THE TOYOTA MINDSET

The Ten Commandments of Taiichi Ohno

by

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Publisher's Note

Taiichi Ohno is often described as a person who was loud, in your face, and absolutely brilliant. Commonly known as the founder of the Toyota Production System, Ohno was a man who believed unwaveringly in his ability to get people to use their intellect to solve the problems of the shop floor.

The stories and examples recounted in this book provide valuable insight into his belief, as well as giving a glimpse into the transitional period of Toyota's history that led to them becoming a world leader in manufacturing. There are not many other books out there that can give a reader such an in-depth look at the man who revolutionized the way manufacturing is done.

Another reason this book is such an invaluable addition to any library of Lean or Toyota Production System books, is the fact that it shows you the reasons *behind* the way things are done. You are provided with stories of how

Ohno devised the now common standards of practice. Not only do we get to see how his mind operated and how he dealt with people on a regular basis, but also the reasoning behind his decisions. The revolutionary ideas that he generated remain unsurpassed in their vision of streamlined efficiency. These ideas, these gems of wisdom, are what make this book magnificent.

I decided to have this book translated based on a number of factors, not the least of which was the fact that it gets right to the heart of how the Toyota Production System came into being. There is no in-depth discussion of principles, merely descriptions of how these principles came to be. What events took place to bring these fundamental tools into being? Why did the standard of practice change? Such are the questions this book answers.

Many people who have read about Taiichi Ohno and the Toyota Production System ask themselves, "What would Ohno do in a situation like this?" After reading this book you will be better able to answer that question and many more.

The stories include both the people who were invaluable to the birth of the system and the challenges that they needed to overcome to make it possible. It is my hope that by engaging in a deeper understanding, and using the knowledge that is given in this book, you will be better equipped to deal with situations and problems that may arise within your own company.

It is my hope that you will cherish this invaluable guide to the inner workings of a brilliant mind and enjoy reading this book as much as I did.

Collin McLoughlin
Publisher

Foreword

In Culman Co., LTD, many of my colleagues, as well as myself, worked under Taiichi Ohno in the past. When we talk about Taiichi Ohno everyone remembers him as an intimidating person. When he would inspect our shop floor while we were conducting continuous improvement, we often found ourselves hiding from him behind machinery. We would avoid eye contact with him so that he would not initiate conversation with any of us. Every once in a while, we ran out of luck and were pinpointed by him. In that case, as I will describe in detail in this book, Ohno would throw work-in-progress items at us with great intensity.

He would sometimes order us to do things that were puzzling to us. He would tell us, "Go stand in a circle and observe the shop floor for a while," or "Follow me around while holding this box in your arms." Some workers even saw him cut a tie in half, worn by a staff member that hap-

pened to be wandering around the shop floor.

We were young and innocent shop floor workers back then. We hardly understood Ohno's strange behaviors and just concentrated on meeting his expectations by trying our hardest to solve problems with our own ideas.

The next thing that my colleagues often mention is that the way they looked at Ohno changed dramatically once they had left Toyota. It was when we became consultants for adapting the Toyota System in many companies and factories outside of Toyota that we discovered the true implications and magnitude of what Ohno was trying to teach us over the years. To this day Toyota principles continue to be the common practice for many manufacturing industries.

The transformation within a production system is realized progressively by establishing mutual understanding among those who possess different philosophies. By accomplishing these processes on our own we become capable of translating his words in the right way and acknowledging that he too had faced the same challenges in the past. We all appreciate his effort from the bottom of our hearts and contribute our success to his commitment to teaching us his principles on the shop floor.

When Fujio Cho was the president of Toyota, he gave a recommendation to my first book, titled "Toyota's Production System and Empowerment of the Workers." At the same time he paid his greatest tribute to Ohno by saying, "Ohno was an extraordinary leader, as well as an educator, who never lost faith in his beliefs or his workers." I could not agree more.

The Toyota Production System, as well as its application to larger-scale production improvement, has attracted a great deal of attention among many industries in recent years. Books, including my own, that help us learn about the transformation always mention the name "Taiichi Ohno." In addition, when faced with difficult challenges and situations in which the right judgment is not easily reached, many people around me often seek answers by

reading Ohno's books, such as *The Toyota Production System*, and try putting themselves in his shoes to derive effective solutions—as he had in the past.

This is the magnitude of influence that Ohno had over the Toyota System. Thus, it is obvious that people desire to study in more detail his personality and his way of thinking, as well as how work should be performed under his guidance. That is the very reason why I decided to write the 10 Commandments, which are strictly based on Taiichi Ohno's philosophy.

It is true that Ohno did not throw out the 10 Commandments in the same way as I have described in this book. The 10 Commandments are described, in my own words, into 10 main ideas that are based accurately on Toyota's way of thinking and the work ethic that I have learned over the years, both from Ohno and as a Toyota worker and consultant.

In some cases, Ohno would deny some of the ideas found in the 10 Commandments. However, I strongly doubt that the 10 Commandments are very far off from his original way of thinking. I have been straightforward to convey my real experiences and knowledge, which helped me to learn the difficulties of work and the degree of commitment required for achieving goals.

The most important element is to have faith in human intelligence and potential. Humans can be empowered by taking full advantage of their innate intelligence. This is the unbreakable foundation upon which Ohno's beliefs were built. *What training is missing on the shop floors these days?* Many leaders have failed to both challenge their workers with hard-to-achieve goals and believe strongly in their intelligence and ability to grow.

Ohno would show his commitment by spending 3 straight days discovering the true cause of defects. My colleagues, who were found responsible for a defect, had received some serious scoldings from him. However, it was an inevitable reaction toward them as Ohno strongly believed that defects should never reach the hands of cus-

tomers whatsoever.

He also went as far as believing that producing defects equaled wasting the lives of responsible workers. These beliefs helped workers endure hardships and later discover the extraordinary essence behind Ohno's philosophy.

I want readers to utilize the 10 Commandments as a starting point. There is nothing more rewarding than having Ohno's principles, described in this book, be realized by readers as a way of creating stronger organizations and higher self-esteem.

- Yoshihito Wakamatsu, President of Culman Co., LTD.

The 10 Commandments

I. Wastes hide so start by disclosing all of your mistakes

II. Discover the truth beyond your understanding

III. Increasing production while limiting the number of workers is the only way to gain true success

IV. Act on problems right away, don't procrastinate

V. Don't feel satisfied by saying, "I finished the job" Go beyond that and say, "I can do more"

VI. Add "Appropriate Timing" to "Appropriate Method" in problem-solving

VII. Believe in "I can" and question "I can't"

VIII. The key to achieving progress is to never give up

IX. Don't do work at an average pace; The shortest way is always the easiest

X. Change yourself first if you want to change someone else

Commandment 1

"You are a cost. Eliminate wastes first, for that is the only way for you to develop your potential."

WASTES HIDE SO START BY DISCLOSING ALL OF YOUR MISTAKES

DO NOT HIDE DEFECTS

The creator of the Toyota Production System (also know as the Toyota System), Taiichi Ohno appeared intimidating to every one, including myself. In fact, he was a truly compassionate man whose words were always correct. He was always full of a radiance that is unique to those whose level of dedication toward creating innovative methods is extremely high.

One of the characteristics of the Toyota System is elimination of wastes in an absolute manner, and there are many categories of wastes to be removed. Most importantly, eliminating defects is the key strategy for improving the production cost, quality, and delivery of finished

products.

In the 1950's, when the Toyota System was first practiced in production, Ohno was on everybody's back and persistently ordered workers to present defects in front of everybody's eyes. When defects occurred, the shop floor workers had a habit of storing them away in places where nobody could easily find them. This was because defects often led supervisors to question the skills of the responsible worker, which was the main reason why Ohno's orders remained unrealized on the shop floor.

One day, Ohno stepped into the shop floor. Workers were always intimated by him and continued to perform their jobs without making eye contact.

> Ohno suddenly jumped into the production line and asked with anger, "What in the world are these?"

The line leader approached Ohno to find that he was pointing his finger at the pile of work-in-progress items in the corner. Ohno began to scold the shop floor.

> "These are all defects. Why are these all hidden away? I told you so many times to place the defects where everyone can see and stop production entirely. "

The line leader was apologetic, but Ohno never liked hearing excuses. We never figured out how he got the strength to lift up all the defects and start throwing them into the hallway, until they were all gone from his arms. One of the defects even hit the head of the line leader but Ohno did not care about that at all.

> He stressed again, screaming, "Never hide defects! Bring them out into the hallway so that everyone can see."

After that, he left the shop floor. The line leader was left standing in front of his workers, which must have been quite embarrassing. If this still happens these days then it must have been a serious issue in the work place back

then, though the shop floors at the time were much more roughly-mannered. I still remember the intensity of Ohno in this kind of situation quite vividly.

IT IS WASTEFUL TO CORRECT DEFECTS

Why was Ohno so fixated on the idea of disclosing defects so that everyone could see them? When a mistake occurs, or defect in this case, humans have a tendency to hide it away and try to resolve it later. They do not go out of their ways to stop the entire production line or process so that it can be dealt with immediately upon discovery. That is the main reason why the true cause of defects is never discovered. In this manner, the same defect continues to emerge, as no effective solutions can be formulated to eliminate the cause. This is a huge waste.

In addition, it is essentially a waste to correct defects later on. If defects are found on a given day and solutions cannot be formulated until the next day, then the time between the discovery of the defects and a solution is simply wasted. In this case, a whole day. This is the very reason why Ohno demanded to disclose all defects, so that workers had an opportunity to question themselves about why such defects occurred in the first place and discovered the true cause. The true cause lies beyond what can be seen on the surface and is the fundamental element that leads to mistakes.

He also stressed the importance of conducting continuous improvement repeatedly, with the involvement of every worker, so that the same mistakes could never occur again. For example, say that a defect was made by assembling the wrong components in a certain assembly process. In such a case, the defect should not be hidden away but presented to everyone on the shop floor so that everyone can ask why the mistake was made and improve the process by continuous improvement, in a rather casual manner. Ohno strongly believed that a company could grow tremendously if such an effort was systemized and carried out at all times on the shop floor.

Many unexpected things can still happen to the actual place of work (gemba) no matter how much continuous improvement effort is made. For the shop floor environment, as far as human workers are concerned, certain conflicts continue to occur as result of the gap between the levels of expertise among workers. Even an expert worker can still make mistakes if he is feeling sick or simply in a bad mood. As far as machinery is concerned, no matter how much attention is given to its safety, machinery breakdown is still beyond our control. You may also find defects among the items that were delivered from your suppliers.

These are the reasons why the shop floor is often considered excellent as long as "the first run rate" scores around 97–98%. The first run rate determines the ratio of defect-free products against the defects, after a quality inspection. In this case, the waste associated with correcting defects is limited to only two to three percent of production.

In practice, even the best manufacturer in the world finds it extremely difficult to yield a first run rate of 100%. Some people joke around saying that the only way to achieve a zero-defect goal in production is to not run production lines at all.

In fact, many factories permit a certain percentage of defects to be produced and believe it to be unrealistic to achieve zero-defects, while at the same time promising 100% defect free products to consumers. What sets Ohno separate from these factories is that he denied these assumptions and strongly believed that it was realistic to do so. Consequently, he made sure that these 2 principles were in place to achieve a zero-defect goal:

(1) Visualization

When defects are found, the entire production line is stopped. Defects are then brought to the foreground so that every worker can learn from them.

(2) Repeat "Why?" 5 times

The true cause of defects must be pursued thoroughly and elimination of such a cause is carried out by continuous improvement.

Visualization has become one of the standard principles in the Toyota System. However, it was extremely challenging to implement Visualization when the Toyota System first came into practice. This was because the successful implementation of Visualization had to remove any fear from the workers; the fear that bringing defects to the foreground placed blame directly onto the workers responsible for them. For this reason, workers often tended to deal with their mistakes on their own. However, neither mistakes nor defects could have been eliminated in this manner.

Ohno successfully inculcated the Visualization principle in the shop floor workers to make sure that defects and mistakes became a collective wealth among them all, so that workers became capable of formulating solutions to remove wastes more effectively. At the same time, he was also committed to teaching workers to maintain a high level of awareness toward cost-management. I will explain this in detail in the next section.

REASONING BEHIND THE TOYOTA SYSTEM

In the Toyota System, processes build the quality into a product. Product quality is never enhanced by tightening standards used for an inspection. Inspections serve only one purpose; rejecting defects so that they do not reach the end-users. Every time a defect occurs you must repeatedly ask yourself "Why?" and eliminate the true cause. By doing that persistently your ability to produce only good products will be enhanced. That is what makes it true to say that processes build the quality into a product.

COLLECTING SMALL PARTS LETS YOU IDENTIFY BIGGER WASTES

WHAT WOULD YOU DO IF IT WAS MONEY?

"Hey you, Mr. A. Carry this box and follow me around," Ohno ordered Mr. A, while he was conducting continuous improvement activities on the shop floor in Toyota. Ohno began wandering about the floor before he even finished the sentence. Mr. A picked up a wooden part box he found nearby and started following Ohno.

In a situation like most people would ask to find out where they were being led to, however Mr. A wanted to avoid confrontation with Ohno as he knew how intimidating Ohno could be. Ohno continued to roam around the shop floor while studying every aspect of the factory. Workers on the shop floor continued their work without making eye contact with Ohno, as usual.

It was a strange scene for everyone to observe as Mr. A following Ohno ever so quietly. It was also a funny scene, in a way, but nobody dared to either laugh at him or ask Mr. A what was going on. Mr. A continued to follow Ohno without uttering a word. They spent a good amount of time circling the entire factory.

> Ohno finally turned to him, upon returning to the starting point, and asked, "Mr. A, didn't you realize that there were many components lying on the floor?"
>
> "Yes. I did notice some components lying on the floor," Mr. A replied.
>
> "If you did, why did you not pick them up?" Ohno asked again.
>
> "You just told me to follow you around. You never told me to pick up those components," Mr. A replied.

> "Shame on you! Go around the factory again and pick them up!" Ohno instructed him with anger.

Mr. A hurried back down their trail thru the factory and picked up the components, placing them into the wooden box. He told himself that he should have been told to pick them up in the first place but he could never rebel against Ohno. His colleagues saw Mr. A picking up the components and asked what was going on. He replied by saying "I am just doing what I was told to do by Ohno." All they could do to help Mr. A was show him their sympathy. "Good luck, Mr. A…"

Mr. A went back to where Ohno was standing and showed him the wooden box. Ohno picked up one of the components from the box and asked Mr. A,

> "Do you have any idea how much these components are costing us?"

Unfortunately, Mr. A was not knowledgeable about the price of each component at the time.

> "I have no idea," he replied.

> "I see. How about I tell you the cost for these items you just picked up? I want you to calculate the total cost based on that," Ohno told Mr. A.

Mr. A took out his abacus and started punching in numbers (electronic calculators did not exist at the time.) What was so impressive was that Ohno had remembered the exact prices, including cents, for every item in the large box of components. However, what was more striking was the result of the calculation. It was quite shocking to see how small bolts and screws could cost the factory such a large amount of money. Usually, these items were ignored as they only represented a fraction of the total cost on their own.

> "Were you surprised to learn how much money we are wasting?" Ohno asked Mr. A.

"Yes indeed. It opened my eyes," Mr. A replied.

"I understand. Everyone ignores these small items because they are insignificant, but what would you do if they were money? I am sure you would pick them up before anyone else. Imagine how much money you could gather up at the end," Ohno told Mr. A.

Ohno did not say anything more about it to Mr. A. This experience became the most important lesson that Mr. A learned in his career.

There are many other shop floor episodes like this one. I, myself, was trained to be cost-conscious in this manner by Ohno.

VISUALIZATION OF COST HELPS YOU MANAGE UNNECESSARY COST

The Toyota System never plays a guessing game in determining the cost of producing certain items. The cost per product can be calculated in advance by taking into consideration the price of each component and other expenses, such as labor, storage spaces, and so on. Therefore, any reduction in cost can be easily witnessed as a result of continuous improvements in the production processes.

In order for Ohno to teach workers this lesson of becoming cost-conscious, sometimes drastic, or rather unique, methods were often used. One of the methods that he used was being able to recite from memory the exact prices for each and every item used in the factory, which no one else in the factory could do at the time.

The scenario of Mr. A, who followed Ohno around on the shop floor, is a great example. Workers became cost-conscious and developed a new approach to their work by picking up discarded items from the floor with their own hands.

It seems that humans can change their actions when it is

about money. If workers are fully aware of the production cost and their labor expenses, they will naturally learn to think a great deal about the shop floor and, at the same time, find better ways to conduct their work so that the overall cost will be diminished. On the other hand, workers often find their work unbearably redundant in the administrative sector, where the cost does not directly affect their operation.

Let me tell you a story about the delivery company that was a part of a large corporate affiliate group. In the past, workers did not care about costs and did everything as ordered by their parent company, who had helped them financially over the years. One day, the company was asked to become financially independent. At this point, workers calculated the cost for everything and analyzed methods for reducing the cost by changing how they drove their trucks (even how to step on the gas and clutch) and selecting more efficient delivery routes.

To reduce cost effectively it is essential that every worker foresees the cost. Visualization allows workers to identify problems diligently and approach their work with cost-sensitive minds, which leads to them becoming a great source of continuous improvement ideas. Since that bitter experience with Ohno, Mr. A began to approach his work and continuous improvement activities with a tremendous level of attention to every cost involved in the production process.

Cost-awareness among workers cannot be attained by simply ordering workers to save and eliminate costs that exist on the surface. It has to be done, and enforced, by clarifying every cost that is to be acknowledged by every worker.

REASONING BEHIND THE TOYOTA SYSTEM

The Toyota System advocates the principle of "Visualization of Cost." If you were bluntly told to reduce the cost mainly because the company was going through some hard times, you would neither take it seriously, nor

change the way you perform work. However, if every cost was displayed behind glass with clearly articulated goals to achieve cost reduction, everyone would take the matter seriously. This is the ultimate sharing of critical information in a workplace. Moreover, companies should disclose any information related to their business conditions to their workers so that solutions for solving problems will be automatically generated from concerned workers.

DON'T PLAN WITH NUMBERS FROM THE PAST OTHERWISE THE SAME WASTES WILL BE INHERITED

HOW COULD YOU BASE YOUR FUTURE PLANNING OFF OF PAST RESULTS?

In the early 60's, Mr. B was working as an administrative operator for Toyota's production management department. Since becoming his superior, Ohno's thinking and attitude had greatly influenced Mr. B. At that time, Ohno was assigned the role of Factory Leader for both the headquarter factory and the Kamigo Factory in Toyota City, Nagoya. He was also a managing director for Toyota. Even though Ohno had been known as "God of the shop floor," the administrative department including, Mr. B, underestimated the fact that Ohno could ever have influenced the way their job was done, even though they had experienced many encounters where their common administrative processes had been completely overturned by Ohno.

For example, a task was given to analyze the level of production efficiency for certain machinery on the shop floor. By calculating the capacity and handling of machinery, when production was to be increased the production management department was able to determine how much production needed to be outsourced with great accuracy. This task was considered to be the most important step in their operation.

After a tremendous amount of effort, they submitted their final report to Ohno. However, he did not intend to

read it at all and instead he simply threw it away.

> "I am so disappointed in all of you. You can only do wrong calculations," Ohno admonished.
>
> "How can the performance records of the past be used to determine future performance?" Ohno asked the team and turned them away by saying, "If you have time to spare like this you should step onto the shop floor and study it."

Every member in the administrative department, including managers and directors, were completely lost as to how to interpret what Ohno had said. What was more puzzling to them was that the shop floor was able to maintain its calmness despite the fact that they would typically experience chaos when the administrative department became completely lost.

In another case, when a branch factory submitted a request to production management to have a portion of their production outsourced, due to the lack of their production performance, such a request was usually accepted as long it was found to be sound and feasible. However, Ohno no longer accepted such requests, which was later withdrawn by the factory manager. The production management team thought that the request was reasonable enough and that the factory would fail completely if their production could not be outsourced. Instead the factory managed to overcome the hardship without any adverse effects.

Mr. B wondered why the factory did not fail and asked the factory manager,

> "How did you manage to survive the situation?"
>
> "Since our request was denied by Ohno we immediately thought about another way by which our production could be contained. We made various continuous improvements and figured out a way to pull it off without any outsourc-

STOP WRITING "DEATH CERTIFICATES"

As Ohno's strategies continued to become rooted in production, the number of requests made by factories for outsourcing production dramatically reduced. In addition, the amount of work that needed to be performed in the administrative department was also diminished.

A few months later Ohno created a continuous improvement team within the production management department, where Mr. B was assigned to continue his work. The team conducted various continuous improvement activities under the guidance of Ohno. The team was referred to as the "Production Inspection Lab," which is still present in Toyota factories today. By the way, I am going to tell you the big secret of this story. Mr. B is Fujio Cho, the current president of Toyota Motors.

I believe that administrative duties should be alleviated by the advancement of information technology but instead I often come across distressed factory managers, who complain about the lack of time they have to step onto the shop floor. Apparently, they are required by higher management to process a high volume of paperwork, for which they spend most of their time in front of their computers. I often ask if such paper work is really necessary. If workers were assigned to produce data that nobody would ever utilize again, the time spent for preparing such data would be the biggest waste of all.

When I would do some paperwork on my desk in the early part of my career, my superior used to tell me, "You can take that paperwork home, but you cannot bring the shop floor with you." This experience taught me the importance of conducting continuous improvement at the actual place, the shop floor. Therefore, I often advise people to ask themselves this question, "Which is more effective to make progress, doing paperwork in the office or formulating solutions on the shop floor?"

I am not suggesting that collecting data or doing paperwork is always wasteful, however if you are being kept away from the shop floor because of it, it would be like

concentrating on circumstances at the expense of the main issue. We must start focusing our attention on eliminating the wasteful time spent by asking questions repeatedly like, "Are these documents really necessary?" and "What should be done now?"

REASONING BEHIND THE TOYOTA SYSTEM

Generally speaking, our future planning is often based on historical data. However, Ohno conveyed that historical data inherits various wastes that can be passed on to our new decisions. Therefore, we must refrain from building our decisions upon historical data to avoid the same wastes and flaws our decisions made in the past. The Toyota System believes that continuous improvement in the actual place is the only effective method to eliminate our reliance on historical data.

MEASURE YOUR PERFORMANCE BY PRODUCTIVITY, NOT BY HOW BUSY YOU ARE

DO REAL WORK FOR AT LEAST ONE HOUR PER DAY

In 1946, Ohno gathered up young workers on the shop floor without notice and told them the following,

> "Fellow workers, I urge you to do real work for at least one hour a day. Your work is so wasteful. Show your ideas and stop being so wasteful just for one hour."

This kind of a remark made every worker feel offended and utter words of rebelliousness. Workers said to one another,

> "He must be joking. We are doing the best we can and even work overtime. What did he mean by "doing real work for at least one hour"?"

Some workers showed a bit of hostility against Ohno. Workers thought that they were trusted by Ohno and felt

that the trust was broken for no reason. Their reaction was totally understandable, as they frequently had to work an average of 9 to 10 hours of overtime in a row. Ohno must have known this fact, as he was the managing director of the factory. Being their superior made him realize that their work was being performed in a wasteful manner.

In an example of punching holes in metal rods, a young worker processed 80 rods manually in one day.

> "Why are you punching holes by manual feeding when you have automated machines to do the same job?" Ohno ask the young worker.
>
> "It is because I can process it faster in this way than automatic feeding," The young worker replied.

Admittedly, the automation required 40 seconds to process one rod, whereas processing by hand only took 30 seconds. However, Ohno kept on questioning the young worker.

> "If one rod takes 30 seconds, 2 rods can be processed in one minute. That means that 120 rods can be processed in one hour, correct?" Ohno asked.

The young worker found himself at a loss for words because he had thought that he was doing his best by processing only 80 rods in one day.

> "According to my calculation you should be processing 80 rods within 40 minutes, meaning that you are putting in real work for only 40 minutes per day. I am sure that you are trying your best but your performance is not acceptable. Do me a favor and perform real work at least one hour per day," Ohno said to the young worker, with a gentle tone in his voice.

The reasons why the young worker took 8 hours to process 80 rods are as follows:

(1) Manual Feeding

It takes 30 seconds to process one component by manual feeding. However, the tip of the drill gets overheated after 3 components are processed consecutively and must be sharpened frequently. Workers have to wait in line to sharpen the drill, as the number of grinders available on the shop floor is limited. Grinding of the drill takes only 30 seconds, however the whole process usually takes 10 minutes if you include the trip to and from the grinders.

(2) Automatic Feeding

In contrast, it takes 40 seconds to process one component by automatic feeding. The drill automatically turns off before it gets overheated, therefore there is no need for grinding the drill. All workers have to do is set the components to be fed into the machine and let it run automatically while they continue to perform other tasks.

REMOVE WASTES FROM WORK ITSELF

Ohno often emphasized that various wastes existed in the way we had always conducted our work. He always helped his workers to realize this, which led to an increase in their productivity. Ohno may have used a harsh way of telling them to do real work at least for an hour a day, but he was only hoping to motivate workers.

There is actually a good reason behind Ohno's method, who had taken such a harsh attitude toward his workers since the 1940's, when World War II had finally come to an end. The year the war was over, Kiichiro Toyoda, the founder of Toyota Motors, gave a pep talk to his company workers.

> "We must catch up with American auto-makers within three years, otherwise the Japanese automobile industry will be bound to fail completely."

In those days, productivity of Japanese industry was only 1/8th of that of American industry. Ohno determined the productivity of Japanese workers had to be increased by 8 times. However, he never thought that Japanese workers would have to work 8 times as hard as American workers, nor that Americans were working harder than Japanese workers. He thought that the difference in productivity could be explained by the fact that Japanese workers were being more wasteful in production. Therefore, Japanese industries could manage to exceed American industries by completely eliminating wastes from production.

With this in mind, Ohno looked carefully at the shop floor and not to his surprise, observed various wastes. There were many cases where workers would waste 8 hours of labor and perform real work for only 40 minutes to yield a true added-value to production. Ohno's strong belief was that production could be boosted by 8 times once each worker learned to perform waste-free work for 8 hours, even if they had to start doing so by performing productive work for only 1 hour per day. This was the starting point of Ohno's principle, "Working with Human Intelligence."

In the beginning, Ohno's request to perform actual work for at lease one hour each day was accepted with resistance among the workers. Most workers already tried their best and often received compliments for their devotion from their supervisors. It was understandable that they became offended when they were told by Ohno to do real work for at least one hour.

As a matter of fact, Ohno intended this to be as sort of shock treatment. With his shocking remarks and persistent effort of getting workers to visualize wastes in production, Ohno attempted to convey the true purpose behind his behaviors.

INVENTORY IS A CRIME

The basic principle in manufacturing is to analyze market demand carefully and base production on that. In the past, a high economic growth period various commodities were scarce, therefore every product was sold easily because of the high demands among consumers. Having stock was a common practice back then as it was only a short matter of time before products were cleared out of inventories.

Large machinery was purchased for production to keep up with the market demands. Workers did not even take into consideration any sales needs or market demands, all they needed to focus on was manufacturing a wide range of products, as many and as quickly as possible. Factories had operated under these circumstances for many years and mass production had become the main process taught to the shop floor workers.

During that same time period Toyota Motors had started to take a different approach to production. Their approach was, fundamentally, to "produce only saleable items." Toyota learned that very important lesson when it faced bankruptcy in 1950, due to holding a large volume of inventories. In other words, the Japanese automobile industry, in the post-war period, became financially vulnerable and could not afford to maintain inventories in order to complete with well-established companies overseas.

What did Ohno mean by "necessary items?" It basically means a "sales trend." Everything is determined by the market demand. The necessary items are decided by the market and should not be controlled by decisions made only on the shop floor. The real challenge here is to produce the necessary items at the lowest cost possible. It is referred to as "Limited Amount Management," or limiting both the cost and quantity of production. This is what separates it from the "Make to Stock" production system.

The "Make to Stock" production system is simply based on assumptions and the sales forecasts of producers. However, such assumptions are often inaccurate, which causes

factories to suffer from excessive inventories. Even with elaborate sales forecasts, which are made by carefully analyzing the market, it is not that simple to predict the market as business climates and people's hobbies change quite unexpectedly. Another disadvantage of the "Make to Stock" production system is a failure to meet the market demand when it exceeds the volume of production. This also means a loss of opportunity to sell more items on the market.

The Toyota System clearly understands that their production systems must accommodate gradual changes in the market demand and allow a flexible production mechanism in order to facilitate efficient transitions for both an increase and decrease in production. In order to systemize such a production system, the shop floor management had to associate a sense of guilt with holding inventories and to keep firmly in mind, at all times, that only saleable items needed to be produced.

REASONING BEHIND THE TOYOTA SYSTEM

It is considered wasteful to:

- Produce items that are assumed to sell
- Produce items in less time than needed
- Produce more items than needed

Over-production, especially, can lead to various wastes other than maintaining inventories, such as an increase in In-Process Stock (increased holding time due to material shortages or process delays), waste of movement, and waste of transportation. True work lies in a production system where only the necessary items are produced in the necessary quantity at the right time. The Toyota System calls it "Just-In-Time."

"You idiot! How are you going to stand in such a small circle?" Ohno asked.

Mr. C redrew a bigger circle and was ordered by Ohno to stand in the circle and observe the shop floor for a while. Mr. C had no clue as to what this was all about, but he could not object to Ohno and decided to stand in the circle as told.

Around lunch time Mr. C heard nature calling, so he stepped out of the circle to use the bathroom. When he returned to the circle Ohno was standing by it to see what had happened.

> "Why did you step out of the circle without permission?" Ohno asked.
>
> "Well, I needed to use the bathroom pretty badly," Mr. C began.
>
> "After you have lunch come back to this circle and stand in it. If you need to leave the circle for any reason, you must get permission," Ohno gave his instructions to Mr. C and left the scene.

Mr. C simply had no choice so he stood in the circle. He did not know what to look for and just observed the shop floor without any purpose.

> In the early evening Ohno came back and asked Mr. C, "So, have you figured it out yet?"
>
> "I just have no idea," Mr. C answered honestly.
>
> Ohno gathered his thoughts and said, "I see. You can go home now, but you will need to stand here tomorrow morning as well."

Mr. C almost brought himself to ask Ohno what this was all about but he knew, as always, that Ohno would ask him to figure out the answer to his own question.

He returned and stood in the circle the next morning. He

was smart enough to know that he needed to be looking for some problems, since Ohno had personally ordered him to observe the shop floor, but he could not figure out what the problem was, much less what he was supposed to be doing about it.

> Ohno came to see him around lunch time and asked, "Have you figured this out yet?"
>
> "Yes. There is a problem," Mr. C answered with uncertainty hoping to put an end to the whole situation.
>
> Ohno did not ask him what he discovered, but instead pointed a finger at the shop floor and said, "Observe how the shop floor workers conduct their operations. You told me that you had continuously improved the shop floor but it has gotten worse because of your instructions! If you know what the real problem is now, go and fix it right away."

He looked at the shop floor again and agreed that workers were still having a hard time doing their duties. He immediately interviewed the shop floor workers and formulated another continuous improvement strategy to remedy the issues.

The problem was that he automatically assumed that his initial continuous activity had been successful and did not carefully confirm its results. Ohno knew immediately that the problems that still existed on the shop floor; instead of telling Mr. C right away, Ohno wanted to teach him a lesson in his unique way of ordering his workers to stand in a circle.

Ohno focused on teaching workers two things:

> (1) Observe the shop floor closely.
>
> (2) See through a continuous improvement activity and confirm the positive results with your own eyes.

It took as long as one and a half days for Mr. C to learn the lesson but this experience had opened his eyes and enabled him to approach the shop floor with a greater level of accuracy and confidence throughout his career.

HOW CAN YOU BASE YOUR FUTURE PLANNING ON PAST RESULTS?

> Once, when Ohno was touring a company, he asked the factory tour guide, "How much time does this process take?"
>
> "I think it is around 15 minutes," the tour guide answered, without knowing anything for sure.

Without moving at all Ohno continue to observe the shop floor workers in detail. He counted down the time and the process did not get completed within the 15 minutes.

> "I knew it. It took more than the time you specified. This is because your workers are doing their jobs in a wasteful manner. You must fix the problem by continuous improvement right away," Ohno told the management personnel and continued touring the factory.

As Ohno emphasized all the time, if there is a problem the true cause of it must be identified by observing each process carefully. At the same time, the existing issues and assumptions must be confirmed by stepping onto the shop floor and determining their accuracy. *Both the starting and ending points of true work reside on the shop floor.*

I personally have had similar experiences with Ohno. When I told him that a certain continuous improvement activity was carried out on the shop floor he often asked me if I had seen any positive results because of it or not.

There is a famous episode with the founder of the Toyota Group, Sakichi Toyoda, in which he would spend all day observing some elderly females weaving in the neighborhood while he was inventing the automatic loom. Ohno

was simply the same way. Continuous improvement requires a perfect comprehension of the shop floor and to accomplish that Ohno repeatedly told his workers,

> "Stand in the shop floor and observe the processes all day long. You will come to understand what must be done to resolve the most critical problems."

REASONING BEHIND THE TOYOTA SYSTEM

It is easy to say "Observe the shop floor" or "Know the shop floor," however it is always challenging to discover the true problem and figure out an effective continuous improvement solution simply by our observation. When you think that you have figured it all out, your decisions are still often limited to the scope your own knowledge. Therefore, continuous improvement solutions created in this manner often fail to succeed.

You will begin to establish the most effective solution by persistently searching for truths and observing every process on the shop floor repeatedly until the real issues are discovered. The Toyota System has strongly encouraged this self-training process among their workers in order to promote the most effective problem-solving skills.

AVOID FIRST-AID REMEDIES; DEVELOP A HABIT OF ANALYZING PROBLEMS THOROUGHLY ON THE SHOP FLOOR

DID YOU APPLY AN APPROPRIATE SOLUTION?

A Toyota worker, Mr. D, had worked for Toyota for 5 years when he was assigned to work on a project that was designed to increase manufacturing productivity for newly released cars. While working on this project he had an opportunity to meet Ohno for the very first time. Mr. D had heard about Ohno's unique personality and leadership, however it was not until he actually worked with Ohno that he was truly astonished by Ohno's passion and

REPEAT "WHY?" FIVE TIMES

The assignment given to Mr. D was not simply to locate the missing Kanbans. He was supposed to analyze the true cause of the problem and facilitate a continuous improvement solution so that the same mistake would not be repeated ever again on the shop floor.

Mr. D found that Kanbans had been attached to the top of the component boxes and were pasted, by accident, onto the oily bottoms of other boxes as they were stacked. To solve this problem, Mr. D instructed that Kanbans should be attached on the side of the component boxes, which successfully eliminated the issue of missing Kanbans. After this incident the supplier became proficient in utilizing Kanbans in their operations.

Mr. D came to understand that first-aid solutions should never be applied and instead an analysis of the true cause of a problem is absolutely necessary so that effective solutions can be put into practice. He also acknowledged that 2 important lessons had been taught by Ohno:

> (1) Implacability in asking yourself "Why?" five times.
>
> It is easy to simply instruct people to repeat "Why?" five times. However, as in the case of Mr. D, a tremendous effort and devotion is often necessary to draw answers for the first "Why?" Many of my colleagues from Toyota had experiences of being instructed by Ohno to discover the true cause of problems over the period of several days, or even that of many months. In some cases, asking "Why?" needed to be repeated six or seven times until the true cause was discovered. Solutions formulated after asking "Why?" only two or three times are not the real solutions, as the true cause has yet to be found. In this case, the same problems are often repeated and lead to more serious conse-

quences.

(2) Fix it at the core instead of just patching it.

Ohno taught me the difference between "fixing" the problem and "patching" (first-aid) the problem. When a machine breaks down it may require some first-aid repairs, such as replacing parts. However, the machine is most likely going to break down again, as the true cause of the problem was never fixed at the core. This is just "patching" the problem and is not "fixing" the problem. "Fixing" seeks out the true cause of a problem and removes it so that the same mistake is never repeated. "Fixing" is one of the most important practices in Toyota. Toyota also applies this practice beyond machineries to many other sorts of problems so that a strong-minded shop floor is established in the end.

REASONING BEHIND THE TOYOTA SYSTEM

The Toyota System requires "Why?" to be repeated until true causes are discovered. It is indeed a tough challenge for everyone, but our work requires a strong commitment to overcome problems if it is to be meaningful at all. In other words, a new array of work becomes apparent to us as the result of our devotion to the existing work.

DON'T JUST DO WHAT YOU CAN, DO UNTIL YOU CAN

SEARCH FOR THE ANSWER UNTIL YOU FIND IT

In the world of quality control it was often considered acceptable to find three defects in 1,000 products. That is a defect rate of only 0.3%. This could easily pass the quality control standards of the past, however it is simply unthinkable by today's quality standards. Despite the fact that such an allowable defect rate has been improved over the years, many factories still believe that a certain per-

centage of their production is inevitably going to become defects in one form or another. As I described previously, Ohno strongly believed that defects could be reduced to absolute zero with no exceptions.

Mr. E was a technical instructor who worked on the assembly line for the factory managed by Ohno. He was in charge of attaching clamps and screw nuts onto the body frames in the automobile section. One day, a frame advanced to the post process without a necessary clamp attached completely to it, and was later returned back to Mr. E. Ohno happened to step into the shop floor and found this defective frame was being kept on the floor.

> He immediately called for Mr. E and asked, "What in the world is this all about?"
>
> "It was retuned by the post process because it was missing the clamp on it," Mr. E replied.
>
> "Have you learned where and why it was detached from the frame?" Ohno asked.
>
> "I have no clue," Mr. E replied.
>
> "Shame on you! It is the most important aspect of your work. Investigate this case until you are absolutely sure how this happened," Ohno fumed.

It was his first time being reprimanded by Ohno with such intensity. Because of his experiences in working as a technical instructor he knew the significance of inspecting reasons why the defect came about in the first place. However, he had wished that this would be an exception due to its rare occurrence. He knew that rarity, and the many possible causing factors, were just too large a problem to manage on his own and he did not like to push disruptions onto other departments. He also knew that Ohno would never accept this as an exception since the problem had come to the surface in the first place.

Mr. E started his investigation as ordered by Ohno,

though he knew it was going to be extremely difficult. In order to find defects he had to observe the "scene of the crime" of the defect at the time it was produced. Since the reoccurrence rate was so low he thought it was simply impossible to witness the same defect occur again. Mr. E persistently looked for the defect for over two days with no luck at all.

He reported to Ohno hoping that he would be ordered to stop searching.

> "I spent the last two days looking for it, but nothing could be found."
>
> "Keep on looking until you find it," Ohno simply replied.

On the third day, he witnessed the moment when the clamp snapped off in the engineering shop. It was outside his jurisdiction so he called the manager in charge and instructed him to implement a continuous improvement measure to eliminate the problem.

As ordered by Ohno, he spent three straight days investigating the cause and successfully overcame what had been considered impossible. If he had simply given up, this could never have been achieved.

NEVER ACCEPT EXCEPTIONS

I was often told by Ohno that exceptions such as three defects out of 1,000 products should be cherished as they always indicate room for more improvements. By eliminating exceptions one by one, the zero-defect goal becomes more attainable while at the same time improving the quality of overall production.

Toyota's quality control tactics have deep roots in the development of automated weaving machines by Sakichi Toyoda. Sakichi's weaving machines were equipped with safety devices that allowed stopping of the machines when threads snapped or ran out, for instance. This mechanism successfully eliminated even the slightest chance for any

I finally found it."

REASONING BEHIND THE TOYOTA SYSTEM

The elimination of defects is a never-ending goal in the field of manufacturing. This goal can never be achieved if even the slightest percentage of defects are viewed as exceptions. A strong determination for our "zero-defect goal" must be present and we must dedicate ourselves to observing the shop floor for a number of days until we can witness the crime. It sounds extremely challenging to accomplish, however you must try until you pull it off. That is the Toyota way.

DON'T BECOME CONCEITED BY BEING SATISFIED WITH IMMEDIATE RESULTS; AVOID BEING OVERCONFIDENT

FORGET ABOUT WHAT HAPPENED YESTERDAY

The most difficult stage in a continuous improvement activity is when positive results begin to appear on the surface. "Everything we could possibly do was done. Nothing more can be continuously improved at this point." Such a self-conceited attitude should be eliminated. One must reset oneself and go back to their first objective so that new motivation towards continuous improvement can be attained.

The reward is usually huge and easy to see during the beginning stages of implementing continuous improvement measures. Positive results are easily achievable and enjoyable by even rough measures at first. This is more true if continuous improvement activities are initiated in a more wasteful production environment. Our challenge remains, after acquiring the first set of objectives (by carrying out only the most basic continuous improvement), to define the next set of goals and overcome the tendency to be satisfied with only the easily-attainable goals.

A widely-improved shop floor often says, "We have done great work so far. We have nothing left to improve."

This is a sign of over-satisfaction.

Toyota worker Mr. F performed a series of continuous improvements in the production line, which enabled performing a certain process by only three workers, instead of five. As a result, the production cost was reduced dramatically and Mr. F received many compliments from his colleagues. He himself thought it was a wonderful job and felt overly satisfied with the end result.

> Ohno told Mr. F, "Think beyond that. What comes after reducing the number of workers?"

Mr. F had no idea what Ohno meant at first. He honestly thought there was nothing more to be done after eliminating two workers. The result was good enough and no other department had been as successful in reducing the number of workers as drastically as he had.

> "There is nothing more that can be improved from this," he told Ohno.

> "Improve further what you have already continuously improved. That is what separates true professionals from average workers," Ohno replied.

Ohno strongly believed that only death can separate continuous improvement from a worker. When one sprout of waste is removed another sprout grows immediately in its place. Workers must always think beyond their achievement and should not remain satisfied with what was already accomplished in the past or they would miss a new sprout of waste.

Ohno once told me an analogy to explain the dangers of self-conceit. He used the story of a student and master of Japanese sword fighting. To become a sword fighter, a student trains under his master in the beginning. After vigorous training the student was able to win one game out of three from his respected master. If he thinks and feels satisfied here, "I can win one game out of three against my master therefore there is nothing more for me to learn," he

ceases to improve himself beyond this point.

For those who become true masters, they will focus on nurturing their intelligence at this point. They may meditate or isolate themselves in the mountains to reflect on their past knowledge and experiences so that they could become free from all distracting thoughts. By doing so, ones moral character and a higher level of intelligence are formed, reaching the realm of a sword fighting master.

Ohno thought that feeling satisfied with your own continuous improvement was like being content with winning only one game of sword fighting out of 3, and that such workers would be limiting their own potential to grow. To promote this idea on a daily basis, Ohno often said,

> "Forget about what you accomplished yesterday. Do not think about tomorrow either. Something is wrong and wasteful with what you are doing now and today. There is still room for continuous improvement as we speak."

With this recommendation in mind, Ohno guided his workers through continuous improvement on a regular basis.

ONCE THE GOAL IS REACHED, REPLACE IT WITH A NEW ONE

Mr. F started to think differently after the incident with Ohno.

> "No matter how hard I work to get the results I desire, I should not remain satisfied. As a professional, it is extremely important for me to initiate a new challenge on my own in an attempt to seek the ultimate production mechanism by a never-ending continuous improvement effort. "

It is extremely important to feel a sense of triumph in our intellectual development, to a certain degree. However, if it turns into excessive self-satisfaction, humans will cease to grow beyond that, and, in some cases, can even begin to

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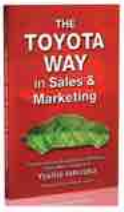

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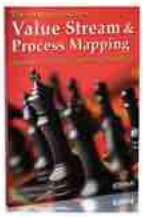

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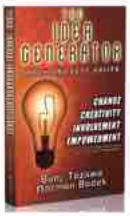

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THE TOYOTA MINDSET

The Ten Commandments of Taiichi Ohno

From the brilliant mind of a legend in the LEAN Manufacturing world comes the reasoning behind the importance of using your intellect, challenging your workers and why continuous improvement is not only a helpful tool but a necessity on the shop floor. Mr. Wakamatsu recounts captivating, first hand experiences with the man who changed the way the world looks at manufacturing.

"If they do it with three people, we will do it with one!"
Taiichi Ohno

For anyone wishing to gain insight into how the Toyota Production System came to be or who wishes to know more about the founders of the TPS, this book is for you. Through personal accounts and inspirational quotes, the story of Taiichi Ohno and the Toyota Production System is recounted in a manner that will give any reader a solid foundation in the LEAN world.

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Mr. Wakamatsu was born in 1937 in Miyagi Prefecture, Japan. After joining Toyota Motor Corp, he devoted his life to testing, implementing and continuously improving the TPS under the direct guidance of Taiichi Ohno. Since 1984, he has helped agricultural machinery manufacturing companies and housing construction companies to adapt the Toyota Production System. In 1991, he became an advisor for Daewoo Motor Corporation of Korea. Since 1992, he has served as the president of Culman Co. Limited of Japan.

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