Kamigo Engine Plant Tour Review

Toyota Motor Corporation needs no introduction. The company is the second leading producer of automotive vehicles in the world and is rapidly closing in on number one General Motors. In addition Toyota is a regular recipient of quality awards and is always near the top of the Harbour Report’s productivity rankings. Toyota has earned over $10-12 billion in profits each of the last two years while major competitors have lost several billion over the same period. Indeed Toyota has not reported a net loss in income since the early 1950’s.

One of the most famous plants in the company is Kamigo Engine Plant located on the outskirts of Toyota City, Japan. The facility was established as the first dedicated engine plant in the company in 1965 and Taiichi Ohno was the founding plant manager. The plant was considered the “model” facility for Toyota’s production system with respect to the pillars of Just in Time production as well as the more difficult concept of Jidoka.
Many of Mr. Ohno’s early disciples are from either this engine plant or the original Honsha plant machine shops.

I formerly worked at this facility in Administration, Maintenance, and Manufacturing Engineering quite some time ago. This fall I was able to return and visit the facility for the first time in several years for an extended tour and discussion with senior managers. The following is a summary of some the different discussion points over the two separate visits. The names of the individuals are kept anonymous based upon requests that I will of course honor.

Art:

*Toyota seems to really hitting on all cylinders these days?*

Appearances are usually deceiving. If you are talking about profits yes they are indeed at an all time high as is production volume but it has put a real strain on the system in terms of keeping up. It feels like we are running flat out in many respects.

Art:

*So what is behind all these profits?*

We have both a very favorable sales mix and overall sales trend working in our favor right now especially in the United States. Over half our profits come from this one market. The higher margin vehicles are selling really well. In North American alone we are adding the equivalent of a whole new facility per year to keep up with the volume growth.

Art:

*What has changed the most since I worked here?*

So many things have changed I am not even sure where to begin. First the 10 engine lines here have almost all changed. The old S family engine machining lines are all gone. RZ/TZ line you worked on last is still here but is now our oldest in the facility. The other lines are all new aluminum block and head models as well. The casting shop no longer produces cast iron blocks it has been converted to all aluminum die casting. It is much cleaner and nicer how. The old press department is gone as well.

Art:

*No deep details needed but what is the overall volume and number of employees now?*
We produce over 10,000 engines per day off ten different machining and assembly lines. At last count there were almost 4,000 employees in the facility.

Art:

That is a big change in capital structure, volume, and personnel!

That is only the tip of the iceberg. The labor structure has changed entirely in Japan since you left. Back then we had veteran employees with 15-20 years experience on average in production. Today we have around 40% temporary employees on six month contracts. Most are very young in their early to mid 20’s and half of these are female. By law in Japan we are required to achieve “labor equality” in terms of ratio so the number of female workers will continue to increase and become part of the permanent labor pool.

Art:

That is a big change. Temporary workers were at most 5-10% when I was here and the first two female production employees had been hired an put on the RZ/TZ engine line in my old area. What has been the effect of all this change?

There has been only positive effects with the addition of the female population to the workforce in all honesty. That has been a real positive as far as management is concerned in every respect and forced us to adapt and improve in many ways that we should have long ago. The real challenge has been simply the high number of temporary workers and the turn over in the work force. The younger population is more likely to work for 12-18 months and them move on or take an extended period of rest. This has put a real strain on Toyota and even more on the supply base. The suppliers are having to import foreign workers on temporary work visas in many cases due to the labor shortage here in Aichi Prefecture.

Art:

I see that Toyota is taking quite a hit in terms of quality lately. Is this all related?

I assume you are referring to the increase in warranty claims and recall incidents. The causes of these problems are split evenly among production, product design, and supplier defects. There have been incidents in production of errors that trace back to newer employees and we are taking steps to simplify processes even further and prevent defects from occurring and escaping. I suppose the same is true in the case of product development and the supplier errors. Everyone is acknowledging this fact right now and working long hours to correct the problems as best possible.
Art:

I toured the AZ engine line at the far end of the plant. It seemed in excellent shape?

Yes it is operating at 5 ppm of defects off the engine final test line. Most components in machining are in the .2% scrap level in terms of pieces produced. The problems have been more in assembly in many cases. Many product development related problems are things like bracket failure on doors etc. that were not sufficiently tested or analyzed in product development. They are small but inexcusable mistakes and they will not be repeated if everyone does their follow up work correctly.

Art:

That is the most amazing thing to me about Toyota after all these years. It is not that the company is perfect it is that emphasis is on learning from failure and the emphasis on recurrence prevention is so high.

We are so far from perfect that it is laughable to even put that word in the same sentence with our company. They key in management is still to focus on your abnormal cases and problems and eliminate the true root causes for these items. That is the only way to really improve in the long run.

Art:

So what is the DNA of Toyota in your opinion and the reason why are you still so successful?

Once you strip away all the fancy buzzwords surrounding the company it is simply rigorous problems solving or kaizen depending upon which side of the performance line you are on. If you are underachieving you have a deviation from standard or a problem by definition. If you are at standard then the bar is raised and you must improve using some creative methods to accomplish kaizen. The endless cycle of PDCA for improvement is the only constant along with the pressure to perform.

Art:

What have you worked on improving the most lately?

It has been a lot of back to the basics. Proper job instruction for new workers and teaching them properly from day one. “Mieru-ka” is a movement lately meaning to make things more visible. We have a lot of safety covers and things obstructing views of the production process in our environment. So you can not see into the process at all in many
cases. We’ve been working on ways to remove the covers and make the process both more visible and safe at the same time. The reason is that in machining operations we want the production operators to see the cutting chips and coolant flow more clearly and understand the process better. In general just more emphasis on problem solving related to scrap and rework. Ownership of daily maintenance items related to cleaning, lubrication, and simple checks by production is always a priority as well.

Art:

It is kind of strange for me as a former employee but did you know that the prevailing notion in the U.S. is that you are aligned in value streams with a single manager from end to end running the whole flow of materials and you draw material and information flow maps to make improvements. Can you comment on this?

I believe that is an American created term or made up by some other people. We continue to have departmental managers in production and work in a sort of matrix style organization. No one manages production from raw materials all the way to the end of the vehicle plant for example. That does not even happen in the engine plant. There are managers for casting, machining and assembly here. Machine shop managers have a department and manage a machine shop with many component lines within it such as cam shaft, crank shaft, cylinder block, cylinder head, piston, etc. The vehicle plant has managers for stamping, body welding, paint, plastics, and final assembly. This practice has not changed at all since you worked here.

The Value Stream Mapping tool you refer too is an analysis technique not widely used here in machine shops. Actually very few people in the company use it. I have never drawn one. Someone might use one to measure the lead time from casting, through machining, to vehicle assembly or to count inventory. There might be one or two in this entire plant of 4,000 people but maybe none. Is just a spot analysis technique and nothing more for us.

Art:

This brings up a good question. What improvement tools are mostly used in a Toyota engine plant?

Rigorous thinking and problem solving. You can’t get anything done without this capability. On the engine assembly lines improvement requires the ability to conduct time studies, motion analysis, material flow analysis and other simple kaizen techniques to raise productivity. Fixing quality problems requires the ability to thoroughly execute the PDCA cycle and the structured steps of problem solving.

Improvements in machining are more technical and can’t be solved with just industrial engineering type techniques or simple flow mapping. The value add is performed by the
cutting tool removing metal in machining so you need to learn more about the machines, materials, tooling, and the mechanical properties of chip removal.

Art:

So how are you training people to make improvements in machining areas?

It is still the same way that you had to learn via OJT. There is no easy shortcut for this area. In some cases like yours we have people initially work in the spare parts machine shop to learn the basics of turning, milling, and grinding for example.

Then they are assigned some basic quality and downtime problems to be solved in detail. No value stream mapping is used but they have to learn the 30 processes that make up the crankshaft line for example one by one. We have people sketch the machining process, identify the datum point, study the clamp mechanism, learn the type of cutting tool, and how the chip is removed for example. It is lot of attention to detail and it requires “getting your hands dirty” as the old saying goes.

There is lots of technical documentation involved and process capability issues as well. We still think it takes 5-7 years to make a young engineer learn all the basic aspects of the job in machining and become proficient in kaizen.

Art:

What key points of advice for anyone wanting to improve using TPS style activities in this sort of environment?

Number one it is a lot of hard work so don’t kid yourself into thinking otherwise. Mr. Ohno started TPS in the machine shops of Toyota and this is where the real TPS pillars of JIT and Jidoka concepts come from. It did not happen over night and it was a long battle that involved improvements in processes, tooling, maintenance, etc. for example.

Second don’t confuse the “objective” versus the “method”. I keep seeing or reading these comments about flow, standardized work, pull, or visual control etc. being the “goal” of different companies production system or improvement efforts. Those items are merely techniques and they will get you no where in the long run if you only focus on applying them. The real objective in TPS is to obtain a profit and satisfy the customer. In manufacturing our small role is to build in the highest possible quality, reduce cost, and deliver in the shortest time possible. Everything else under that is just a method whether it be kanban, or standardized work, or level production for example. The methods and tools will change over time. Don’t waste time copying Toyota’s tools. Figure out what your own biggest problems are and solve those.

Third the real emphasis in machine intensive shops is building in quality and separation of man from machine. Jidoka is equal if not more important that JIT in machining. You can fix the flow fairly easily if you have great processes. If you just have JIT and poor
processes then you are in trouble. For some reason Americans and proponents of Lean overseas that I hear about only seem to like JIT activities. I guess that is easier to understand.

In the end though it is all about people development. In production we need cross function workers able to run all thirty of the processes on the crankshaft line who are also skilled in simple maintenance, tooling, and gauging techniques. The engineering and management staff has to be developed to support different areas over time as well. In both cases we need to develop people who can think and lead. In the end human resources are all we really have as a company so we must focus on developing this critical resource.

*Thank you for your time and cooperation.*