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Removing Borders: The Influence of the Toyota Production System on an American Office Furniture Manufacturer

Susan E. Koole

Grand Valley State University

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By

Susan E. Koole

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THESIS

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WE HEREBY APPROVE THE THESIS SUBMITTED BY

Susan E. Koole

ENTITLED Removing Borders: The Influence of the Toyota Production System on an American Furniture Manufacturer

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ABSTRACT

The Toyota Motor Corporation is one of the top automobile manufacturers in the world and behind its success is the Toyota Production System (TPS). TPS is a philosophy based on continuous improvement and eliminating waste in processes and in the space where work is performed. At the center of this philosophy is the emphasis on learning. Although several companies attempt to implement the methods and tools of TPS, many do not understand the learning organization culture that must be developed to support it.

This case study reveals the needs of Herman Miller, Inc., an American office furniture manufacturer, as it continues to implement TPS, subsequently named by Herman Miller as the Herman Miller Production System (HMPS). Through literature, online research, interviews with Herman Miller employees, workshop attendance, and a tour of a plant that has been practicing TPS since 1996, the author concluded that many factors are essential to building and sustaining a learning organization at Herman Miller. These factors include: implementing a standard method of communication regarding HMPS throughout the organization, encouraging supervisors to commit to the HMPS philosophy while becoming knowledgeable of employee work processes, systematically reporting the changes in standardized work of the surrounding production lines, continuously enabling employees to make changes in how they work, and building trust between employees and company leadership.

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CHAPTER I

Introduction

Situation Analysis

The Toyota Motor Corporation is one of the top automobile manufacturers in the world and behind its success is the Toyota Production System (TPS). TPS is a philosophy based on continuous improvement and eliminating waste in processes and in the space where work is performed. At the center of this philosophy is the emphasis on learning. Toyota understands the importance of a learning organization and how to foster a culture that sustains it. Moreover, its willingness to bring TPS to the United States for the benefit of the struggling manufacturing industry demonstrates its dedication to a learning organization culture and it also reveals how the manufacturing industry in the United States must shift its thinking about learning in its daily operations.

Three men developed TPS including Sakichi Toyoda, his son, Kiichiro Toyoda, and a production engineer named Taiichi Ohno. After World War II, Toyota faced very different business conditions than the Ford Motor Company and the General Motors Corporation. While Ford and GM used mass production, economies of scale, and big equipment to produce as many parts as possible, Toyota's market in post-war Japan was small and did not have the money to invest like Ford and GM. Toyota also had to make a variety of vehicles on the same assembly line to satisfy its customers. Thus, the key to their operations was flexibility resulting in Toyota making this critical discovery: when lead times are short and the focus is on keeping production lines flexible, the results are better productivity, better utilization of equipment and space, higher quality, and better customer response (Liker, 2004).

TPS was influenced not only by the events surrounding Japan after World War II, but by individuals who approached production methods as experiments. The philosophies of Henry Ford and W. Edwards Deming emphasize a scientific method approach toward continuous improvement. They believed in the importance of giving workers the freedom to experiment as a way to find the best method to complete a task. This played an intricate role in the development of TPS. According to Taiichi Ohno (1988), "There is one universal element—and Ford called it 'true efficiency.' Ford said efficiency is simply a matter of doing work using the best methods known, not the worst" (p. 108).

Ohno (1988) complements Ford and references his book, *Today and Tomorrow*, as a means by which he was able to gain insight about the theories of one of the world's most famous automakers. While many recognize Ford for his assembly line, Ohno credits Ford for promoting the standardization of one's work as a means to improvement, eliminating waste so that human labor can be more effective, leveling work to eliminate the need for excess inventory, and recycling excess materials. Ford (1926) also believed in taking the work to the man and not the man to the work.

W. Edwards Deming, an American industrial consultant, began his career as an industrial engineer investigating problems of quality control. He pointed out that quality is not improved by after-the-fact inspection of a product, but by control over the production process as it happens (Sashkin & Kiser, 1993). Deming saw that workers were the only parties who could exercise such control. The problem was that the typical worker did not have the autonomy or the skills that were required.

The beliefs of Ford and Deming reinforce the importance of empowering workers to experiment and learn how to continually improve a process within an organization.

Consequently, the organizations that will excel in the future will be those that discover how to tap one's commitment and capacity to learn at all levels of the organization (Senge, 1990). In building learning organizations, there is no "there," no ultimate destination, only a lifelong journey. Toyota refers to this as True North.

The journey of TPS continued through the oil crises of the 1970's which affected the world's economic system. The impact of the shift in the global balance of oil supply power was profound. When the Organization of the Petroleum Exporting Countries (OPEC) cartel cut production, it was impossible for the U.S. to increase its capacity enough to satisfy domestic demand (O'Keefe, 2005). Japan and countries in Western Europe that would normally sell excess oil to the United States found themselves struggling to supply their own domestic needs.

The 1973 oil embargo against the United States, combined with other limitations in worldwide supply, resulted in the price of oil nearly quadrupling. In 1973, pre-crisis crude oil cost $3.29 per barrel; by 1974 the price had skyrocketed to $11.58 per barrel (O'Keefe, 2005). Later in 1975, the Energy Policy and Conservation Act established fuel efficiency standards for automobile manufacturers. It marked the end of the era for passenger cars that were averaging 13-14 miles per gallon and for vans and pick-up trucks guzzling gas at an average 10.5 miles per gallon (O'Keefe, 2005). Japan, also reeling from the effects of the OPEC oil embargo, stepped up its efforts to improve the fuel efficiency of its vehicles and ushered in the era of the compact car.

Beginning in 1978, a chain of events in Iran including the collapse of the Shah-led monarchy, the return from exile of Ayatollah Khomeini, and the establishment of a fundamentalist Islamic regime led to the Iranian hostage crisis. President Carter responded by placing an embargo on Iranian oil imports and freezing their assets; the Iranians countered by refusing to export their oil to the United States. Crude prices soared again, reaching $25.08 per barrel in 1979; within a year the high water mark for oil prices hit $37.96 per barrel (O'Keefe, 2005). Eventually the hostage crisis was resolved and the oil flowed again.

TPS and the methods of other Japanese automakers were tested through a harsh decade, although it was during this time that Toyota distinguished itself from other automobile manufacturers all together. As Americans learned that gasoline might not always be cheap and available, fuel-efficient imports became increasingly attractive. In 1973 the Japanese manufacturers produced the best of fuel-efficient small cars in contrast to the small cars that Detroit offered which were designed poorly and lacked quality and amenities. In spite of this, the American cars still sold well but demand was so high that Detroit could not build enough and customers had no choice but to trade in for a Toyota ("The Oil Crises," 1996).

The end of the first energy crisis gave Detroit a respite and a chance to recover, but American manufacturers did not seize this opportunity with much resolve. One reason was that as soon as the crisis was passed, Americans once again began demanding big cars. When the second oil crisis hit in 1979, Detroit was no better prepared than it had been six years earlier. Because it was essentially producing the same large automobiles, it plunged into a three-year recession. In 1979, Chysler Chairman Lee Iacocca asked the U.S. government for $1.5 billion in federal loan guarantees to keep the automaker from bankruptcy (Mateja, 2005).

The 1980-1981 sales of the U.S. automobile industry declined by about one-third from the 1977-1978 average while profits for domestic producers were negative (Dardis & Soberon-Ferrer, 1994). This led to Voluntary Export Restraints (VERs) or quotas for Japanese automobiles in March 1981 which initially increased profits for U.S. automobile manufacturers. When the quotas were relaxed in March 1985, Japanese manufacturers built factories in the United States to avoid import quotas and to save time and costs of transporting automobiles to the United States. As a result, the Japanese share of the car market grew to 27.9 percent by 1990 (Dardis & Soberon-Ferrer, 1994).

As the Japanese share of the car market increased, their superior quality became a rationale for their competitive success. Japanese quality levels were seen to be more substantial than domestic production. With their emphasis on quality and performance the major Japanese firms acquired a kind of "reputation capital" that enhanced an already formidable competitive position (Automobile Panel, 1982).

More specifically, however, Spear and Bowen (1999) comment that TPS has long been hailed as the source of Toyota's outstanding performance as a manufacturer. What is curious, however, is that few manufacturers have managed to imitate Toyota successfully—even though the company has been extraordinarily open about its practices. Some believe that Toyota's success lies in its cultural roots, but other companies such as Nissan and Honda have fallen short of Toyota's standards (Spear & Bowen, 1999).

The fact that the scientific method is so ingrained at Toyota explains why the high degree of specification and structure at the company does not promote the command and control environment one might expect (Spear & Bowen, 1999). Watching people doing their jobs and in helping to design production processes, Spear and Bowen (1999) indicate that they learned that the system actually stimulates workers and managers to engage in the kind of experimentation that is widely recognized as the cornerstone of a learning organization. They believe this distinguishes Toyota from other companies.

Interestingly, in the early 1980s, Toyota formed a joint venture with GM called New United Motor Manufacturing, Inc. (NUMMI). It was Toyota's first overseas plant and since they did not want to act independently, they agreed to teach GM the principles of TPS. Toyota proposed to take over a light truck factory in Fremont, California that had been closed by GM in 1982 and run it according to the universal principles of TPS. Even when the plant had been run by GM, the union local had the reputation of being militant, even calling illegal strikes (Liker, 2004). Nevertheless, when Toyota took over management of the plant against the advice of GM, Toyota decided to bring back the UAW local—and bring back the specific individuals who represented the UAW local in the plant. Under Toyota's new management, the old factory reopened in 1984 and surpassed all of GM's plants in North America in productivity, quality, space, and inventory turns. It became an example of how TPS can be successfully applied in a unionized U.S. plant with workers who had grown up learning the traditional culture of General Motors and the traditional adversarial relationships between union and management (Liker, 2004).

Liker (2004) writes that GM's initial motivation for entering the venture was to outsource production of a small car. As GM learned more about TPS, they became more interested in using NUMMI as a learning laboratory. Hundreds of GM executives, managers and engineers entered the doors of NUMMI only to be transformed by the teachings of TPS by the time they returned to GM.

Liker (2004) presents the question: “Why would Toyota teach their coveted lean manufacturing system to a major competitor such as GM?” There were many different motivations for starting the joint venture. One consideration was that Toyota realized GM was the world’s largest carmaker and was struggling in its manufacturing operations. By helping to raise the level of manufacturing at GM, they were helping society and the community as well as creating high-paying manufacturing jobs for Americans. Moreover, the senior executives at Toyota speak of giving back to something to the U.S. for the help they provided Japan to rebuild its industry after World War II.

Toyota also furthered its contribution to U.S. industry by building the Toyota Supplier Support Center (TSSC) in Erlanger, Kentucky in 1992. Chappell (2000) admits the goal of the TSSC is not merely to make a few of Toyota’s U.S. suppliers more productive and capable of higher quality by teaching the system, but to foster TPS practices to help improve the overall condition of American industry. As of 2002, the center has helped more than 100 companies adopt Toyota’s practices such as eliminating inventory, leveling production, and kaizen (Chappell, 2002).

Toyota has kept learning at the center of its production system and as a result it has distinguished itself from its competitors through events such as World War II, the oil crises of the 1970’s, the implementation of TPS at NUMMI, and its development of the TSSC. Toyota understands that all people are learners and possess a natural curiosity about how things work. Therefore, when learning is encouraged throughout the organization, the results are extraordinary.

Purpose of the Study

The Toyota Supplier Support Center (TSSC) was established by Toyota in the United States to teach other companies the TPS philosophy. Liker (2004) explains that its leader, Hajime Ohba (a disciple of Taiichi Ohno), fashioned the center after a similar Toyota consulting organization in Japan called the Operations Management Consulting Division (OMCD). They have worked with many U.S. companies in different industries, in each case doing a "lean project" which consists of transforming one production line (or model line) of a company using TPS tools and methods—typically in a six to nine month period (Liker, 2004). Companies usually apply to TSSC for these services.

There are three aspects to the purpose of this study:

Question 1: How does TPS foster a learning organization?

Question 2: Once a company begins implementing TPS, how does it educate its employees about TPS?

Question 3: What factors hinder a company from fostering TPS?

Identification of the Case

Herman Miller, Inc. (HMI), an office furniture manufacturer based in Zeeland, Michigan, sought the help of the TSSC in 1996. Reliability and quality were low at the Integrated Metal Technology plant in Spring Lake, MI, so HMI applied to the TSSC for their services. HMI has since adopted TPS and renamed it the Herman Miller Production System (HMPS). Ten years later, HMI still encounters obstacles as it tries to implement HMPS across the organization.

Significance of the Problem

Schweizer and Balan (1994) believe many companies in competitive manufacturing emphasize improving performance through modern equipment and process technology rather than people. Conversely, Toyota has proven that it is the people that will benefit the organization the most if given the opportunity to continually improve their work processes rather than relying on expensive machinery.

It is one thing to realize that TPS is a system of nested experiments through which operations are constantly improved, yet it is another to have an organization in which employees and managers at all levels in all functions are able to live those principles and teach others to apply them (Spear, 2004). As corporations admit to practicing TPS, it does not mean they support a learning organization based on the TPS philosophy. However, Spear notes that the organization that applies the rules surrounding TPS in designing its operations and in managerial training will have made a good start at replicating the DNA of TPS.

Organization of the Thesis

This chapter presented a background of TPS and the learning organization. Chapter two will follow with a review of applicable literature that will present research findings, relating to organizations that have adopted TPS. Chapter three will include the research techniques utilized to collect data from Herman Miller, Inc. in its efforts to adopt TPS. Chapter four will include the findings of this study. Chapter five will present the conclusions and implications of the findings. It will also include suggestions for implementation.

CHAPTER II

Review of the Literature

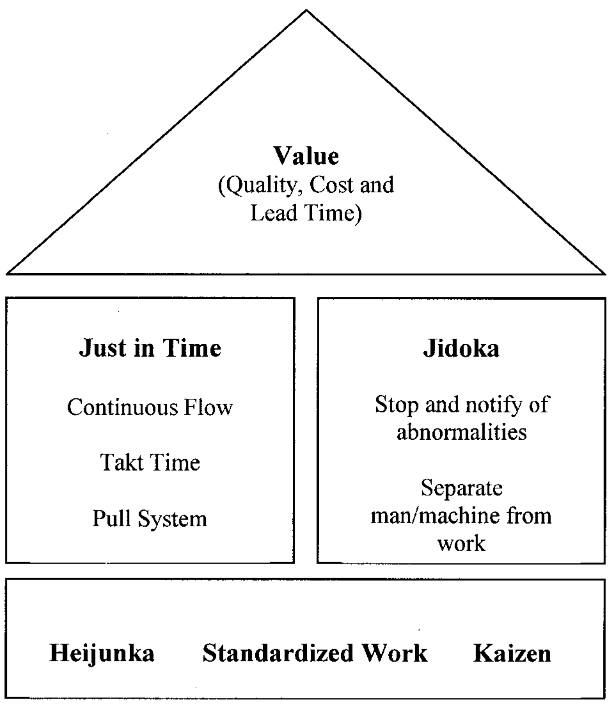
Summaries of Related Studies

The Toyota Production System (TPS) showcases the method of just-in-time (JIT). This method was developed by Taiichi Ohno of the Toyota Motor Company after World War II as a response to produce several different kinds of automobiles in a shorter amount of time while maintaining a quality focus. This system aims at eliminating waste (or muda in Japanese) or non-value-adding activities of all kinds to achieve a lean production system flexible enough to accommodate fluctuations in customer order as well as adapt to changing business conditions.

Toyota's success is ultimately based on its ability to cultivate leadership, teams, culture, devise strategy, build supplier relationships, and to maintain a learning organization (Liker, 2004). This idea of the learning organization is essential as TPS creates a community of scientists. Spear and Bowen (1999) indicate that whenever Toyota defines a specification, it is establishing sets of hypotheses that can be tested. In other words, it is following the scientific method. To make any changes, Toyota uses a rigorous problem-solving process or systems thinking that requires a detailed assessment of the current state of affairs and a plan for improvement that is an experimental test of the proposed changes (Spear & Bowen, 1999). With anything less than such scientific rigor, add Spear and Bowen, change at Toyota would amount to little more than random trial and error.

The Technical Tools of TPS

Liker (2004) believes that the incredible consistency of Toyota's performance is a direct result of operational excellence. This operational excellence is based in part on tools and quality improvement methods made famous by Toyota in the manufacturing world. The following diagram demonstrates how each is essential to support the goal of True North (also see Appendix A for an additional list of definitions for terms and acronyms):



Liker includes that tools and techniques are no secret weapon for transforming a business. Toyota's continued success at implementing these tools stems from a deeper business philosophy based on its understanding of people and human motivation.

Consequently, the man behind TPS, Taiichi Ohno, was determined to eliminate all forms of waste (Imai, 1986). He felt that overproduction was the central evil that led to waste in other areas. To eliminate the problem of waste, Ohno devised a production system based on two main structural features: the just-in-time concept and jidoka.

Just-in-time. Just-in-time (JIT) means that, in a flow process, the right parts needed in assembly reach the assembly line at the time they are needed and only in the amount needed. A company establishing this flow can approach zero-inventory. The concept of just-in-time means that the exact number of required units is brought to each successive stage of production at the appropriate time (Imai, 1986). Putting this concept into practice meant a reversal of the normal thinking process. Components of JIT include continuous flow, takt time and the pull system.

A continuous flow system eliminates the stagnation of work between processes by producing one piece at a time and passing it directly to the next operation until the product or operation is complete. Ordinarily, units are transported to the next production stage as soon as they are ready. This method results in a significant decline in inventory levels (Imai, 1986).

Takt is a German word for rhythm or meter. It is the length of time it takes to make one piece of the product, usually in seconds or minutes. It is also the rate of customer demand—the rate at which the customer is buying product (Liker, 2004). It is determined by the production quantity required and the operating time.

The pull system is a concept Ohno witnessed in American supermarkets in the 1940's. He observed that a supermarket is where a customer can get (1) what is needed, (2) at the time needed, (3) in the amount needed; therefore, the supermarket is a place where one can buy according to need.

Ohno's study of supermarkets resulted in his development of the kanban. Ohno (1988) explains this connection further:

> Commodities purchased by customers are checked out through the cash register. Cards that carry information about the types and quantities of commodities bought are often then forwarded to the purchasing department. Using this information, commodities taken are swiftly replaced by purchasing. These cards correspond to the withdrawal kanban in TPS. In the supermarket, the commodities displayed in the store correspond to the inventory at the production plant (p. 27).

Ohno (1988) admits that in the beginning, those who worked with him felt that if a kanban was used skillfully, all movements in the plant could be unified or systemized.

Kanban, meaning signboard or label, is typically a piece of paper contained in a rectangular vinyl envelope and is attached to each box of parts as they go to the assembly line. Because these parts are funneled to the line as needed, the kanban can be returned after the parts are used to serve as both a record of work done and an order for new parts (Imai, 1986). Imai further explains that the kanban also coordinates the inflow of parts and components to the assembly line, thus minimizing the processes.

Even after Ohno came up with the kanban concept and initiated it on a trial basis, it took almost ten years for total adoption in all Toyota plants (Imai, 1986). Yet, once kanban was established at Toyota, Ohno began extending it to Toyota subcontractors. He then invited subcontractors for tours of his plant and sent his engineers out for consultation with subcontractors. The delivery of units that arrive "just-in-time" for assembling operations is the result of joint efforts by Toyota and its subcontractors (Imai, 1986).

Ohno (1988) explains that in the beginning, everyone resisted kanban because it seemed to contradict conventional wisdom. "Therefore," he admits, "I had to experiment with kanban within my own sphere of authority" (p. 35). He also testifies that to make kanban understood throughout the company, everyone has to be involved. "If the manager of the production department understood it while the workers did not, kanban would not have worked," he writes (p. 35).

Jidoka. The key to jidoka is to give human intelligence to the machine and, at the same time, to adapt the simple movement of the human operator to the autonomous machines (Ohno, 1988). Ohno notes that at Toyota, a machine automated with a human touch is one that is attached to an automatic stopping device, otherwise known as an andon. For example, stopping the machine when there is trouble forces awareness on everyone. When the problem is clearly understood, improvement is possible. Ohno indicates that there is a rule that even in a manually operated production line, the workers themselves should push the stop button to halt production if any abnormality appears. In the autonomated system, visual control can help bring production weaknesses to the surface. Ohno (1988) admits that this process allows action to strengthen the players involved.

Heijunka. Liker (2004) refers to heijunka as a way for leveling out the schedule. It is a foundation for flow and pull systems such as TPS and for minimizing inventory in the supply chain. "Leveling production means smoothing out the volume and mix of items produced so there is little variation in production from day-to-day" (p. 8). Liker stresses that one must work to level out the workload of all manufacturing and service processes as an alternative to the stop and start approach of working on projects in batches.

Standardized work. Ohno (1988) believes in the importance of visual control in each of the Toyota Motor Company plants. For example, standard work sheets are posted prominently at each workstation. Standard work sheets and the information contained in them are important elements of TPS (Ohno, 1988). The standard work sheets effectively combine materials, workers, and machines to produce efficiently. At Toyota, this procedure is called a work combination and the result is the standard work procedure.

A standard work sheet plays an important role in Toyota's visual control system. It clearly lists three elements of the standard work procedure as cycle time, work sequence, and standard inventory (Ohno, 1988). Cycle time is the allotted time to make one piece or unit. A work sequence refers to the sequence of operations in which a worker processes items, transports them, mounts them on machines, and removes them for machines (Ohno, 1988). Standard inventory or standard in-process stock refers to the minimum intra-process work-in-progress needed for operations to proceed.

Kaizen. Imai (1986) believes there are many interesting things which Western companies can learn from the Japanese industrial environment. The most significant concept of Japanese management is the kaizen. Kaizen means continuous improvement in Japanese implying that improvement includes everyone—both managers and workers—and entails relatively little expense (Imai, 1997). The kaizen strategy is a continuing challenge to constantly revise and upgrade every standard, specification, and measurement.

A kaizen has a dual purpose. It is a method for achieving results and it is essential for one's personal learning and development. Since a kaizen starts with the recognition that any corporation has problems, it solves problems by establishing a corporate culture in which everyone can freely admit these problems (Imai, 1986). Imai (1997) further explains that although improvements under kaizen are small and incremental, the kaizen process brings about dramatic results over time. It is based on common sense and low-cost approaches and assures incremental progress that will ultimately pay off. Kaizen fosters process-oriented thinking since processes must be improved for results to improve.

Learning Organization Theory and Systems Thinking

Senge (1990) believes learning organizations are organizations where people continually expand their capacity to create the results they desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning how to learn together. In his book, *The Fifth Discipline*, Senge (1990) explains that we are all learners and that over time we learn how to achieve extraordinary results.

Senge (1990) admits what will fundamentally distinguish learning organizations from traditional authoritarian "controlling organizations" will be the mastery of certain basic disciplines (p. 5). These disciplines include systems thinking, personal mastery, mental models, building a shared vision, and team learning. Systems thinking is a conceptual framework to make full patterns clearer and to assist in determining how to change them effectively. Personal mastery is the discipline of continually clarifying and deepening one's personal vision, of focusing one's energy, of developing patience, and seeing reality objectively. Senge explains mental models as deeply ingrained assumptions, generalizations, or pictures or images that influence how one understands the world and how one takes action. In addition, Senge indicates that the practice of shared vision involves the skills of unearthing shared "pictures of the future" that foster genuine commitment and enrollment rather than compliance (p. 9). In conclusion, Senge describes team learning as vital because teams, not individuals, are the fundamental learning unit in modern organizations.

Senge (1990) believes it is vital that the five disciplines develop as an ensemble. He labels systems thinking as the fifth discipline because it is the discipline that integrates the others and fuses them into a coherent body of theory and practice. Without systemic orientation, there is no motivation to look at how the disciplines interrelate.

Senge (1990) writes, "The practice of systems thinking starts with understanding a simple concept called 'feedback' that shows how actions can reinforce or counteract (balance) each other" (p. 73). "Feedback," according to Senge, "means any reciprocal flow of influence" (p. 75). He believes that nothing is ever influenced in just one direction.

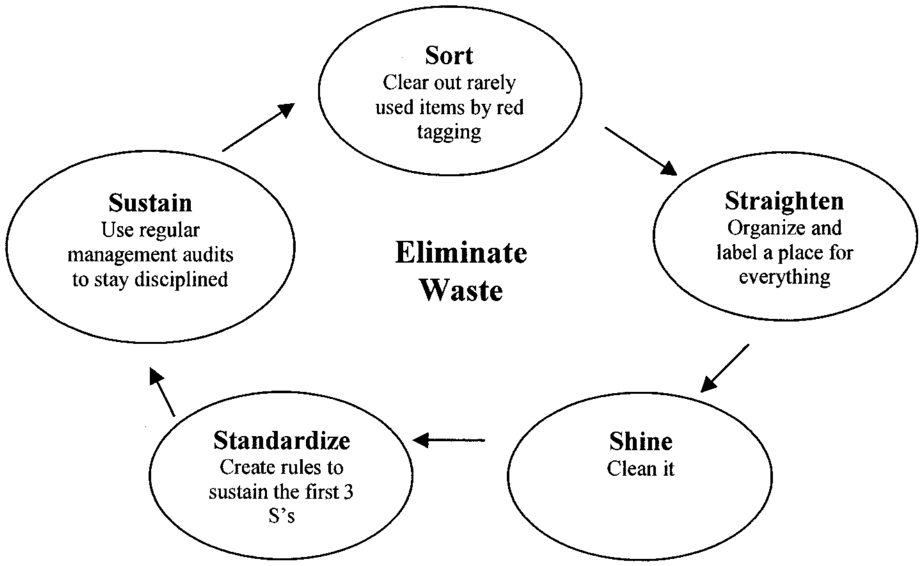
Senge (1990) believes that the key to seeing reality systemically is seeing circles of influence rather than straight lines. He notes that this is the first step to breaking out of the reactive mindset that comes inevitably from linear thinking. In addition, every circle tells a story. By tracing the flows of influence, one can see patterns that repeat themselves time after time making situations better or worse.

In Japan, for example, there are 5S programs that comprise a series of activities for eliminating wastes that contribute to errors, defects, and injuries in the workplace (Liker, 2004). This is the essential component of any kaizen project. Liker includes the five S's (seiri, seiton, seiso, seiketsu, and shitsuke) translated into English:

> (1) Sort through items and keep only what is needed while disposing of what is not, (2) Straighten so there is a place for everything, (3) Shine because the cleaning process often acts as a form of inspection that exposes abnormal and pre-failure conditions that could hurt quality or cause machine failure, (4) Standardize to develop systems and procedures to maintain and monitor the first three S's, (5)

> Sustain as maintaining a stabilized workplace is an ongoing process of continuous improvement (p.150).

Liker (2004, p. 151) includes a causal loop diagram of the 5S process:

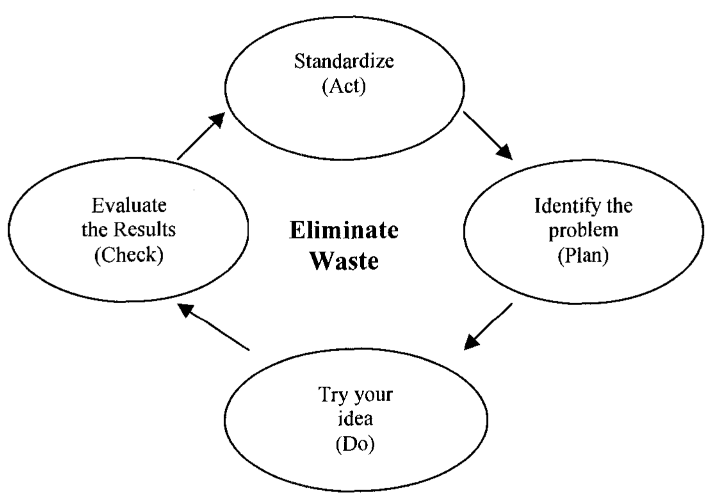


Liker (2004) cautions that TPS is not about using 5S to neatly organize and label materials, tools, and waste to maintain a clean and shiny environment. Visual control of a well-planned lean system is different from making a mass-production operation neat and shiny. Hirano (as cited in Liker, 2004) believes 5S is a tool to help make problems visible and if used in a sophisticated way, can be part of the process of visual control of a well-planned lean system.

There are two distinct types of feedback processes according to Senge (1990): reinforcing and balancing. The behavior that results from a reinforcing loop is either accelerating growth or accelerating decline. Either way, reinforcing feedback processes are the engines of growth. Senge indicates that balancing feedback or stabilizing feedback operates whenever there is a goal-oriented behavior. For example, if one is in a balancing system, one is in a system that is seeking stability.

Senge (1990) believes that virtually all feedback processes, also known as causal loops, have some form of delay. A delay is when the effect of one variable on another variable takes time. He notes that delays are often either unrecognized or not well understood and can lead to instability and breakdown. Senge includes that the decreasing of system delays is one of the highest leverage points for improving system performance. He adds that the Japanese have concentrated on reducing delays and this effort has been a much more successful effort than the action of American manufacturers controlling the amount of inventory in a warehouse.

Liker (2004) admits Deming encouraged the Japanese to adopt a systematic approach to problem solving which later became known as the Deming Cycle or Plan-Do-Check-Act (PDCA) Cycle, the cornerstone of continuous improvement or kaizen. PDCA usually applies to fairly detailed work processes, but Liker (2004) suggests that a learning enterprise is continually using PDCA at all levels of the company, from the project, to the group, to the company, and ultimately across companies. Liker (2004, p. 264) includes the process of creating flow and PDCA in the following diagram:



According to Imai (1997), Plan refers to establishing a target for improvement, Do refers to implementing a plan, Check refers to determining whether the implementation remains on track and has brought about the planned improvement, and Act refers to performing and standardizing the new procedures to prevent recurrence of the original problem or to set goals for the new improvements.

In addition, the PDCA cycle revolves continuously; no sooner is an improvement made than the resulting status quo becomes the target for further improvement. PDCA means never being satisfied with the status quo. Imai (1997) believes that because employees prefer the status quo and frequently do not have initiative to improve conditions, management must initiate PDCA by establishing continually challenging goals.

The five-why analysis also plays an integral role in Toyota's product development. Basically, it means asking "why?" five times when it comes to approaching the problem solving process. Ohno (1988) calls the five-why (5W) process the basis of Toyota's scientific approach. He believes that by repeating "why?" five times the nature of the problem as well as the solutions becomes clear. Liker (2004) reveals that most problems do not call for complex statistical analysis, but instead require painstaking, detailed problem solving. Once the root cause(s) are determined through the 5W process, countermeasures can then be taken at the deepest level of feasible cause and at the level that will prevent recurrence of the problem.

Liker (2004) adds that acting on the fact that people are visually oriented, new employees at Toyota learn to communicate with as few words as possible but with visual aids. The A3 report, a report in which all necessary information to make a complex decision is presented on one side of one 11" by 17" piece of paper, is a key part of the process of efficiently getting consensus on complex decisions. Liker (2004) adds that this report is called an A3 because it is the largest sheet of paper that can fit through a fax machine. The objective is to limit the size of the paper to 8½" by 11" with the intent that less is more.

The problem solving A3 report, explains Liker (2004), contains a succinctly stated problem, a documentation of the current situation, a determination of the root cause, suggestions for alternative solutions, and a cost-benefit analysis. Once the groundwork is laid, one is ready for the Deming Cycle steps—the plan, doing or implementing the plan, then checking and acting. Toyota views this process as a better alternative to a lengthy report filled with technical descriptions, business jargon, and tables of data.

Toyota's A3 report can be connected to Senge's (1990) beliefs about the learning organization and systems thinking. He believes that systems thinking such as PDCA is needed more than ever because workers are becoming overwhelmed by complexity. "Systems thinking," writes Senge, "is a discipline for seeing 'structures' that underlie complex situations" (p. 69). Systems thinking and thus the learning organization is a way for seeing interrelationships which provides an easier way for workers to continuously improve the tasks around them.

Herman Miller, Inc.

Herman Miller, Inc. began in 1923 when founder D.J. DePree, his father-in-law, Herman Miller, and others purchased the Star Furniture Company in Zeeland, Michigan. In the 1920s Herman Miller manufactured traditional home furniture. That direction changed in 1931 when DePree observed how contemporary furniture design addressed the real needs of modern living.

For many years, Herman Miller practiced the methods of the Scanlon Plan. The Scanlon Plan is a model by which workers make suggestions to management for ways to improve such things as quality, productivity and customer service. It is also a plan by which workers receive compensation from the financial gains that result from their contributions.

D.J. DePree was first introduced to the Scanlon Plan in 1949 at a meeting held in Grand Rapids, Michigan. Dr. Carl F. Frost from Michigan State University was the speaker. D.J. knew this was the approach the company needed and he implored Frost to help Herman Miller implement this system. At that time, Herman Miller was using a piecework system in manufacturing. Those who could produce the most parts in the least time earned premium wages; they also kept to themselves any tricks or methods for streamlining the work. The transition to the Scanlon Plan, named for Massachusetts Institute of Technology lecturer Joseph Scanlon, was not universally accepted, especially by those who were doing well under the piecework system (Brown, 1982). Yet, after it was introduced, employees began to help each other and demonstrate how to improve their work.

As leadership changed and the company expanded, the Scanlon Plan no longer seemed to be a fit for the company. In 1996, however, TPS was introduced to Herman Miller, specifically to the Integrated Metal Technology plant in Spring Lake, Michigan. Its philosophy and methodology is still being taught to employees across the organization.

CHAPTER III

Methodology

Study Design Overview

This is a case study of Herman Miller, Inc. It is designed to reveal the methods used to implement TPS and how its elements create and foster a learning organization. Herman Miller, Inc. provides complete solutions that help create great places for people to work, heal, learn, and live. Recognized for its research, design, manufacturing, furniture management, and strategic consulting services, the company's presence extends to individuals and organizations in more than seventy countries worldwide.

Headquartered in Zeeland, Michigan, the publicly held company's businesses, brands, and distribution channels include: Herman Miller, Meridian, Geiger, Herman Miller for Healthcare, Herman Miller for the Home, Herman Miller Workplace Resource, and Sonare Technologies. Combined sales reached $1.52 billion in its fiscal 2005 and it currently employs approximately 6,000 people (Herman Miller, Inc., 2005).

In 1996, TPS was introduced to Herman Miller, specifically to the Integrated Metal Technology plant in Spring Lake, Michigan. For ten years its philosophy and methodology have been taught to employees across the organization, even though there has been some resistance to its implementation and lack of understanding of what it takes to create and sustain a learning organization. This study will clarify what the company has been doing to create and sustain a learning organization through TPS and define where the company can strengthen its efforts. The research questions for this case study include:

Question 1: How does TPS foster a learning organization?

Question 2: Once a company begins implementing TPS, how does it educate its employees about TPS?

Question 3: What factors hinder a company from fostering TPS?

Data Collection Procedures

To collect data for this study, Internet research was conducted utilizing the Google search engine to locate information on the TQM, TPS, Toyota Motor Company, Herman Miller, Inc., and the learning organization theory. The Grand Valley State University Voyager database was also utilized to find books, journals, magazine articles, and other information that contributed to this study.

The author conducted interviews from December 2004 until December 2005 with key personnel from Herman Miller to seek varied opinions about the implementation and progress of TPS. Questions were asked regarding its implementation, methods of instruction, communication, successes, failures, and strategy to sustain learning among individuals and teams.

The author also participated in the Herman Miller Production System overview course in June 2005 led by members of the HMPS team. This course is offered to all Herman Miller employees approximately once a month and provides the opportunity to participate in a paper airplane production facility simulation.

The HMPS team provides tours to the public, mainly customers of Herman Miller, of the Integrated Metal Technology plant in Spring Lake, Michigan. The author participated in a tour in October 2005 led by a member of the HMPS team and noted the progress of HMPS at this facility since its implementation in 1996.

Data Analysis Procedures

The author compiled the results of the interviews and analyzed the data to find differences, similarities, concerns, and suggestions for the HMPS. The author also compiled notes from the HMPS overview course and determined if this course is beneficial for fostering a learning organization. The method of instruction for this course was also analyzed. The analysis included the tools, materials, and agenda provided for the participants. The author also noted how the IMT tour is facilitated and determined how this tour represents the learning organization at Herman Miller. The notes from the interviews, overview session, and tour will be analyzed and compiled in Chapter Four.

CHAPTER IV

Findings of the Study

Information Analysis

Through a series of interviews with key HMPS team members, an HMPS overview session, and a tour of a facility known for its HMPS practices, several similarities and differences with the experiences surrounding HMPS were revealed. After ten years of learning and practicing HMPS at Herman Miller, it is evident that optimism and opposition are both in existence in several areas of the organization; however, as the numbers of those becoming HMPS coaches increase, it is apparent that HMPS is a philosophy that is becoming part of the culture at Herman Miller.

Interview A. Interview A was with an HMPS manager on November 19, 2004. Her responsibilities include bringing the HMPS philosophy to Herman Miller's dealer network. She completed a two-year internship at the TSSC in Kentucky and now coaches dealer principals and staff with kaizens and incorporating standardized work practices.

She believes there are three elements to HMPS: True North which means having a vision or a state of perfection, the blend of customer and human development (providing a safe environment physically and mentally), and coaching and support. The supervisor must also know his or her employee's job so he or she can help to solve problems and make improvements. A problem arises when some supervisors cannot teach or have no interest in solving problems. Oftentimes their egos prevent them from becoming a receptive student.

Another issue with Herman Miller pertains to its focus is on the innovation in the product and not on the innovation in manufacturing. Conversely, Toyota's belief is that ordinary people make an exemplary system. If one considers himself or herself an expert, the mind of the student will be lost. One should highlight failures and then be a coach to encourage learning from the experiences. She believes that Herman Miller needs this behavior all over the company otherwise the trust of the employees will be lost. She recommends that superiors remember that problem solving is the key to development. This is not about the results—it is about how one achieves the results.

She is also concerned that HMPS is not systematically reported. There is a desire to get information out through the Monthly Business Exchange video and the New Employee Experience. Currently, it is communicated through pocket cards and a four-hour overview session for employees. She leads HMPS informational sessions upon request for departments or dealerships.

She notes that Toyota has a television channel at its Kentucky facility that continuously updates on changes made and problems solved. Ironically, TPS implemented technology to communicate systematically. Toyota takes advantage of the "ripple in the pond theory" when it comes to problem solving. There is continual education: problem identification, how it is solved, how it is applicable to other production lines, and communicating the remedy to the proper areas.

Ideally, she envisions a champion for HMPS in executive management—someone who understands it and wants to make a commitment to TPS. This person would develop a strategy and identify key people to teach the TPS philosophy. She emphasizes that communication is key to the strategy of TPS. In order to address this issue, it is necessary to identify the business need, the current situation, and the target. This is necessary before determining a communication plan. She reiterates that one needs a target before implementing a plan, plus there is a need for something to measure (before and after). This could be one line and one particular shift.

Interview B. Interview B was with the former vice president of engineering operations on December 7, 2004. In his opinion, Americans focus on tools because of the lack of understanding of having a philosophical basis behind one's work processes. Toyota has people fail in order to learn more. He believes that one will not understand HMPS unless it is practiced. A barrier for learning HMPS is the belief that reading about it will mean knowledge of how to practice it. He believes one must always be a student.

Interview C. Interview C was with the director of HMPS and the HMPS learning coordinator on June 23, 2005. Both individuals announced that the HMPS team is growing. Currently, there are seven HMPS positions in operations, three for the dealer network, and five for suppliers. As more departments are learning about HMPS, the demand for coaching is increasing. The HMPS team has assembled a learning journey (see Appendix B), unfortunately there are not enough coaches to assist with the learning journey as it takes approximately two years to develop a coach. Currently there are fourteen individuals within the organizations engaged in internships which will ultimately lead to a role as a coach.

As more individuals further their knowledge about HMPS, there is the inevitability of being called back into a work team to fill a role if the work load increases. Both of the interviewees commented that Toyota managers go through an internship for three years at the TSSC. The goal for Herman Miller is that each manager will enter a 12-month internship working on problems that HMI is currently trying to remedy.

Both individuals in Interview C agree there is a need for a standard method of communicating HMPS. First, however, there is a need to understand the general knowledge of HMPS in order to teach it to other employees. As some members of the HMPS have completed internships with the TSSC and Grand Haven Stamping Products, the team is looking for additional ways to educate its members.

Interview D. Interview D was with an HMPS manager on October 13, 2005. This person's background includes an engineering education and working with a company that had a relationship with the TSSC. He worked with Toyota suppliers and over a two-year period he realized how an organization can change when it applies TPS principles.

He came to Herman Miller and worked with its supply base. He spent one week with suppliers such as a coil manufacturer, an ergonomics accessories manufacturer, a stamping company, and a powder paint manufacturer to help them incorporate TPS principles. He now works internally at Herman Miller specifically at the Spring Lake campus. He is a work team leader over one person at the Integrated Metal Technology plant, one person at the Hickory facility and one person at the 171st facility. He helps these individuals learn TPS/HMPS, and coaches on them how to lead the plant.

He adds that Herman Miller has specific A3 thinking. An A3 is an 11 by 17 inch sheet of paper with the left side representing a current process and the right side representing the desired vision of the process (see Appendix C). It also lists the steps that are necessary for getting the employees equipped and educated to achieve the desired results.

Each side of the TPS pyramid represents philosophies, technical tools, and the management system as explained by Liker (2004). Human development is in the center of the pyramid. He explains that the management system side of the pyramid is often overlooked by companies trying to implement TPS and thus it will not work for them. In addition, he explains that the TPS pyramid hierarchy approach of management is different from the average pyramid hierarchy. Many companies have a general manager, operations manager, a work team leader, and a team manager as a standard hierarchy as a means for supporting and enabling team members complete work. HMI wants to invert the pyramid.

He believes TPS is a system that uncovers waste. When the focus is mainly on the system, the goal of developing people is lost. Equal time needs to be given to both. The management system needs to develop people capability.

Herman Miller focuses on two ways to solve problems: the "five why" process which is helpful for evaluating large, vague, infrequent problems, and the Plan Do Check Act (PDCA) process which is applicable to more obvious and frequent problems. Both of these problem solving methods are tied into the management system. Herman Miller is focused on developing people to incorporate PDCA into their work.

He also stresses that TPS is all about incremental changes. Other methods create large changes and do not educate workers on the reasoning for the changes and the learning piece is often overlooked. He notes that Ohba, head of TSSC, believes that there is a difference between lean manufacturing and TPS. The reason why organizations are lean and not TPS is because the learning organization piece is missing. TPS is a system and it is incomplete without learning.

Interview E. Interview E was with the work team leader of the Aeron chair production line and the work team leader of the Mirra chair production line on October 20, 2005. Before the introduction of HMPS, the Aeron line ran multiple lines at the former Herman Miller chair plant in Holland for its A, B, and C lines. Now it uses one line for all sizes. It formally utilized a batch and queue system. Arms and seats were assembled in different areas. Now the Aeron line represents the continuous flow concept. Compared to the old method of production, workers can now detect poor quality parts right away instead of finding them after assembly.

To learn more about the kaizen method, chair plant employees participated in a simulation exercise where they were separated into teams by department and asked to improve processes. This demonstrated what management was asking them to do on the production floor. However, Herman Miller operations did not call this HMPS. During this time it practiced elements of lean manufacturing. They looked at the Aeron line specifically and incorporated a site team consisting of representatives from the material planning team, plant managers and engineers. There were four to five people on each site team. Kaizen events were held for three days approximately once a month. These were led by the corporate continuous improvement team and the site team. For these kaizens, there was an agenda and the team would go through a training session on how to eliminate waste in its daily operations. They would set an objective which could include finding ways to save on labor or searching for better safety precautions. A measurable target was sought for each kaizen.

Since 2003, the chair plant has utilized day-to-day kaizens instead of monthly kaizens. They developed the facilitator role (or team lead) and incorporated the A3 sheet to track the progress of the facilitator. There are four facilitators for the Aeron line who help to solve problems, fill-in for breaks and assist when more help is needed. Each facilitator represents a zone of the line and each zone rotates hourly.

Both work team leaders want line workers to suggest improvements and continually ask them about their struggles with their work process. As work team leaders, they want to improve working conditions for their teams. Occasionally, some line workers feel they cannot speak-up, perhaps a result of trust issues. Perhaps they offered a suggestion and it was not implemented. Then, too, some individuals do not like change. One work team leader believes that interpersonal management skills are important for encouraging change or understanding human behavior when change is occurring.

The Aeron chair line work team leader believes that all workers on the Aeron line have adapted well to TPS methods, even though some do not understand TPS terminology. They were explained during the simulation, but not reinforced. For example, takt time is the beat of customer demand, yet some line workers do not understand the meaning of takt time. Now all new chair plant employees go through the HMPS overview session as this is where new employees are exposed to the TPS philosophy and terminology.

Both work team leaders believe HMPS training is inconsistent. Everyone is at different levels of understanding. One work team leader maintains a flip chart of training ideas and tries to involve different people in training as a way to prepare them for tours and questions. To keep employees motivated, the question is continually asked of the team, "How do we make it better?" Both comment that remembering the seven forms of waste is important (over production, waiting, conveyance, process, inventory, motion, and correction).

Regarding production time, two years ago the cycle time for an Aeron chair was 615 seconds. It is now 435 seconds. The operation elements in the cycle include the time at which the customer order is received to the time the ticket is scanned at the end of the line. In addition, versatility is important to the Aeron line. A, B, and C chairs used to have exclusive parts for each chair. Now parts are interchangeable. This saves space, time and money.

Both work team leaders stress the importance of standardized work to highlight waste. There can be no kaizen without a standard. First, a standard work process is established because this gives a worker a place to start. If a process changes, the standardized work sheet is rewritten. This also helps to balance the line. At each stage, a time is established otherwise known as takt time. When you time the process, this helps to know how many workers are needed or how fast the line must move in order to finish the order. This is driven from the customer order volume.

One work team leader noted that as the change was made from first to second shift, it became apparent that there needed to be some way to communicate changes made to standardized work process during one shift versus another. A kiosk was assembled next to the line to show those coming in for their shift what changes had been implemented during the previous shift. An example of a change made on the line includes simplifying the manifest (build ticket) used to communicate the parts needed to assemble a chair. Instead of getting separate bulk orders of parts used for the base and arms, it asked the manufacturer to build specific arm kits that can be move along the line (kits specifically designed for adjustable arms, fixed arms or no arms). A single number on the manifest tells a worker what kit is needed to assemble a chair. The manufacturer delivers the kits six times a day and knows what kits to restock based on the build ticket that is scanned at the end of the line. This is a change implemented by an HMPS manager. It changed from a batch system to a one-piece flow system.

Next to the line is a PDCA sheet (see Appendix D) which is a structural approach to problem-solving and an hour-by-hour chart which tracks the issues that workers faced (i.e. reasons why the andon was utilized and why takt time was not achieved). This is helpful for highlighting specific problems encountered by employees.

Interview F. Interview F was with the general manager of seating operations on December 1, 2005. This person remembers when Herman Miller first attempted kaizens in the production area. He admits that learning was not the purpose of these events. Rather, the emphasis was placed on results and many times the workers were told to make changes without understanding why the changes were being implemented. With the implementation of TPS and then HMPS, management and workers developed an understanding of the true purpose of a kaizen which includes developing the understanding of the situation and the results as a process which leads to continuous improvement.

He also emphasizes the need for coaches for those working at every level in operations. The latest addition to the A3 report is a human development sheet that is being utilized to develop the learning of those working in a specific capacity. The intent of this sheet is to incorporate an evolving coaching structure which will help others understand a specific process and therefore share the process and transfer the learning experience to others.

He admits that attitude is the key to HMPS and that is no such thing as standing still. One can either improve and move forward or do nothing and fall behind. As a result, he believes that HMPS has been more successful at the shop floor level rather than when change was implemented without learning or understanding behind it. The only issue is that he would like more coaches and facilitators working with those in production to develop workers the correct way. This involves small, incremental changes to a work process. He believes that if a change is made too quickly, it results in losing a true understanding of the process and the result. Consequently, he notes that HMPS requires a cultural shift on how one approaches work and also recognition for those accept this cultural shift by continually seeking improvement around them and setting an example for others to follow.

Herman Miller Production System overview. This workshop occurred on June 30, 2005. It was led by four members from the HMPS team and the participants were grouped into three teams of six people. Each team was given the task of building paper airplanes for a fictitious customer. The customer had specific guidelines for the airplanes that were ordered and there was a deadline set for delivery. Each member of the team was given a specific job title and instructions for building the airplane.

Five rounds of production were held during the four-hour workshop to see how many airplanes could be manufactured by each team in the time that was issued by the customer. Before and after each round, the members of the HMPS educated the participants on the importance of the TPS tools and philosophy. Before the first round, no example (boundary sample) was provided for the workers, so the directions for each role of the team were followed. However, without a boundary sample to compare with, the airplanes were produced poorly. So before the next heat, a boundary sample was provided to give the team a better idea of how to produce the product.

Although the quality improved with each round, the deadline was still not met consistently. The participants realized after reviewing each round how important it was to establish a continual flow of operation and see where the waste was in the process. Some members of the team became overburdened with his or her work which led to unevenness in tasks. As a result, the team members were relocated around the table to establish a better flow for production and the communication improved between the team members after each round. The roles of each team member were also rotated after each heat. This flexibility led to additional suggestions for improvement from the team members which subsequently underwent testing during each round.

Implementing continual flow to the production of the paper airplanes was important to this task. As a result, the importance of takt time, the beat of customer demand, was revealed to the team. Takt time equals the total daily operating time divided by the total daily customer requirement. The team realized that when each task is given an equal amount of time for completion (i.e. 10 seconds), the production process becomes more level, resulting in heijunka. The completion time of production was then established and lowered from that point by continually ridding waste in the process.

This course highlighted several elements related to TPS. For example, it is everyone's responsibility on the line to make sure the product represents quality. Additionally, it is important to develop the tools associated with TPS such as rotating jobs, performing multiple tasks, and operating several types of machines. The advantages of this include improved flexibility, clearer understanding of the business, more ideas for kaizens, and better ergonomics.

The importance of PDCA was also emphasized during this course. Plan means to grasp the current conditions and set targets, Do means to utilize a hands-on focus on the shop floor, Check means to confirm the results, and Act means to standardize the behavior and make it permanent until a better process is created. This represents systems thinking. Yet, overall, trust between team members and management is essential for building and sustaining a learning organization.

Integrated Metal Technology plant tour. This tour occurred on October 26, 2005. It was led by a former member of the HMPS team. It began with an explanation of the history of the HMPS at Herman Miller which can be traced back to 1996 when the pedestal line was suffering at the Integrated Metal Technology (IMT) plant. Herman Miller discovered that Grand Haven Stamping Products, an automotive supplier to Toyota, was working with the TSSC to implement TPS. Herman Miller sent individuals to Grand Haven Stamping Products for a six month internship to learn more about TPS. Herman Miller requested the assistance of the TSSC and they agreed when TSSC individuals saw the wasteful processes occurring at IMT.

Since the implementation of HMPS at IMT in 1996, IMT has been the showcase location for HMPS because of its "value stream." For example, a 62-hour pedestal file process has been reduced to 2-3 hours. A number of kaizens were utilized to eliminate waste resulting in reduced production time and improved quality.

According to the tour guide, IMT maintained five days of inventory, product was difficult to locate, the inventory was stored in tall racks, and mistakes were discovered late in the manufacturing process, so the whole unit would have to be discarded. IMT leaders believed a $6 million expansion of the plant as the only way to accommodate inventory. When the individuals returned from their six-month internship at Grand Haven Stamping Products, they told the plant leaders to stop planning for an expansion to store inventory. Those who returned from Grand Haven Stamping Products also saw processes that were unnecessary such as looking for parts among the racks, reaching above the head to find parts, working on a concrete floor, and bending over to drill into the pedestal files.

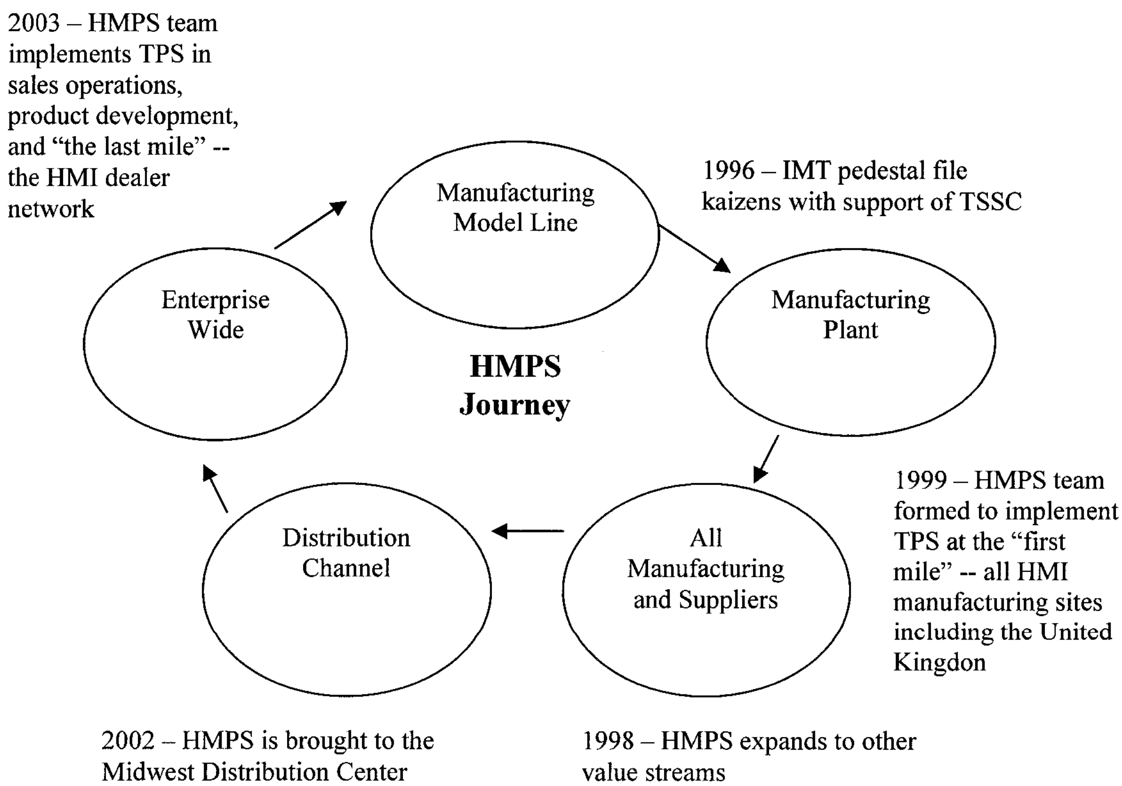
Currently, when orders come in, a manifest is printed and attached to every pedestal unit to explain to the worker what is required for its assembly (see Appendix E). This is a visual system. After the pedestal file is produced, the manifest is scanned into the system to indicate the pedestal file is ready to be shipped and then it is discarded.

In addition, PDCA sheets are used to encourage scientific problem solving among the workers. Kanbans are also utilized to manage the inventory of parts. The takt time for the pedestal production line is currently 42 seconds. This means that each worker on the line has a set amount of time to complete his or her function on the line. For example, if there is a rise or fall in the order volume, the takt time can be adjusted for each station from 42 to 40 seconds.

The andon is also utilized. It is a button above every worker so that if there is a problem, a work team leader can be notified. A record is kept to track the number of times the andon is pressed and the reason it was pressed. There is also an hour by hour chart located near the production line to track problems.

There is a conveyance person who circulates throughout the plant every 20 minutes to collect the kanbans and replenish parts needed for the production line. At the end of every month, the supervisor looks at the number of parts that have been used and adjusts the order based on that number.

As a result of the kaizen work at IMT, production lead times have improved by 93.5 percent, inventory rotations have improved by 215 percent, and the amount of scrap has improved by 72 percent or from approximately $1 million a year to $200,000 a year. The diagram below represents the journey of the HMPS at Herman Miller beginning with the manufacturing model line in 1996 to the entire enterprise in 2003:



Overall, the tour represented how HMPS has decreased lead times, improved reliability, quality, flexibility, and the commitment to continuous improvement.

Interpretation of the Findings

The benefits of HMPS are clear; however, it appears that there are issues with the implementation of HMPS at Herman Miller. Chapter Five will incorporate the key findings from Chapter Four and explain how these findings support and hinder the development of a learning organization.

CHAPTER V

Conclusions and Recommendations

Conclusions and Implications of the Findings

Several key concerns became apparent through the series of interviews and HMPS events observed by the author. Factors such as implementing a standard method of communication regarding HMPS throughout the organization, encouraging supervisors to commit to the HMPS philosophy and becoming knowledgeable about all of their employees' work processes, systematically reporting the changes in standardized work of the surrounding production lines, continuously developing employees to enable them to make changes to his or her work, and building trust between employees and the leadership of the company is essential to building and sustaining a learning organization at Herman Miller. Without the implementation of these factors, the chances of sustaining the learning organization will be hindered. This answers the third research question for this study which is, "What factors hinder a company from fostering TPS?"

Implementing a standard method of communication regarding HMPS throughout the organization is essential as both Aeron and Mirra chair production line work team leaders believe that training around HMPS is inconsistent. Since many employees do not understand the terminology surrounding HMPS, it is difficult to encourage them to make changes to their work and use terminology interchangeably with their co-workers. In addition, the director of HMPS and the HMPS learning coordinator are concerned about the consistency of the HMPS overview sessions and the production orientation for new employees. Depending on who is leading the session, the message might be interpreted differently among the participants leading to confusion or misunderstanding.

Encouraging supervisors to commit to the HMPS philosophy and becoming knowledgeable about all of their employees' work processes is imperative according to Interview A. Interview B concurs by suggesting that in order to learn HMPS, one must fail to make progress. Additionally, one cannot learn HMPS by reading books that support it. Interview A emphasizes that there are no experts of HMPS and there is no room for egos in the learning process. The learning should never stop because the state of perfection should be the constant goal of all who practice the HMPS. If a supervisor understands the work of his or her team, that person can then encourage and assist his or team members with changes to the work processes therefore building trust within the team.

Systematically reporting the changes in standardized work of the surrounding production lines is a piece that is missing at Herman Miller, according to Interview A. Toyota has its own broadcast that is always updating employees on the latest changes in work processes so that each line can benefit from the changes of another line. The spreading of knowledge across the organization will help others make changes to his or her work and lead to increased communication between the production lines. Although Herman Miller may not have the ability to produce a broadcast of its HMPS learning achievements, there needs to be a way of circulating the message of continuous improvement.

Continuously developing employees to enable them to make changes to their work is another factor that needs improvement at Herman Miller. Interview D and Interview F emphasize that human development is key to sustaining the HMPS. Yet, Interview B believes that Americans focus too much on the job and not the philosophy that can improve the quality of work. Interview D suggests that companies need to give their employees time to learn about the elements of their work in addition to seeking ways to eliminate waste that surrounds their work. It is also important to remember that incremental changes to work processes are essential for learning. If changes are made to a process, the worker and his surrounding co-workers should be informed of the change and learn about why the change was introduced and its benefits to the team. Interview C and Interview F note that coaching teams about HMPS is difficult because of the increasing demand of learning more about HMPS around the organization. Meanwhile, some production lines already rotate employees within the line to give them a better idea of how processes can be continually improved.

Building trust between employees and the leadership of the company is also essential to building and sustaining a learning organization at Herman Miller. Interview A believes that Herman Miller needs an executive "champion" to support HMPS and ensure that it becomes part of the culture of the organization. Interview E admits to witnessing mistrust by those employees who feel their suggestions for improving a work processes might not be taken seriously. Those who believe that if work processes improve, their jobs will be eliminated. Although Interview E believes some employees lack interpersonal management skills and are unwilling to change, it is hopeful that when trust is emphasized among the team, employees will feel enabled to suggest changes to work processes and assist others with learning more about the HMPS philosophy.

Suggestions for Action

Herman Miller is only ten years into its implementation of the HMPS; however, as a reminder, Senge (1990) believes the mastery of certain basic disciplines will fundamentally distinguish learning organizations from traditional authoritarian "controlling organizations." Moreover, Senge's five disciplines help to answer the first research question of this study which is, "How does TPS foster a learning organization?" The TPS philosophy employs Senge's disciplines of systems thinking, personal mastery, mental models, building a shared vision, and team learning and wraps them together to support a complete system that creates and fosters an environment focused on learning.

If these five elements of Senge's learning organization can be brought together, the HMPS philosophy will blast across the organization. Although books are helpful and overview sessions educate employees about the methods enveloped in HMPS, the concerns of those interviewed reveal that employees have specific needs that need to be addressed in order to provide an environment for learning.

Interview A was correct in saying that Herman Miller needs an executive "champion" for the HMPS. The literature supporting TPS reflects this belief as it constantly reinforces the idea that a production system should be introduced and supported from the top-down. This answers the second research question of this study which is, "Once a company begins implementing TPS, how does it educate its employees about TPS?" Following Senge's criteria for a learning organization, an executive "champion" can sustain a shared vision of the organization, celebrate the uniqueness of individual mental models, develop managers and supervisors to focus on his or her personal mastery along with that of his or her employees, support team learning by insisting that extra time be devoted to employee and team development, and reinforce the element of systems thinking as a representation of how continuous improvement and learning can thrive throughout the organization.

Limitations of the Study

The author of this study is an employee of Herman Miller and admits that an objective approach was intended throughout the research, interviews and events. In addition, Herman Miller was the only case utilized for this study and it is still premature in its implementation of HMPS. The author interviewed a number of individuals who are involved with HMPS in different capacities, but did not interview anyone at the executive level or participate in the HMPS workshop for top management. The author did not interview anyone from the Toyota Motor Corporation or TSSC and did not seek any feedback from other companies working with the TSSC.

Recommendations for Further Study

The author recommends that further research be located about the Toyota Motor Company and its expansion into the United States. Although Toyota is a leading example of a learning organization, the author recommends seeking other approaches to the learning organization. Although Senge's (1990) work is well-know in this area, it would be interesting to research other theories that are relevant to the learning organization or study companies (automotive or other) that are currently practicing the elements of a learning organization. Henry Ford and W. Edwards Deming would also be interesting figures to research further as both were large contributors of this movement. Overall, this study answered the research questions set forth by the author.

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APPENDICES

Appendix A

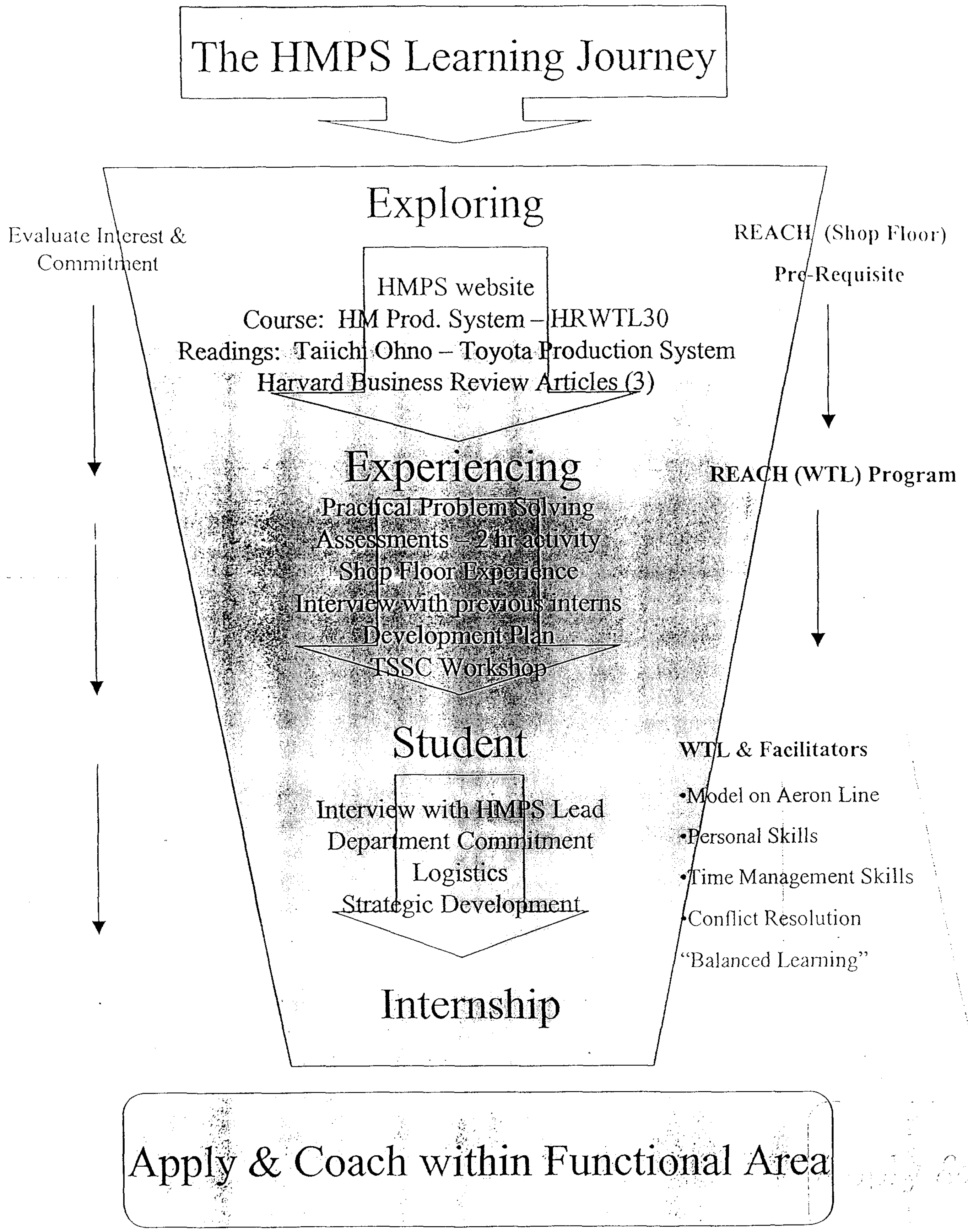
Definitions for Acronyms and Japanese Terms

A3 Report	A report in which all necessary information to make a complex decision is presented on one side of one 11" by 17" piece of paper. It is a key part of the process of efficiently getting consensus on complex decisions. Liker (2004) adds that this report is called an A3 because it is the largest sheet of paper that can fit through a fax machine.
Continuous Flow	Eliminating the stagnation of work between processes by producing one piece at a time and passing it directly to the next operation until the product or operation is complete.
Five S (5S)	Seiri Seiton Seiso Seiketsu Shitsuke or Sort Straighten Shine Standardize Sustain
Heijunka	The leveling of the production schedule by volume and variety over a given time period.
HMI	Herman Miller, Inc.
HMPS	Herman Miller Production System
IMT	Integrated Metal Technology
Jidoka	The ability of production lines to be stopped in the event of a problem such as equipment malfunctions or quality problems.
JIT (Just-in-Time)	Production and conveyance of only what is needed, when it is needed, in the amount needed, meeting the exact demand of the customer.
Kaizen	The process of people making improvements to eliminate waste and improve their work.
Kanban	A visual signal used to trigger material replenishment.
Learning Organization	An organization where people continually expand their capacity to create the results they desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning how to learn together (Senge, 1990).
NUMMI	New United Motor Manufacturing, Inc.
PDCA	Plan Do Check Act

Pull System	A production system where processes withdraw from proceeding processes the parts they need, when they need them, in the exact needed amount.
Standardized Work	A documented sequence of steps to perform a job in the most efficient way.
Takt Time	The time which should be taken to produce a product based on customer demand. It is calculated as follows:
	$$\text{Takt Time} = \frac{\text{Total Daily Operating Time}}{\text{Total Daily Customer Requirement}}$$
TPS	Toyota Production System
TSSC	Toyota Supplier Support Center

Appendix B

The HMPS Learning Journey


The HMPS Learning Journey
Exploring
Evaluate Interest & Commitment
REACH (Shop Floor)
Pre-Requisite
HMPS website
Course: HM Prod. System – HRWTL30
Readings: Taiichi Ohno – Toyota Production System
Harvard Business Review Articles (3)
Experiencing
REACH (WTL) Program
Practical Problem Solving
Assessments – 2 hr activity
Shop Floor Experience
Interview with previous interns
Development Plan
TSSC Workshop
Student
WTL & Facilitators
•Model on Aeron Line
•Personal Skills
•Time Management Skills
•Conflict Resolution
"Balanced Learning"
Interview with HMPS Lead
Department Commitment
Logistics
Strategic Development
Internship
Apply & Coach within Functional Area

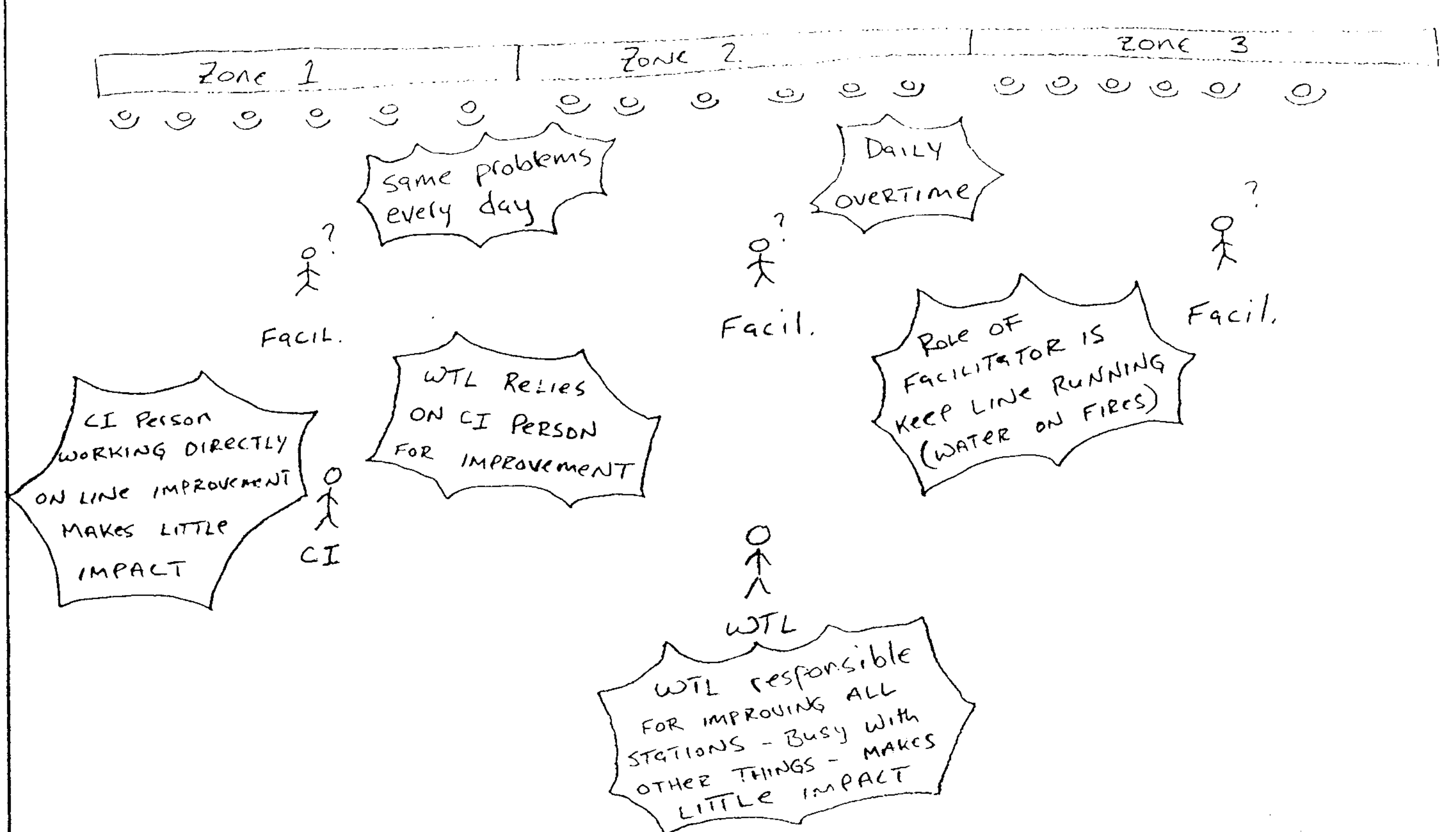
Appendix C

A3 Report

Project: FACILITATOR DEVELOPMENT 60

Learning Need Related to Business Need:
Develop Facilitators who are able to make daily increment improvents to safety, quality, reliability, cost & moralle

Current Condition:



"BIG" Problem

Implementation Plan:

	Organization Level/ Desired Behavior	Learning Need	How to Develop	Schedule ~~Start~~ Duratio	~~Fin~~
(1)	WORK SAFELY ~~AUDIT WORKPLACE AFTER A~~	BEHAVIORAL APPROACH TO SAFETY *	CLASSROOM + APPLICATION		
(2)	IDENTIFY WASTE, UNEVENESS, OVERBURDEN	MUDA, MURA, MURI *	MODULE + COACHING		
(3)	PERFORM ALL JOBS TO SW W/I T.T.	DEMONSTRATE S.W & KNACKS *	M + C		
(4)	SYSTEMATIC APPROACH TO PROBLEMS	PDCA	M + C		
		MACHINING / BOSCH / CREFORM *	M + C		
		5 WHY *	M + C		
(5)	DOCUMENT & COMMUN. IMPROVEMENTS	HR x HR CHARTS, PDCA SHEETS	COACHING		
(6)	STANDARDIZE PROCESS & WORKPLACE	STANDARDIZATION *	M + C		
		STANDARDIZED WORK	M + C		
(7)	MAINTAIN SAFE, PRODUCTIVE WORK ENVI.	5S *	M + C		
(8)	DEVP SENSE OF COOP. & TEAMWORK	IMS	WORKSHOP + COACHING		
		FACILITATION	"		
		COACHING	"		
		CHANG MGMT	"		
(9)	QUICK RESPONSE TO ANDON	JIDOKA (STOP & NOTIFY) ANDON *	M + C		

RY (HUMAN DEVELOPMENT) Date 11/3/04

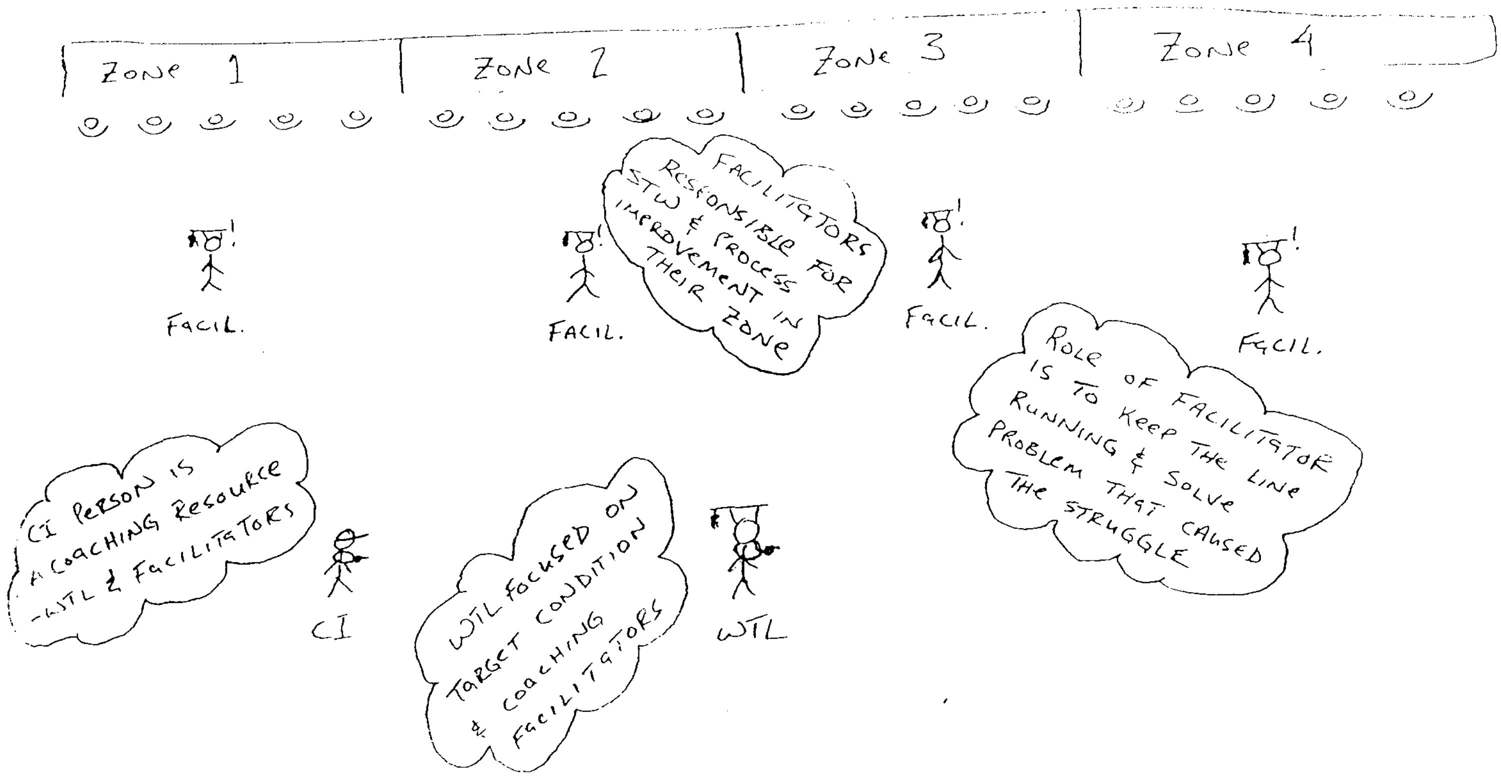
Names: 61

Reflection on Learning:

SCORE

Red/Gree

Target Condition:



Top Barriers:

Implementation Plan (continued)

Organization Level/ Desired Behavior	Learning Need	How to Develop	Schedule Start	Schedule Finish
(10) MONITOR ; INSURE QUALITY AT SOURCE	JIDOKA - BUILD IN QUALITY *	M+C		
(11) CONTRIBUTE TO PLANNED IMPV. (A3)	Break down Problem *	PROBLEM Solving , M+C		
(12) PROACTIVE RESP. TO CHANGE - PRODUCT	(SW, JIDOKA, KAIZEN)	M+C		
- CUST DEMAND	LINE BALANCE *	M+C		
(13) ABILITY TO FACILITATE OTHER AREAS	CROSS TRAINING	OJT		
(14) Can connect HMPS philosophies & Tools	Understand HMPS as an Integrated System	HMPS Overview		
(15) MONITOR PULL SYSTEMS, use FOR KAIZEN	PULL SYSTEMS	M+C		

Handwritten is preferred - please do not type

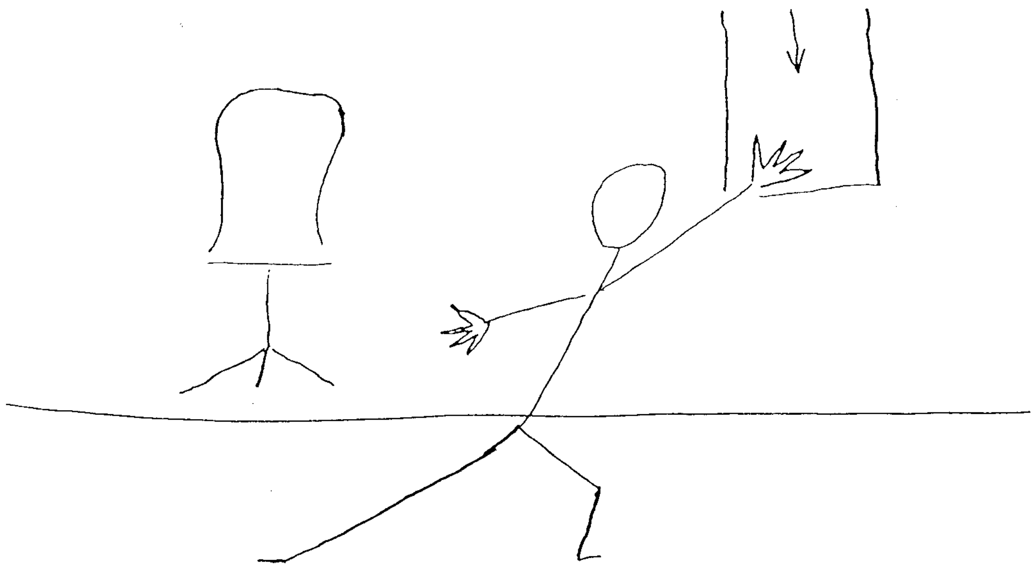
Appendix D

Plan Do Check Act (PDCA) Report

Line: AERON

Theme: ELIMINATE WASTE

Before Kaizen



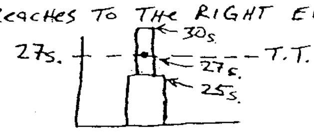
Specific definition of what goes in each area?

CURRENT CONDITION

Facts (symptoms):

– OPERATOR STEPS AND REACHES TO THE RIGHT EVERY CYCLE WHEN GETTING ARM PAD

CURRENT CYCLE TIME



Problem: EXCESS MOTION WHEN GETTING ARM PAD

Cause: ARM PAD PRESENTATION 24" TO RIGHT OF POINT OF USE.

Dave V. and Goal

Measurable Target: REDUCE AVG. CYCLE TIME BY 1 SEC.

PLAN

Hypothesis (If I do this, then that will happen):

If I Reduce lateral reach for ARM PAD,

then CYCLE TIME WILL GO DOWN

Countermeasure: MOVE ARMPAD PRESENTATION 24" TO LEFT

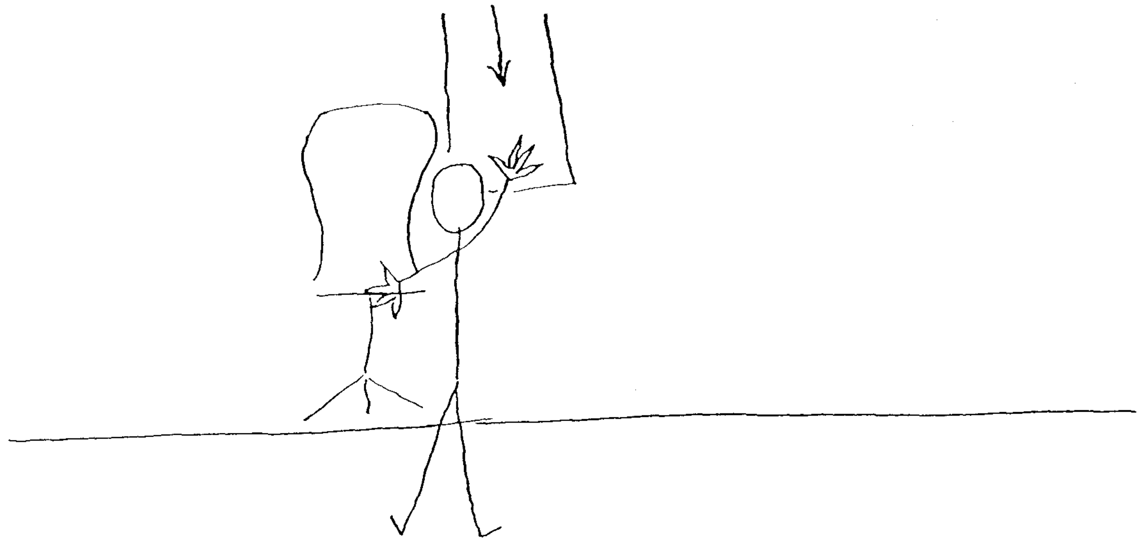
Predicted Measurable Result: CYCLE TIME REDUCED BY 2 SEC.

How testing: – HOLD PARTS IN NEW LOCATION

– OBSERVE AND TIME 20 CYCLES

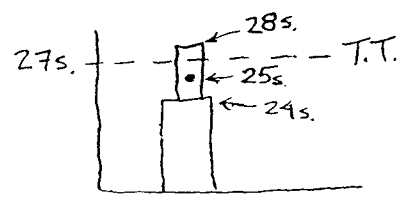
Name: TED LARNED | Date: 10/14/05

After Kaizen



DO

Results from Test (facts):



CHECK

Did Test results confirm hypothesis? NO **(YES)**

New Problems created: 1) ______

2) ______

Impact on Current PROBLEM: REDUCED EXCESS MOTION WHEN GETTING ARM PAD

ACT

Hypothesis Failed 1) Learning: ______

2) Go back to **PLAN**

Hypothesis Confirmed - PARTS PRESENTATION MOVED TO NEW LOCATION

1) Steps taken to Standardize and Communicate - PDCA PRESENTED & POSTED IN ZONE

2) Steps taken to spread ideas to other areas INVESTIGATING PARTS PRESENTATION IN OTHER ARM STATION

Tania → Business Learners? Personal Learning? Reflection ?

Appendix E

Manifest Example

Configured : FAF10.2015FMTSIMTKA1F
Description : PEDESTAL-STATIONARY
Customer : GOODMANS INTERIOR STRUCTURES
Rhythm : 03057 ASMPD/ASSM Ped
Prod. Qty. : 1 Due Date: 10-25-05

Prod. : 432889

Block : 016 Manifest : 096304

PRINTED 10-24-05 20:32
FO : 511756
ICO : SG5558
Country : US
State : NM
Dock : 20
Direct Ship F

1 of 8

Mix Code: BE

WRAPPER	FRONT	PULL	DRW CONFIG	
MT	MT	FMT	6 6 12	
WRAPPER	SPREADER	LEVELER	LOCKBAR	FRONT
W2	B	N	L24	F
TOP	CLIP	BRACKET		DEPTH
TG2				20
BASE	LOCK	SLIDE	SLIDE	SLIDE
BG	P	SR	SR	SB
COUNTERWEIGHT	HANDLE INSATLL	B-OPTION	INSTRUCTION SHEET	PACK
2	UP	PUR		T1

FAF10.2015FMTSIMTKA1F
PEDESTAL-STATIONARY
511756 PED 1 of 8 1
432889 016 096304 2 B

Desc	Part Number	Qty
6" FRONT	16978MT	2
12" FRON	16981	1
COMPETE	17198MT	3

MADE IN USA
P 10-24-05 20:32 20

FAF10.2015FMTSIMTKA1F
PEDESTAL-STATIONARY
511756 PED 1 of 8 1
432889 016 096304 2 B
Desc Part Number Qty

MADE IN USA
P 10-24-05 20:32 20

FAF10.2015FMTSIMTKA1F
432889 016 096304 2 B
511756 PED 1 of 8 1
Dock: 20

MADE IN USA
P