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Authors:
Mr. William C. Schwagerman III
Dr. Jeffrey M. Ulmer

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ATMAE
1390 Eisenhower Place
Ann Arbor, MI 48108

www.atmae.org

The A3 Lean Management and Leadership Thought Process

Mr. William C. Schwagerman III, Dr. Jeffrey M. Ulmer

William Schwagerman is currently a Senior Process Improvement Analyst at the Fike Corporation. Schwagerman has 35 years of continuous manufacturing experience in roles including management and supervision within production, logistics, engineering, and quality assurance having worked at Prier Brass Manufacturing, Western Electric, AT&T Technologies, and the Economy Machine Shop. Schwagerman has also been a state level Baldrige/Missouri Quality Award examiner for 2012 and 2013. In relation to education, Schwagerman completed a Bachelor of Science in Industrial Technology in 2009, Masters of Science in Industrial Management in 2012, and earned a Lean Six Sigma graduate certificate with the University of Central Missouri in Warrensburg Missouri.

Dr. Jeffrey M. Ulmer is an Associate Professor of Engineering Technology, Technology and Industrial Management at the University of Central Missouri in Warrensburg, Missouri, teaching both undergraduate and graduate students. Ulmer is an American Society for Quality Certified Six Sigma Black Belt and a Certified Manager of Quality & Organizational Excellence. He is also a trained Lean Six Sigma Black Belt (from the Regal-Beloit Corporation) and has worked for 25 years in industry in the areas of product engineering, quality assurance / control, and production management.

ABSTRACT

This research paper will review the Plan-Do-Check-Act (PDCA) cycle of process improvement and how the PDCA cycle is integrated into the Toyota Motor Company's business practices. The paper will also examine the A3 problem-solving tool and how that tool is embedded in the Toyota culture to promote further learning and continuous improvement. This continuous improvement methodology is an employee-driven, fact-based culture assisted by the appropriate training and mentoring in PDCA, Toyota Business Practices (TBP), and A3. The Toyota Motor Company has consistently rated well in production efficiency, design, and sales over the last several decades; much of the success has been attributed to the company's culture. Many years of in-plant research, subsequent books, seminars, and other educational resources about Toyota's methods have assisted companies, but have not yielded the same level of success found at Toyota. It's become ever more evident that it's not just about the lean tools such as 5S, Value-Stream Mapping (VSM), Kaizen, and Kanban, but also company culture, the people, how they are taught, and how they learn. These factors lead to behavior patterns which are unique, yet seemingly unattainable and not explained in company documents. The way Toyota leads and manages its people is at the heart of Toyota's success. There is a management tool that helps all employees learn how to learn for optimum benefit. The PDCA-based tool aligned with the TBP called the A3 problem solving process instills continuous improvement. This is accomplished through a variety of lean methods and by establishing employee and organizational habits which become an inherent process of continuous improvement. It creates a culture of employee engagement, empowerment, and embedded PDCA thinking among employees. This is something Toyota has developed and mastered over several decades, and continues to do in their never-ending pursuit of continuous improvement.

INTRODUCTION

Toyota Motor Corporation's production system and its lean activities of manufacturing has received much attention for several decades. However, there is a paucity of information regarding how the company manages people to achieve operational learning. Henry Ford, with his early 1900's continuous assembly line, flow concepts and implementations provided the roots that led to the eventual development of Toyota's Production System (TPS), or what Americans today call lean manufacturing (Sobek & Smalley, 2008). The Japanese and Toyota took the basic ideas of Ford and other American quality and manufacturing genius in Deming, Shewhart, and Juran and expanded it to what exists today ("Lean Mfg. Strategy," n.d.). Toyota improved upon these original American strategies and methodologies. In contrast, other companies, although applying lean strategies have, not had the same success in manufacturing efficiency. In 1990, Toyota was one-half the size of General Motors (GM) and two-thirds the size of Ford. In 2007, Toyota easily grew larger than Ford and began to surge past GM to become the largest and most successful industrial enterprise in the world (Womack, Jones & Roos, 2007). It's relatively common knowledge that Toyota's success is pulled from a management philosophy and culture that is grounded in what was originally developed by American Walter Shewhart, called Plan-Do-Check-Act (PDCA) which is aligned with the Toyota Business Practices (TBP) and an A3 report template (Wescott, 2005). The TBP pyramid of 4 P's consists of philosophy, people, process, and the culminating piece to Toyota's success; problem solving. Toyota's practice of PDCA is the driving force of the use of lean manufacturing and can be captured in an A3 proposal.

The A3 proposal is a problem solving tool with a solid structure to implement PDCA management. PDCA is a system for continuously improving and managing an organization. Many PDCA loops are going on at any one time, each aligned to achieve Toyota's overall goals (Sobek and Smalley, 2008). However, widespread use of the A3 in organizations has allowed additional benefits through this standard methodology for innovating, planning, problem-solving, and building foundational structures integrating larger, more in-depth thinking, which in turn produces organizational learning deeply rooted in the actual work (Shook, 2010). This approach leads to successful behavioral patterns which have a significant impact on lean company management and leadership of employees (Rother, 2010). This occurs as their thinking reframes any activity as a learning activity at all levels of the organization, whether it's standardized work and 5S at the employee level, system kaizen at a manager's level, or strategic decisions at the executive level. This research paper will review Toyota's cultural use of the PDCA cycle and A3 problem

solving tool for manufacturing performance success. This research contributes to the industries by providing insights and guidelines for effectively applying the A3 problem solving tool following the examples of TBP. This continuous improvement methodology is an employee-driven, fact-based leadership thought culture assisted by training and mentoring in PDCA, TBP, and A3. The A3 process has proven valuable and effective not only in manufacturing, but also the healthcare, and educational fields (Sobek & Jimmerson, n.d.).

PRINCIPLES AND THEORY

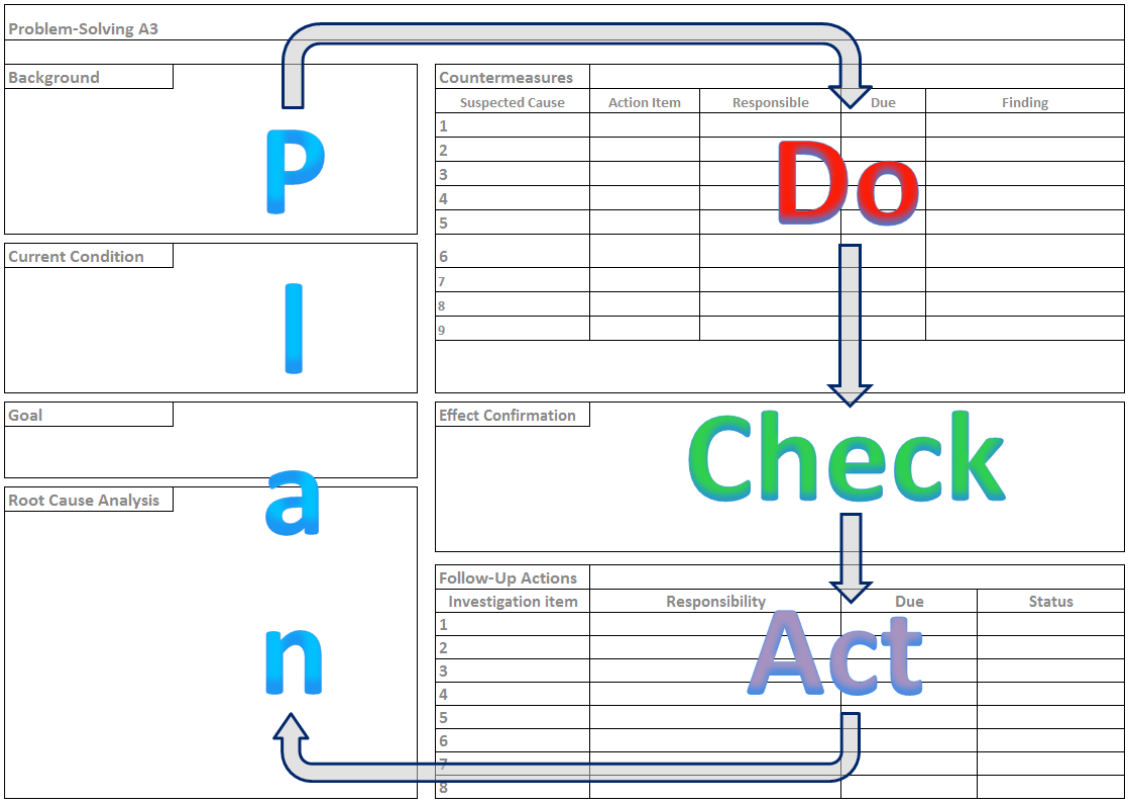
A3 for Problem Solving

A3 problem solving began in the 1960's as the problem solving format called Quality Circles. It evolved at Toyota and became the standard format for problem-solving, proposals, plans, and status reviews (Shook, 2010). The A3 Report is intended to be flexible and adaptable to the problem at hand (Anderson, Morgan, Williams, 2010). An A3 lays out entire plans or reports, large or small, on one sheet of paper and tells a story, laid out from the upper left hand side to the lower right, which anyone can understand. It is visual and very concise (See Figure 1).

A3 reports fit on one side of an A3-sized sheet of paper, which is about the same size as 11X17-inch paper. The A3's purpose is to document on one page the results from the PDCA cycle. The "Plan" phase begins the PDCA process by stating the problem clearly and objectively while also giving some background and context so that everyone involved gains a common understanding of the issue and root causes identified. The "Do" phase takes the hypothesis and tests it by scientific method. If improvements are necessary, things are simply changed and adjusted. During the "Do" phase, accurate data is identified and retrieved from what the Japanese call the "Gemba," or the place the work is being done. The "Check" phase is initiated to study the effects from the "Do" phase. Facts are revealed, analyzed, and discussed to determine what worked and what didn't work. The fourth phase of PDCA is "Act" and is sometimes referred to as "analyze" because it is designed to identify what worked and what didn't, and why. If the results were good, the group will determine how to standardize and share the success and eventually go back through the PDCA cycle to improve further. If the results were poor the group would determine how to prepare to repeat the PDCA cycle once again.

The A3 is a template or tool for addressing root causes of problems in the workplace in a rigorous and systematic way. Imbedded in the methodical

FIGURE 1. A3 TEMPLATE SHOWING PDCA OVERLAY



steps of the A3 tool is the PDCA cycle of problem solving. The A3 system can be summarized in seven elements: alignment of the effort with strategy/objectives, being consistent throughout the organization, a systems approach to problem solving, a logical thinking process, presenting information in a nonjudgmental way, using processes and achieving results, and using only critical information and visualization. The graphic nature of the A3 contributes to deep understanding of the current condition and the target condition whether manufacturing, healthcare or education related (Lean Healthcare West, 2012). The A3 tool provides a visual manifestation of what is being reasoned or considered by the user. With that, careful thought of the problem statement and current state details must be considered before addition to the A3 tool. Once a future state is identified, a future state/current state gap can accurately be determined. This methodical process is referred to as A3 thinking (LEI, 2012).

Obviously lean manufacturing has gone through planning and deployment in many organizations. On the average it has had a positive impact in individual process efficiencies and some bottom line results depending on the company's approach and follow-up. However, Toyota has taken the A3 process much further by utilizing it not only for problem solving but also as a tool for organizational culture management. The main theme is to pull from the thinking generated by the use of the A3. At first, A3 templates appear complicated as they are composed of a sequence of mandatory methodical steps. First, individual boxes cover the business context and problem statement. Then the user is to use the tool to describe the current state, identify the desired future state, analyze the situation to establish causality, propose countermeasures, prescribe an action plan, and finally map out the follow-up process (Liker & Hoseus, 2008). However, what appears complicated is deceptively simple as users practice this to the point it becomes a natural thought process.

The PDCA "Plan" phase is the most heavily weighted half of the A3 (See Figure 1) and includes the background section, current state, future state or goal, and root-cause analysis. This is completely consistent with the lean A3 thinking approach where the end results will be better from planning efforts upfront. It's all too common for people to just jump in and "solve" the problem. Incidentally, the Toyota culture promotes investing much time and effort in the "Plan" phase, dividing it into specific steps as necessary. The first step addressed on the A3 is the Background section which highlights information essential for understanding the extent and importance of the problem. For optimum value, the A3 author(s) must be aware of his/her audience and connect the background to the company's goals (Sobek & Smalley, 2008). Step two addresses the Current Condition/State section which can be described in words or even better, pictorially as with a Value-Stream Map (VSM). A VSM is a lean tool that helps us understand the flow of material and information as product makes its way through the value stream (Rother & Shook, 2009). Visual explanations such as charts, diagrams, and graphs are crucial to effective A3 writing (Sobek & Smalley, 2008). Step three, is to address the Target Condition/Goal section with the use of flowcharts, metrics or an optimized VSM. The target condition will highlight the sources of waste and eliminate them (Rother & Shook, 2009, p. 49). Step three should also address two fundamental issues that define project success at the end of the implementation and what will be used as a standard or basis for comparison. For example: Our goal is to reduce damaged parts from handling errors by 70% as compared to 2011 results. Now a gap between the current and future state/goal is identified on the A3. Step four involves investigation of the Current Condition section to identify the root cause of the problem. The most common technique used by practitioners of lean, and heavily emphasized by Toyota, is the 5 Why's method while the Ishikawa, also known as the "fishbone diagram" method, and the Reality Tree work well (Chakravorty, 2009).

The PDCA "Do" phase begins in step five and closes the gap between current state and future state with the Countermeasures section which focuses on proposed improvements occupying an action list for solving the problems. Early in the Countermeasures section an action plan will be outlined including tasks, those involved, and schedule of completion. Step six is the Effect Confirmation section which is simply "Checking" results. However, traditionally in business, implementation occurs and time passes without verifying whether the problem was actually eliminated and the future state attained (Shook, 2010). The next step in PDCA is to "Act" to reflect any further changes or adjustments in the Follow-up section (Shook, 2010).

Hypothetical A3 Example

A hypothetical A3 report is shown in Figure 2. The "Background" section captures how the problem relates to a company 2012 strategic goal of gaining 25% more market share with a particular product while lowering manufacturing costs. The audience that's being considered here are middle level managers that must dedicate resources to the effort and also be able to report to upper management. The "Current Condition" section simply explains that the current standard lead time is 3 weeks while the competitor has a 2 week standard lead time. The "Goal" section states that there exists a gap of 1 week and this is to be reduced to match the competitor's lead time. The "Root Cause" section shows the summary of using the 5-Why's and Ishikawa (fishbone) diagram. It was revealed that

the root cause of major inefficiencies related to the lack of good production flow due to traditional batch processing and the poor flow from suppliers. Batch processing was a major factor in the inefficiencies in machine, manpower, and methods. The proposed "Countermeasures" section lists the areas that will convert from traditional batch processing to one-piece flow to decrease leads times. Task leaders and due dates are also provided to keep the effort on track. The "Effect Confirmation" section shows that the countermeasures have reduced the lead time to within one day of the 2 week lead time goal. The "Follow-up Actions" section provides further opportunity for improvement to continue to strive for the original goal which could also be captured in another A3 if desired.

or "go and see" similar processes on the shop floor that can be better summarized in the A3 (Liker & Hoseus, 2008). An important consideration is that an experienced mentor allows someone developing A3 reports to gain a deeper understanding of the process. Toyota's positive results haven't been due to the fact that their legendary figures were brilliant, but because Toyota focuses on continuous training (Sobek & Smalley, 2008). The required decades of learning may seem daunting, but it should be understood that this is how long term success is achieved, by gradually continuing to improve.

Like the A3, PDCA is embedded into the Toyota organizational culture and has evolved over many decades. After years with no formal name for the culture, it became known as The Toyota Way in

FIGURE 2. HYPOTHETICAL A3 EXAMPLE

Problem-Solving A3: Strategic Goal - Increase Marketshare for Product XYZ Author: WCS Report Update: 12/31/12

Background

One of the 2012 Corporate Strategic Goals is to reduce leadtime of Product XYZ by 30% in an effort to gain 25% more market share.
A byproduct of this reduction will also be a reduction in manufacturing costs.

Current Condition

Customers are quoted a standard leadtime of 3 weeks for Product XYZ. Competitors provide a similar product in 2 weeks.

Goal

Quote a standard 2 week leadtime without raising manufacturing costs or increasing scrap or rework by January 2013. The current gap is therefore 1 week.

Root Cause Analysis

5 Whys utilized revealing inefficiencies with batch processing and material management of material supply.

Ishikawa (fishbone) revealed machine, manpower, and method, inefficiencies.

See attached 2 pages for 5-why and fishbone diagrams.

Countermeasures

Suspected Cause	Action Item	Resp.	Due	Finding
1 Batch Processing - CNC lathe	Develop one-pc. Flow	WCS	12/2/12	38% flow increase
2 Batch Processing - CNC mill	Develop one-pc. Flow	TRD	12/2/12	29% flow increase
3 Batch Processing - Assy	Develop one-pc. Flow	APE	12/2/12	35% flow increase
4 Material Management Supply	Vendor Partnerships	RTQ	11/20/12	25% delays due to late mat'l.
5 Inspection Inefficiencies	In-Process Inspection	BDW	11/20/12	15% delays - inspector avail.
6				
7				
8				
9				

Effect Confirmation

Lead time reduction of 26% as of 12/15/12 (current lead time of 2 weeks, 1 day). Further continuous improvement action to be taken to continue to strive for the full 30% leadtime reduction goal.

Follow-Up Actions

Investigation item	Responsibility	Due	Status
1 Kaizen of CNC areas	TRD	12/25/12	5% gained efficiency
2 Kaizen of Assy areas	APE	12/25/12	12% gained efficiency
3 Report overall progress	WCS	1/15/13	Monthly report
4 Sales and marketing update	JPP	3/15/13	Pending
5			
6			
7			
8			

The A3 process is taught as part of developing competent and able people within Toyota manufacturing. For example, group leader pre-promotion training curriculums at the Toyota Motor Manufacturing Kentucky (TMMK) plant includes group A3 problem solving exercises. First the team runs through a problem solving simulation which includes a "mini factory" setup for participants to build Land Cruisers. Group leaders are working towards the highest quality, at the lowest cost, and in the most efficient amount of time. During the process the group could practice genchi genbutsu

2001 and it documented five core values of lean leadership. These foundational five values were: having the spirit of challenge, having a continuous improvement mind, going to the where the work happens, embracing teamwork, and having respect for the people (Liker & Convis, 2012). The Toyota leadership model contains four phases representing PDCA which promotes repeated cycles of learning while focusing on "True North," which is a stable vision of where the company should be headed. For Toyota, it's based on the values of the Toyota Way (Liker & Convis, 2012). The first phase focuses on

learning to live "True North" values while phase two promotes coaching and developing others through self-development learning cycles. Phase three ensures that local capability is built throughout for daily management and Kaizen/process improvement. Phase four ensures that the vision is created and aligned with goals not only vertically but also horizontally (Liker & Convis, 2012).

The Toyota Culture

In general, many manufacturing plants that have embarked on lean manufacturing with any seriousness and dedication may have a plant that resembles a Toyota facility. Yet, over time these same workplaces gradually revert at some level, to operating as before. These organizations adopt the appearance of lean, without actually practicing it. It may be called TPS with no real overall substance and with the real work of implementing lean yet to begin. That's because it's more than a set of efficiency and improvement techniques, it's as much or more the culture. Many books, articles, presentations, seminars, and workshops exist with statistics about Toyota's success (Rother, 2010, p. 3):

- Sales growth for over 40 years, while other U.S automakers' sales reached a plateau or decreased.
- Toyota's profit exceeds that of other automakers.
- Toyota's market capitalization has for years exceeded that of GM,
- Ford, and Chrysler; and in recent years exceeded that of all three combined.
- In sales rank, Toyota has become the world leader and risen to the number two position in the United States.

Traditional companies and their workers tend not to comprehend the culture behind TPS. Without the proper culture, lean tools are just tools. Without a culture of continual learning, continual improvement and an engaged workforce, the tools' power have become drastically limited (Rother, 2010).

It's the people that bring the system to life within The Toyota Way by communicating, working, growing together, and resolving issues. Employees are active in making improvement due to Toyota's culture. TPS and the Toyota Way contribute to a system designed to provide the resources necessary so that people can and will continually improve their work. The reduction of inventory and identification of obscure issues can only be addressed by the people. Through teamwork, a sense of urgency, and purpose, people may prevent depletions. Engineers, quality specialists, operators, vendors and team leaders are all involved in continuous problem solving and improvement, each and every day, and learning to learn better the PDCA-based tool they use is A3.

In 2005, Mr. Fujio Cho, the vice chairman of the board of Toyota Worldwide, announced personally that an adjustment was necessary to how The Toyota Way could be more easily integrated on a global scale. The TBP, again with PDCA embedded, were established to better put The Toyota Way in action consistently throughout all Toyota companies world-wide. The eight steps of the TBP drive concrete actions and processes in an effort to, in Cho's words (Liker & Hoseus, 2008):"…contribute to society, our customers, and Toyota itself, which will lead to our continuous personal growth and satisfaction as professionals." (p. 150). The eight steps of the TBP not surprisingly mirror the A3 process, since both are founded directly on PDCA (Liker & Hoseus, 2008). It's Toyota's continuous improvement culture utilizing PDCA that continues to enlarge the gap between them and other automakers' performance. One major difference, as witnessed by former General Motors employee Steve St. Angelo, president of the Georgetown Toyota plant, were the difference in problem solving strategies. St. Angelo stated in an interview, "Some differences I see at Toyota are that we are very process oriented and traditional companies are very results oriented" (Liker & Hoseus, 2008). Toyota considers PDCA in everything they do and by focusing on the process, the results will improve (Liker & Hoseus, 2008).

The accumulation of an organization's principles and practices at any point in time is a result of the routines of thinking and behavior by its members. Human behavior and the routines and habits by which the people conduct themselves each and every day, are what lead the organization to be competitive, have the ability to adapt, and produce and promote the necessary improvement culture. The study of psychology shows that with practice, behavior patterns can be changed and learned, and can be reproduced simply by focusing on developing daily behavior patterns. A3 problem solving develops a pattern of behavior through repetition of utilizing a consistent PDCA process for any problem facing employee teams. The behavior is one of learning development that occurs over time, experienced by each and every employee through a managed and consistent process (Shook, 2010).

A3 for Learning

The A3 process goes beyond the practical application by embedding deep thinking as a key tactic. Toyota managers uniquely use A3's to mentor others in root-cause analysis and scientific thinking, which simultaneously aligns the interests of individual people and departments within the organization by promoting positive dialogue and assisting people to learn from each other. The A3 report is also used to nemawashi, a Japanese word for a process of gaining agreement with those involved

by quietly laying the foundation prior to the presentation of a problem or formal proposal. Another critical purpose for the A3 report is to be used as a "bashing draft" so that it can be respectfully and productively criticized in an effort to make it more accurate. There must be a mutual understanding that the author of the A3 will not be emotionally attached to the first draft and that "bashers" are only critiquing the information, not the author in an effort to get to the real communication needed (Liker & Hoseus, 2008).

The A3 management system allows people to learn in a manner that comes most naturally, through their experience, learning from errors, and through plan-based trial and error. A3's assist organizations to make decisions, distribute authority to the appropriate level for good decisions, align individuals and teams on common goals, and learn for continuous improvement. It could be considered a customized checklist generated by fact-based information which is referred to over and over as necessary. Ultimately, A3's make the process of problem solving transparent and teachable in a manner that builds an organization of thinking, learning problem solvers. With this, the A3 lean management and leadership process powerfully expresses the essence of operational learning (Liker & Hoseus, 2008).

CASE STUDY – NUMMI PLANT

In 1984, New United Motors Manufacturing, Inc. (NUMMI) was formed with permission from the Federal Trade Commission (FTC) as an independent California corporation between competitors Toyota and General Motors (GM). The manufacturing plant to be used was the GM-Fremont facility that had been shut down in 1982 because of poor quality, poor productivity, and labor problems. After the incorporation of NUMMI, 5,000 former GM-Fremont employees received applications for employment. In December 1984, the plant produced its first Chevrolet Nova and in April 1986 its first Toyota Corolla FX16. The Nova and the Corolla FX16 were produced on the same assembly line by the same workers (Duerr & Duerr, 2005). The NUMMI plant closed after Toyota pulled out in April 2010; twenty-eight years after the venture began (Kiley, 2010).

Manufacturing at NUMMI, under Toyota control, became a success early in the operation. In the first two years, attendance was at 98 percent with most of the absences occurring for excusable reasons. Only one grievance was not solved informally. Absentee rates were still low and labor relations still good in 2004; twenty years after the plant opened. The Toyota vehicles from NUMMI won a number of Initial Quality awards, J. D. Power and Associates awards, Top Car under $15,000 ratings from the American Automobile Association (AAA), Consumer Digest's "Best Buy" rankings, and others. Also, NUMMI received a number of J. D. Power and Associates Plant Awards for its factory, and it received DNV Certification Inc. Environment Management Certification (ISO 14001). During operations, productivity was high and labor turnover rate was lower than most U.S. facilities while labor relations were good. Both Toyota and GM benefited from what they learned in the joint venture, and produced many quality cars to increase sales and revenues. Increasing market share was Toyota's primary objective in beginning manufacturing in the U.S. while GM had two major objectives in entering the joint venture: "to gain first-hand experience with the extremely efficient and cost-effective Toyota Production System" and to obtain high quality automobiles for its Chevrolet division (Duerr & Duerr, 2005).

GM's goal was to apply what it learned at NUMMI within its other plants to gain great benefits company-wide. At NUMMI, Toyota had the responsibility for manufacturing and GM handled marketing of all completed product. Toyota's full intention was the use of its own manufacturing approaches (Duerr & Duerr, 2005). With that, NUMMI encouraged consensus decision-making and avenues for staff feedback. GM executives at the plant felt this caused delayed decision-making but admitted that all managers at the facility were well informed and fully aware of all aspects of the business. The practice of cultural transparency, consensus decision-making, and creating channels for staff feedback lasted while the NUMMI plant existed (Duerr & Duerr, 2005). Toyota's approach consisted of cooperative management-labor relations development, extensive training of workers, encouraging responsibility and teamwork of the individual within work groups, placing safety and quality first and giving the worker responsibility and authority to assure it, and implementing Toyota's TPS upon the foundation of the other key factors. Appropriately so, as TPS was intended to be founder Taiichi Ohno's integrated management system (Russell & Taylor, 2009).

Toyota stressed the importance of well-trained employees and applicants for positions at NUMMI. Applicants were carefully selected based not only on their abilities but willingness to learn and continuously improve. For example, hiring began in May 1984 yet initial assembly did not begin until December 1984 and actual full production on the first shift wasn't reached until eleven months later. Toyota's plan and follow-through was to provide a high level of training even if production began later in the process. Workers were also sent to Japan to Toyota's Takaoka plant beginning in June 1984. Several groups of 32 members each were sent for three weeks of in-class and on-the-job training with an eventual total of 450 group leaders and team leaders. (Duerr & Duerr, 2005)

In his early days at NUMMI, the general manager

of the plant had no room for inventory in the body shop, proper employee training and equipment stability was a daily challenge, and TPS provided many, many opportunities for development. With the frequent breakdowns of the machines, fixing the root problems was essential to maintaining production. Although production was kept running with great effort and skill, there was still a large gap between NUMMI's equipment uptime and the level of performance in Toyota plants in Japan (Liker & Convis, 2012).

Ironically, the person who brought the body shop to a new level was not a manufacturing executive, but someone who came out of finance in Japan. Changes were instituted by a new NUMMI president, Mr. Fumitaka Ito. Mr. Ito was also dissatisfied with the uptime of the body shop and lack of engineering personnel on the shop floor where the problems were so he immediately introduced A3 problem solving. Mr. Ito knew from TPS that uptime referred to processes being required to generate entities or doing value–added work 100% of the shift time. In traditional manufacturing, the definition of uptime is related to the availability of the process to do any work, rather than the process doing any work (Wedgewood, 2007). Mr. Ito required the general manager and his engineers to obtain a breakdown report for each case in the shop and have the Japanese engineers in the body shop show the American engineers how to prepare the A3 report. Engineers were not only to fix the breakdown, but to identify the cause of the breakdown (for example, improper maintenance, user error, or defective inputs) and then address root causes for future prevention. The engineers were to present the report personally to the general manager and Mr. Ito within a week of these breakdowns (Liker & Convis, 2012).

Mr. Ito addressed the production problems that NUMMI was having in a sustainable way instead of making production goals priority. This would prevent letting the Japanese engineers just solve the problems. Also, a development opportunity was occurring for the American engineers to practice their problem-solving skills. By having the American engineers take the lead and take responsibility for the A3 reports, Mr. Ito had them learn problem solving and the value of genchi genbutsu or "go and see" on the plant floor. Finally, he was giving the general manager an opportunity to stay engaged in the problem-solving process and the opportunity to learn the responsibility of developing the engineers (Liker & Convis, 2012).

Mr. Ito would focus on asking questions and critiquing the reports during the presentations to help the engineers learn to learn. He ensured that the problem statement was clear, and that it progressed to the 5 Whys, and determined whether the countermeasure clearly connected to the root-cause analysis. Mr. Ito had years of proper training and cultural background which gave him the ability to pick out key holes in an engineer's thinking, and to expose missing parts of the story by digging deep with the proper questions. Again, Mr. Ito was a finance man, not an engineer, and did not know the technical details of a problem but he was well trained in A3 thinking and managing to improve learning. By following the Toyota way of critiquing, Mr. Ito would mark up an A3 report so that the engineer would be allowed to learn from it and improve (Liker & Convis, 2012). Mr. Ito taught that the goal of filling out the A3 report is not to fill out the form perfectly, but have the tool serve as an aid to clearer thinking and learning in the problem-solving process. Mr. Ito listened to the presentations and reviewed the A3's to assess each engineer's capability, their thinking and reasoning, and how deeply they thought about sustaining improvements. The key to developing leaders at Toyota was to teach that the A3 reports are a powerful technique for developing problem-solving ability. Those in charge of the engineers began to understand the reviews as a way to measure both the capability of the worker and their own capability as a teacher and coach. Immediately, the A3s improved, and so did equipment uptime which began to approach the levels at Toyota plants in Japan (Liker & Convis, 2012).

CONCLUSION AND RECOMMENDATIONS

The evidence of the last 20 years indicates that trying to copy or reproduce another company's techniques, tools, or principles does little to change an organization's culture. It's clear that Toyota has been very successful due to their continuous improvement culture and tools based on PDCA. PDCA is the heart of the culture, the business practice, the tool, their total way of learning and thinking. It's a gradual process that has been an accumulation from many decades of effort. This has proven itself in recent times with the economic crisis of 2008-2009, the Toyota recalls of 2010, and the tsunami of 2011. Toyota, like any company has its weaknesses and these were readily apparent across the globe. However, Akio Toyoda, president of Toyota Motor Corporation stated that it was not failure of The Toyota Way, but instead failure by some departments to follow The Toyota Way. Much was learned from the valid failures which arose, but only after the root causes were identified and understood. Toyota's performance metrics are rising again and the future looks very strong utilizing both PDCA and their simple lean management and leadership learning tool called the A3 within their organization, business practices and culture.

Toyota's PDCA culture continues to develop in a gradual process which involves individuals thinking outside of themselves. Due to the analysis

derived from this paper, the authors recommend that a company avoid having employees in problem solving situations jump to conclusions providing what seem to be obvious solutions. These "sure" solutions normally have a component of emotional attachment which may not address the true issue. The organizational culture must pull from other team members who can contribute to the deeper solution. Missing the optimum opportunities squelches performance opportunities which only accumulate throughout the year. Like Toyota, organizations with the A3/PDCA mentality should drive lean management and leadership thought processes, which allows larger chunks of improvement to be reaped. Through training and mentoring, more employees should become champions of improvement, thinking objectively, and be free of ego. With that, like Toyota, the physical A3 paper may even begin to go away as the process is ingrained in the mind. To be like TPS, A3 and PDCA must live and breathe in everything being done in the organization so that employees will constantly learn how to learn to be most effective.

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