International Journal of Research in Advent Technology (E-ISSN: 2321-9637) Special Issue
National Conference "IAEISDISE 2014", 12-13 September 2014

Time Reduction using Change Concept for Agility-A Case Study

Pankaj Sharma [1], Dr.P.Thareja[2], Dr. G.S. Brar [3], Vikas Ucharia [4], Rupinder S. Kanwar[5]
School of Mechanical Engineering[1, 2, 3, 4, 5], Bahra University[1, 4, 5] PEC University[2] GNDEC, Ludhiana[3]
Email: Sharma.pankaj230@gmail.com[1]

Abstract- A change concept is a general approach to change that has been found to be useful in developing specific ideas for changes that lead to improvement. The ability to develop, test and implement changes is essential for any group or organization that wants to improve continually. After generating ideas, run Plan-Do-Study-Act (PDSA) cycles to test a change or group of changes on a small scale to see if they result in improvement. Concept of managing time provides an opportunity to make time a focal point for improving any organization. An organization can gain a competitive advantage by reducing the time to develop new products and cycle times for all functions in the organization. Present study at TATA Motors had been done for the dressing of different engine blocks before testing and time was noted down. The whole process was analyzed properly and use of Coupling for exhaust, Plug for rectifier supply and Quick Release Coupling for fuel supply connection was improvised. After applying change concept, productivity is improved by decreasing the dressing time.

Index Terms- Time Reduction; Change Concept; Productivity Improvement; PDSA cycle.

1. INTRODUCTION

Change Concept plays an important role in any effort to improve. Since improvement comes from the application of knowledge, any approach to improvement must consider how knowledge is obtained and applied. An article in 1996 on Quality Progress [1] introduced methods to facilitate creative thinking and to integrate these methods into improvement activities using the Model for Improvement [2]. The use of the model encourages making improvements by obtaining new knowledge, then using this knowledge to develop, test, and implement changes. A practical approach to enhancing organizational performance identified seventy-two change concepts, falling under nine overarching categories. These categories are: eliminating waste, improving work flow, optimizing inventory, changing the work environment, enhancing the consumer relationship, managing time, managing variation, designing the system to avoid mistakes, and focusing on a product or service.

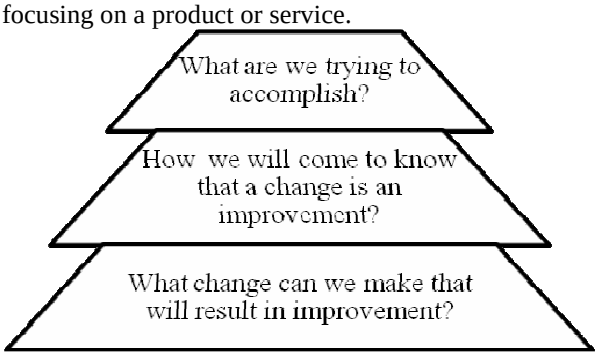


Fig: Model for Improvement

Originating from a general and abstract change concept, a change idea is an actionable, specific idea for changing a process. Change ideas can come from research, best practices, or from other organizations that have recognized a problem and have demonstrated improvement on a specific issue. Change ideas can be tested to determine whether they will result in improvement and are often revised as a result of these tests. Teams test change ideas by running Plan-Do-Study-Act (PDSA) cycles, which are also called tests of change. These tests of change are about learning what works and what does not in your efforts to improve your processes. Initially, these cycles are carried out on a small scale to see if they result in improvement. Teams can then expand the tests and gradually incorporate larger and larger samples until they are confident that the changes will result in sustained improvement. It can be challenging to get started and know when or how to begin the first PDSA cycle in an improvement process. With each PDSA, teams will improve the design of their change ideas and be able to determine how big (or small) subsequent PDSA cycles need to be.

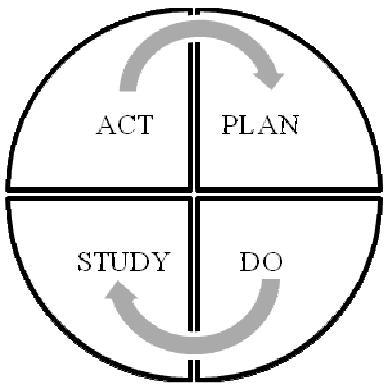


Fig: PDSA Cycle

The PDSA Cycle is commonly used for Continuous Quality Improvement (CQI) through Change Concept. It is generally known as 7 Step CQI Process. The seven steps which come under it are as follows:

1) PLAN
- Identify area for improvement.
- Define current situation.
- Analyze current situation.
- Set goals based on process needs.

2) DO
- Implement best changes

3) STUDY.
- Analyze what happened.

4) ACT
- Monitor results.
- Standardize and Plan further.
- Make sure changes are permanent.

It is important to remember that there is no one-size-fits-all solution to reaching your destination. Knowledge about a system, combined with change concepts, can lead to creative change ideas that lead to improvement in that system. This convergence of knowledge, change concepts, and change ideas is referred to as a "Change Package" [3]. A change package consists of a number of high-level outcomes supported by evidence-based concepts and change ideas that, when implemented, bring about quality improvement. A change package is created by experts to capture what is known about best practices and processes based on evidence from literature, research, and the experiences of others. CQI is a systems approach that may be used to describe and improve an existing service or product or to design a new service or product. CQI had its origins in research done by Walter Stewhart of Bell Laboratories in the 1930s. Stewhart showed by using intricate statistical means if variations in a process were due to randomness or were the result of a faulty process itself. Stewhart subsequently proposed to increase quality by decreasing the faulty elements of the process. The systems approach, which is used in CQI, is "both a management philosophy and a management method."[3] The philosophical basis of CQI is the assumption that problems in producing a quality product arise most often not from "a lack of will, skill or benign intention among the people involved in the processes," but most often from a "poor job design, failure of leadership or unclear purpose." "Quality can be improved much more when people are assumed to be trying hard already" [4]. Guiding principles of expected behavior are another shared organizational policy that may be developed and utilized by health care organizations in CQI. The guiding principles "reflect the organization's assumptions about the responsibilities and desired actions of leaders for the creation of a learning environment for work" [5]. These principles can place the approaches of Deming's 14 points for Management, Juran's 6 steps to Quality Improvement, or Crosby's 14 steps to Quality Improvement into models for developing an organizational quality improvement environment. From these 3 philosophical methods leadership preferably with input from employees can evaluate and choose the most suitable, stepwise approach for enacting quality improvement.

2. CASE STUDY

***Company Profile*:** Tata Motors Limited is the leader in commercial vehicles in each segment, and among the top in passenger vehicles with winning products in the compact, midsize car and utility vehicle segments. It is also the world's fourth largest truck and bus manufacturer. The Tata Motors Group's over 55,000 employees are guided by the mission "to be passionate in anticipating and providing the best vehicles and experiences that excite our customers globally." Tata Motors is committed to improving the quality of life of communities by working on four thrust areas - employability, education, health and environment. The goal of environment protection is achieved through tree plantation, conserving water and creating new water bodies and, last but not the least, by introducing appropriate technologies in vehicles and operations for constantly enhancing environment care. With the foundation of its rich heritage, Tata Motors today is etching a refulgent future.

PROLIFE is a pioneering product support strategy in India, from Tata Motors Ltd, operational from its head quarter at Lucknow and a franchisee unit at Coimbatore Tata Motors laid the foundation of Prolife in year 1999 at Delhi, Later it was shifted to Lucknow in 2003 Prolife offer reconditioned Long Block and the other aggregates to customer in exchange of their failed/old engines & aggregates, Reconditioned aggregates are placed with our agents/Dealers, the customer comes to agents with his failed vehicle and reconditioned aggregate is fitted on his vehicle against the failed aggregate. The failed/old aggregate is sent back to Prolife; this aggregate is reconditioned and sent to agents for exchange

***Problem Statement*:** The study of time reduction using change concept had been done at Tata Motors Prolife. The problem encountered by organisation was less productivity and less profit to the company. The quality of the product was the biggest challenge for the organisation and the time taken for the dressing of engines was very much high.

***Problem Formulated*:** In this study time was noted down for the dressing of engine blocks before the testing and then some ideas using change concept were given for the change to improve the quality and

reduce the time as well so as to increase the productivity and profit.

Time Study for Dressing of Engine:-

Time Study - Engine Testing (Model - 6 BT) with load					
Operation	S.No.	Work Content	Time (min:sec)		
			D1	D2	T1
Engine Dressing	1	Bringing engine from engine assembly	04:09		
	2	Fitment of dowels & bolts	02:37		
	3	Fitment of fuel injectors		03:32	
	4	Fitment of tensioner, alternator, pulley & belt	07:07		
	5	Fitment of mtg. bracket & dummy plate(air compressor)	02:34		
	6	Fitment of FIP & feed pump		08:09	
	7	Fitment of H.P line & leak off line		07:46	
	8	Fitment of turbocharger assembly	06:46	06:46	
	9	Fitment of flywheel & flywheel hsg.	08:33	08:33	
	10	Fitment of dummy plate of cordon shaft	05:19		
	11	Fitment of oil filter		01:21	
	12	Fitment of coolant		02:29	
		Total Time :-	37:05	38:36	
Engine Loading	1	Loading engine to testing trolley		03:12	
	2	Trolley docking to test bed		02:15	
	3	Connection of Coolant hoses	04:08		
	4	Connection of intercooler hoses	03:36		
	5	Connection of fuel supply		04:45	
	6	Connection of exhaust pipe	04:16		
	7	Connection of rectifier supply & throttle wire		02:58	
	8	Connection of cordon shaft to dummy plate	05:28		
	9	Connection of oil pressure gauge		01:24	
	10	Filling of lubrication oil into sump		02:48	
		Total Time :-	17:28	17:22	
Engine Testing	1	Engine cranking & starting			07:22
	2	Engine test cycle running			30:36
	3	Checking of noise & leakage			02:16
	4	Draining of water			03:11
	5	Card filling			02:06
		Total Time :-			45:31
Engine Unloading	1	Removal of oil pressure gauge		01:21	
	2	Removal of exhaust pipe	04:19		
	3	Removal of fuel supply		02:29	
	4	Removal of throttle wire & rectifier supply		02:30	
	5	Removal of Coolant Hoses	03:28		
	6	Removal of intercooler hoses	02:45		
	7	Removal of cordon shaft to dummy plate	03:23		
	8	Trolley Undocking from test bed		03:01	
	9	Unloading engine from testing trolley		04:37	
		Total Time :-	13:55	13:58	
Engine De-Dressing	1	Removal of oil filter & plate(air compressor)		03:03	
	2	Removal of flywheel & flywheel hsg.	07:32	07:32	
	3	Removal of HP line	05:06		
	4	Removal of FIP & feed pump	06:02		
	5	removal of dummy plate		02:31	
	6	removal of mtg. brackets		02:39	
	7	Removal of turbocharger assembly	05:45	05:45	
	8	Removal of fuel injectors	03:27		
	9	Removal of alternator, tensioner & pulley		06:05	
	10	Keeping block in PDI		02:40	
		Total Time :-	27:52	30:15	
		Grand Total Time :-	1:36:20	1:40:11	0:45:31

Table: Time Study for Dressing of Engine

After noting down the time area for improvement is identified and ideas were generated for a change so that time can be reduced to increase the productivity.

***Proposal 1*:-**

In connection of exhaust pipe coupling method can be used rather than connecting it with Air Runner as in fig.

Fig: Coupling for exhaust

***Proposal 2*:-**

Different Benzo can be fitted to the different FIP's and with help of QRC (Quick Release Couplings) for fuel supply connection time can be saved as in fig.

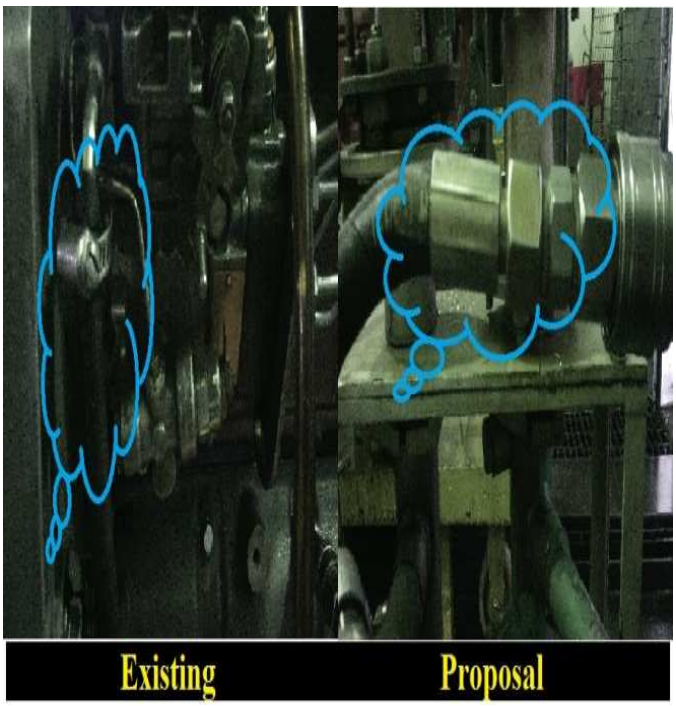


Fig: QRC for fuel supply

***Proposal 3*:-**

In place of connection of separate H.P line, it can be formed as a group and can be fixed in less time as in fig

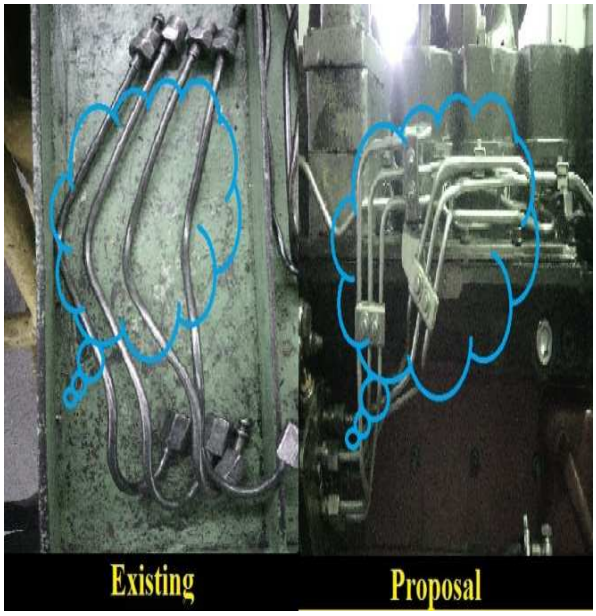


Fig: Group for H.P Line

***Proposal 4*:-**

For connection of rectifier supply plug can be used in place of connecting it with ring spanner as in fig.

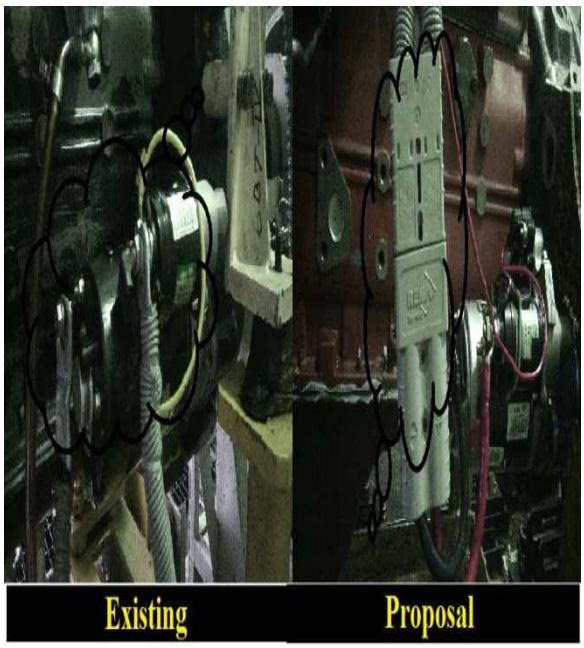


Fig: Plug for Rectifier Supply

These four proposals were given for a change to increase the productivity of the engine blocks and applied on a small scale. After applying the changes time was noted down again to check the applicability of changes made.

Time Study after applying changes:-

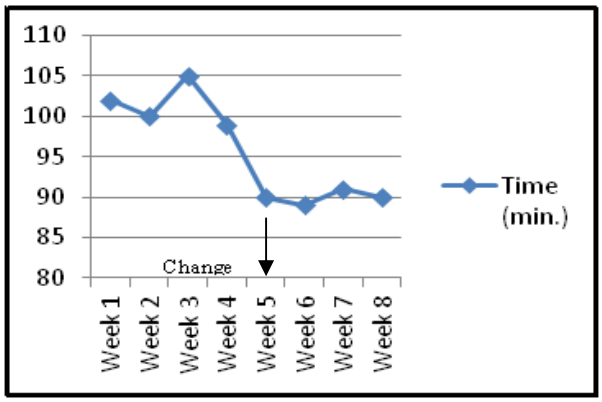
Time Study - Engine Testing (Model - 6 BT) with load					
Operation	**S.No.**	**Work Content**	**Time (min:sec)**		
			D1	**D2**	**T1**
Engine Dressing	1	Bringing engine from engine assembly	04:09		
	2	Fitment of dowels & bolts	02:37		
	3	Fitment of fuel injectors		03:32	
	4	Fitment of tensioner, alternator, pulley & belt	07:07		
	5	Fitment of mtg. bracket & dummy plate(air compressor)	02:34		
	6	Fitment of FIP & feed pump		08:09	
	7	Fitment of H.P line & leak off line		04:56	
	8	Fitment of turbocharger assembly	06:46	06:46	
	9	Fitment of flywheel & flywheel hsg.	08:33	08:33	
	10	Fitment of dummy plate of cordon shaft	05:19		
	11	Fitment of oil filter		01:21	
	12	Fitment of coolant		02:29	
		Total Time :-	37:05	35:46	
Engine Loading	1	Loading engine to testing trolley		03:12	
	2	Trolley docking to test bed		02:15	
	3	Connection of Coolant hoses	04:08		
	4	Connection of intercooler hoses	03:36		
	5	Connection of fuel supply		02:15	
	6	Connection of exhaust pipe	02:36		
	7	Connection of rectifier supply & throttle wire		00:48	
	8	Connection of cordon shaft to dummy plate	05:28		
	9	Connection of oil pressure gauge		01:24	
	10	Filling of lubrication oil into sump		02:48	
		Total Time :-	15:48	12:42	
Engine Testing	1	Engine cranking & starting			07:22
	2	Engine test cycle running			30:36
	3	Checking of noise & leakage			02:16
	4	Draining of water			03:11
	5	Card filling			02:06
		Total Time :-			45:31
Engine Unloading	1	Removal of oil pressure gauge		01:21	
	2	Removal of exhaust pipe	02:09		
	3	Removal of fuel supply		01:29	
	4	Removal of throttle wire & rectifier supply		00:45	
	5	Removal of Coolant Hoses	03:28		
	6	Removal of intercooler hoses	02:45		
	7	Removal of cordon shaft to dummy plate	03:23		
	8	Trolley Undocking from test bed		03:01	
	9	Unloading engine from testing trolley		04:37	
		Total Time :-	11:45	11:13	
Engine De-Dressing	1	Removal of oil filter & plate(air compressor)		03:03	
	2	Removal of flywheel & flywheel hsg.	07:32	07:32	
	3	Removal of HP line	04:26		
	4	Removal of FIP & feed pump	06:02		
	5	removal of dummy plate		02:31	
	6	removal of mtg. brackets		02:39	
	7	Removal of turbocharger assembly	05:45	05:45	
	8	Removal of fuel injectors	03:27		
	9	Removal of alternator, tensioner & pulley		06:05	
	10	Keeping block in PDI		02:40	
		Total Time :-	27:12	30:15	
		Grand Total Time :-	1:31:50	1:29:56	0:45:31

Table: Time Study after applying changes

When the changes made were successful then they were applied for the whole process which is the last step of PDSA cycle.

3. CONCLUSION

The change concept for improvement, results very good to reduce the time for engine dressing and increase the quality and productivity of the engine blocks. The productivity is increased by 15% and the down time of engine is reduced as well.
As shown in the graph before week 5 the cycle time was high but after making changes it is reduced from 100 min. to 90 min.



REFERENCES

[1] Provost, L. and Sproul, R. (1996), "Creativity and Improvement: A Vital Link," Quality Progress.
[2] Langley, G.J., Nolan, K.M. and Nolan, T.W. (1994), "The Foundation of Improvement" Quality Progress.
[3] Langley, G.J., Moen, R., Nolan K.M., Nolan T.W., Norman C.L., and Provost L.P. (2009), "The Improvement Guide: A Practical Approach to Enhancing Organizational Performance".
[4] Graham, N.O. (1995), "Quality in health care"
[5] Gaithersburg, MD: Aspen Publishers, Inc.
[6] Batalden, P.B. and Stoltz, P.K. (1995) "Quality management and continual improvement of health care: a framework", The Journal of Continuing Education in the Health Professions.
[7] Brar, G.S., Ucharia, V., and Kanwar, R.S. (2013) "Growth through Engineering Six Sigma", International Conference on Research and Innovations in Mechanical Engineering.
[8] Sharma, P., Ucharia, V., Kanwar, R.S. and Rafi, M. (2014) "MSA and Process Capability Effective Tools of Six Sigma to Enhance the Productivity", National Conference on Innovation in Engineering, Pharmaceutical, Legal and Management Sciences.
[9] Sharma, A., Sood, A., Kanwar, R.S., Ucharia, V. and Babbar, S. (2014) "Application of Agile Manufacturing New Designs and Enhance Cycle Time: A Case Study", National Conference on Innovation in Engineering, Pharmaceutical, Legal and Management Sciences.