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**TenStep Supplemental Paper**

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# Workgroup Effectiveness in High Technology Manufacturing

Before high technology became a part of manufacturing, operators were involved only with basic tasks. Now, innovation and automation in production processes are necessary to compete and gain an edge in rapidly changing market situations. Focusing and increasing productivity has introduced the concept of working in a 'group.' Now, operators frequently involved in monitoring and troubleshooting have found that problems are easier to resolve while working as a group.

In today's high technology manufacturing environment, implementation of lean manufacturing practices, and the automation of production has helped the worker, considerably. Operators have realized that the scope of their jobs has expanded, and in consequence they have to update their skills. Workers are trained in statistical process control, JIT inventory policies, continuous improvement and preventive maintenance. Operator involvement in these new manufacturing practices often affects workplace dynamics among operators, supervisors, engineers, technicians and others on the shop floor. Autonomy is not granted to individuals, but rather to the production work group as a group/unit.

What is high-tech manufacturing? It is automated, with highly complex production processes. Capital allocation in such an industry is large because of high product value and rapid changes in product-mix. In such an industry, the technically skilled constitute a large part of the work force.

To prevent costly human error, most of the controls and processes are computerized. Efforts for improvement focus on reduction of process cycle time, costs and waste. Operators are organized into work groups like continuous improvement teams, autonomous work groups, quality teams, etc.

The work group has to face external relationships, like the one between a workgroup and a production supervisor. Supervisors today are no longer bosses who give orders, but are facilitators who guide the group. Work group interactions with engineers, technicians and other technical support staff have significant ramifications on the performance of employees.

Task dependence is all about how much an individual team member relies on someone other than him/herself to complete his work. This task dependence is divided into two components - internal and external. Internal task dependence is dependence on members within the group whereas external task dependence is reliance on outside agents such as equipment technicians, production supervisors, etc.

An external relationship can be task-centered or group-centered. Such a relationship is affected by technical and administrative variables. Administrative factors include group discipline and other personnel issues.

To examine work group effectiveness, three elements need to be examined:

1. **Reward Valence**. The belief that good performance will be rewarded.
2. **Monetary Valence**. The belief that good performance results in an increase in pay.
3. **Verbal Valence**. The belief that good performance will lead to praise and recognition.

Extrinsic components measure happiness with pay but intrinsic components measure all other forms of happiness such as job satisfaction, opportunities for growth etc. Performance is measured both as actual and perceived performance.

With this preface, let's briefly touch upon some research on how work group effectiveness is different in high-tech manufacturing environment.

In this study, the hypothesis tested was whether an 'external variable' (e.g. external communication, external conflict, external task dependence) will prove an important predictor of performance and attitudes for high technology work groups.

**Methodology Adopted**

1. Sample Considered
    - Eight semiconductor fabrication facilities represented seven major companies
    - Three of the eight participated in a benchmarking study of the industry
    - They had identical equipment set
    - Production bottlenecks for them were in the same areas
2. Data Collection
    - Through site visits
    - Quantitative performance data for one to three months
    - Semi-structured hour-long interviews with employees in every job type
    - A four-hour unguided tour on the shop floor with informal discussions
3. Records
    - Direct labor productivity measured as wafers processed per operator hour
    - Indirect labor productivity was calculated as wafers per man-hour, taking all other categories of personnel into account
4. Measures
    - Design factors, process variables, education and organizational tenure were linked up
5. Self Report
    - Self report questionnaire data obtained from 72% of work groups

6. Analysis
    - Pearson correlation coefficients – correlations served as a check for the direct link between design factors and outcomes. A separate regression model was built for outcome variables. Backward regression with list- wise deletion of missing cases was performed in each instance.

**Results**

- There is a direct link between design factors and work group outcomes, and this is supported by perceived performance and intrinsic satisfaction.
- Perceived performance and intrinsic satisfaction are positively correlated to technical and administrative autonomy, external feed back, organizational supportiveness and team training.
- External variables do not predict either intrinsic or extrinsic job satisfaction.
- Internal variables dictate job satisfaction, whereas external variables predict productivity.

Thus, in conclusion, you have to identify external variables, which have a significant effect on the productivity of the work group. At the same time, you should learn that it is the internal variable that has profound effect on job satisfaction.