

# **Understanding Innovation in Maintenance and Repair Ecosystem**

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**By:**

**Jayesh Vinod Jadhav  
(Roll number : 22B1056)**

**Guided by:**

**Prof. Pankaj Sekhsaria  
(CTARA, IIT Bombay)**

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Lastly, I would also like to thank Mr. Tauseef Sheikh who accompanied me on my field visits in Malegaon and provided much of the information about innovations in the town.

## 2. INTRODUCTION

This report analyses the unorganized sector of maintenance and repair. The report is divided in two main parts. The first part concerns the repair workshops in Powai region in Mumbai. It mentions the kind of daily work happening inside these workshops, the life of people involved in this ecosystem, the economic aspect of their work in terms of incomes of owners of the workshops and workers employed by them. It then takes a brief look at a common innovation in Powai that involves modification of bikes.

The second part of the report concerns the innovations done in automobile repair workshops in Malegaon town in Northern Maharashtra. It mentions different kinds of innovations done in Malegaon, the economic aspects of these innovations, and then compares the innovations done in Powai region in a large city like Mumbai to the innovations done in a relatively small town like Malegaon.

It should however be noted that these two main parts are divided to form four topics in the report corresponding to sections numbered 4 to 7 in the contents table.

## 3. METHODOLOGY

The regions of study include Powai region in Mumbai and Malegaon town in Nashik district in Northern Maharashtra.

1. The study in Powai is based on visits to four repair workshops. One person was interviewed in each of these workshops. Two of the people interviewed were owners, while the other two people interviewed were workers in their respective

workshops. Out of the four workshops visited, three were for repairing bikes, while one was a car repairing workshop.

2. The study in Malegaon is based on visits to ten sites and interviews with thirteen people. Ten of the people interviewed were repair mechanics on sites, two of them were Inspector of Motor Vehicles and the last was Mr. Tauseef Sheikh who accompanied me to these sites.

## **4. ANALYZING MAINTENANCE AND REPAIR IN POWAI REGION**

### **DAILY WORK IN REPAIR WORKSHOPS**

The daily repair work in the repair workshops involves small repairs in bikes. Some common type work includes servicing of bikes, cleaning fuel tank and carburetor, changing engine oil, and resolving problems in wiring (of horns, indicators, battery, etc.) in bikes.

The working hours generally range from 10 hours to 13 hours per day. The mechanics said that the number of bikes that they repair in a day varies, but as per the observation made, the mechanics usually take 15 to 30 minutes to repair one bike. If it be assumed that the mechanics are working all the time in their 10 hour working day, then it can be roughly estimated that they repair at least 20 bikes in a day.

### **ECONOMICS OF REPAIR AND MAINTENANCE**

The workshops were generally small in size with an average godown size of 15 ft. by 15 ft. The rent for these godowns was found to be Rs. 14,000 in Powai. Some additional space is also used by the mechanics to repair the bikes. This additional space could be in front of the shop or beside the shop. The godown is used to store the bikes that take more than one day to repair, or the bikes that are to be modified (we will take a look at modification in a later topic).

Other expense includes payment to the BMC (Brihanmumbai Municipal Corporation) and the Police. As per the information given by a workshop owner, Rs. 4,000 is paid every month to the BMC and the Police combined.

The profit margin for the small daily repair is nearly 50 per cent. The material for repair is bought from the spare parts shops in wholesale market. One such wholesale market is in Opera House region in Mumbai.

Out of the four shops visited, the data on number of workers (including the owner) is:

Shops	Shop 1	Shop 2	Shop 3	Shop 4	
No. of workers	2	2	3	4	Total = 11 Average = 2.75

On an average, there were 3 workers per shop.

The income of the owners ranges from Rs. 20,000 to Rs. 60,000. There is no upper limit on the income of the owners but a lot of hard work needs to be done in order to go beyond Rs. 80,000. Needless to say, there are some workshop owners that do achieve higher incomes. The income of the owners depends on

1. the popularity of the shop
2. experience of the owner
3. number of hours that the mechanics work for
4. number of workers in the workshop
5. number of customers of whom the owner has been able to gain the trust of
6. quantity of innovations that supplement the income by common repair work

The income of the workers ranges from Rs. 4,000 to Rs. 15,000. The income of the workers depends upon the amount of experience and skills acquired.

## **LIFE OF REPAIR MECHANICS**

The repair mechanics do not have any formal education in their field of work. The average educational qualification of the repair mechanics is much below class 10<sup>th</sup> level. The highest qualified repair mechanic that was interviewed had passed 11<sup>th</sup> class. Most of the repair mechanics are from Uttar Pradesh, but there are also workers from Bihar and Orissa.

A mechanic's journey starts by working in a garage as a worker at an age 14 to 18 years. He gains knowledge and experience under the employer's guidance. After working in someone else's garage as a worker, the mechanic generally leaves his job to open his own garage.

Let us now take a look at story of a worker as told by him:

"Working in our village is not profitable. . . I was forced to work for a living after passing class 10<sup>th</sup>. So, I started learning to repair cars, and this is when I came to Mumbai. Only three people in my village own a car, so, going back to village and working there as a car mechanic is not a good idea. The pay received from the people living in the village is also low compared to the pay received from the people in Mumbai for the same work that we do."

“I however do regret the decision to choose to learn car repair; I should have learned bike repairing work instead (Consistent with the fact that 75% of vehicles in India are two wheelers).”

“When I came here from Uttar Pradesh 6 years ago, to join the garage, my starting salary was Rs. 4,000, after working for 1 year it increased to become Rs. 7,000. After working for some 2 years or so, I was paid Rs. 10,000 then again in two years the salary became Rs. 12,000 and now after 6 years of joining the workshop, my salary is Rs. 15,000. Living in the city is not a problem. There are relatives of mine living here. I just need to make food for them sometimes. So, I am able to send most of my income to my home in UP.” said a worker in a car repairing workshop. The worker added that he was not yet fully skilled in the work he does and knows only the mechanical part of the repair work, whereas his *seth*(boss/employer) looks after the repair work of the electric parts of the vehicles.

The state of the workers in two wheeler garages was also found to be similar to the person working in a car repair workshop. A worker in a two wheeler garage said that he was paid a salary of Rs. 12,000 per month. When asked a workshop owner, he said that he generally pays the workers a salary lying in the range of Rs. 7,000 to Rs. 10,000 per month. Another worker in the two wheeler repair workshop said that he is paid Rs. 14,000 per month.

Nearly all the workers working in the repair workshops have migrated to Mumbai from a different state. However, they all share a common version of the story as mentioned in the beginning of this section.

These workers come to Mumbai, work hard, and then rise above in level from workers to workshop owners after gaining enough skill and experience in the repair work.

The life of the owners of the workshops with monthly income ranging from Rs. 20,000 to Rs. 60,000 was found to be better compared to the workers. The workshop owners often live in the house of their own. They are generally in their 30's and can afford education to their children.

## **5. ANALYZING INNOVATION IN POWAI REGION**

There are a few innovations going on in Powai. Innovations consist of modification of old bikes into new bikes. Customers interested in modifying their old bikes, which are out of use, come to the workshops for getting their bikes modified, so that the bikes get a new look and proper working condition for being ridden on roads.



Fig1. Original Yamaha FZ  
(Source: Google Images)



Fig 2. Modified Yamaha FZ  
Notice the conversion to dual tank and the modification in silencer, which are illegal modifications





Fig 3. Yamaha RX100 given a brand new appearance  
Note that the production of Yamaha RX100 was stopped in 1996



Fig 4. Royal Enfield old model with left side brake restored to complete working condition

The workshop owners take Rs. 40,000 to Rs. 60,000 from the customers to modify a bike. It takes 2 months to modify a bike and 5 to 6 bikes are modified in a year. This supplements the income of the mechanics from daily repair work.

However, not many workshop owners could do these innovations. On asking a workshop owner regarding the innovations that they have carried out till now, he said,

“We do not get time to do any innovative things. The number of customers coming to us for repair works and servicing of their bikes is enough to keep us busy.”

The owner of the workshop who could do these innovations mentioned the lack of available space for carrying out more innovations. He also mentioned that customers for such modifications are less in numbers due to illegal status of some modifications in the bikes.

## 6. SOME INNOVATIONS IN MALEGAON REGION

### NEW INSTRUMENT FOR OPENING SHOCK ABSORBER PIPE



On entering a repair workshop in the town, a worker was seen repairing a fork oil seal leak and a bend in the shock absorber pipe.

I was introduced to a new instrument that would be used to open the bent shock absorber pipe.

I was informed that they themselves design and make this instrument as it is difficult to open the bent shock absorber pipe. It is rightly said that, “*Necessity is the mother of invention.*”

It can be deduced that problems in shock absorber pipe were common to the bikes coming to be repaired here.

Fig 5. The worker opening the shock absorber pipe using self-made instrument



## SOLVING BS6 BIKES PROBLEM

A mechanic talked to me about the problem in some BS6 bikes, that the silencer becomes red hot due to heat. 3 such incidents were seen by him. He said,

*“When I saw this for the first time, I was quite startled. Then I opened the plug and saw that the plug point was burnt. Then I thought that let’s put new plug and a cap. When I did this, I found that the problem got solved.”*

It is not clear what he did to solve this problem, but we can gain an insight into the process of how a new problem is solved in the maintenance and repair ecosystem. New problems are solved by experimenting and trying out different things.

## SCRAPPED AUTO RICKSHAW TO NEW AUTO RICKSHAW

A site was visited by me where the auto rickshaws which are scrapped after being declared as unfit for running on road, are converted to new auto rickshaw. It is important to note that this work is classified as illegal by law.

For 3 to 4 days of work behind making a new rickshaw, he gets 4,000 to 5,000 rupees as profit, and it costs him rupees 9,000 to 10,000 to make this new rickshaw. When I went to this place, there were 5 rickshaws waiting to be made, and there were 5 workers in this shop. No godown for storing rickshaws was seen. Besides rickshaws, there was only a small shade made of tin with a container to place the tools.



Fig 6. Scrapped auto rickshaw (left) restored to give it a brand new look (right)

## CONVERSION OF THREE WHEELERS TO FIVE WHEELERS

An interesting innovation that is done in a workshop in the town is to transform 3 wheelers into 5 wheelers. We will briefly look at this particular innovation; understand its working and the economics behind this innovation.



Fig 7. Turning wheel (left) and its position in the five-wheeler (right). The shown three-wheeler is in process to be transformed into a five-wheeler.

The turning wheel is used as the pivot where the trolley will be attached to the front part containing the original three-wheeler. The trolley has two wheels which will support the vehicle from the back. The turning wheel reduces the turning radius of the vehicle, which would otherwise be large as the length of the vehicle also increases as we increase the number of wheels. It becomes easier for the five-wheelers to move in the narrow streets of the town due to the reduced turning radius.

**Economics behind the innovation:** The vehicle is used for carrying goods in the town. The town is famous for its loom industry. So, the vehicle is mostly used by the workers involved in the transportation of goods in the loom industry. Many five-wheelers could be seen roaming on the streets carrying intermediate as well as manufactured goods in the loom industry. People involved in transportation of goods from one factory to other prefer to use this vehicle instead of using pickup trucks for the following reasons:

1. Trucks are costly when compared to the cumulative price of three-wheeler and the cost of converting it to five-wheeler
2. Trucks are big in size, so maintenance and fuel costs will also be high
3. Trucks have a mileage of 10 kmpl while it is 30 kmpl for five-wheelers



The company-made three-wheeler carries 700 to 800 kilogram load. But after modifying it to five-wheeler, it can carry minimum 1.5 tonne load. The mechanic said that he uses 'heavy' material to make it lift heavy load. By 'heavy', he means strong material. On asking about the cost of making the five-wheeler, he said that the cost depends on the price of iron. Sometimes the iron is 35 rupees per kg at other times it can be 45 rupees per kg, so, the cost of making the five-wheeler also fluctuates. If the total cost of iron is 7,000 rupees for him, then he takes 23,000 to 25,000 rupees from his customer. However, the exact cost also depends on demand of the customer as to what other modification is needed in the vehicle.

The concerned mechanic has 21 years of experience in this field of work.



Fig 8. A three-wheeler turned into a five wheeler

## INDEPENDENT DEVELOPMENT OF SELF START IN BIKES

A mechanic with 40 years of experience in the field of maintenance and repair claimed that he had independently developed self-start in bike at the time when self-start bikes were not common. He had also converted a 6V Royal Enfield bike to a 12V one quite early on in his life.

There is no way to check his claims, but it will be unfair to him to dismiss his claims due to lack of evidence from the past. The mechanic is quite famous in the town, had 10 workers working for him and had quite large godown.

## MINI BIKE

A mechanic in the town had made a mini bike using different parts from different bikes that lied unused in his workshop. So, the fuel tank was cut out of Splendor bike's fuel tank; the tyres used were taken out of a scooter; and so on for different parts of the mini bike.



Fig 9. Mini bike made by the mechanic

## INSTALLING HYDRAULIC LIFTER TO A PICKUP TRUCK

There was also an innovation where hydraulic lifter was installed onto the pickup truck. The owner of the site however did not share any figures like income, profit, and cost.



Fig10. Hydraulic lifter being installed on a pickup truck



## MISCELLANEOUS INNOVATIONS



Fig 11. Broken part originally made of fibre (right), repaired by putting a metal clip at the place (circled orange). Service centers would replace the headlight visors completely. This easy fix would cost the owner just Rs. 40 to Rs. 50



Fig 12. A worker welding the petrol tank to fix the leakage. Replacing the entire tank would cost 5,000 to 6,000 rupees to the owner. Welding the tank is a cheaper alternative.



## 7. COMPARING INNOVATIONS IN POWAI AND MALEGAON

The innovations in Malegaon were found to be more diverse and more numerous than those in Powai region. While the main innovation found in the Powai region involved modification of old bikes to new ones, the innovation in Malegaon involved conversion of three-wheelers to five-wheelers, restoration of scrapped auto-rickshaw to form a new rickshaw, installing hydraulic lifter on pickup trucks, and many more mentioned in the earlier section.

The factors that influence the diversity and scale of innovations include

1. Availability of space—the more the available space, the more is the scale of innovation, as more number of vehicles can then be stored for innovating
2. Availability of time—the more is the available time, the more creatively the mechanics can think of innovations. The amount of available time also influences the scale of innovations.
3. Illegal status of the innovations—“many innovations are classified as illegal by law, so, not many vehicle owners like to get into the trouble that they may have to face later”, a repair mechanic in Powai said.

The number of workers also influences the availability of time for innovation. More number of workers increases the amount of time available for innovation. At least 4 workers (including owner) are needed to get enough time for innovating.

A mechanic in Powai said, “There are many ideas in my mind for doing innovations, but the only problem is the lack of space. I have only one godown for working on the bikes. This available space is not sufficient.” Another workshop owner said that he did not get enough time to carry out any innovations, so he only does the regular repair work. The reason why the earlier workshop owner did not face this problem was that he had three workers working in his workshop (besides him), whereas the latter had only one worker to assist him.

This is generally not the case for repair mechanics in Malegaon region, where the workers had enough time to design their own tools for repair and maintenance of vehicles, as was seen in section 6 earlier. Often, no fixed amount of space was used to work on the innovation. For example, the scrapped auto-rickshaw restoration was carried out in an open space with no godown or shop, as mentioned in section 6 earlier.

Also, the authorities are not very strict in the town.

*“We are aware of the illegal innovations. We appreciate some of the innovations but are concerned about the safety standards of these vehicles”,* said an Inspector of Motor Vehicles.

## **8. CHALLENGES FACED BY MECHANICS**

Some challenges faced by the automobile repair mechanics are listed below.

1. The models of vehicles keep on changing and it becomes difficult to understand the new models when it comes for repair in the workshop. It takes some time for the mechanics to familiarise themselves with the new models (e.g. the mechanics have not fully understood the BS6 engine vehicles yet).
2. The electric vehicles are completely new to them and they have not yet understood the working of electric vehicles.
3. The challenges faced by mechanics in Powai region in particular include, lack of availability of space and time.
4. The illegal status of some innovations is a difficult challenge to the repair mechanics everywhere (despite the fact that authorities might be lenient in some regions)

## **9. KEY FINDINGS**

The following findings can be listed after analysing the maintenance and repair ecosystem in Powai and Malegaon.

1. The number of repair workshops in Powai region are in the range of 50-60 as found using Google Maps
2. The repair mechanics do not have any formal education in their field of work. The average educational qualification of the repair mechanics was much below 10<sup>th</sup> class. The highest qualified repair mechanic found had passed 11<sup>th</sup> class.
3. Most of the repair mechanics are from Uttar Pradesh, but there were also workers from Bihar and Orissa.
4. There are 3 workers (including owner) in each workshop on an average.
5. The workers get a salary ranging from Rs. 4,000 to Rs. 15,000.
6. The average size of godown is 15 ft. by 15 ft. The average rent of godown is 14,000 rupees in Powai region.
7. Average working time is 10 to 13 hours per day.

8. A mechanic's journey starts by working in a garage as a worker and gain knowledge and experience under the employer's guidance. After working in someone else's garage for certain number of years, the worker generally leaves the job to start his own garage.
9. The owner's monthly income varies from Rs. 20,000 to Rs. 60,000 depending on the experience and popularity of the mechanic. There is no upper limit on the income, but going beyond Rs. 80,000 rupees is difficult and a lot of hard work is required.
10. The main innovation in Powai is to modify old bikes to give them a new appearance and good performance. The mechanics generally take Rs. 40,000 to Rs. 60,000 from their customers to modify one bike and it takes 2 months to complete the modification of one bike.
11. While the main innovation is modification of bikes, not everyone is able to innovate.
12. The material used for repair work is brought from the spare parts shops in wholesale market.
13. The profit margin for small repair work is approximately 50 per cent. The profit margin is calculated with respect to the price that is charged to the customer minus cost of material required.
14. The scale, diversity and freedom of innovation is more in small towns than a bigger city like Mumbai
15. There are interesting innovations happening in both Powai and Malegaon.
16. The mechanics are hardworking, but they display detachment from the wealth they earn. Most of them like the work they do.

## **10. CONCLUSION**

The repair and maintenance ecosystem is a rarely studied field. The economy of repair and maintenance appears to be large. Besides the regular repair work, there are interesting innovations going on in these repair workshops. The innovations done by the mechanics must have a larger impact in reducing waste, as the mechanics have embraced the concept of repair over replacement.

It can be concluded that "understanding innovation in maintenance and repair ecosystem" is an interesting topic and there is a lot of scope for studying this vast area of maintenance and repair.



Fig 13. A broken chair being used inside a repair workshop

## Appendix

### RELATION BETWEEN COMPANY AND WORKERS

A very interesting piece of information was shared by an owner of a repair workshop in the town. The owner said, "Sometimes it so happens that some problematic vehicle, like a vehicle that has had an accident, comes to showroom for repairing. But, if the showroom workers cannot resolve the problem in the vehicle, then the showroom people give that vehicle to us for resolving that problem."

**"All showrooms have a special person appointed who gets the repair work done from outside the showroom."**

On asking him if the showroom owners pay them appropriately, he responded affirmatively. I then asked him why not the repair mechanics work in the company showrooms and service centres instead of working in the repair workshops. To which, he said that he is able to earn more in the workshops and additionally he is the owner of the business and not the employee working under someone. The repair mechanic did not like to work as an employee.

His words may not be completely trusted, but his statement cannot be ignored. Research about the relation between company showrooms and the repair mechanics is necessary to find out if such things do happen in the maintenance and repair ecosystem.