Title: A Critical Review of "Comparison of Manufacturing Performance of Three Team Structures in Semiconductor Plants"

Course: EMGT 520/620
Term: Fall
Year: 1998
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Report No: P98031

Abstract: A paper titled "Comparison of Manufacturing Performance of Three Team Structures in Semiconductor Plants" is critically reviewed in this individual report.

A Critical Review of "Comparison of Manufacturing Performance of Three Team Structures in Semiconductor Plants"

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EMP-P98031

Research Paper Evaluation:

"Comparison of Manufacturing Performance of Three Team Structures in Semiconductor Plants"

Summary and Concepts

Various quality improvement programs have been used in semiconductor manufacturing to improve the manufacturing performance by utilizing employees' skills and knowledge in higher degree of involvement. Three types of improvement-team programs studied in the paper are continuous improvement teams (CIT's), quality circles (QC's), and self-directed work teams (SDWT's). These programs have different level of autonomy, decision-making power, and training.

The concepts used in the paper include the concept of continuous improvement, semiconductor manufacturing, quality circles, teamwork, engineering management, and employee participation. Based on the description of the programs, SDWT has the highest degree of autonomy over administrative matters, decision-making authority, training in technical matters, and team-based training. The difference between self-directed work teams and its predecessors, such as quality circles, is that team directions is not a program but a profound change in how companies do business [1].

Research was conducted among those three improvement-team programs from eight semiconductor fabs. This research was focusing at improvement programs for manufacturing in semiconductor plants. Based on the premise that autonomy, training and modified tasks play important role in performance, the hypothesis for the research was increase in those subjects would lead to better performance. It was expected, due to the higher degree in those subjects, that SDWT would result in better performance among the three improvement-team programs.

Research Methodology

The statistical tool used in the paper to test the hypothesis was analysis of variance (ANOVA). The approach to this method was to find whether there were significant differences in production performance, between the three improvement-team programs and in what aspect of improvement-team programs that those significant differences occurred. The independent variable is the type of the team program.

Since this research focused on the outcome of improvement-team programs, the variable used in the research were result oriented. There are two groups of variables used in the analysis. The first group of variables is associated with productivity, and the second group with non-product characteristics, such as autonomy, training, and task description. The first group of variables can be measured and quantify, but the second group of variables often produce intangible products, such as ideas or solutions, that are hard to measure, and therefore it can not be compared directly.

Samples were taken from eight semiconductor plants. The author compared her category for the improvement-team programs with the plant managers and other researchers in order to validate the categorization of the sample plants. ANOVA was used in this independent variable validation.

The author used pilot fab to familiarize herself with work organization and product aspects of semiconductor manufacturing. Quantitative data was collected at workgroup level for both direct and indirect productivity. Additional qualitative data was collected by interviewing employees at every job level within engineering. Five-point Likert-type scales was used in qualitative data collection. For interview purpose, supervisors selected operators, who were considered active in the team program. Bias from this procedure was acknowledged.

Paper Contribution

This paper extends the discussion in quality improvement field by comparing different improvement-team programs. Each improvement program is intended to increase the performance of processes at where that program is deployed. Each of them has been successfully applied at industries, however implementation of those programs is not easy and many companies or manufacturers have failed to implement them.

As those programs different in certain level of aspects, such as training and authority delegation, higher level of those aspects is perceived as a guarantee of success. The statistical research of this paper shows the results of implementing different level of those aspects. It gives a perspective of how different improvement programs would result within one industry area, in this case semiconductor manufacturing.

By knowing the different performance of those improvement programs, this paper shows that there is certain situation where each of those programs is best applied. It shows that choosing improvement-team program must not be based on the concept of the program, instead it must be judged from the needs, capability, and purposes of employing that program. In this paper, the result shows that although SDWT has higher degree of training, level of autonomy and modified task, it does not suit the needs of process improvement at work level in semiconductor manufacturing process.

Other Research Publication

Many researches were conducted in this field. Most of them reported a significant process improvement from implementing the improvement-team programs. Delegating authority and increasing employee involvement in business or manufacturing operations result in a big difference in terms of performance and productivity.

Compared to other researches in improvement program area, this research approached the issue from different angle, giving new insight of quality improvement areas. While the other researches focus on how to implement those improvement [2] [3] [4], what are the

results of those programs [1] [5], what are the cause of success and failure implementing those programs [6] [7] [8], this research investigated and compared the effectiveness of those programs in one particular area, to see whether or not one program is better than the others.

Result from the research shows that there was a significant increase in process performance by implementing improvement-team programs, although it varies among each of them. This result is also supported by the findings from this paper. Managing technology needs to involve the engineers in higher degree of business process in order to utilize their potential. The trend shows flatter and more horizontal relationship in technology management. In more and more complex process and organization relationships, self-directed team could be the best answer to overcome the complexity of the process [2].

Not everyone succeeded in implementing self-directed team in quality improvement program. There are many researches investigated this problem to find out reasons of the failures. This issue was also addressed in the paper to explain the inferior result of SDWT. The possible causes pointed out in the conclusion are supported by the findings from other researches.

Strengths and Weaknesses

The strength of this research is that this research did not only measure the quantitative results but also the qualitative results of implementing improvement-team programs. It approached from the tangible and intangible aspects. It has good references that could support and explain the finding of the research.

Quality variables were not measured in this paper. Had these variables measured, this paper would have had more solid result, whereas quality is one issue that is arguable in the result.

Factors that are contributing to the success or failure of improvement program implementation were not measured. Factors like leadership and management involvement could affect the implementation of such programs [8] [3], incentives, or work environment. This research assumed that those factors were balanced and applied at same degree and therefore the results of those improvement programs were fairly comparable.

Conclusion

The result of this research paper shows that SDWT does not result in higher productivity compared to QC and CIT, despite of the higher degree of autonomy and training in SDWT, and therefore there was not enough evidence to accept the hypothesis. In other words the findings show that performance does not improve as much as expected with higher degree of decision-making participation, autonomy, and training. This result can not be interpreted as the inferiority of SDWT compared to the other two, since factors that influence the success or failure of these improvement-team programs were not measured.

Possible reasons for this result were also provided in the paper. First, semiconductor manufacturing is ill suited to participation, especially to autonomous teams. This shows that the effectiveness of improvement program might depend on the type of industry. Second, not enough support, from employees' moral, infrastructure, or management structure, for the program to succeed [8] [2].

Conclusion stated in the paper is also supported by other research in improvement program field. Not enough support is one of the reasons that impair the implementation of self-directed teams. One issue brought up by this research in explaining the underachievement is the question of at which area or level that improvement team is best used. The company's structure could work against the team [8]. As written in the paper, low-level worker with problems that are not complex enough, are not appropriate for participation schemes.

Another cause that was not mention in this paper is the lost of focus in program purpose due to more vary tasks and extensive training that employees deal with in SDWT. The real probabilities to succeed are diminished by a long overdue commitment to employee participation, by excessive emphasis on training, and by a lack of result-centered actions. [7].

Improvement-team program is a good way to improve process performance. In managing technology that moves fast, it is necessary to have continuous improvement environment. Optimizing engineers potential by giving them more authority, decision-making power, and training could bring process improvement. But assessment of which improvement-team program suits the needs and condition of the process is as important as assessment of how to implement improvement program for engineers. Higher degree of training, decision-making power, and authority do not guarantee the success of improvement program.

Future Research

Regarding to the finding of the research, there are reasons that lead to underachievement of implementing improvement program with higher degree of authority, training, decision-making, and tasks. Program focus could easily lost and employees might be overwhelmed with the new tasks. Research could be conducted in the same area but from different perspective. It could be approached from another perspective that tries to investigate level of difficulties, changes in relationship, or changes in employees' moral as the result of implementing improvement-team program. This approach could show the level of difficulty that would complement the explanation of this paper finding. Another extension for this paper would be the comparison of improvement-teams regarding the quality of the result.

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