CASE STUDY

Productivity Enhancement at Indus Motor Co. Ltd. Through Focusing on 3M’s

*MURI (Over Burden), MUDA (Non Value added), MURA (Unevenness)*
PRODUCTIVITY ENHANCEMENT AT
INDUS MOTOR CO. LTD.
THROUGH FOCUSING ON 3M’S
Muri (Over Burden), Muda (Non Value Added), Mura (Unevenness)

by

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1) BACK GROUND

1.1. Indus Motor Company Ltd (IMC) was established in Dec. 89 and the plant situated at Port Qasim rolled off the first Toyota Corolla Car 1300CC XE in March 93. The company has joint venture with Toyota Motor Corporation (TMC) Japan & Toyota Tsusho corporation (TTC), Japan for manufacturing of Toyota vehicles in Pakistan and the installed capacity of Plant at Port Qasim was 10,000 vehicles/year, single shift. The management control is with House of Habib (HOH) with 50% share, while TTC/ TMC have 25% share and the rest is public, being a limited company.

1.2. With Single model of 1300CC Corolla XE in March 93, the company kept on growing each year in terms of production volume, product variants, market share and by June 99, 100% capacity utilization was achieved as during July 98 ~ July 99. 10,000 Units of Toyota vehicle were produced with 12 models/ Variants as mentioned below

<table>
<thead>
<tr>
<th>COROLLA 1300CC</th>
<th>COROLLA 1600CC</th>
<th>COROLLA 2000CC</th>
<th>HILUX PICKUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>XE</td>
<td>Gli M/T</td>
<td>2.0D</td>
<td>4X2 S/C</td>
</tr>
<tr>
<td>XEG</td>
<td>Gli A/T</td>
<td>2.0DG</td>
<td></td>
</tr>
<tr>
<td>GL</td>
<td>GLI MT SE</td>
<td>2.0D LTD</td>
<td></td>
</tr>
<tr>
<td>GLI A/T SE</td>
<td>2.0D LTD SE</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1.3. With current investment of Rs. 2.0 Billion, the plant has a total land of 426,500 Sq M with covered area of 45,000 Sq M while the factory building alone consists of 30,263 Sq M mainly comprising of Weld shop, Paint and Assembly shop. The degree of complexity of vehicle production system can be judged from the fact that there are 22 work stations in weld shop, 37 work stations in Paint shop and 32 work stations in Assembly shop and 8 work stations at final
inspection through which every vehicle has to pass prior to reaching to CBU (Completely Built Unit) yard.

1.4. VEHICLE MANUFACTURING

The process of vehicle manufacturing consists of welding of body parts to form what is called a ‘shell body’, painting it to desired colors, assembling different functional and aesthetic parts to the painted body to convert it into a vehicle and ensuring that its looks & performance matches customer expectation.

1.4.1. Welding Process – The Shell Body

There are about 300 body parts which are welded together by 3,000 weld spot using 150 electronically controlled Guns and 60 welding jigs to form a shell body. The shell body welding process starts by building the underbody or frame work. The body sides and roof structure are built as major sub assemblies which are transported to shell body line by over head conveyors. The Toyota ‘Built in Quality” is assured by welding jigs with appropriate locators for correct part positioning. An incorrect part is not accepted by welding jigs. For controlling the process parameters which effect weld strength namely electrode pressure, current amperage and time for flow of current, are pre-set and the fully trained team member has to only press a button, positioning the gun at appropriate location as per process instruction sheet visible to him all the time. The various sub-assemblies made are finally put on ‘Marriage Jig” for welding to take the shape of a shell body and after installing doors hood, and fenders the shell body is finally inspected before being ‘Pulled’ by paint shop for next operation.

1.4.2. Painting Process – The painted Body

The conveyorized painting process ensures that vehicles are prevented from rusting besides giving these an attractive look for customers. The rust prevention is achieved through Cationic Electro Deposition (ED) painting prior to which, the vehicles are washed degreased and phosphate coated on automatic line. After ED painting and baking through oven primer paint is applied, followed by baking and then final coat or Top coat paint is applied again followed by baking. Sealer & PVC application in the paint shop eliminates any possibility of water leakage in the vehicle. The built-in Quality is ensured through monitoring of process parameters like bath/ tank temperature, viscosity, humidity voltage etc. and an alarm gets raised in case of any deviation for which a prompt countermeasure is then taken. The painted body is then inspected in Paint shop before being pulled by Assembly shop.

1.4.3. Assembly Process - The Finished Vehicle

The assembly process is also conveyorised and gradual value addition takes place as parts are installed progressively at each work station of the Assembly Shop. There are 32 work stations in Assembly shop which is divided into 3 sections namely ‘Trim Line’, ‘Chassis Line’ and ‘Final
Line’. The parts which are not normally seen and hidden like silencer pads, wiring harness, steering mechanism parts, etc are installed on this line. The partially built vehicle then moves to ‘Chassis Line’ where underbody installations like Brake & Fuel lines, Suspension, Transaxle assembly Fuel Tank installation etc along with Engine installation take place. The ‘Final Line’ is responsible for installing parts like Instrument Panel, Radio Cassette Player, Seats, Carpets, Wind Shield, Tyres etc. Besides filling all fluids like gasoline, brake oil, steering oil etc. The Built-in-quality is achieved through trained team members who follow work instruction sheets which tells them the sequence of operations, the methods to be followed, the tools to be used and the critical check points.

1.4.4. Final Inspection – Customer Satisfaction.

Before the vehicle is delivered to Finished Vehicle Yard, the Quality Assurance department evaluates vehicle performance on V.P. I. (Vehicle Performance Inspection Line) for confirming Toyota Quality Standards and meeting customer expectations.

2) TOYOTA PRODUCTION SYSTEM (TPS) PRACTICES AT INDUS MOTOR CO.

The Toyota production system basically emerges from a Mutual trust between employees & management and results in employees satisfaction. The production from these satisfied employees through the two principles of Just-in-Time and JIDOKA meets customer satisfaction as shown below:

2.1. JUST-IN-TIME

Just-in-time production is one of the basic pillars of TPS and refers to manufacturing and conveyance of only what is needed when it is needed and just the right amount needed.
It eliminates the need for maintaining large inventories (reducing financial cost & storage cost), thus enabling quick response to changes. It also eliminates the waste that occurs when defects go undetected in manufacturing of large batches. Various tools and techniques are used to put this concept in practice like:

2.1.1. Leveled Production

Distributing the production of different kind of items evenly through the day and week to allocate work evenly, thus using the resources optimally. For example for monthly production requirement of 600 Corolla and 233 Hilux Pickup, the daily production planned is 38 Vehicle/Day with further breakup 27 Corollas and 11 Hilux per day.

2.1.2. Pull System

Creating a physical link between proceeding process and following process, through a tool called ‘Kanban’. A ‘Kanban’ is a communication tool giving instruction for next operation and can be a sheet of paper, metallic plate/ wooden board etc. A painted body when pulled by Assy Shop team member has a metallic Kanban attached to it which tells the team member that this vehicle is Corolla Gli or 2.0D and consequently he starts assembling the requisite parts in the vehicles from a shelf which has many parts for other models also. Actually the Kanban is a tool that enables employees to operate the TPS by taking responsibility for managing their own jobs. The operator sends the Kanban back to the preceding process as order for additional components to replace the ones he has used. The operator is shouldering an important part of the ‘Management function’ of ordering parts and managing inventory.

2.1.3. Continuous Flow Processing

Making items literally one at a time wherever possible. This means arranging work inside each process to flow smoothly from one step to the next. This calls for laying out plant and devising logistic so that work moves smoothly and on schedule from raw material to machine shops to Assy shop to distributors, dealer and Customer.

2.1.4. Takt Time

Establishing a time frame for linking the pace of work in every process to the pace of sales in the market. This is calculated by dividing the available time with required production based on market pull. In case of IMC it was 10.5 Minutes for 38 Vehicle/Day.

2.1.5. Multiskilled Operators

Developing operators who can handle more than one process. Thus by developing multi process handling an operator handles different kind of machines/ equipment to keep work moving in a continuous flow:
2.2. JIDOKA

The 2nd pillar of TPS is Jidoka and according to this principle the work is stopped immediately whenever a problem occurs. This stoppage could be mechanical (equipment designed to detect abnormality and stop automatically) or operators are equipped with means of stopping production flow when ever they note anything suspicious. This mechanical and human Jidoka prevents defective items from progressing into subsequent stage of production and thus it prevents waste that would result from producing a series of defective items. In case of IMC a yellow string is passing through each station of production. Which can be pulled by any Team member if he observes any abnormality or defect in the process he is doing, Which brings the production line to a stop. The line starts again after the abnormality has been removed.

2.3. STANDARDIZED WORK

Standardized work is a tool for maintaining productivity, quality and safety. It provides a consistent frame work for performing work at the designated Takt Time and for illuminating opportunities for making improvements in work procedures. The three elements structuring standardized work are:

- Takt time
- Working Sequence and
- Standard in process stock.

The working sequence is the series of steps that is determined to be the best way to perform a task. Standard in-process stock is the minimum number of work piece that are required on hand in a process to maintain a smooth flow of work. Standardized work provide detailed step by step guide line for every job in TPS. Team leader determine the most efficient working sequence and with the help of team members continuous improvement (Kaizen) is made in that sequence. Kaizen thus begets new pattern of standardized work.

3. PRODUCTIVITY ENHANCEMENT

3.1 THE NEED

As mentioned earlier, Indus Motor Co. Ltd had plant capacity of producing 10,000 vehicles/ year in single shift. With signing of Technical Assistance Agreement with Daihatsu Motor Co. Japan, for production of 850CC Daihatsu Cuore 3,000 Units in the first year, increase in production capacity by 30% became inevitable. One obvious conventional method was to increase the number of work stations which would have resulted in capital investment for providing additional equipment / tools & utilities on one hand and consequent increase of man power on the other hand. However it was decided to increase the capacity by improving productivity.

In simple terms the requirement was to increase daily production from 38 vehicle/ days to 50 vehicles/ day thus reducing Takt time from 10.5 minutes/ vehicle to 8.5 minutes / vehicle.
3.2) THE STRATEGY
Reducing Man Hours through reduction in 3Ms.

3.2.1 Understanding of 3Ms

3Ms is an abbreviation of 3 Japanese letters which start with English Alphabet ‘M’ namely:

- MURI = Over Burden
- MUDA = Waste
- MURA = Unevenness

The concept can be best understood from the following diagram:

Here 12 boxes of 1 ton each need to be transported from one station to the other with the help of a pickup of 4 ton capacity. If the operator chooses to load 6 boxes at a time and makes only 2 trips, he is overburdening the pickup and also himself. The short term gain of making only two trips, will be nullified by excessive maintenance of the pickup resulting from over burdening, this is “MURI”. The operator has another choice to make 6 trips by carrying only 2 boxes at a time. This is share “waste” which is “MUDA” as the cost of transportation will escalate. He may also choose to make 3 trips, but the loading in each trip may vary, e.g. 1st trip only 2 boxes, 2nd trip 6 boxes and 3rd trip 4 boxes. This is unevenness of operation and is called “MURA”.

While identification of MURA & MURI in production processes is some what easier if one takes a close look at the operations, the identification of “MUDA” is some what overlooked. MUDA can be in anyone of the following form:

- MUDA of Motion Any motion that does not contribute directly to adding value.
- MUDA of Correction Any Repair is Muda.
- MUDA of inventory Any more than the minimum to get the job done.
- MUDA of conveyance Any conveyance is essentially Muda. Should be kept to a minimum.
• MUDA of waiting  Waiting for parts to arrive or for a machine to finish a cycle.
• MUDA in processing  Over processing.
• MUDA of over Production  Production too much or too soon.

3.2.2 Commitment & Challenging the existing

The prevailing Man hour/ Vehicle for each process were as follows:

<table>
<thead>
<tr>
<th>Department</th>
<th>Production Department</th>
<th>Production Planning &amp; Material control</th>
<th>Quality Assurance Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processes</td>
<td>Welding Process</td>
<td>Painting Process</td>
<td>Assembly</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Engine Assembly</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Part Supplying</td>
<td>Final Ins. &amp; Audit</td>
</tr>
<tr>
<td>Man hours/ Vehicle</td>
<td>10.0</td>
<td>12.0</td>
<td>7.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>8.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5.0</td>
</tr>
</tbody>
</table>

Each department / Section of Indus Motor Co. was asked to examine critically each work activity at every station and eliminate / reduce 3Ms specially the MUDA. As MUDA will reduce, the time spent for doing a process will reduce, which will in turn reduce Man-hour/ Vehicle.

The basic philosophy adapted was to challenge every current activity on the work station and pose fundamental questions like, why the activity is necessary? Can it be eliminated altogether? If not, can the time be reduced for doing the same activity? Is this the best method of doing it? Can we merge this activity with some other activity for better result? Can this activity be brought forward? Or can it be done at a later station? etc. etc.

All shop in-charges and supervisors of each and every section were clear and committed for their goals and made their activity plans for achieving the same

3.4) YAMAZUMI CHART -- THE TOOL

Yamazumi is a Japanese word comprising Yama (Mountain) & Zumi (Building up) meaning “Building up of Mountain”. It is a measurement of total time taken in Minutes/ Seconds for completing all activities resulting in a finished product.

The time spent for doing any process can be divided into two broad categories:

a) Time spent in doing Standard Job Element
b) Time spent in Muda (walking, picking, unpacking etc)
A standard job element is a value added activity e.g. tightening of bolt for fixing a part which may take 6 seconds. However the time spent in walking to a rack & picking the bolt and bringing to work station which may be taking 4 seconds is a non-value added activity and hence a waste, Muda.

3.4.1 Making of Yamazumi Chart

The first step is to carryout a time study of all process elements involved and record the time for standard job element and MUDA. For example a finished product may require processes A to G, which may have time study as shown below:

The next step is to put these time elements one on top of the other to get the total time for the finished product. This is what is called a Yamazumi Chart.
Once this chart is made the value added activities & the non-value added activities are clearly visible for the entire process and concentrated efforts can be made for reducing Muda and rearranging processes so as to achieve required Takt Time say 8.5 Min/ product.

3.5 **TYPICAL CASE STUDY OF TRIM LINE IN ASSEMBLY SHOP**

The Trim line in assembly shop has 10 stations and the team member work on both left hand and right hand of the vehicle on the conveyor making a total of 14 work stations as shown below:

![Diagram of Trim Line](image)

Taking a typical example of station No. 2 Left Hand (designated as T2, LH) there are 49 process elements done on this station. A careful Time Study of each process on this station revealed the following Graph showing time spent on Value added and non-value added activities:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>ACTIVITIES</th>
<th>TIME (Sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CHECK THE SPEC SHEET</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>FIT DOOR OUTER HANDLE &amp; FRONT OF DOOR WITH FHL</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>FIT DOOR HANDLE &amp; FRONT ON BODY WITH KNOB</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>FIT DOOR FRONTAL ARM PANEL TO DOOR PANEL</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>FIT DOOR OUTER HANDLE &amp; FRONT OF DOOR WITH DRL</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>FIT DOOR OUTER HANDLE &amp; FRONT OF DOOR WITH DRL</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>FIT DOOR OUTER HANDLE &amp; FRONT OF DOOR WITH DRL</td>
<td></td>
</tr>
</tbody>
</table>

Recording of Activities at T2 LH

Only 7 process element/ activities are shown above and one can easily add up the time spent in non-value added activities for the 7 processes. When the total effect of 49 process performed on this particular station is taken into consideration the picture emerges as shown below:
Thus out of 10.5 Min working on this station, 3.8 minutes (36%) is spent on non-value added activities of walking, unpacking & picking of parts. A further breakup of non-value added activities indicate that 53% time is spent in walking, 21% in unpacking & 26% in picking the parts as shown below:

By conducting similar time study for all the 14 stations of Trim Line the following picture emerged:
Thus out of a total 147 minutes of Trim line operation at 14 stations, 41 minutes were spent on non-value added activities, which was further analyzed as follows:

![Diagram showing Trim Line operation with Value Added and Non-Value Added times]

### 3.6 STEPS TAKEN TO REDUCE MUDA

#### 3.6.1 Reduction in Walking Time

51% of non-value added activity consists of walking by Team member for going to part rack for picking the part, bringing it to the vehicle, installing it and then going back to part rack for the next part. This movement was reduced by:

1) Reducing Picking frequency of parts from racks
2) Introduction of Movable Rack

#### 3.6.1.1 Reduction in Picking Frequency/ Extra movement

It was observed that team members were in the habit of picking one part at a time from part rack, and after installing it in the vehicle would go to part rack for next part. Thus if he is to pick up 7 parts A to G as shown in the sketch below, he will go and come back from the rack 7 times:

The team member was advised and trained to pick up as many parts as he can conveniently from the racks and put these in the vehicle and install the parts one after the other. Then for next picking again pick up 2 or 3 parts and bring these to vehicle for installation. This way as can be seen from the sketch below, the picking frequency was reduced.

![Sketch showing before and after picking frequency]

Before:
Picking frequency was 7.
extra movement got reduced as the picking frequency got reduced from 7 to 3:

By adapting this method a total saving of 7 minutes in walking time was observed.

3.6.1.2 Introduction of Moveable Rack

For small parts like grommet, washer, screws etc small trolleys were introduced which can be attached with the moving vehicle on conveyor as the vehicle approaches a work station. The simultaneous movement of trolley with vehicle, enables team member to access to the small parts without walking.

The above resulted the saving of one minute in Walking time

3.6.1.3 Standardization of walking was also done and each team member was given enough training to take 2 steps in 1.4 Sec. A saving of 4 minutes in walking time was observed as a result of this standardization in Trim Line.

3.6.2) Reduction in Picking Time

As 27% of the non-value added time spent in picking of parts the following counter measure were taken to reduce the same:

3.6.2.1) Introduction of Flow Racks

A close observation of the motions/ actions of team member revealed that the parts rack available on line side had fixed shelves and often if the size of the box containing part is larger
than the distance between the two shelves the team members had difficulty in taking the part out of the part rack.

To reduce this problem roller type racks were introduced in which the shelf height could be adjusted according to size of parts/box. Because of the slight inclined angle and presence of roller the next part becomes easily available due to gravitational flow to the team member after he picks up the first part as shown in the picture:

The Team members can make & modify easily these racks according to the part size and accessibility.

After introduction of Flow Racks 5 minutes saving in pickup time was observed.

3.6.2.2) Introduction of Hardware & small part (Grommets, clips etc.) Racks

The non availability of a quick means for identifying model wise hard wares and small parts (like grommet, clips etc.) was observed to be one of the major contributing factor for increasing Muda in picking operation. Hence hardware and small part racks were introduced with color coded plastic boxes identifying respective models. As hardware grommets unpacked from polyethylene bags are poured in each color coded plastic box, having tag for part name & part numbers, the team members did not have to waste his precious time in identifying & segregating the appropriate hardware etc for the requisite model. The countermeasure brought, saving of 2 minutes in pickup time.
3.6.3) Minomi (Unpacked) Supplies

Team members production time which was being wasted in opening of boxes/polyethylene bags for unpacking of parts, was saved by asking PPMC department (Production planning & Material Control department) to supply parts to line side racks in unpacked condition as shown below:

The introduction of Minomi supplies brought the saving of 5 minutes in unpacking time.

3.7 SUMMARY OF IMPROVEMENT AT TRIM LINE

The net effect of making Yamazumi Chart for Trim line and taking the above mentioned steps for reducing 3Ms, can be summarized as under:

- The non-value added time reduced from 41 Minutes to 17 Minutes (a reduction of 58%).
- The Takt time for each station reduced from 10.5 min/vehicle to 8.5 min/vehicle (a reduction of 23%).
- As a result of above and by rearranging process elements, two working station were eliminated from the trim line (Namely T9LH & T-5 RH) as shown below:

- The consequent increase in production of Trim line was 30% with the same man power there by reducing man hour per vehicle.
3.8 **YAMAZUMI charts for Other Processes**

The same exercise was conducted for each and every station of weld shop, Paint shop, Engine shop, PPMC and Quality Assurance and every where there was identification and recognition of 3M’s and every where when countermeasures were taken the result was reduction in man-hour, and consequent decrease of Takt Time. As Toyota Production System is based on ‘Pull’ the Takt Time of the preceding station has to be the same as that of the following station. Consequently the entire plant got operated at 8.5 min. Takt time increasing productivity by 26%.

3.9 **SPACE SAVING**

The side effect of focusing on reducing 3Ms’ resulted in space saving on shop floor. It appeared from time study of each work station that part racks should be as close to the vehicle as practically possible to reduce walking time. The introduction of adjustable flow racks resulted in space saving on shop floor. Elimination of work station resulting from careful study of 3Ms also reduced the work space, which can be used for further expansion. It may be noted that TPS is also called lean production system i.e. lean in man-power, lean in equipment and also lean in space on shop floor.

One technique adapted to save space on assembly line side was ‘Jundate’ (Sequential supply). Taking example of a bulky part like seat set or Fuel tank which requires a larger storage area on Shop floor, and if for example 3 models of vehicle are being produced, then a minimum quantity of these bulky parts will have to be present on line side, requiring of lot of space. The solution was found in supplying the part of requisite model as is needed on the station. Thus the sequential supply system for bulky parts has reduced the required storage space on line.

Another glaring example of space saving done during this exercise was to rearrange CKD boxes in CKD warehouse such that the storage capacity increased to 44%. The previous arrangement of placing CD boxes could store 111 Lots ( lot consists of 10 Units), but by making Yamazumi chart and doing Kaizen (continuous search for improvement), the same CKD ware house can now store 160 lots. This is infact 57% saving in space in CKD ware house and because of which construction of a new CKD ware house was avoided at the time of introduction of Daihatsu Cuore.
4. RESULT OF REDUCING 3MS

The net result of focusing on reduction of 3Ms, at Indus Motor Co is shown below:

<table>
<thead>
<tr>
<th>KEY AREA</th>
<th>NET RESULTS</th>
<th>STATUS BEFORE &amp; AFTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production Capacity</td>
<td>Increase by 30% (3,000 Veh./Year)</td>
<td>[Graph showing increase from 10,000 to 13,000]</td>
</tr>
<tr>
<td>(Built-in-Quality as per TPS)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Productivity</td>
<td>Increase by 26% (Reduction of 12 M-hrs/Vehicle)</td>
<td>[Graph showing decrease in Man-Hour]</td>
</tr>
<tr>
<td>(Man-Hour/ Vehicle)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work Space</td>
<td>Saving in space by 20% (4,782 M² space reduced)</td>
<td>[Graph showing reduction in Meter Sq.]</td>
</tr>
<tr>
<td>(Meter Sq.)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. CONCLUSION

The strategy & techniques adapted at Indus Motor Company were based on Toyota Production System (TPS) and can be applied to other industries/companies specially those involved in continuous assembly line. Preparation of a Yamazumi Chart is the first step towards elimination/reduction of ‘3Ms’. The purpose of sharing this experience with others is to encourage them that with participative management, clarity of objectives, motivation and Techniques of Toyota Production system others can also achieve similar results & even better.
Biography of Author

The author is a Mechanical Engineer with Master Degree in Material Science from Cranfield Institute of Technology UK, and has more than 27 years of experience in the field of Quality, Production, Part Localization and Production engineering in Automobile and related Automotive vendor industries.

Currently working as General Manager Production & Production Engineering in Indus Motor Co. Ltd, The manufacturer of Toyota and Daihatsu Vehicles in Pakistan for last 10 years.

Reference