The Journey of Toyota Product Quality & Productivity

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**Abstract**

In this article we look at the giant car manufacturer Toyota and view its development to become one of the best car manufacturers if not the best. The company has gain a reputation of producing the top quality cars in addition it is known of inventing one of the famous productivity systems called just in time. Also, we will show the principles established behind its Total Production System TPS and how it responded to its quality problems.

**History** (Success from a single thread.)

It was a single thread that gave a man a dream, created a little history and a family with resourcefulness in its genes.

Sakichi Toyoda wasn't all that interested in fast-moving machinery -- just machines in motion. It's how the Toyota Production System began. Today it's evident on every production line at Toyota and at other companies that use the system. And it's how Toyota Motor Co. is what it is, even if the wheel of progress didn't begin as a wheel.

This family empire was born of thread, not tread as Toyoda was more interested in perfecting the loom, a machine used to weave textiles. It was an unusual start for what would become an automotive giant. But, then, Toyoda always seemed to plant grandiose plans that flowered into unlikely prosperity.

By age 23 he made his first invention, the wooden hand loom. Less than a decade later, he created the automatic loom and founded the Toyoda Group. The invention automatically stopped if any of the threads snapped, opening the way for automated loomworks where a single operator could handle dozens of pieces at a time.

In 1929, when the British textile machinery maker Platt Bros. paid Toyoda $150,000 -- a fortune at the time -- for the rights to his latest loom, he earmarked the money for a venture that would make automobiles. Ford and General Motors Corp. were already building cars in Japan. Toyoda challenged his eldest son, Kiichiro, to "build a Japanese car with Japanese hands."

Toyoda didn't live to see it happen. He died on the day before Halloween in 1930 at age 63. But it did happen.

Soon after, Kiichiro set up the automotive department at Toyoda Automatic Loom Works and within a year had built the first engine ... a genuine copy of a Chevrolet.

Kiichiro also took his father's idea of efficiency in production and turn it into a system of "lean" manufacturing. If parts could be delivered to the assembly line just in time to be installed, the company could save money. Tools were grouped according to necessity and flow of production. He then had suppliers jump on board with the just-in-time system.

By 1950, With Sakichi's nephew, Eiji, involved in the company, Toyota realized exporting to the United States was the way to go, filling large-volume orders with another innovative form of production. The kanban system would call for the ordering of parts and supplies as they were used and correcting defects when they were discovered. Every Toyota worker had the power to stop the production line if a defect was found.

It was the same principle that revolved around the family loom. It would have made Sakichi proud. And so would the Crown, the first full-scale production model to roll out of the Toyota factory in 1955.

Eiji based his system on the American supermarket, something he viewed as the ultimate in buyer-supplier relations.

Eiji had gone to the United States to see car plants, but he found the most ingenuity in the grocery stores, marveling at the self-service and reliance each section had on the next. Still, success wouldn't come easy. By the 1950s, when Eiji Toyoda went to Detroit, the Japanese company was making 40 cars a day, one-200th of what Ford was doing. But Toyota would find its niche in smaller cars such as the 1966 Corolla and the Corona before that.

Today, Toyota makes cars all over the world. What's more, the way the company makes cars still reflects Sakichi's ethic. It is the standard, the blueprint for the auto industry. It is the most efficient car maker in the world. In fact and from a personal experience, one of the European part supplier to Japanese firms in general and Toyota specifically indicated to me that before dispatching any parts to them , they will ensure that it fully meet the set standard. As they are the most strict client.

**Toyota Principles**

To be successful Toyota management and laborer had to embraces and totally believe in fourteen principles. These principles directed their productivity and quality production. The more I have studied TPS and the Toyota Way, the more I understand that it is a system designed to provide the tools for people to continually improve their work. The Toyota Way means more dependence on people, not less. It is a culture, even more than a set of efficiency and improvement techniques. You depend upon the workers to reduce inventory, identify hidden problems, and fix them. The workers have a sense of urgency, purpose, and teamwork because if they don’t fix it there will be an inventory outage.

Section I: Long-Term Philosophy

Principle 1. Base your management decisions on a long-term philosophy, even at the expense of short-term financial goals.

Section II: The Right Process Will Produce the Right Results

Principle 2. Create a continuous process flow to bring problems to the surface.

Principle 3. Use “pull” systems to avoid overproduction.

Principle 4. Level out the workload (heijunka). (Work like the tortoise, not

the hare.)

Principle 5. Build a culture of stopping to fix problems, to get quality right

the first time.

Principle 6. Standardized tasks and processes are the foundation for continuous improvement and employee empowerment.

Principle 7. Use visual control so no problems are hidden.

Principle 8. Use only reliable, thoroughly tested technology that serves your people and processes.

Section III: Add Value to the Organization by Developing Your People

Principle 9. Grow leaders who thoroughly understand the work, live the

philosophy, and teach it to others.

Principle 10. Develop exceptional people and teams who follow your company’s philosophy.

Principle 11. Respect your extended network of partners and suppliers by

challenging them and helping them improve.

Section IV: Continuously Solving Root Problems Drives Organizational Learning

Principle 12. Go and see for yourself to thoroughly understand the situation (genchi genbutsu).

Principle 13. Make decisions slowly by consensus, thoroughly considering

all options; implement decisions rapidly (nemawashi).

Principle 14. Become a learning organization through relentless reflection

(hansei) and continuous improvement (kaizen).

**Toyota TPS**

Toyota has long been recognized for its manufacturing excellence, it is the Toyota product and process development performance that drives the amazing bottom line success of the company. (and, I offer, eliminates/minimizes the work life issues described above). Many people understand that the shop floor success of the Toyota Production System (TPS) is greatly enabled by the product and process designs which originate in the development labs and teams. Some results which the development teams have delivered are:

1. Rarely/never slipping a product launch date

2. Use of about 1/3 less technical resources to deliver new products to the shop floor

3. Launching new product lines (eg. Lexus) with quality as good or better than existing high quality and highly reliable products

Toyota development principles are anchored in keys to the TPS shop floor success including:

1. Incremental and flexible capacity

2. Build quality and personal accountability into the design

3. Maintain flow of material and information

4. Use of standard work

**The connection between TQM and learning Organization**

The connection between TQM and the learning organization is evident in two ways. First, there is a cause and effect relationship, i.e. learning is an intended outcome of TQM. Second, there is a correlation between two powerful systems – process improvement and organizational learning, which are operating in a concurrent and integrated manner.

It is suggested that, to become a learning organization, companies need to be skilled at the following five activities:

* *Systematic problem solving*: Relates to the philosophy and methods of the quality movement, relying on scientific method rather than guesswork; uses actual data rather than assumptions and simple statistical tools.
* *Experimentation with new approaches*: Systematic searching for and testing new knowledge; motivated by opportunity and new perspectives and not by current difficulties.
* *Learning from their experiences and past history* : A review of successes and failures; reflecting and self-analysis.
* *Learning from experiences and best practices of others*: Benchmarking; looking outside the immediate environment; openness to the outside world; environmental scanning.
* *Transferring knowledge quickly and efficiently throughout the organization*: Knowledge transferred quickly and efficiently throughout the organization; mechanisms in place to facilitate the process; written and oral reports; site visits; tours; rotation programmers; education and training programmes.

To determine the link between TQM and learning organizations we examine three organizations which we regard as having successfully adopted the TQM philosophy. The three organizations are Toyota Motor Corporation Australia, Ramset Fasteners Limited and W.A. Deutscher Metal Products Group – all located in Melbourne, Australia. Full details of the implementation of TQM in the three companies have been described elsewhere.

**The link between TQM and learning organizations**

Below we analyse the TQM initiatives of the three companies by using Garvin’s five building blocks of learning organizations. What this analysis has shown is a clear link between TQM and organizational learning.

***Systematic problem solving***

Deutscher has introduced mechanisms to collect data on which decision making and problem solving can be based. These include – the introduction of various quality oriented programmes; quality history sheets; the installation of automatic load monitors to track quality variations; the tracking of control limits at the cold forge process and a customer feedback study to determine which of their products were in demand and why.

Competitive advantage at Ramset Fasteners is clearly focused around product quality. To this end the company has introduced many initiatives, which include: the checking of first runs against specifications; check sheets for measuring rejection rates; logistics analysis and, in an attempt to eliminate guesswork, it has taken a more scientific approach to warehousing and distribution.

At TMCA an internal product audit checks 100 motor vehicles per month for a number of deviations against set targets. Extensive survey activity has been a vital measure of customer feedback. This data has given Toyota a much better understanding of the direction in which it should move to improve its manufacturing competitiveness. Data is also collected from customer profiles, dealer reports and customer assistance centres.

***Experimentation with new approaches***

Deutscher needed to address some major strategic issues and improvements had to be made in quality, customer orientation and production processes. In an attempt to achieve these improvements, the company streamlined its organizational structure and management reporting relationships, and adopted a number of innovative manufacturing methods and techniques.

The introduction of TQM at Ramset saw the following initiatives: improved communication; “bright ideas scheme” to facilitate workers’ ideas and the installation of a computer system to replace the physical control of inventory and process control.

At TMCA the Toyota Production System (TPS) was introduced to integrate plant facilities, materials and labour, which led to the basis for the achievement of TQM.

***Learning from their own experiences and past history***

New management reporting procedures at Deutscher enabled effective review and implementation of corporate strategies. The main benefits of teamwork and two-way communication were clarity of purpose, clear accountability and effective measurement of past performance, which in turn enabled rapid response to changes in internal and external conditions.

The concentration of the TQM programme in one specific section of the operation gave Ramset the opportunity to learn from this experience. The formation of project teams and regular training sessions facilitated a continuous review of the TQM process.

At Toyota, team leaders meet on a daily basis to discuss company progress, policy implementation and target achievement. On a weekly basis this information is then shared and discussed with co-workers at formal team briefings.

***Learning from experiences and the best practices of others***

Regular trips to Japan have given Deutscher’s general managers and manufacturing managers a working example of TQM and encouraged their own study of the philosophy. Deutscher also learn from others by continually testing competitors’ products and by focusing on specific problem areas, they have developed a link between how their business operates and their external environment.

In order to learn about contractual aspects of purchase, product use and after-sales service experiences of their customers, Ramset’s branch, regional and administrative managers, together with sales representatives, meet regularly with major customers.

To meet the requirements of export customers, Toyota’s Australian plants must be able to match Japanese quality. This involves benchmarking against Toyota plants worldwide. The feedback from this benchmarking is used towards the more effective utilization of resources and the achievement of an improved Australian ranking.

***Transferring knowledge throughout the organization***

The main indicators that appear to facilitate the effective transfer of knowledge throughout Deutscher are: the organizational climate, which emphasizes teamwork, two-way communication and shared vision; regular team briefings; monthly management meetings; use of cross-functional teams; product demonstrations; new product launches; a TQM induction programme and company-wide awareness programme.

The catalyst for effective knowledge transfer at Ramset appears to be the streamlined organizational structure. This restructuring has led to improved communication, especially between the research and development and marketing departments. Intensive training programmes and the introduction of the “bright ideas” scheme have also added to the knowledge flow.

At Toyota specific training modules have been designed to give employees specific knowledge to guide them through the different levels of the production process. Other ways of improving the transfer of knowledge are: the use of regular team meetings, quality circles, technical work manuals and employee suggestion schemes.

**Another new Toyota's continuous improvement actions**

At its Princeton plant, by contrast, Toyota is using the down time to hone its workers' quality-control and productivity skills. The company has pledged never to lay off any of its full-time employees, who are nonunion.

Jim Lentz, president of Toyota Motor Sales, the company's U.S. sales unit, said the company believes keeping employees on the payroll and using the time to improve their capabilities is the best move in the long run. "It would have been crazy for us to lose people for 90 days and [then] to rehire and retrain people and hope that we have a smooth ramp-up coming back in," Mr. Lentz said. In Princeton, senior plant manager Norm Bafunno said he can already see the benefits of the training. Mr. Bafunno cites a Teflon ring designed by an assembly worker during the down time that helps prevent paint damage when employees install an electrical switch on the edge of a vehicle's door.

In the past, the drill used to install the switch could slip and damage the paint, affecting two or three vehicles each shift. These vehicles would fail quality inspection and have to go through another process to buff the scratches, hurting the plant's overall efficiency numbers.

Coming up with tweaks like this is known at Japanese companies as kaizen, meaning continuous improvement. This is what management hopes to extract from the months of down-time training: better quality and productivity when production resumes.

Throughout the factory, workers sit in classrooms, repaint hazard areas bright yellow, lift weights, complete dexterity drills and get steeped in Toyota's corporate philosophy.

Near one idle line, assembly worker Bob Mason sat with four others employees around a table looking at a flip chart with PowerPoint printouts on it. The employees went through a problem-solving module based on a technique in Toyota's production system.

**Toyota is used to enhance the medical System**

Toyota manufacturing methods is used mainly to produce the best cars, however; day after day people find it to be feasible to enhance their process. A good example is the application of Toyota system medical quality and productivity. Up until five months ago, Ted Gachowski's weekly chemotherapy appointment was one long, tedious slog through the Virginia Mason Medical Center.

Today, chemotherapy at Virginia Mason is a much shorter trip: The distance from lab to exam room to treatment is less than 12 feet. Once Gachowski is hooked up to his IV, he never has to leave the cheery private room -- flat-screen television, computer, nursing supplies and bathroom are all right there. And his physician, Henry O. Otero, is so close, "I can almost shout to get him," said Gachowski, seated in a reclining chair as the drug dripped into his arm.

The inspiration for Virginia Mason's newfound approach to cancer care came from a most unlikely source: the assembly line at Toyota Motor Corp. Like the Japanese automaker's plants, the glistening new cancer center here was designed around themes of high quality, super-efficiency and putting the customer first. Errors are embraced as learning opportunities, and every one of Virginia Mason's 5,000 employees is encouraged to offer ideas. According to hospital executives and some industry analysts, the management principles that made Toyota the world's most successful car company could have similar results at Virginia Mason.

Another example related to medical is to determine whether the Toyota production system process improves Papanicolaou test quality and patient safety. This was an 8-month nonconcurrent cohort study that included 464 case and 639 control women who had a Papanicolaou test was performed. The Office workflow was then redesigned using Toyota production system methods by introducing a 1-by-1 continuous flow process. The frequency of Papanicolaou tests was measured without a transformation zone component, followup and Bethesda System diagnostic frequency of atypical squamous cells of undetermined significance, and diagnostic error frequency.

The Results after the intervention showed that the percentage of Papanicolaou tests lacking a transformationzone component decreased from 9.9% to 4.7% (P =.001). The percentage of Papanicolaou tests with a diagnosis of atypical squamous cells of undetermined significance decreased from 7.8% to 3.9% (P =.007). The frequency of error per correlating cytologic-histologic specimen pair decreased from 9.52% to 7.84%. This means that the introduction of the Toyota production system process resulted in improved Papanicolaou test quality.

Manufacturing giants such as General Motors Corp. and Dell Computer Corp. began stealing Toyota's model decades ago, but hospitals took much longer. Today, about a dozen are experimenting with elements of the approach, but "nobody has been bolder in what they are trying to do than Virginia Mason," said Premera Blue Cross president and chief executive H.R. Brereton "Gubby" Barlow, who is watching the effort as both an insurance executive and a patient.

In adopting the Toyota mind-set, Kaplan said, the 350-bed hospital has saved $6 million in planned capital investment, freed 13,000 square feet of space, cut inventory costs by $360,000, reduced staff walking by 34 miles a day, shortened bill-collection times, slashed infection rates, spun off a new business and, perhaps most important, improved patient satisfaction.

**Toyota Downtime**

After nearly doubling its revenue in the past decade and redefining competition in key parts of the auto business, Toyota suddenly finds itself confronting mushrooming quality problems. Torrid growth has spread thin the company's famed Japanese quality gurus. This means that, in places like Toyota's Georgetown, Ky., plant, the pressure is on to retrain American workers to take up more of the slack. At the same time, Toyota has launched a world-wide campaign to simplify its production systems

To stop the quality slide, Mr. Cho says Toyota has launched multiple "special task forces" at trouble spots in places such as North America and China to overhaul shop-floor management. Toyota also has established a Global Production Center in Toyota City to train midlevel factory managers so they can more effectively run plants outside Japan. Toyota now is re-evaluating some of its most fundamental operating strategies.

**Toyota Resources stolen by competitors firms**

In the late 1980’s **Chihiro Nakao** left Toyota after nearly 25 years of learning from Taiichi Ohno, the father of TPS, and his disciples. As he worked with numerous international companies he soon learned that he was challenged to explain and implement the use of Toyota development principles into organizations which did not have the decades-long TPS understanding and/or culture. Thus, he **developed** and taught **the Production Preparation Process (3P)** to greatly facilitate the use of Toyota development principles and standard development work by his worldwide customer teams.

Overall 3P consists of all the Processes that take place in Preparation for the **smooth start-up** of Production. Typical **smooth start-up** goals from 3P use are:

1. Greatly improved quality and productivity

2. Reduced capital and operating cost

3. Zero rejects and rework

4. Suppliers building and supplying parts within takt time

5. Meeting Health, Safety, Environmental and Ergonomic goals

6. Significant competitive advantage

Use of 3P for over 15 years by Nakao and his master teachers have brought many refinements and application learnings such as when to best apply 3P. Some of those times are:

1. When a technological breakthrough is needed

2. When off the shelf equipment provides no competitive advantage

3. When continuous improvements generated by shop floor application of TPS are inadequate to meet business objectives

4. To assure quality is built into product and process designs

The 3P process itself consists of a series of steps which are thoroughly executed by a **carefully selected, multi-discipline, dedicated team** with the full support and **active participation by senior leadership sponsors**. A number of the steps call for team and individual activities which are often considered “unusual” of development team personal. These steps can be characterized as helping to uncover alternative creative approaches/designs which are carried forward in parallel paths. The alternatives are quickly tried and improved in inexpensive mock-ups and/or simulations – sometimes called “moon shining”. Key TPS principles such as one-piece/u-shaped material flow, pull systems, mistake-proof, auto-eject, people/process flexibility, standard work, etc. are continually used by the teams to generate total performance results beyond those of conventionally designed processes. Persons experienced in the use of TPS product and/or line design principles and methodologies constructively guide and challenge the teams to break old paradigms and deliver bottom line results through a “smooth start-up”.

While it is well understood that it may take decades of constancy of purpose and use of lean principles to transform a company built on more traditional foundations, the application of 3P will greatly accelerate the rate of change.

**Conclusion**

It is with no doubt the impact Toyota continuously making in the industry and its continuous effort to stay on the top has made it difficult for many others to compete with them. I'm sure any downtime in Toyota quality or productivity will never last and will be taken care of before we know it. Thus, using Toyota as a benchmark will definitely result in a success.

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