Title: Aspiring to JIT Assembly with an Emphasis on Quality Assurance

Course:
Year: 1992
Author(s): M. McConnell

Report No: P92014

Abstract: New quality standards are moving to turn the established norms of our society upside down. Manufacturing methods coming out of Japan threaten the economic life of any who would continue to sleep in the inadequacies of yesterday. The fact that people are at the core of the changes is either a blessing or a curse to managers depending on their ability to foster a healthy momentum of continuous improvement in their companies. This paper uses the example of Warn Industries to flesh-out the issues of human resources, corporate culture and possible tools to integrate efforts toward world class manufacturing

ASPIRING TO JIT ASSEMBLY WITH AN EMPHASIS ON QUALITY ASSURANCE

Mic McConnell

EMP-P9214

Term Paper, EMGT 510

Winter of 1992

Mic McConnell

Aspiring to JIT Assembly with an Emphasis on Quality Assurance

Abstract

New quality standards are moving to turn upside down the established norms of our society. Manufacturing methods coming out of Japan threaten the economic life of any who would continue to sleep in the inadequacies of yesterday. The fact that people are at the core of the changes is either a blessing and a curse to managers depending on their ability to foster a healthy momentum of continuous improvement in their companies. This paper uses the example of Warn Industries to flesh-out the issues of human resources, corporate culture and possible tools to integrate efforts toward world class manufacturing.

Key Words

ATO: assemble to order.

DFM/A: design for manufacturing/assembly.

DOE: design of experiments.

EMGT: Engineering Management Program class.

FMEA: failure mode and effects analysis.

GT: group technology.

ISO 9000: The International Standards Organization's quality standards.

JIT: just in time.

MPC: manufacturing planning and control.

MRP: material requirements planning.

Q@S: quality at the source.

QFD: quality function deployment.

TEI: total employee involvement.

TLA: three letter acronym.

WCM: world class manufacturing.

WIP: work in process.

Introduction

The startling success of the Japanese (widely published) has prompted, if not forced, the world manufacturers to rethink the way they do business. The issues of Quality, JIT and WCM are on everyone's minds with a great deal of talking and creative acronym production as evidence of a popular following. The old hierarchical corporate structures and top down operational strategies are giving way to flatter structures and TEI. *1* There have been many successes, but also a great many problems and miss starts as evidenced in the ups and downs of the Malcomb Baldridge winners. A comprehensive program is required in aspiring to WCM with an old school manufacturer needing an amazing integrated evolution to succeed. *2* This paper focuses on the obvious need to start somewhere with an overall plan to allow a simple methodology of continuous improvement to ensure success, maybe even to economic success and the Malcomb Baldridge Award.

Japan's example

While taking a superficial view of the Japanese success, a foolish assumption has established itself as the norm that it was an easily won success. This has prompted the quick-fix tendency of our society to chase after the latest most popular solutions (read best marketed) promising a quick deterministic result. *3* The only way out of this lack-luster noncompetitive stance is to be found in the comprehensive *4* disciplined approach taken by the Japanese. The Japanese culture lends itself to a single-minded, disciplined approach to solving a problem and they readily identify with continuous improvement (success as an ongoing enterprise). *5* Some advantages lie in Japan's homogenous society and unquestioned class system where the ruling class, currently industry and the government, establishes the path for everyone to follow. *6* With everyone accepting "The Plan" as their own the practicality of TEI is much enhanced; an important factor in the movement toward JIT is Q@S, TEI and the empowerment of people. These ideas and the required policies fly in the face of the manufacturing establishment within our western culture. *7*

Human Resources as a key

In the test of JIT within western culture the success and the challenge has been centered around people. *8* The changes in processes, with little or no change in capitol equipment, has shown vast improvements in all measures of productivity. *9* The change of a process toward JIT is, in my view, a people change in that management must empower a group to be self managing, the engineers must accept new ideas from new sources and shop people must see how change will take place and then manage that change. These are not all of the required transitions, but they confront the ingrained way of looking and reacting to the world which is the difficult and essential change in producing real transformation within an institution. *10* The structural changes are for the most part policy and procedure changes such as: the way management measures for financial success; the cross-functional multi-disciplined approach to both component and production system design where engineers utilize teams; and the basic (from the Japanese perspective) *11* training of shop personnel to become a continuously improving quality producer. At each level of the corporation the people must become customer focused; often the manager's customer will be an engineer or shop person and visa-versa. This customer focus is important because it helps define relationships; lines of communication and most importantly it is the foundation for a WCM definition of quality.

There are countless examples of companies moving into JIT with each giving a different view of the pit-falls and helpful hints for implementation. The one consistent insight was the importance of dealing with the human resource issues:

From the Journal of Management Studies, September 1990, "Adopting Japanese-Style Manufacturing Methods: A tale of Two (UK) Factories," , by Nick Oliver and Annette Davies. *12* Their conclusions coincided with other reading previously cited.

- The complex variable of politics, for and against the changes proposed, in a company is easily the most important even though it has nothing to do with the fact of the actual redesign.
- The problem of turf battles is common in any institution, but applying Japanese WCM adds a new dimension: the perceived slavery of taking on a customer focus.

- The requirements for control of the interdepartmental relationships becomes more critical as WIP is reduced and benchmarking measures become visible.
- In the reduction of suppliers a short-term mentality can set in which will hold suppliers hostage rather then developing partnerships for mutual benefit.
- The discrepancy of existing corporate culture and the new corporate strategy required for Japanese WCM makes it difficult for the managers to feel empowered to do their jobs. Far less will the manager find ways to be empowering toward the suddenly "totally involved employees" (TIE).[1]

Warn Industries

In the United States "JIT" is a commonly used acronym, but it is not well understood and most people either think of it as "zero inventory" or a "World Class TLA". JIT in the strictest sense is a specific MPC system with specific parameters and constraints. During this EMGT 510 class I have come to disagree with the broad use of JIT when the intent is to indicate WCM, TQM or simply some aspect of the reduction of waste and not the JIT system of manufacturing. In relation to the case example of Warn Industries' assembly line, the label "JIT" was attached to indicate that the redesign would focus on eliminating waste in the production process. Every process improvement at Warn is given the JIT title, but it is not always clear that JIT will be the optimum solution for that specific process.

For Warn the personnel issues are not new and for the most part they have been dealt with favorably. All the same it seems that management should not be allowed to arrive at it's goal and forget about continuous improvement.

- Warn has gone to a customer/product focused multi-disciplined team structure and has emphasized the whole Warn team by having a company profit sharing program. This team emphasis obviously won't completely stop politicking, but it does promote dialogue and a common frame of reference.

---

[1] I liberally rewrote, added and deleted from the articles conclusions to include items consistent with their overall findings and which I have found to be true from previous experience.

- The issue of "customer slavery" only becomes a problem when people over-commit or when they have a basic problem with the empowerment/concession dynamic of the team. The company has instituted a number of training programs including an extensive class on working relationships.
- Customer focus is the stated policy for interdepartmental dialogue and decision making, but this corporate mandate leaves room for subjective interpretation and is an ongoing problem. Classes have been included for team leaders to cover leadership and interdepartmental issues.
- In supplier relations the situation has turned against Warn with pricing taking an unusual increase immediately after sole sourcing was instituted. The approach to solving this situation has been to hire a purchasing expert to act as the supplier coordinator.
- The discrepancies between corporate culture and strategy have been minimized through an emphasis on continuous improvement in the strategic planning process. Insistence on clear targets is another important tool when people are integrating the strategy into tactics without the comfort of "...the way we've always done it".
- Overall the company believes in the capability of its employees and the value of empowerment and TEI. The overriding theme is to approach problems from the simplest most effective method of solution.

The company ascribes to the Deming philosophy which pretty much agrees with the above findings from Oliver and Davies and the actual Warn experience. ***13*** The above example illustrates how Warn takes to heart the message of Philip Crosby in his, "Quality Without Tears," where hassle free management is extolled. ***14*** Currently a quality manual is being written to establish direction in the TEI environment. The manual is written with ISO 9000 in mind and is intended to stretch the company to the highest standards of customer defined quality utilizing the JIT philosophy of zero waste.

From Warn a case study is utilized to help flesh out the ideas and examples found in my reading (cited in part). The studied assembly line is planned for JIT improvements with a new voluntary group leading and staffing the endeavor. The current structure of the assembly line (pre-JIT) is well thought out

and shows no gross inefficiencies which could not be remedied while keeping the basic design.[2] Three subassemblies are prebuilt and then assembled as a whole. The subassembly benches are essentially GT cells that automatically convey their assemblies to the final assembly with each area independently staffed. Currently various subassemblies arrive to the assembly line complete which if they are included make a total of 6 subassemblies. These complete assemblies make up most of the line's total WIP which has only logistical reasons for existing and no designed necessity. Along with WIP the other point of waste for the line is the long set-up times between model runs. This set-up time is mainly used for determining material requirements and then sorting through the WIP area for the needed items. Clearly a smooth flow of material to the line without undue WIP is a key factor to significantly improving the lines through-put. The main problems with the current line are line balancing, isolation of the individuals on the line, indirect feedback when final assembly finds a quality problem in a subassembly, lack of flexibility and the lack of cross training in whole-assembly building.

A possible redesign that would make line coordination simpler, encourage team work and automatically cross train would be a single final assembly.[3] The assembly and assembler would move around to each subassembly station and then final assembly to start and finish a winch. This system is cumbersome due to the weight of the winch and the move time from station to station. Since the real inefficiency in the line was the flow of parts on to the line and not the line itself, I question how much will be gained. This proposed redesign could be nothing more than capitol expenditure to solve a problem that doesn't exist and where the real problem has to do with establishing efficient MRP for the line and a system for automatic queuing. There are probably other ways to organize this assembly line, but I have not been exposed to them.

---

[2]See drawing in appendix one.

[3]See drawing in appendix two. This system is used on one of Warn's assembly lines.

Quality Assurance at Warn

Quality assurance is a very important item in this winch final assembly with a great deal of company investment coming together to meet the needs of the final customer. Currently the only real control on the assembly line is the dedication, experience and persistence of the assemblers. The prints and processes are poorly developed and no real control plan exists which leads me to put 100% of the root cause for a lack of quality on the engineers and management. In this case a small amount of tweaking will not bring about a comprehensive quality assurance.

The quality plan should start from the ground floor involving design engineering in a reevaluation of the designs in light of all quality measures:

1. How do our customers view quality and do we exceed their expectations;
2. How value adding are our business plans, processes and services;
3. Are we fully involving the people in our organization in meeting our goals?

For design engineering the tools applied to the task are: QFD to quantify the voice of the customer and set value improvement goals; DFM/A to quantify and design-out the unneeded complexity in the components and assemblies; DOE to establish the exact nature of the systems and components thus optimizing toward the quality goals; FMEA in design and processes to verify all final designs in light of human negligence and to identify the severity and likelihood of failure, the cause of the failure and the quality control plans to eliminate failure.

The manufacturing engineer can assume that having completed the process FMEA the product will be built flawlessly, but there may still be points of waste in the way it is made. Eliminating non value adding costs, waste, is the theme of JIT which makes JIT, as a philosophy, a very important tool.[4]

---

[4]I have chosen to limit your exposure to my infantile knowledge of JIT and the tools of the manufacturing engineer which is why this section is so brief.

Finally and most importantly Warn must commit to continuous improvement and fully utilize the vitality in its teams, essentially multi-disciplined quality circles, to produce the WCM required in today's world.

Discussion

The ideas given concerning the assembly line redesign were entirely from my experience along with the reading I have done for the class. I purposely avoided involving myself with the group redesigning the assembly line until I had substantially finished my work. I saw this as offering more value to me in that I could establish my own thoughts and opinions before testing them in the light of day.

The actual assembly line redesign is still in the planning stages (way behind the original schedule) and so the evaluation of the two designs is very general. The same final solution was arrived at, flow of material improvements, but the emphasis is switched. Focusing on rate based Vs time phased as the key to "JIT the assembly line" I identified the part flow as a problem with the extended set-up time viewed as a symptom of the poor parts flow. From Warn it was presented to me the other way around which seems to be a capacity focused system of analyzing the line. This capacity view of the problem is inappropriate in designing for JIT.[5] The line will be reorganized similar to the sketch in appendix two for the purpose of easy line balancing in varying demand and employee turnout. The plans are not yet detailed enough to solve for component move times along the line, but it was agreed that this was a key factor in making the line efficient. The assembly line should be called an ATO process because this is what is capable for the line, as an integrated part of Warn's facility, any time in the foreseeable future. There is more then enough opportunity to stretch toward improvement as an ATO line and at the same time this is a realistic definition of the state of the art at Warn. Warn has certain products which lend themselves to JIT and these production lines correctly titled as JIT could throw a disparaging cloud of ambiguity over the

---

[5]This assessment comes from chapter 9 of the text which I found very helpful in understanding MPC in general.

currently reorganizing line. As a follow on to this paper I intend to involve myself in the assembly line redesign and stay with it through implementation.

References

1. K. Wantuck, *Just In Time for America*. Milwaukee, WI: The Forum Ltd., 1989.

   E. Lawler and S. Mohrman, "Quality Circles After the Honeymoon," *Psychological Dimensions of Organizational Behavior*, pp.522-532, Macmillan Publishing Co., NY, NY, 1991, reprinted from *Organizational Dynamics*, Spring 1987.

2. K. Wantuck, pp. 19-34.

3. L. Ealey, *Quality By Design, Taguchi Methods*. Dearborn, MI: ASI Press, 1988.

4. L. Ealey.

   T. Rohlen, *Japan's High School's*. London, UK: U. of Cal. Press, Ltd., 1983.

5. M. Imai, *Kaizen*. NY, NY: Random House, 1986.

6. T. Rohlen.

7. K. Wantuck.

8. N. Mann, *The Keys to Excellence*. LA, CA: Prestwick Books, 1989.

9. N. Phillips, "Mfg Changes Structure WO Capitol," *Industrial Engineering*, vol. 20, no. 1, Jan 1988, PP26-31.

10. E. Lawler

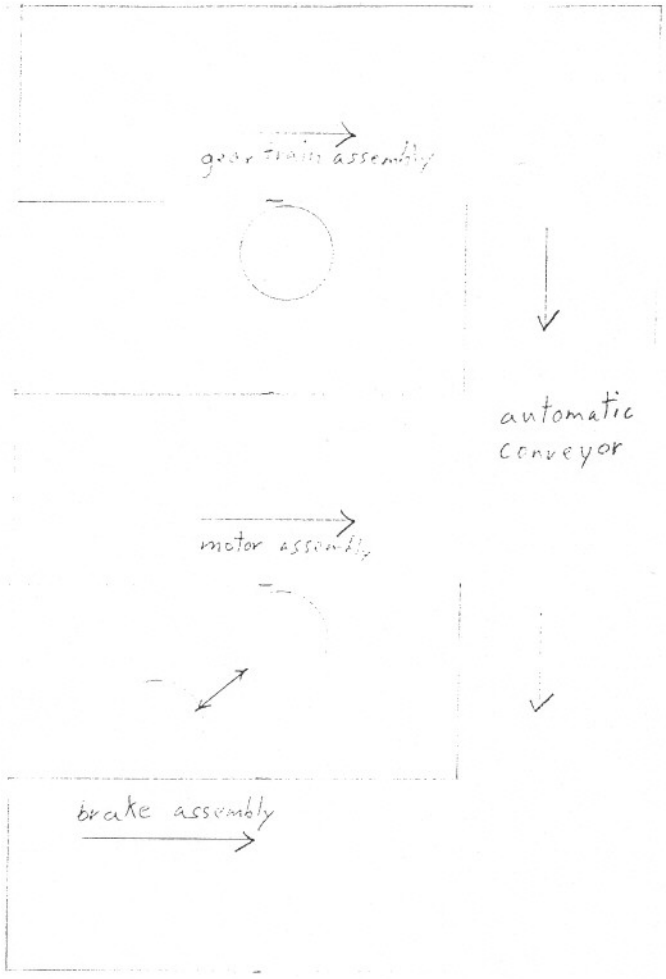
11. T. Rohlen.

12. N. Oliver, A. Davies, "Adopting Japanese-Style Manufacturing Methods: A Tale of Two (UK) Factories," *Journal of Management Studies*, 27:5, Sept. 1990, pp. 556-570.

13. N. Mann.

14. P. Crosby, *Quality Without Tears. Onterio*, Canada: New American Library, 1984.

Appendix I



Hide & Seek material storage

Current Assembly