows the separate workstation & one manpower for 16 nos. cap fitment:

Fig.7 Cap fitment on separate workstation

4.2.2 Input Data/ Structure/ Questionnaire:

i) Cap fitment process not cover within takt time. ii) Single piece flow not maintained.

4.2.3 Analysis/ Solution/ Description:

The approach to finding a solution to this problem is again by applying the why-why analysis tool.

Why-why analysis:

Why1: Low productivity?

Answer: Separate workstation & one manpower.

Why2: Separate workstation & one manpower?

Answer: No appropriate work distribution & line balancing.

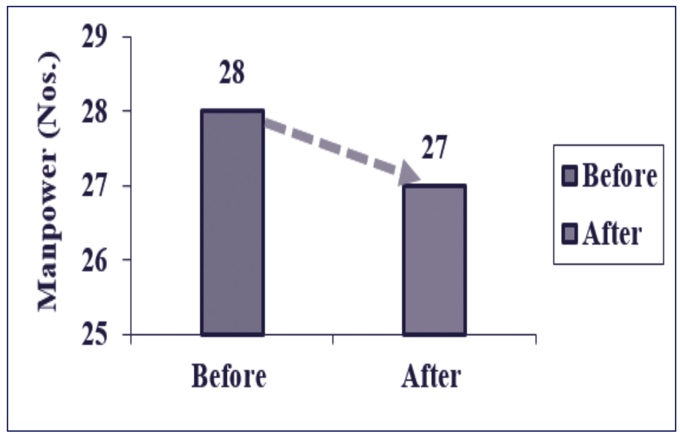
Root Cause: No appropriate work distribution & line balancing.

The following pictures shows the appropriate work distribution & line balancing to eliminate separate workstation & manpower:

Fig.8 Cap fitment distribution on jig board

4.2.4 Final Result: One manpower saved. Following graph shows the one manpower saving:

Fig.9 Result of manpower reduction



4.2.5 Conclusion/ Benefits:

i) Productivity improved by 5%.

ii) Reduce defect of cap missing.

iii) Maintained FIFO.

iv) Reduction of lead time by 2min/job. v) Cost saved by one man-power/shift.

4.2.6 Scope of Future Study:

i) Possibility of horizontal deployment on other line.

4.3 Process Combination of Trough Checker and Clip Checker

4.3.1 Statement of The Problem:

In engine harness assembly line at trough checker workstation, there is separate manpower used due to no combine of trough checker and clip checker workstations.

Following pictures shows the separate manpower for trough checker station:

Fig.10 Trough checker workstation

4.3.2 Input Data/ Structure/ Questionnaire:

i) Extra workstation on line.

ii) Poor line balancing.

4.3.3 Analysis/ Solution/ Description:

This problem has been analyzed with the help of why-why analysis tool.

Why-why analysis:

Why1: Separate manpower at trough checker workstation?

Answer: No combine of trough checker and clip checker workstations.

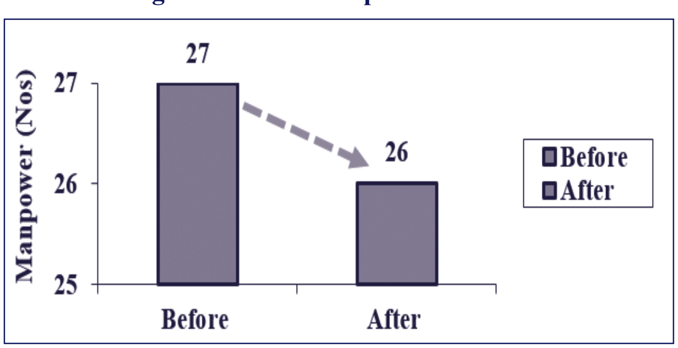
Root Cause: No combine of trough checker and clip checker workstations.

Following pictures shows the combined trough checker and clip checker workstations:

Fig.11 Cap fitment distribution on jig board

4.3.4 Final Result: One manpower saved. Following graph shows the one manpower saving:

Fig.12 Result of manpower reduction



4.3.5 Conclusion/ Benefits: This improvement provides the following benefits:

i) Cost saved by one man-power/shift (people/stage-owner). ii) Easy for Supervision.

iii) Productivity increased by increasing Output/man. iv) Better space utilization.

v) Appropriate work distribution. vi) Zero inprocess inventories, Just In Time (JIT), Single

piece flow & First In, First out (FIFO) achieved. vii) Possible fatigue prevented.

4.3.6 Scope of Future Study:

i) Possibility of horizontal deployment on other harness assembly lines.

4.4 The Actions Taken for Productivity Improvement

Table.1 The Actions Taken for Productivity Improvement

Sr. No.	Improvement Details	Benefits	% Productivity
01	MUDA of waiting for W/H packing	Process time reduced by 30 sec./ job.	2%
02.	Re-layout of engine line to reduce the movement MUDA	Distance reduced by 113 meters.	1%
03.	Combine the operation of cap fitment on jig board conveyor with taping portion	One man-power/ shift reduced.	5%
04.	Grommet insertion fixture modification	Process time reduced by 43 sec./ job.	2%
05.	CRI process element shift on previous station	Two man-power/ shift reduced.	10 %
06.	Glow plug checker station combine with clip fitment station.	One man-power/ shift reduced.	5%
07.	Sub-assembly station de-bottlenecking to meet takt time.	Cycle time reduced by 2 min./ job.	7%
08.	Glow plug process shifted on SA 6 and work redistribution done.	One manpower reduced.	5%
09.	Protector cap fitment combine with grommet operation	One manpower reduced.	5%

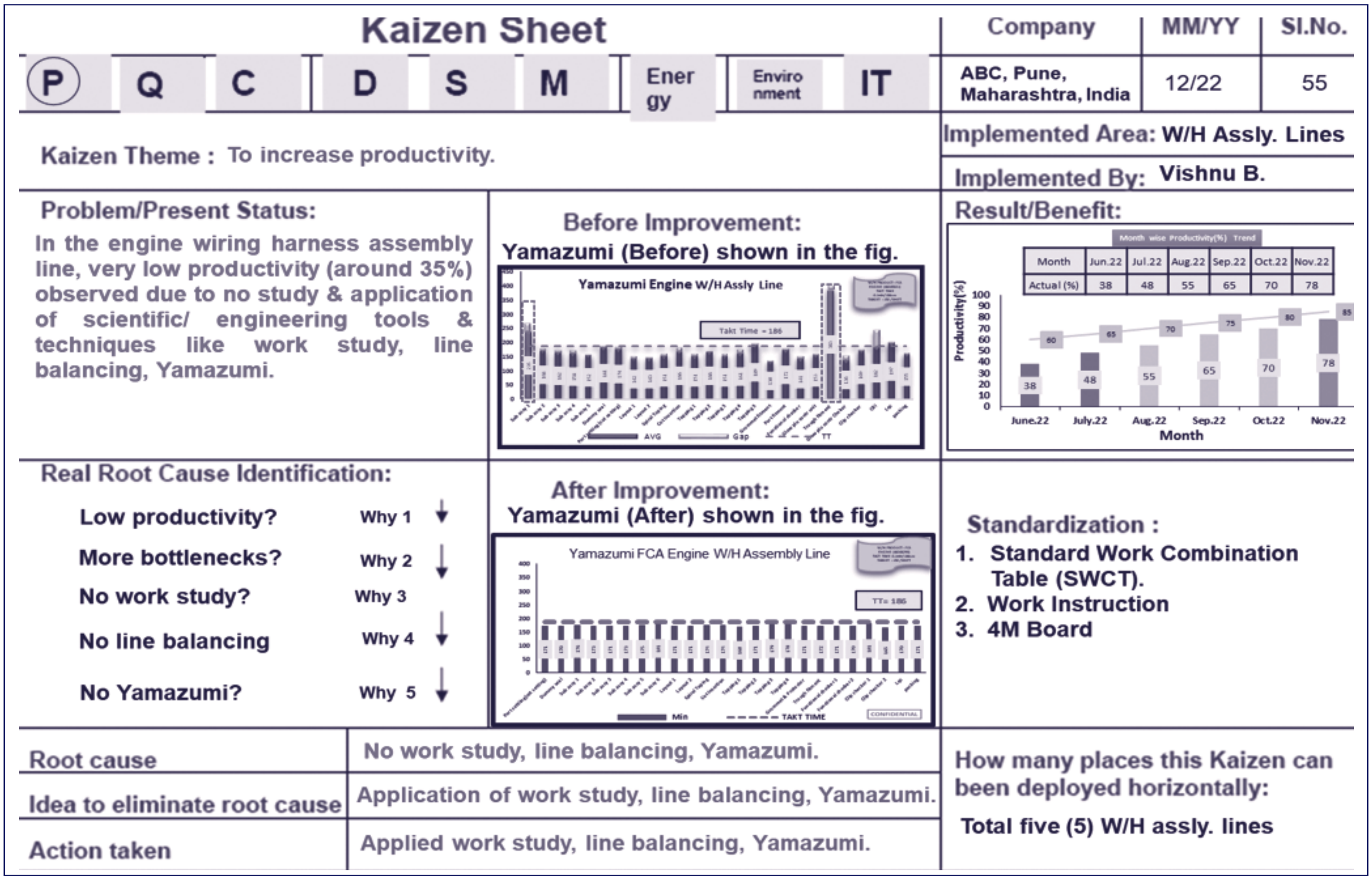
4.5 The Summary of Actions Taken for Productivity Improvement

Table.2 The Summary of Actions Taken for Productivity Improvement

No. of Actions Identified	Actions Completed	Actions Inprocess	No Actions
55	55	0	0

4.6 Kaizen Sheet

Fig.13 Kaizen sheet



5. CONCLUSION

The increased customer expectations and global competition forces manufacturing companies to improve productivity at lower costs and still retain excellent product and service quality. In this study, we discussed one of the major matters, i.e. maximum effectiveness & productivity with minimum efforts required by applying the 'Best In Class' (BIC) techniques.

Noteworthy benefits are summarized as follows:

i) Productivity improvement by reduction of bottleneck stations.

ii) Cost saving by manpower reduction.

iii) Minor stoppage reduction.

iv) The productivity improvement system strengthened in other W/H lines by horizontal deployment.

v) Work fluctuation rate reduced.

vi) Commonization of assembly processes to reduce cycle time.

vii) DWM practicing increased.

viii) QSR activities initiated to improve product quality & reduce minor stoppage loss.

ix) Effective involvement of production people in problem solving.

x) BIC (Best In Class) training imparted as per plan.

xi) Lower WIP inventory achieved.

Following graph shows the result of productivity improvement (W/H Assembly Line):

Fig.14 Month-wise productivity trend

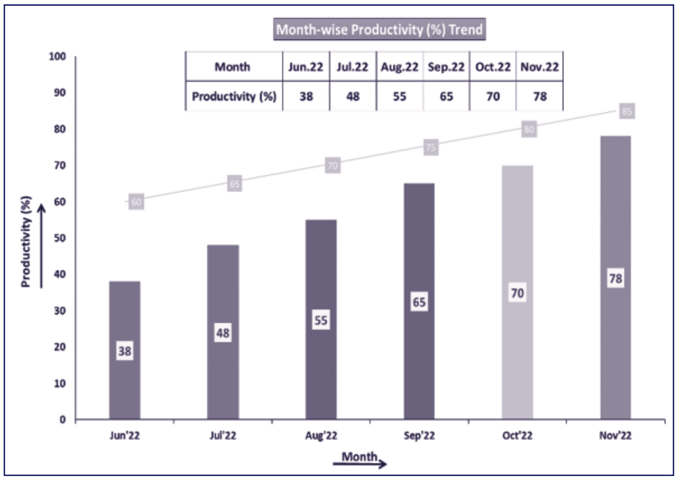
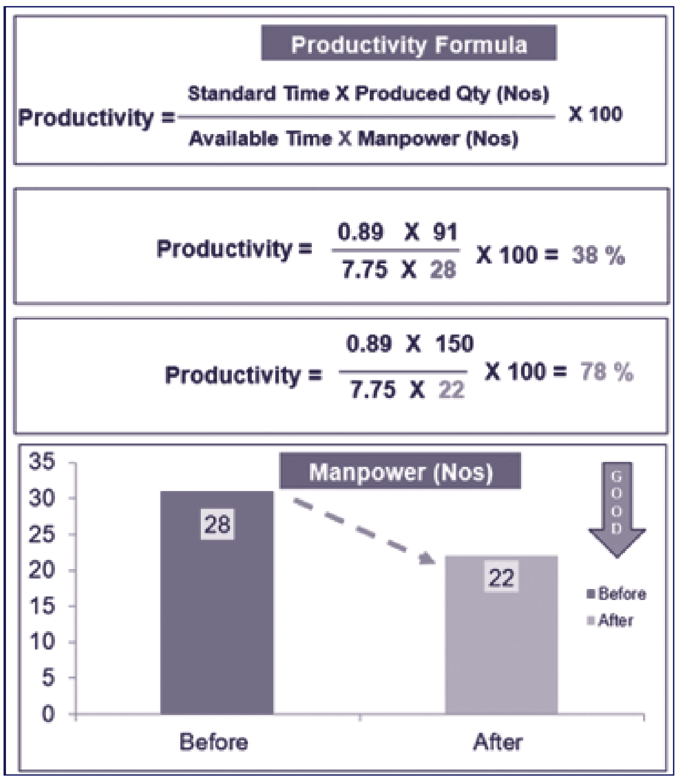


Fig.15 Productivity before & after



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