Self-Directed Work Teams at an Aerospace Company

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ABSTRACT

Self-Directed Work Teams (SDWTs) are a logical extension of the Socio-Technical Systems (STS) approach to organizational design. STSs seek to balance the business environment, technical aspects of the firm and the social aspects of the worker to achieve optimality. SDWTs, if operating effectively, strive to achieve this balance, evolving as the technical, social or business conditions change. SDWTs have not absolutely proven themselves to be a better organizational form in rigorous controlled experiments, but this may have been due to uncontrolled environmental factors. Anecdotal evidence, such as the example presented here, is positive but it is clouded by uncontrolled technological innovation introduced at the same time the SDWTs were introduced.

The introduction of SDWTs to a medium sized aerospace company at a "Mature Plant" and at a "Satellite Plant" was studied. Both plants contrast each other in a variety of ways: union/non-union, older/younger plants, near corporate headquarters/satellite, focussed factory/multiple products-multiple processes. The results for the Satellite Plant have been extremely positive. The Mature Plant, just having started the transition to SDWTs, has yet to realize the benefits. The introduction of the SDWTs were enabled by the existence of manufacturing cells, team training, the backing of the labor union (which represented the employees at the Mature Plant) and the identification and elimination of blockers in the management ranks.

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I. Self-Directed Work Teams, An Introduction

Socio-Technical Systems (STS)

The Socio-Technical concept was developed to understand the relationship between three somewhat disparate concepts within a business system, the business environment, technical aspects of the firm and the social aspects of the worker. As described in Rice[1],

> The concept of a production system as a socio-technical system designates a general field of study concerned with the interrelations of the technical and socio-psychological organization of industrial production systems.... The concept of a socio-technical system arose from the consideration that any production system requires both a technological organization -equipment and process layout- and a work organization relating to each other who carry out the necessary tasks. The technological demands place limits on the type of work organization possible, but a work organization has social and psychological properties of its own that are independent of technology.....A socio-technical system must also satisfy the financial conditions of the industry of which it is a part. It must have economic validity. It has in fact social, technological and economic dimensions, all of which are interdependent but all of which have independent values of their own.

In its simplest form, STS means balancing the often opposing forces. For example, consider a machine where the person running it has only to pull a lever. This may be optimum from the efficiency or technical standpoint of running the machine but it is clearly not optimal from the worker's viewpoint. In this simplistic model the worker may become disenchanted with the job and quit. The job itself, from its repetitive, boring nature, may drive a high turnover rate and cause hiring costs to be higher than they would

[1]Rice, 1958

be with a job that balances the needs of the worker and the technical needs of the production system.

The STS framework also deals with integrating business decisions into the “job”. The machine and the worker are attempting to meet a higher business objective and the STS attempts to marry the three different forces together and reach an optimum.

The three areas, business, social and technical, all have an open and independent set of objectives. If one area is optimized, it may be at the expense of the other two areas. This is due to the three areas being interdependent. By doing a full analysis of the three areas and understanding the relationships between them, an optimal organization structure is found by balancing them.

STS Team Design

The role of the STS design team is to redesign the organization to achieve optimal performance. The STS design team would generally reflect a cross section of the stakeholders in any re-design of the work activity. One method to form the team and to determine the design team structure is to take a diagonal cross-section of functions and levels of management that may be affected by an organizational change. An example is shown in ***Exhibit 1***. The diagonal cross-section is used in order to get representative input from those people who may be affected by the changes. For example, a team may recommend that a manufacturing engineer (ME) be assigned to the production area because ME support is critical for the success of the work group. However the ME representative may feel that being isolated from his/her peers may lead to technological stagnation. Thus, by having a diagonal cross section, the team will have viewpoints that are both particular to specific stakeholders and also representative of them. Lack of

stakeholder participation and representation can lead to severe disruptions when the design team's recommendations are implemented.

Stakeholders are not limited to participants affected by the proposed design, there are other stakeholders whose input must be taken into account. Labor unions who represent affected employees should also be involved. It may be in the form of a union steward, or it may be the president of the union depending on the extent of the proposed change.

Customers are another set of stakeholders who should be involved. If the change proposed has self-inspection, there are certain military customers who would want more information on the proposal and who may react negatively to the proposed change. One may want to actively involve them in the program if this is the case.

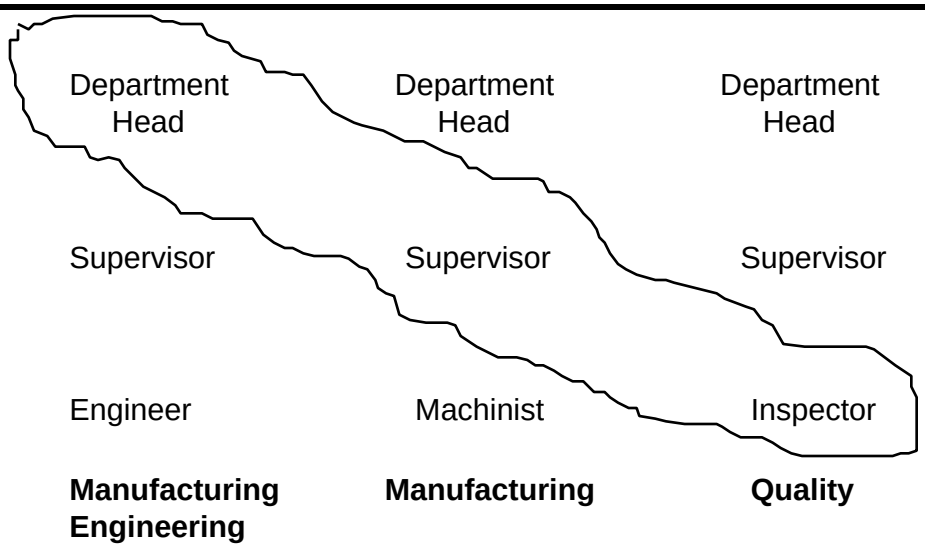

Exhibit 1) STS Design Team Formed by a Diagonal Slice of the Affected Stakeholders.

STS Analysis

Generally, an analysis is done for and with the participation of the smallest work group which performs work within a technological boundary. For example, 5-axis machining operations, or a manufacturing cell that produces a given set of products, thus the analysis is first framed by the technological dimensions. The other two areas that a STS team uses to analyze the nature of the job are business performance issues and social issues. Technical issues are re-visited later in the analysis. The three areas that drive the analysis can be seen in ***Exhibit 2.***

After conducting an analysis, the team uses the results to design the optimal organization (what functions are located within the organization) and what the nature of the work is within that organization (who performs those functions).

The business issues are derived from the overall metrics of the business or organization. The strategy of the organization must also be understood. Armed with these metrics, the teams that are involved in a socio-technical redesign of their workplace will use those metrics to drive them down to a level that they can control or affect the overall metrics. They develop a set of metrics that are consistent with the overall goals and strategy of the organization, but it is a top down setting of metrics.

The social issues reflect the skills, tasks and roles necessary to support the metrics that have been derived from the overall goals of the business. Also included in the analysis are the extrinsic and intrinsic rewards that are currently present and those that are necessary for a positive and proper incentive structure. The final part of the social aspect is determining the performance evaluation system, who does the evaluations and on what grounds people are evaluated.

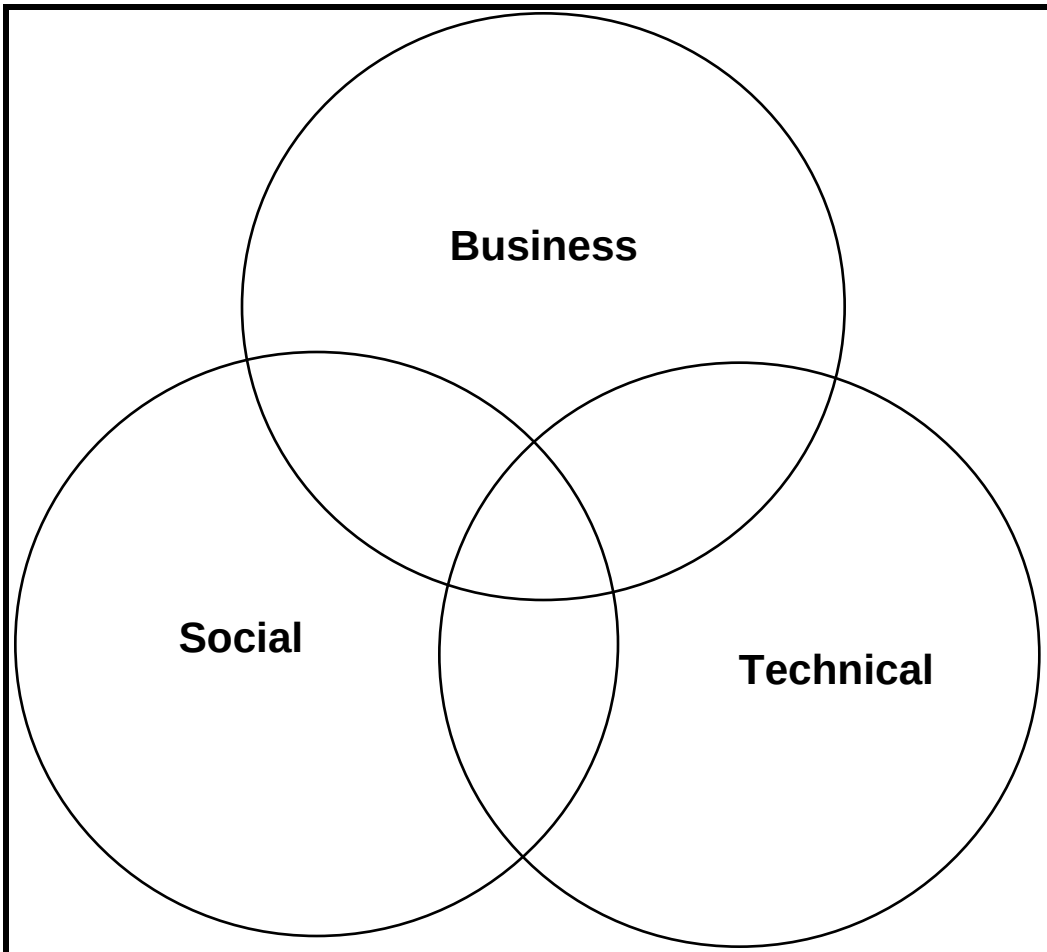

Exhibit 2) Three Areas That Drive Socio-Technical Systems Approach.

The technical analysis (described in Emery[2] as the component that converts inputs into outputs) concerns the production or business process used by the work group (which is their major technical identity). The technical analysis then determines sources and relationships between variances (where variances are defined as those actions that are outside of an individual within the work group's control).

The complete analysis concludes with an integration of the above three analyses. The variance analysis will shape the social analysis. For example, if the day to day scheduling of jobs within an operation severely effects the work group's ability to meet performance standards, then they will conclude that scheduling should be a function within the work group's domain.

As technology, business conditions, customers and social values change, so would the optimal organization. This means that the organizations should be flexible and adaptable using the STS framework, changing as the conditions require. Balancing the three forces of business, technology and social to achieve a configuration that balances all three forces.

Self-Directed Work Teams (SDWTs) are a logical outgrowth of STS organizational design. The SDWT strives to balance the three forces by first, giving the team responsibility for meeting performance objectives or metrics for the organization (generally set by upper management). Secondly, by allowing the team to control the types of technology that is introduced into their area. Finally, the team should have control over the conditions under which they work such as flextime, vacation scheduling, and work assignments.

As described above, the SDWT would control the variances that affect their ability to perform. A correctly functioning team would balance the three forces and reach

[2]Emery, 1959

an optimality. Furthermore, rather than convening as a “team” with a conclusion being the design of an organization (a semi-dynamic system with respect to organizational change) the SDWT would continue to look at their organizational design and change when it is logical.

Self-Directed Work Teams, Definition

The Self-Directed Work Team (SDWT) is generally characterized by:

- The absence of direct, daily supervision.
- Control over the scheduling of work
- Control over assignment of work to individuals.
- Responsibility for meeting team goals (and thus departmental, plant and company goals).
- Teams organized around delivering a set of related products or services to a customer or customer group
- Team members who generally possess the skills necessary to perform most if not all functions with the team’s domain. In other words the team members are flexible with regards to their abilities due to an increase in their skill set. [3]
- Evolution of the team member’s responsibilities as technology, business conditions and social values change.

The SDWT is not, as it may sometimes be characterized: anarchy by the workforce, running amok with no checks and balances and no management control. On the contrary, the absence of direct, daily supervision does not mean an absence of

[3] Wall, Kemp, Jackson and Clegg, 1986

management control. A correctly functioning team has metrics that are consistent with supporting the overall goals of the organization, are readily measurable, are easily understood by the team and are a relevant indicator of the teams performance. The metrics are the control mechanism of management. If a team's performance falls as indicated by a drop in a measurement, then management "helps" the team correct its performance problem. The responsibility for performance passes from management to the team.

Self-Directed Work Teams, In Use

SDWTs have been introduced into a variety of plants, companies, industries and environments. The auto industry has been the most prominent user of the SDWT concept in primarily a represented (union) workforce. Some GM assembly plants, most notably Saturn, are using SDWTs whose workers are represented by the United Auto Workers (UAW). GM's domestic competitors Ford and Chrysler are also using the SDWT concept in many of their plants. Ford has extended it to their Rouge steel plant and the Romeo engine plant.[4]

The use of SDWT has spanned industries ranging from electronics to chemical companies. Rhom and Haas and Shell both use SDWTs in some of their plants. Tektronix, Texas Instruments Defense Systems and Electronics Group, Martin Marietta's GES Division and Timken's Faircrest Steel Mill all use SDWTs. With so many companies adopting SDWT, one may ask the question, "Is this just another management fad, or is there a benefit to teaming, and if there is a benefit, who benefits?"

[4]Parker and Slaughter, 1988

Self-Directed Work Teams, Benefits

There is a strong correlation between an employees (and work teams) empowerment and the degree in which the practices of lean manufacturing are practiced. In theses by Rossen (1994) and also Johnson (1994), the empowerment of employees is argued to be a cornerstone of lean manufacturing. The empowerment seeks to improve the participation of employees, which Just-In Time, Total Quality Management, Total Productive Maintenance, Kaizen and Jidoka need for successful practice. However, it should be recognized that empowerment is a continuum with SDWTs being the farthest extension of empowerment.

The main issue remains to identify the tangible benefits specifically stemming from SDWTs.

There is insufficient data to indicate the difference between a SDWT and a more traditional environment. Technological progress, partial adaptation of lean manufacturing concepts, a general increase in productivity and a more educated workforce all tend to mask the benefits of teams. In addition, the metrics for performance may not be well aligned with measuring the true impact of a SDWT. For example, the use of SDWTs may lower efficiency or equipment utilization,[5] but so will the adoption of group technology (cellular manufacturing). The lower utilization of equipment by using group technology is not bad, in fact it is generally accepted that a drop in that particular performance metric will occur when going to cellular manufacturing. This is the case with SDWTs. The real metrics are whether cost, cycle time and quality has been improved between a SDWT and a traditional manufacturing organization for the same production volume, ceteris paribus.

[5]Wall, Kemp, Jackson and , Clegg, 1986

In a controlled study of the introduction of SDWTs into a two-shift, non-union, English confectionery factory there was an initial drop in performance.[6] The performance of the SWDT factory rose over 2 years until the performance met the goals set by the parent company. It should be noted that the factory was a greenfield site and that there may have been technological/equipment problems and workforce training problems that partially accounted for the poor starting performance.

The goals were basically an output quota on a monthly basis. Metrics related to these goals were individual efficiency, group efficiency and utilization. Efficiency and utilization were low from the start, but as the personnel learned to use the equipment and possibly how to work as a team, the performance rose. Subsequent qualitative analysis (the comparison factories were different enough that a strictly quantitative comparison was invalid) could not prove that the SDWT factory outperformed the conventionally organized factory or vice versa.

There are less rigorous data of gains made in productivity due to the introduction of SDWTs, employee empowerment and teaming in general. These snippets of data are inconclusive, however, because the cause and effect of teaming can not be isolated from other causes.

GE's Bromont plant began producing titanium airfoil blades for the CFM56 engine as a part of an offset program with the Canadian government for the purchase of F-16 military aircraft with a new plant and updated technology.[7] They also began production with an organizational structure derived from an STS approach. They developed SDWTs from this approach and realized the benefits. In 1984 they were 20% more productive than forecast and the losses through scrap and rework (an example of

[6]Wall, Kemp, Jackson and Clegg, 1986
[7]The Globe, November 24, 1985

quality) were 50% below forecast.[8] It is unclear whether this was the result of the introduction of Computer Integrated Manufacturing and Administrative System (CIMAS)[9] and new CNC machining technology or the use of STS design and SDWTs.

Martin Marietta's Government Electronics Systems plant instituted SDWTs starting in 1991.[10] The effort started when, faced with another spate of lay offs, the International Union of Electrical Workers (IUE) suggested that management and the union team up to save jobs. The outgrowth of that effort was the establishment of SDWTs at the GES Moorestown, NJ facility.

Martin Marietta and the IUE cut job classifications from 26 to 4, boosting flexibility. Martin Marietta also cut the number of suppliers from 8000 to 714 and introduced MRP II. Management also introduced a performance-measurement system that has current manufacturing data displayed on the shop floor.

Goals for 1993 were "non-threatening", meaning that productivity was not a goal. Instead a cycle time reduction of 50% and a cost reduction of 25% were the stated goals of the facility. Both goals were met and new goals for 1994 were established around increasing quality and reducing scrap.

Timken's Faircrest plant was established in the early 80's utilizing the latest steel making technology.[11] The plant was established to manufacture low alloy steel used to manufacture bearings, Timken's main product. The plant used electric arc melting of scrap steel and a host of other technological marvels, such as the Hierarchical Computer System (HCCS) which operates on both the plant and process level, managing information flow and also directing specific equipment. They also have the capability to calculate the amount and type of alloy additives released into molten steel.

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[8]World of Work, Vol. 10, No. 9
[9]Montreal Business, Robert Gibbens
[10]Industry Week, October 17, 1994
[11]Industry Week, October 1994

Performance is tracked on-line against goals, then conscientiously displayed for employees to see at terminals and monitors throughout the plant. Programmers can log into the system from their homes if necessary. Field sales engineers deliver customer feedback in real time, fueling a customer-driven approach. To give credence that this is truly a different steel mill, Shoichiro Toyoda, chairman of Toyota Motor Corp., has called Faircrest the cleanest steel mill he had ever seen.

The workforce was drawn from Timken's Harrison plant and arranged into SDWTs. The team charters were to (albeit ambiguously) control and improve the processes. This was accomplished within a union environment.

For Faircrest, the biggest problem was demand exceeding supply. The SDWTs have been successful in restructuring the work so they can meet the demand but without having to add capacity. As the CEO says[12]:

> "If you put the best people on the job, then treat them like partners, the rest almost takes care of itself." After visiting last April's Best Plants conference in Chicago, Mr. Sholley finally confirmed his hunch --Faircrest deserved to be ranked among the best. But the teams of associates already knew it. "Maybe we are arrogant," concludes Rob Merrell. "Then again, maybe we deserve to be."

[12]Industry Week, October 1994

The outstanding results for the Faircrest plant include the following[13]:

- They are No. 1 in world market for large alloy bars.
- Their annual work-in-process (WIP) turns are 32.9.
- They have reduced WIP inventory by 15.3%.
- They have reduced scrap and rework by 27.3%.
- They have reduced customer rejects by 62.3% and warranty costs by 74.9%.
- Production schedules are met 100% of the time.
- They have reduced electrical consumption by 18%.
- Their labor turnover rate is only 0.9%.
- Their manufacturing cost has been reduced by 25% and overall total cost has been reduced by 24%.
- Their productivity has increased by 27.8%.

The question remains whether this is the result of teams or the result of technological improvements and a restructuring of the basic business.

A strong (albeit somewhat subjective) case can be made that SDWTs lead to a flatter more flexible organization that can be as productive as a traditional organization. Due to increased flexibility the organization can respond to changes in the business environment more quickly. Although SDWTs show promise, there still needs to be an independent study, similar to that done for the confectionery company, where the effects of technological and business innovation can be isolated from the effects of the SDWT.

Self-Directed Work Teams, Implementation Issues

The issues of winners and losers is based on a shift of the balance of power and relative stature. The relationship of four example groups including workers (represented as machinists), professionals (represented as manufacturing engineers), skilled trade workers (represented as maintenance) and management (represented as factory supervisor), prior to the implementation of SDWTs can be seen in ***Exhibit 3***. The vertical

[13]Industry Week, October 1994

axis is stature, representing the relative relationship between groups and the arrows represent primary communication between the groups. Note that the manufacturing engineers are relatively high in stature, essentially an equal to the supervisor. The factory supervisor enjoys an elevated status over that of the maintenance worker and the machinist due to his/her authority over those groups. The communication paths are primarily between the manufacturing engineer and the factory supervisor, the factory supervisor and the machinist and maintenance person respectively. The communication is primarily vertical and may tend to reinforce the relative stature levels (or vice versa).

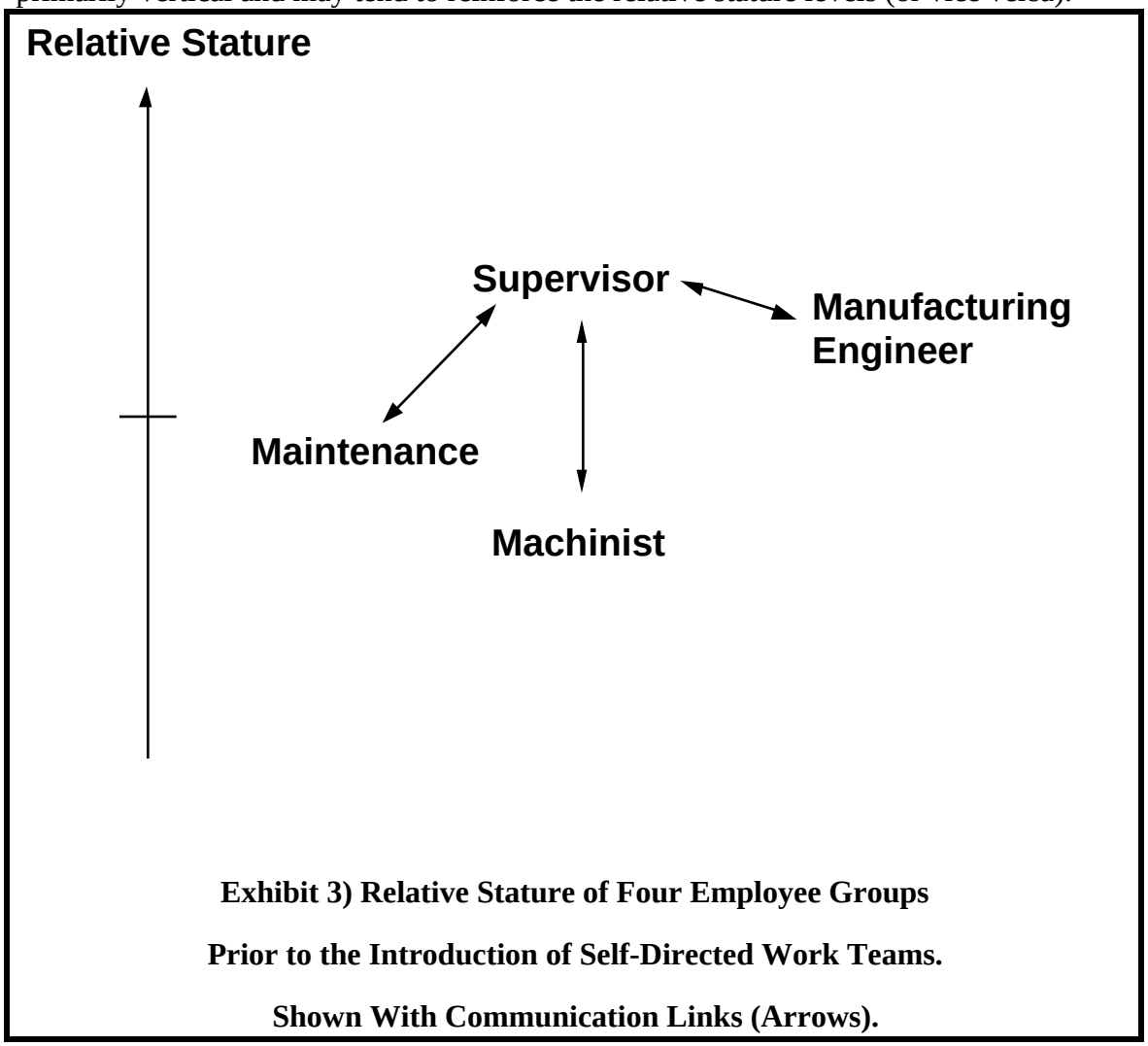

Exhibit 3) Relative Stature of Four Employee Groups Prior to the Introduction of Self-Directed Work Teams. Shown With Communication Links (Arrows).

Exhibit 4 represents the relationships after the change to SDWTs. The basic changes can be categorized as stature and communication. The changes in stature occur primarily between the machinist, supervisor and engineer. The manufacturing worker (in this case the machinist is used as an example) being the beneficiary. The stature becomes much flatter, with relatively less of a difference among groups. The manufacturing engineers may lose relatively little stature, depending on how they are integrated into SDWTs, or they may take a precipitous drop below that of the machinist (not shown). The communication changes radically from being vertically oriented to communication that is dominated by horizontal interactions.

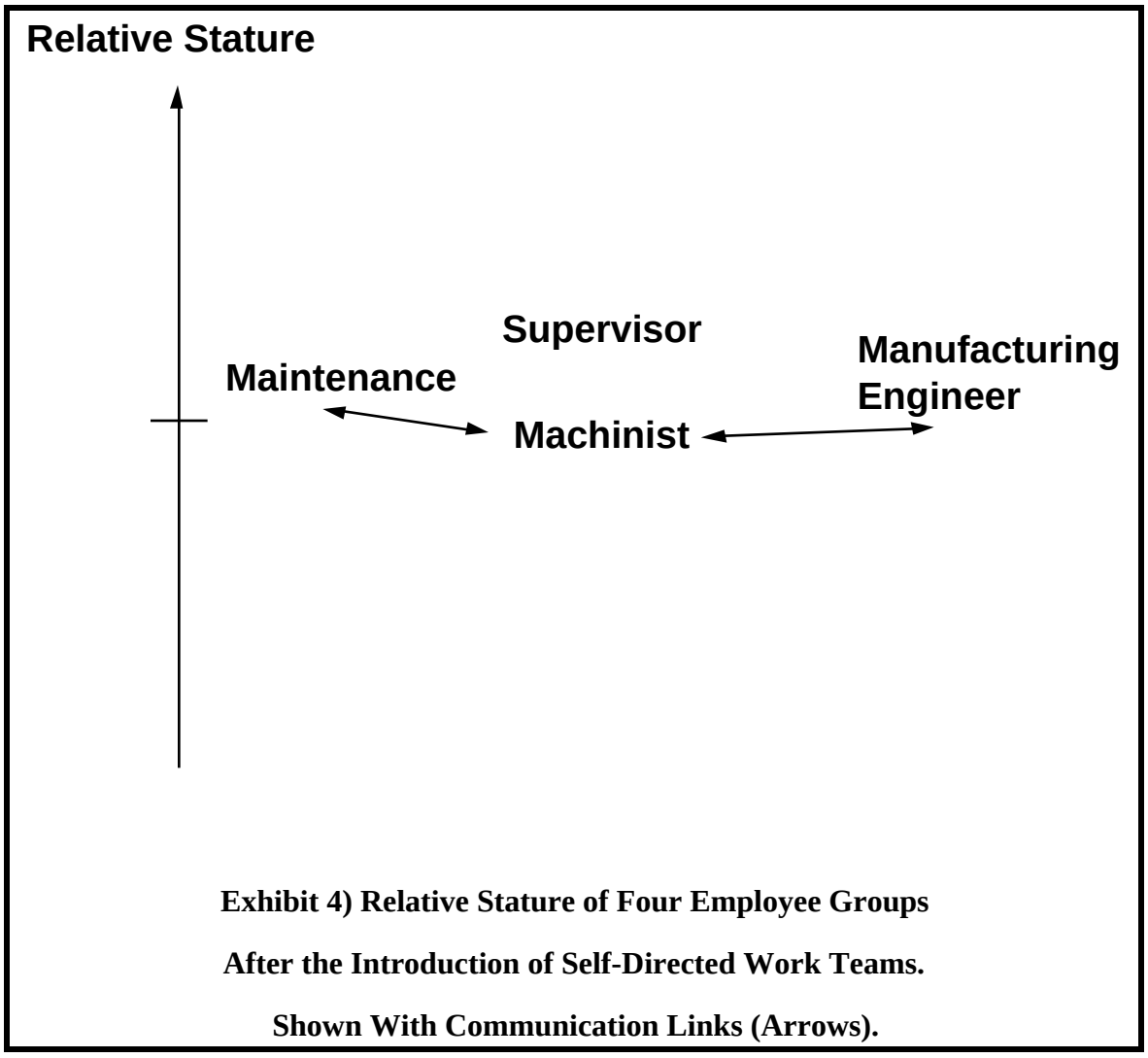

Exhibit 4) Relative Stature of Four Employee Groups After the Introduction of Self-Directed Work Teams. Shown With Communication Links (Arrows).

Stature Issues

Traditionally the first line manager or supervisor took control and responsibility over a wide range of daily tasks. With SDWTs a team is empowered to make many of the decisions that affect it's work, such as daily scheduling of jobs, work assignments, scheduling of vacations, daily problem solving, interacting with other teams and support groups and monitoring their own performance to metrics. The role of the "traditional" supervisor is clearly diminished. With the transition to SDWTs the supervisor becomes a

coach or facilitator. Rather than having direct daily control over 15 to 25 employees, the coach may be responsible for up to 3 shifts, as many as 75 people, and a number of teams. As a result, the company can maintain production with less supervisors.

The transition to SDWTs means management ranks will downsize and flatten and decision making authority (power) will shift down to the lowest levels of the organization. Many change agents and consultants believe that the transition to SDWTs should occur during a growth period, so the displaced managers can move to other areas of the organization. Managers are less prone to blocking the transition when there is no fear of losing their jobs.

The second group affected by vertical shifting of power is the professionals. The shift of authority, power and responsibility to the manufacturing teams may potentially displace some of the professional employees. As workers begin to plan their jobs, the need for manufacturing engineers may be diminished. For example, the manufacturing engineers have traditionally defined and controlled the manufacturing process. By obtaining responsibility for control of the process, the SDWT gains authority at the expense of the manufacturing engineer.

In addition to the shift of power to the worker there is a loss of stature for the professionals and management.[14] Those who gain power elevate their stature, while conversely those who lose power lower their stature. The premise of this is that power is finite and the control of power is a zero sum game.

Professionals generally enjoy higher stature than the manufacturing worker and their stature is generally equal to first line management. As power is shifted to the manufacturing worker the stature is leveled out. This is especially true in the case of SDWTs where the manufacturing team generally becomes the focal point for upper

[14]Klein, 1984

management's attention and the professionals, supervisors and manufacturing workers all are perceived to have essentially the same stature. The workplace becomes more egalitarian, but as George Orwell said in Animal Farm, "some animals are more equal than others". In the eyes of top management, the more equal animals may be the manufacturing worker.

Another issue of stature that arises during a transition to SDWTs concerns the difference between the skilled trades and the manufacturing workers. The skilled trades can be seen as specialized workers, similar in nature to an engineer. The skilled trades have what has termed "Craft Pride"[15] or pride in the specialized skills that they have acquired and pride in the quality of the job they do.

Sharing work with manufacturing can be construed as an assault on the sense of "pride" of the skilled worker. Allowing the work to be done by less skilled people negates their sense of self esteem and tends to trivialize their work (from their viewpoint). This is similar to the loss of stature of the professional, but it may not be the biggest issue.

A larger issue may be the loss of jobs due to sharing or transferring of some of the maintenance functions. There may also be a loss of identity due to being transferred into a manufacturing group. The maintenance worker no longer identifies with skilled trades people because he/she is now lumped in with the manufacturing team. Their identity is no longer maintenance, it is manufacturing.

Essentially, there is a loss of stature that can occur, but the important issue is the fear of job and identity loss by blurring the distinction between the skilled trades and the generally lower paid manufacturing worker. However, it should be noted that union representation of the skilled trades and the manufacturing workers may in effect "freeze"

[15]Klein 1991

the relative status. Very rarely will a union upgrade one member's status at another member's expense. It would only create an internal conflict within the union. These status levels have evolved over time and the union has no incentive to disturb the status levels it has fought to achieve for the employees it represents.

Issues Particular to The Professional

In addition to the stature issues that have been described, professionals may be affected by two other issues, loss of technical resources and the loss of a career path.

When a group of professionals are organized into a SDWT, the supervisor no longer provides technical support.[16] Before SDWTs, many times a supervisor was promoted from the ranks by showing technical expertise and when it was necessary he/she stepped in and did technical work. When there is less management (due to a transition to SDWTs) there is no longer the spot resource for technical help that was once available. The team members feel more pressure as if there is more work to do.

The next issue concerning the professional is the loss of a clear career path. With the downsizing of management due to SDWTs, there are far fewer management slots into which they may be promoted. The career aspirations of many professional employees may be dashed by the introduction of SDWTs.

There may also be a case of the professional losing their individual identity as a "super-achiever". Related to the loss of the career path, the loss of identity is caused by placing the individual contributor into a team environment where the team now gets credit for the individual's work. The individual contributor may have looked at the recognition as a super-achiever as an extrinsic reward or also as supporting his or her elevation to the next level of management.

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[16]Klein, 1988

Finally, a professional may find themselves on a team that is not comprised of their peers. They may be on a team for which they once were a support person. In this case the professional not only loses the technical help of his/her former manager, the career path, and the individual identity, but also a group identity. They are not on a team of their peers, they are now part of a team that may be homogeneous with the single exception of the professional team member. For example, a manufacturing engineer may be assigned to a team of machinists. The manufacturing engineer loses his/her identity as an individual and as an engineer. They are not on an engineer's team but on a manufacturing team. This loss of group identity can be a very strong issue.

Winners

In most cases, the class of people who benefit the most from the transition to SDWTs are the employees engaged in direct manufacturing labor. This may also include those who provide support services such as those who are semi-skilled (material handlers and tool crib personnel), but this depends upon the degree that responsibilities are transferred to the direct manufacturing laborers and the degree to which a support employee is threatened.

The direct manufacturing laborer benefits (or wins) by having more control over their work environment. They are also more aware of what is occurring and more responsible for the performance of their area. Responsibility for performance generally comes with control over aspects of the business that affect the performance. For example, a team responsible for schedule performance should have control of the work schedule. A downside to this is that not all people want the additional responsibility, but generally there is a net benefit.

The direct laborer also has a perceived increase in their status. The importance of the function is validated by management when they trust the laborer with responsibility which is augmented by giving them authority over many decisions that were once in the domain of management. Their ideas matter now, they are trusted, responsible and accountable.

Essentially there are some intrinsic rewards accrued by the direct manufacturing laborer such as increased pride in work, and more control over the schedule, type and pace of work. There is a sense of ownership that is both felt and promoted. The factory supervisor no longer acts as overseer, lording over the production area, making sure that every worker is engaged and producing to their potential. Instead fear is replaced with trust that the worker will perform to the best of their ability and that the workers will assist each other. There may not be specific extrinsic rewards, such as increased pay, but in terms of intrinsic rewards the direct laborers are certain winners.

The next section of the thesis describes a case study of two different plant sites within the same company who have recently introduced SDWTs.

II Case Study of an Aerospace Company: The Transition to Self-Directed Work Teams

Study Approach

The case study concerned an aerospace company that in the last few years has started the transition to SDWTs. A series of semi-structured interviews concerning the transition to SDWTs with various personnel in management and the labor force was used to conduct the study. As much as possible, representatives of all employee groups affected by the transition were interviewed. The interviews were tape recorded and later transcribed into field notes.

The Company

This company has approximately 10,000 employees and is involved in the manufacturing and assembly of highly engineered aerospace components. The company is involved in machine fabrication of aluminum, magnesium and steel detail parts, the assembly of electrical components and the assembly of both electrical and mechanical parts into larger assemblies. The components are designed by the company. The customers for the corporation's products include commercial airframe companies, the Department of Defense and NASA.

The company has multiple plant sites. There is a concentration of semi-autonomous[17] plants around the immediate vicinity (within 10 miles) of the corporate headquarters. These plants have a labor force that is represented by the UAW. The salaried personnel have no union representation. There are also semi-autonomous plants located in other states. These Satellite Plant sites are not represented by any union in any

[17]Semi-autonomous means that the plants are cost centers and the plant managers have authority and responsibility to run the facilities as cost centers, but they can not determine the aggregate merit increases for employees, they do not have direct sales responsibility, etc.

form. All employees are considered by the company to be salaried employees at the Satellite plants.

The plant sites are run as cost centers. They generally have a manufacturing concentration. For example, one plant may perform soft metal machining while another performs electronic assembly.

Plants Studied

Two major plant types were studied, an older group of union represented plants (with various manufacturing concentrations) located near corporate headquarters, and a younger, non-union plant site located in another state concentrating on machining. The older plants near corporate headquarters are collectively referred to as the Mature Plants. The younger plant located in another state is referred to as Satellite Plant.

Both plant types were in various stages of the transition to SDWTs. The Satellite Plant had introduced SDWTs 2 1/2 years ago and had introduced SDWTs to 100% of its original workforce. Some of the Mature Plants have teams in the middle of their first workforce training sessions.

Impetus For Transition to Self-Directed Work Teams

The company was not in financial straights when the initiative to develop SDWTs was started. The movement to SDWTs was not a last ditch effort for corporate survival but rather was viewed as an initiative that would improve productivity, flexibility and streamline the organization.

The idea started with the plant manager of a union represented assembly plant. The assembly plant manager brought the SDWT concept up at a plant manger's meeting. The plant manager had read about SDWTs and believed that this was the organizational

model they should adopt. The plant managers at the Satellite Plants[18] were aware of SDWTs and had been discussing the concept with their own management teams. In fact, one plant manager had begun the transition to SDWTs without corporate approval or knowledge. In hindsight it proved not be career threatening (some of the managers at this plant were somewhat worried about the venture being unauthorized-authorized and a somewhat radical departure from the traditional organization structure) and perceived to be cutting edge.

The collective plant managers then convinced the vice-president of operations that SDWTs were the right organizational form going forward. In mid-1992 the vice-president of operations gave the corporate directive to initiate SDWTs. This sparked the negotiations with the union at the Mature Plants concerning SDWTs.

[18]There is more than one plant located in another state. However, the study concerned only one of these "Satellite Plants".

III Transition to Self-Directed Work Teams, Satellite Plant

Satellite Plant, Background

The Satellite Plant was started in the late 1980's. Initially the concept for the Satellite Plant was to provide machined detail parts to the Mature Plants The Satellite Plant was started with a focus on group technology, or cellular manufacturing. The plant does not do any plating or heat treatment in order to minimize environmental liabilities and effects. It currently has 185 people employed with 13[19] job classifications for the traditionally non-exempt employees.

There is no distinction between plant workers and salaried workers in the area of benefits, however the plant workers are still paid on an hourly basis. The machinists that were initially hired were also expected to perform their own product inspection and buy off and were thus instructed and tested in this capacity. There is only a very small number of inspectors at this plant and they operate skill and time intensive co-ordinate measuring machine (cmm) equipment.

The plant has it's own finance, HR, manufacturing engineering, data processing, manufacturing and maintenance personnel. It is a stand alone plant but not all functions that would be appropriate to a stand alone company are present, such as sales and design engineering.

There have been two attempts to organize the labor force between 1986 and 1992, but these have failed. Since the transition to SDWT there has not been an attempt at organizing.

[19]3 for Fabrication, 2 for Assembly, 3 for inspection, 2 for Maintenance, 2 for Materials Support and 1 for Tool and Die.

Form and Responsibilities

The plant started moving toward SDWTs in the latter part of 1992 with the initial training of the first team. Currently everyone (with the exception of a few new hires) has been trained, but not everyone is in a team.

The teams are formed around processes or by product and are designed by management. The team members were also designated by management. The product focussed teams were formed from members of a manufacturing cell. The manufacturing process teams were formed around a specific process such as 5-axis vertical machining. The manufacturing teams also had a manufacturing engineer added to their team. Some manufacturing engineers belonged to multiple manufacturing teams, others were assigned to only one team. A separate manufacturing engineering team was not formed.

Other teams that were formed were also process based, but rather than having an external customer or a single customer, those with multiple customers were formed into process teams who serviced multiple manufacturing teams. For example support functions such as maintenance, tooling (tool crib), core quality and the "Not Team" were formed. The Not Team is comprised of individual contributors such as the single safety engineer, the HR manager, data processing, finance and Continuous Quality Improvement (CQI) advocates. The reasoning was that these functions were different enough in nature that a single team would be difficult to form and furthermore, as functions with only one individual, they were too small to make an effective team. An example of the plant wide team structure is shown in ***Exhibit 5***[20]**.**

[20]At the time of the study there was a proposal to develop a manufacturing engineering team, its relative position in the team matrix is shown.

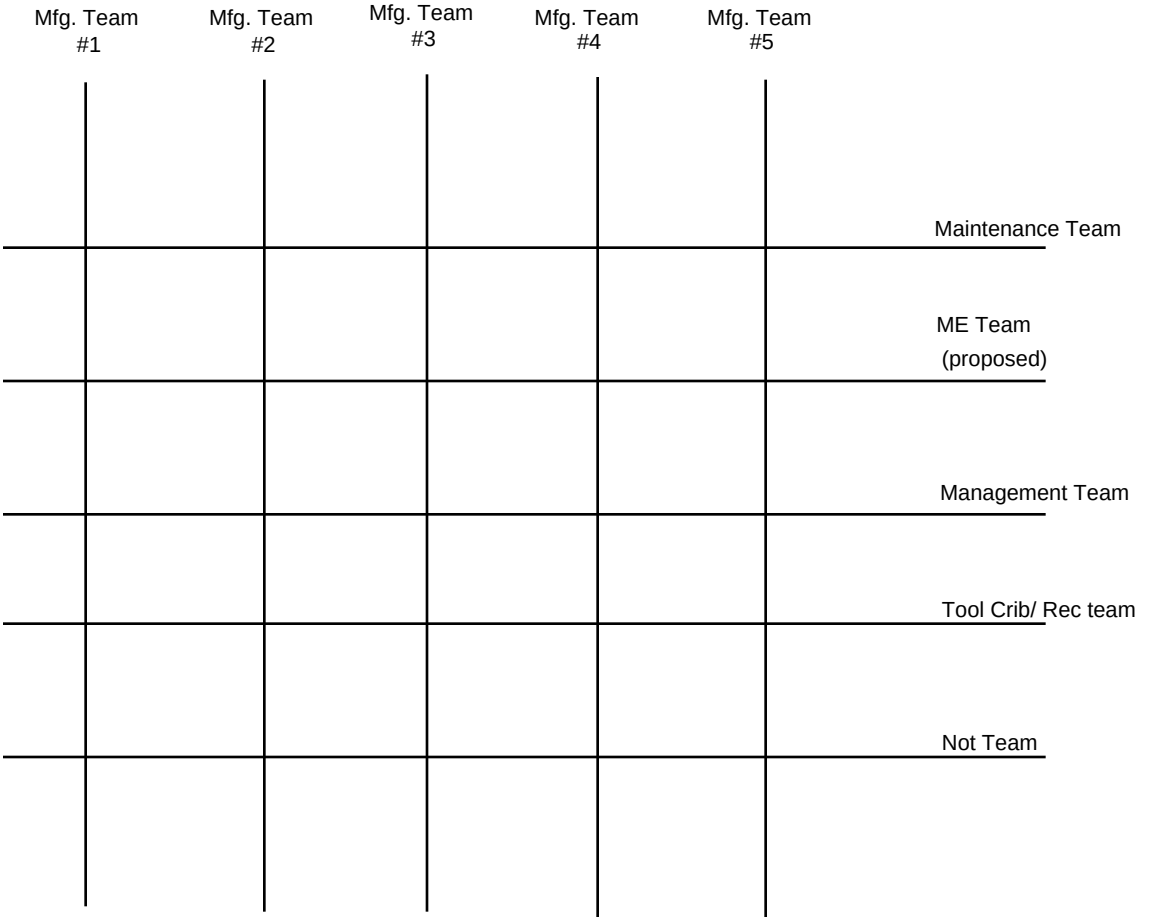

Exhibit 5) Plantwide Team Structure for the Satellite Plant.

The teams range in size from 4 members (a small manufacturing cell) to 18 members (a large manufacturing process). The teams are also spread across shifts. For example, the small 4 member team for the small cell is comprised of 2 first shift people and 2 second shift people. The maintenance team is comprised of maintenance personnel from all 3 shifts. Due to the across shift nature of the teams they have further refined their intershift communications attempting to better establish team communications. They also have rotated the team meetings so that one shift is not unduly inconvenienced.

The team leaders are selected by the team members and the teams have done so since the the beginning of the program. Sometimes this is done by a short straw selection, other times there is an election. The team leaders serve a 4 to 6 month term and may only serve two consecutive terms. The team leader position is one that, ideally, every team member should hold at one time or another.

The team leaders act as communication focals for the team. They obtain written communications and distribute these to the various affected team members, gather the labor tickets and generally perform the various administrative duties that the supervisor once performed. They are also the focal for outside communications. For example, if a machinist wanted to know when a machine may be returned to service, the maintenance team leader is the focal who would find the answer to that question.

Supporting the team member and the team leaders is the team advisor. The team advisor holds a role analogous to the supervisor, but in a SDWT environment this is not exactly what they do. The team advisor's role is more that of a coach or facilitator who is charged with helping the teams achieve their goals and to help remove roadblocks. The team advisors are on the same organizational level as that of the team. Both the team advisors and the teams report to a single person known as the area manager.

The area manager holds a position analogous to that of the department head. The area manager is responsible for the performance of the teams in his/her areas. The teams report to the area manager who relies on the team advisors to help correct performance exceptions and to spur the teams on to higher levels of performance.

Management has delegated many responsibilities to the teams and there has been a considerable expansion of the machinist's responsibilities into those that are in the domain of the professional engineer. This change is not fixed but is in a state of flux, as a team advisor states:

> The long term vision is to have every machinist possessing 3 basic skills (this is not running 3 machines) from the following:. a full set of machinist skills, a set of CMM skills, ME skills, shipping and receiving skills and so on. The organization will be focussed on training to the point that any member can acquire those skills. The plant will give the assignments and training that will give them this capability.

Training

After the divisional directive to move towards teams (a move fully supported by the plant managers), team training was initiated for the HR managers. The managers underwent a 40 hour training session conducted by an internal Human Resources Development person and were certified in Team Training. The Human Resources Development person had been trained by a Human Resources Consulting and Training firm.

The main focus of the Team Training was how to teach and deliver the concepts, and how not to. The training that was eventually delivered to the workforce was primarily focussed on developing "soft" skills. The training was experiential with simulations of real life situations.

During the training the participants learned how to work on teams, be participative, value diversity in viewpoints, habits and work styles, resolve conflicts, and reach consensus. By the end of the training the teams had developed a team charter, norms of behavior and some measures of success as a team.

The initial training at the Satellite Plant was conducted by two people, the HR manager and a quality engineer. However, the HR manager was careful to insure that the ownership of the program was with the mainstream organizations. At this plant they did not want the program to be seen as an HR initiative but rather a manufacturing driven program, for the benefit of manufacturing and the workforce.

Team Boundaries

A the beginning of the SDWT movement, management had clearly delineated the boundaries for the workers, that is, what they would take responsibility for and what would remain as a function of management. An example of the team boundaries, for a facilities engineering function at the Mature Plants, is shown in ***Exhibit 6***.

Proposed Team Boundaries

The following table is a representation of typical activities required to conduct business. Teams will begin taking responsibility for those "ACTIVITIES" designated "NOW" as soon as they are ready. The "LATER" activities will be adopted by some teams after more training, but not all teams may take on these items. "NEVER" designation means the activity is reserved for management.

ACTIVITY	NOW	LATER	NEVER
Prepare Budgets		X	
Manage Budgets		X	
Work with internal customers	X		
Establish work methods	X		
Use continuous improvement	X		
Routine equipment repair scheduling	X		
Assign daily tasks to team members	X	X	
Maintain safe workplace	X		
Resolve pay issues			X
Conduct performance appraisals			X
Resolve team member's performance problems		X	
Hire, promote and fire			X
Select team members	X		
Recommend training needs	X		
Approve training expenses		X	
Schedule vacations	X		
Recommend overtime	X		
Approve overtime		X	X
Establish working hours			X
Approve occasional flex-hours	X		

Exhibit 6) Team Boundaries for a Facilities Engineering Team.

At the Satellite Plant, the team boundaries were similar to that shown in ***Exhibit 6***. However, the Satellite Plant's team boundaries have evolved over time. For example, one of the critical boundaries that was considered to be fixed was that of setting the work hours. The teams made a proposal to management concerning the team's ability to set their own working hours. According to the plant manager:

> At first, setting work hours was out of bounds. The teams came to us and said they would like to set their own work hours. Initially we said no, that is out of bounds, but then upon reflection we said that it was OK: You (the teams) have to get so much work out a week and keep your queues down, but lets try it. Productivity went up.
>
> Today I don't not know who is going to be at work or when. The teams decide that.

The teams are also becoming more involved in hiring decisions. They do not extend the job offer, but they do have input into the hiring decision and conduct some of the interviews. For example, some of the machinists have interviewed new hires for the plant. Three machinists and three managers interviewed the personnel. The machinists tended to ask technical questions during the interview, but they did not focus solely on technical ability. Rather, they looked for a demonstrated level of competency and then, more importantly, excellent teaming skills. The ability to work well with others was the most important attribute the machinists looked for. As one of them said:

> We can teach someone how to be a good machinist but it is more difficult to teach them to be a good team player.

Another boundary which has blurred is in the purchasing and justification of capital budget items.

> The workers also do their own capital equipment justification. All the equipment in the retainer cell (about $500,000) was justified, researched and the authorization for expenditure was written, by the retainer cell team. They also installed it and put it on line.
>
> Now we have several other teams with projects going. For example, there is a group of lathe operators who wanted Rome chucks for the lathes. They gave their personal commitment to me (the plant manager) that the new jaws would drop their set up times by 20 minutes per job. Then the I (the plant manager) helped them go over financial plans and internal rate of returns, and the other financial metrics that we use for equipment justification. They then committed to the plan.
>
> Out of 180 people at the plant I have 160 managers. The people have control over resources and think like managers now. There's a big payoff for that.

As noted in a previous section, there is also a shifting of traditional manufacturing engineering functions to the machinists. This is best described by the machinist himself, who now has all the skills necessary to perform an ME function and who has been given the latitude to exercise those skills:

> I am a machinist first, but there is not much ME stuff that I don't do. I cover everything from simple process updates, program changes to complete processing and NC programming from scratch. I also do some of the Quality Engineering functions such as the gage planning. It all depends on how much time I have and on whether I want to pas the QE work on to one of the quality engineers. I also interact directly with design engineering to redesign existing parts so that they are more manufacturable.

The machinist started performing the functions because a vacuum developed. The ME who originally supported the cell had quit and there was no replacement. In order to achieve the cell objectives this particular machinist took it upon himself to get trained in the ME functions. As he says:

> I got started in Renta-ME (the term for a machinist who can perform ME functions) because ME staff was so overloaded that they did not have time to do the program updates. You see, the ME for the cell had quit and the other MEs tried to cover, but they did not understand the parts in the cell. Nobody had the same experience with the cell parts that I had so I was a natural to help out. The other MEs usually had to ask me what to do with the problem parts anyway, so I decided to start learning the ME job.
>
> Then there was a large change of parts from cast iron to aluminum and they needed someone to help in doing the changes. I was already doing some ME work so they asked me to help with the changes.

He had trained himself by reading manuals and going through tutorials on Unigraphics (a computer program). He also asked other people questions when necessary, but essentially was a self taught ME.

Responsibilities have been transferred to the workers that were not envisioned at the beginning of the SDWT initiative. The transitions have been relatively painless. However, there are two areas that are still in the domain of management that may have a much more tumultuous evolution. Those areas are discipline and compensation.

Discipline and Compensation

In theory, the disciplinary function is still maintained by management, however in practice, they rely on the teams for input. Given the span of control that a team advisor may have (52 people across three shifts) there may be considerable discipline problems

that occur without the direct knowledge of the supervisor. Without this direct knowledge it is difficult for a supervisor to act in good conscious when disciplining a worker. Instead there has been a subtle shift where the teams are having to deal with their own problems. This was not expected in the beginning but it shows how evolution may occur due to other forces than company mandate.

Even though management still says that they maintain control over formal discipline procedures, the team members themselves also must play a role in providing information to management. As the plant manager said:

> We have terminated two people because the teams recommended it. They came up and said they had tried the following things and the problem persisted.

A team advisor also commented that:

> I have asked that the teams collect documentation on performance problems. The team advisor can not be there all the time.

From the perspective of the area manager (a second level manager) the following comments were obtained:

> Some teams are comfortable with saying that we have dealt with this person and we can not handle it any more. It is time for you (management) to step in. This is a big issue in some teams, while some teams may say it is an issue because of other teams even though it does not affect them. Not all teams know how to handle the non-performer.

> The teams are not yet to the level where they can deal with free riders. They try to deal with the offender but the offenders are not listening. Peer pressure is not working. They(the free rider) try to ignore it.

> The teams are starting to go to area managers now. At first, no one would do it for fear of being classified as a Rat. A couple of teams

> have now brought issues to Area Managers as a team. Individuals have also done this, but one needs to be careful that this is truly an issue for the team and not just an issue between individual's.

From the perspective of the worker, one felt that management had backed off too fast. The teams were not able to deal with discipline problems effectively and management was no longer around to notice and handle the discipline problems. The problems were not rectified in a timely manner and to some extent were ignored.

As in other boundaries that are evolving it seems that discipline is but the evolution is much slower and more difficult. Eventually there may be teams that entirely handle their own discipline process with management having only a figurative place, but this will take time.

Compensation is also in the domain of management. Currently the workers have their compensation (merit increases) determined by an individual rating applied by management. This is a separate effort from the performance appraisal system.

The plant had attempted a peer review performance appraisal that was to be separate from the compensation system, however it suffered from a fatal flaw. The peer review was to be accomplished by three selected peers for a given individual. The peers were selected by the individual being rated. Due to this and the fact that the performance review occurred very closely to the compensation review there was an upward bias for the appraisals. In fact:

> We tried team evaluations. Everybody rated everybody else almost perfect. There were some problems such as the peer performance evaluation being too close to merit time. The raters thought that if they gave a poor evaluation then the ratee would get a low merit and would get upset. So they rated people with 5s.

They dropped the peer review the same day they tried it. Currently the teams have not demonstrated and ability to handle the compensation and review process on their own, so this will stay in the management domain.

The compensation is still based on individual performance as viewed by a manager or group of manager's whose span of control is over 50 individuals apiece and across 3 shifts. It is very difficult for them to rate each employee objectively. As one manager said:

> I have to do career development planning and performance appraisals for 52 people. The performance appraisal is made on a gut feel level. I do not spend a lot of time with them, maybe only seeing them once a week or every two weeks. Instead I rely on team input.

This shows that while the performance appraisals and compensation rewards are in the domain of management, there is pressure for them to become a shared part of the team's responsibilities. Previous attempts to allow formal team input have succumbed to a market failure however and this, like discipline, will evolve very slowly.

IV Transition to Self-Directed Work Teams, Mature Plants

Mature Plants, Background

The company is over 90 years old with aerospace operations dating back 50 years. The plants which are located near headquarters initiated operations in 1968. These plants are unionized and represented by the United Autoworkers Union (UAW).

Relations between management and the union have been strained in the past. In the mid to late 1980's there was a lock out, after which there was a strike. The main points of contention were a series of economic and non-economic issues such as a 14% pay increase, cost of living allowance, night shift pay premium, unlimited union business time off, and preferential hiring of UAW affiliated workers. The union then worked without a contract until 1989 where upon a new contract was ratified and a relationship with the company's management began again.

There are currently 48 job classifications for non-exempt workers with employment of non-exempt workers equaling approximately 665 employees spread over a number of small plants. The plants assemble the products for which this aerospace company is recognized and also do some of the primary machining and detail part fabrication.

Form and Responsibilities

Following one of the tenants of STS organizational design, stakeholder involvement, the company and the UAW entered a negotiation period in order to implement SDWTs in the unionized facilities. In mid-1993 the union and company ratified the World Class Commitments (WCC). In the spring of 1994 the first team training began at the Mature Plants.

The language of the WCC gives rise to the form of the teams. There was language put in place that helped to mitigate the effect of combining job classifications on certain UAW represented workers. For example, there were inspectors that would have a significant portion of their job and responsibility move to a production worker (termed a certified operator).[21] This was addressed partially in section XII of the WCC. Some of the responsibilities that were in the domain of the office employees would be transferred or shared by the inspectors so the inspector's jobs would not be jeopardized by the move to SDWTs. Other items put in place to mitigate the effect of combining job classifications and displacing workers were an inverse seniority voluntary layoff and a tuition reimbursement of $3,000 for a laid off employee. However, the most important part of the WCC that dictates the form of the teams is section VI Job Classification Evaluation.

In section VI, the Job Classification Evaluation Plan (J.C.E.P.), there are a series of steps that must be taken in order to add significant[22] responsibilities to a job classification or to combine job classifications. The basic process for combining job classifications is to:

1. Identify the affected classifications and the rationale for the changes.
2. Simulate the staffing of the proposed changes to see the Article 5 (layoff, bumping, recall, etc.) impact.
3. Identify employees who may be reduced and/or have previously held any part of the newly combined classification since they have bumping rights by virtue of previously held status.
4. Assess the job posting impact.

[21]This was not an issue at the satellite plant as the machinists were always certified operators and also were hired in with the expectation that they would be inspecting and certifying their own work.
[22]Significant responsibilities has a specific meaning here. Significant responsibilities, for example, could be adding scheduling responsibility to a machinist in a cell as opposed to having scheduling performed by a shop floor scheduler. Significant responsibility does not mean adapting to technological progress. For example, a janitor using a motorized floor sweeper rather than a manually operated push broom.

5. Identify the training required and estimate the time it will take to implement and complete.
6. Prepare the new job description and submit it to the J.C.E.C.[23] for evaluation.
7. The J.C.E.C. will evaluate the new job description and submit their recommendation to the Joint Bargaining Committees for consideration and action.

This process effectively puts a cost on the process of combining even simple duties, such as adding the checking and refilling of a machine tool's hydraulic fluid to a machinist's weekly duties. It also adds to a feeling of separateness between job classifications. SDWTs tend to blur work responsibility boundaries, but the union still seeks to control these boundaries.

A contrasting viewpoint on such a process is that the act of documenting it will give continuity to the job evaluation process. Even though there is a lot of energy exerted to get the process rolling, there is a lot of momentum built up and it is difficult to derail the process.

The teams studied at the Mature Plants were generally within cells or processes, as in the Satellite Plant, but the responsibilities that were given to each team were not as great as those at the Satellite Plant. As one manager stated:

> We have a cell which has assemblers and material handling clerks. The assemblers primarily assemble and material handling clerks primarily handle material. They do not currently take on ME jobs, but they are sharing some of the work, such as scheduling. The team members are also assisting in making tools, purchasing tools, etc.

There did not seem to be a high degree of job responsibilities being transferred from one represented employee to another, with one exception, inspection.

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[23]J.C.E.C. is the Job Classification Evaluation Committee comprised of 3 union representatives and 3 company representatives.

The major added responsibility to manufacturing employees was that of self inspection by a production worker. This was known as the certified operator program.

As already noted, the Satellite Plant was initially started with this type of program in place and it was this type of program that was introduced to the Mature Plants (i.e. training, testing and auditing of certified operators). In the Mature Plants, the transition was first initiated with the ratification of the WCC. In the WCC the union and management agreed that:

> The purpose of having Certified Operators is to place the responsibility for product quality in the hands of the employees who perform the work.
>
> In order to attain this end, the Company agrees to fully provide the necessary training so that employees can inspect, document, analyze and produce defect-free products.
>
> Any proposed classification for certification will be submitted to the Job Classification Evaluation Committee for review and evaluation under the Job Classification Evaluation Plan.
>
> Section XII addresses certifications that impact Line and Surface Plate Inspection in Plants 1,2, and 6, and PML Inspection job classifications. As new job classifications are considered for certification, the process that resulted in Section XII will be followed.

Section XII had implications for the office employees. Section XII is as follows:

> XII. New Bargaining Unit Work and Shared Work
>
> It is our intent to implement these changes as we implement Certified Operator to maximize opportunities for those whose positions are eliminated, as they are eliminated. The Company is obligated to provide the necessary training as required.

ADD TO LINE AND SURFACE PLATE INSPECTOR
JOB DESCRIPTION

1. Prepares, revises and maintains Outline Job Instruction Sheets.
2. Makes CMM program changes to meet Engineering change and/or other revision requirements.
3. Become certified in customer buyoff (e.g. DMIR, DSQR, etc.) and FAA as customer requirements permit.
4. Will perform inspection checks in Quality Assurance Lab, CMM and bench inspection for engineering checks, do Receiving Inspection purges, and is responsible for casting layout dimensional checks and overchecks.
5. Maintain the files for packing slips and test data in Receiving Inspection are.

WORK TO BE SHARED BETWEEN OFFICE AND L&S
PLATE INSPECTORS

1. Assigning of functional gaging and gage planning.*
2. Debugging original programming.*
3. Source inspection/vendor audit within a 100 mile radius.*
4. Writing original CMM programs.*
5. Casting layout report.*

* It is the intent of the World Class Commitments to drive decision-making and product responsibility toward the employees who have the most direct, hands-on contact with the product. With this philosophy in mind, the parties agree to periodically review "shared work" to assess the viability of transferring it to the Bargaining Unit.

As a result, inspection jobs were saved at the expense of office employees, who once had these responsibilities.

The company also involved another set of stakeholders in the change process by communicating with their customers. The company recognized that some of their customers, specifically manned space flight, unmanned space flight and missiles, would be very concerned with any changes to quality assurance. To this end the company

developed a document entitled the “Transition Plan for Integration of Quality” and sent that to all their customers. Feedback was then appropriately dealt with.

The team members were not designated by management but rather by the implementation team. The implementation team was comprised of a diagonal slice of the organization and had a full cross section of all disciplines that were affected by the change to SDWTs. For example, the implementation team may have representatives from NC programming, manufacturing engineering, maintenance, inspection, clerical functions and production planning.

The team leaders were selected in the same manner as that for the Satellite Plant. This was not an issue at the Mature Plants as the union had agreed (through the WCC) that team leaders would be initially appointed, but thereafter elected to the position by the team. The team advisors and area managers also followed the same pattern as those in the Satellite Plant.

Training

The training process was similar to that described in the section on the Satellite Plant. However, there were some differences.

The training at the Mature Plants was staggered. Not all the teams were trained at the same time, nor all the plants. Training started with the office employees and moved out into the plants later. The Mature Plants have are currently trained approximately 75% of their workforce.

The Mature Plants also augmented the training. At the beginning of the training session there was a 3 hour module developed by the UAW. The module explained the UAW’s understanding of the SDWT concept, how SDWTs can be implemented without interfering with the rights of workers, and that the UAW fully supports the effort. The

training given to the union workforce at the Mature Plants was conducted by two co-facilitators. One co-facilitator was from the bargaining unit and the other co-facilitator was from the office area (representing management). Both were certified as Team Trainers. The management co-facilitator was most likely an HR manager but ay have been a manager from the area where the SDWTs would be formed, an engineer or some other “office” person.

Team Boundaries

The history of the SDWTs at the Mature Plants has not been long enough to ascertain whether the boundaries are evolving or will remain stagnant. Currently the team boundaries are similar to those shown in ***Exhibit 6.***

Discipline and Compensation

There again was a feeling is that management has backed off too fast with respect to discipline, expecting the teams to use peer pressure to correct performance problems. However, most managers and team members of newly formed teams were optimistic that peer pressure would work.

One of the older teams did not feel this way. They found it difficult to coach a problem employee whom they have to work with everyday. Instead they have tried to send signals to managers that there is a problem. The managers in turn have difficulty in determining what the signals are, what they mean, how important is this problem, and should they step in. The managers are having a difficult time understanding when they should interfere with the team as it goes against their concept of a SDWT. They feel this would strip authority from the teams.

V Benefits of Self-Directed Work Teams

Directly measuring the benefits accrued from the transition to SDWTs is a difficult task. There may initially be a decrease in efficiencies and increases in costs. As described by one manager who had helped initiate SDWTs at another plant 2 1/2 years ago:

> In our plant there was a drop in efficiency. This was due to a lot of chaos at the beginning, workers not doing work but rather indirect functions. Utilization will not return to its existing level, but utilization is a poor metric. We were asking people to do a lot of tasks that they have not done before.
>
> We had an "insight" video taped where the plant manager said that metrics need to be revised, they were not the right metrics. He also said that costs were not dropping but rising. Costs started to drop again after about a year and now they are below what they were prior to the teaming effort. This is not a quick program for decreasing costs and increasing efficiency.

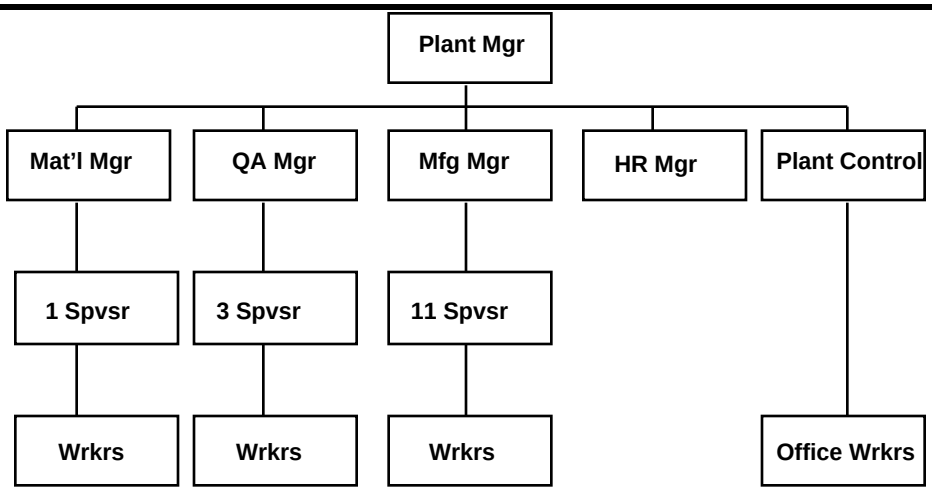
The Mature Plants are still undergoing the transition to SDWTs with only about 75% of the workforce being in teams, thus the best plant with which to measure the benefits of SDWTs is the Satellite Plant.

The Satellite Plant has been operating with SDWTs for about 2 1/2 years, long enough to be able to clearly measure the benefits and long enough to have gotten over the hump. It must be noted that these benefits can not be isolated from other effects such as technological innovation. However, it was the view of those interviewed that the improvements in performance were mainly due to the introduction of SDWTs. The performance improvements are described in the following pages.

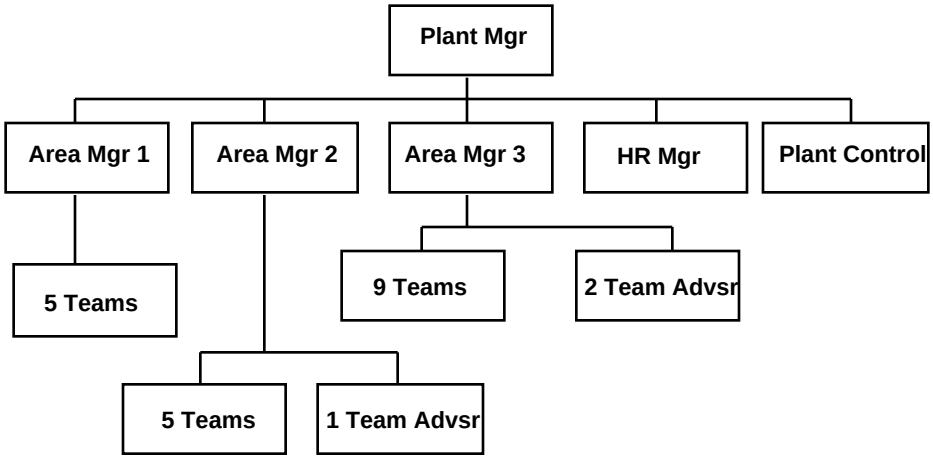
Organizational Flattening

The organizations are dramatically flatter and leaner. ***Exhibit 7*** shows the difference in the organizational structure for the Satellite Plant before and after the introduction of the SDWTs. Along with the organizational flattening comes flexibility. There is also a considerable increase in the amount of horizontal communication from one function to another ***(See Exhibits 3 and 4)***. Rather than having communications going vertically through a set of management filters, one worker may communicate directly with another. The flat organization fosters this type of communication. For example, the Renta-MEs at the Satellite Plant now regularly communicate with design engineers helping the designers to design products which fit standard tooling, thus reducing the tooling costs and machine set up times. Before SDWTs, a suggestion for changing a design to fit standard tooling may have had to be communicated to an ME, who then alerted a supervisor, who then communicated to a design supervisor, who then communicated with the designer in charge. This vertical mode of communication, which can lose vital information or contextual nuances due to the number of people who must pass the communication along, has been replaced by a simpler form of horizontal communication through a significantly reduced number of people.

In a similar manner to the grade school exercise, where a message is passed from one student to another and when the message returns to its originator it is unrecognizable, vertical communication through a number of people or filters can render a message unrecognizable and thus hinder communication. The flatter organization, which promotes short, horizontal communication, does not fall prey to this defect.



Organizational Structure Before Self-Directed Work Teams



Organizational Structure After Self-Directed Work Teams

Exhibit 7) Organizational Structure of the Satellite Plant Before and After Self-Directed Work Teams

Safety

The Satellite Plant workers helped to design a program that provides an incentive for safe practices and cutting down on the abuse of the safety programs. The first program was termed Safety Bingo. For every day that there was not an accident, management drew a bingo number. Every worker had a bingo card and the first person to get BINGO was awarded $300. After that, the game continued until a blackout occurred. However, if there is an accident the game starts over.

The workers would police themselves and peer pressure would be applied to some people who would milk the accident system. The people who were known to go home or to the hospital for a slight cut were spoken to by other employees, especially those who had a good chance of winning the next Bingo game.

The results for this worker designed program were to cut safety costs by 99%. The plant has also gone for as long as a year and a half without a lost time accident. The plant used to have one of the worst safety record in the division, but now they have the best.

Schedule

The workers track the schedules of jobs that are close being due to the customer. They also track those jobs that may have a problem getting to the customer, expediting them and even calling another company or plant that may need to do some processing on the parts in order to insure the parts get to the customer on time. Employees have been known to meet “hot” parts at the airport in order to expedite the finishing of the parts and after subsequent processing, hand load them on to another airplane where they are delivered to the customer. As a result of this attention to schedule, the on time delivery of

parts to the customer has hovered around 95% and in one week was 100%. Prior to SDWTs the Satellite Plant's schedule maintenance ranged between 60 to 70%.

Tooling Cost

Tooling represents 25% of the entire plant's budget. The teams and employees are constantly questioning the design engineers about product designs and recommending changes that would allow the use of tooling already built. This has reduced the cost of tooling by 21% as measured by the amount of direct labor hours expended.

Part Costs

Unit costs today are slightly higher than in 1992 (pre-SDWTs), but this is due to lower volumes going through the plant. However, looking at variable (marginal costs), they have been reduced significantly. Since going to teams, the 20% of the part numbers that represent 80% of the volume (termed driver parts) have undergone significant reductions in cost. Some (not all) of the parts now cost 1/3 of what they did 2 years ago. This was accomplished through SDWTs making improvements to their processes, reducing spoilage, improving quality and finding more efficient methods of producing more with less.

Quality

Part quality and labor charging quality has improved over the period that the plant has gone to teams. Labor charge errors are 10% of what they once were, meaning a dramatic savings in data processing. Defects per 1,000 parts have been cut in half every year for the last three years and are projected to be cut in half again this year. This is impressive as some of the cells have defects per 1,000 measured in the 1/10ths.

VI Items That Enable the Transition to SDWT.

There were some items identified during the study that enabled the transition to SDWTs. First and foremost was the use of cellular manufacturing which had been introduced in the Mature plants, and was the backbone of the Satellite Plant.

1) Use of Cellular Manufacturing.

This was clearly identified by the persons interviewed as easing the transition to SDWTs. Without exception, every person who was asked if introducing SDWTs in a cell is easier than in a traditional process layout replied affirmatively. Furthermore, the ease of introducing SDWTs into manufacturing cells was so great that, in order to help promote teaming, the Satellite Plant is going to form “loose” group technology cells. Rather than having parts that are in a part family that have similar production and set up characteristics, the Satellite Plant will relax the set up constraint and form cells around similar production flows.

It seems logical that a cellular manufacturing environment would be an easier one into which SDWTs are introduced. The product focus of the cells is one of the precepts of the STS design approach. The cell generally has a group goal or set of metrics that each person in the cell is held accountable for. The people working within a manufacturing cell need to be flexible with regards to job assignments. The cell members generally bond together around the group goals and form a team. Many people commented that the cell members were teams long before the introduction of SDWTs and the formal proclamation of SDWTs was only a recognition of this fact.

2) Training

As described earlier, there was a considerable amount of training given to the teams. Additionally, the trainers were plant personnel whose education during the training sessions will stay with the plant rather than reside with an itinerant consultant not associated with the plant.

The training was structured using what most would consider techniques for enabling adult learning. Simulations and role playing were very much in evidence as was a continual stressing of values that enable teamwork.

The use of a union co-facilitator was also critical for the success in the unionized plant. The use of the union member as co-facilitator allowed the member to address union specific issues relating to SDWTs with authority and confidence. As one management facilitator said:

> My union co-facilitator has helped me a lot. My co-facilitator steps in when the discussion turns to unionism, and takes over the discussion. He is one of them and they listen to him.

Without the backing of the union, which was very visible from the use of the union member co-facilitators, there is no doubt that the transition would have been many times more difficult.

3) Union Backing

For the union represented plants, without the backing of the union, the SDWT effort may have been a point of contention at the next contract negotiations. Rather than discussing SDWTs along with other issues during the contract negotiation period, union and management reached a separate agreement, the World Class Commitment. Within the agreement is the Job Classification Evaluation Plan (J.C.E.P.). As described earlier,

the J.C.E.P. gave the bargaining unit members a sense of security and due process and also allowed the union to maintain job classifications as a bargaining issue. While this may be seen as a hindrance in a non-union environment, in a union environment the very existence of the process gives the union members a sense of security. The union will still be looking out for them. As previously mentioned, the backing of the SDWT concept by the International Union was also very well communicated.

More specifically, the International Union, prior to the ratification of the WCC, brought in an Executive Director of the Aerospace Group to address the union membership at the local union hall. The executive director spoke about the issues and concerns that the local members had with the SDWT program and why she thought it was good for the union to stand behind the program. Six months after the initial local union meeting, the executive director came out again, officially kicking off the WCC. This time she addressed the company's management as well as the local union leadership, fully endorsing the SDWT program. She spoke about fostering a close and cooperative relationship between labor and management, working together to gain jobs and secure employment, and that SDWTs are a very good way to do this.

The grievance process is still in place as is the ratified contract. There is a 3 hour union module embedded in the training and there are union members who act as co-facilitators/team trainers. All of these add to the security of the bargaining unit members.

On the other hand, management employees generally saw the representation of employees by a union as at least a hindrance, and at most a strong barrier to SDWTs. One manager at the Satellite Plant saw the presence of a union as making the transition "200% more difficult". The Satellite Plant personnel (of which many had been previously affiliated with a labor union) also believed that a union would not allow the workforce to be as cross-trained and flexible as they have become. At this particular plant site, a

machinist may operate a machine, inspect their own work, operate a co-ordinate measuring machine (cmm) and perform all the functions of the manufacturing engineer. This is all within the same labor grade or pay class.

Management at the union represented facility also believed that a union would hinder the change to SDWTs. They did not think that the UAW would be as flexible as necessary with respect to job descriptions. They thought the union would not allow some bargaining unit employees to cannibalize other bargaining unit employees by taking over their functions.

4) Identifying and Eliminating Blockers

Blockers are defined as people who actively or passively resist change. Their actions include extreme vocal dissension, semi-private vocal dissension, or passive resistance. Klein[24] cites "bad-mouthing" the proposal, which discouraged the subordinates from actively participating in the change process as an example of blocking. Klein[25] also cites supervisors taking a "hands off" attitude with regards to the teams. For example, when a problem occurred, the supervisors disclaimed responsibility saying that it was a team problem.

There are many underlying reasons why the blockers behave as they do. The particular types of individuals and reasons for blocking that were uncovered during the course of the research are described below.

[24]Klein 1984
[25]Klein, 1984

First there are people who only half-heartedly go along with the initial program believing that, like other programs, this too will pass. The employees may be quite skeptical if there is a history of trying the latest manufacturing or management concept only to abandon it a short time later. This will cause people to be wary of putting forth an effort to understand and help implement the new initiative.

The second group of people who behave as blockers are those that are uncertain in the short term about their continuing employment with the enterprise. This may be due to a perception that SDWTs are a way to trim management staff and pass on the work to subordinates. The movement to SDWTs may also threaten the worker. Inspectors may feel threatened with obsolescence as the operators start to self-inspect. Maintenance workers may feel threatened as preventative maintenance is taken over by machine operators.

The third group of people who may actively or passively block the transition to SDWTs are those who see an end to the upward career path. Generally professional employees, they can quickly become disheartened when they find that, along with SDWTs, there will be less management and thus less opportunity for upward mobility within the company.

The elimination of blockers was considered by the management at the Satellite Plant as a key to success. Identifying blockers and then eliminating them sent a number of strong messages. One message was that the company is committed to the change. Another message was that if you are not committed, then you will not be employed by the company. It also showed that management was not being fooled by fakers. The workforce could tell who was actively promoting or who was passively blocking. As noted by one worker:

> The laying off of some of the supervisors really showed us that management and the company was serious about the change and that they knew who was for it and against it. They got rid of the people who were bad mouthing the program behind their backs. It was nice to see that they weren't fooled.

5) Plant Management

Plant management plays a pivotal role in the adoption and success of the SDWTs. The feelings that the workers have concerning the SDWTs and management's commitment to the team ideal are set by both verbal and non-verbal communication. Plant management can play a powerful and positive role, enabling the transition rather than hindering it. The first example is by being very up front about the change process. People who are fighting the change and are ignored by top management send a signal to the other employees, plant management does not really back the change. In this instance, through the use of layoffs and other devices, those people fighting the change were dealt with in a very visible manner sending a credible signal to the other employees about management's true feeling about the movement to SDWTs.

Secondly, the SDWT effort was the top agenda item at the plant during the transition and well into the transition. The plant manager supported the effort by making it the most important item on the agenda at the plant. While this alone will not engender change, this along with the nonverbal communications of management's dedication helped the transition.

Plant management, however, can hinder the transition. For example, if management states that SDWTs will be implemented yet takes responsibilities away from certain individuals with no corresponding increase in other responsibilities, those individuals who had responsibilities stripped away may believe that the SDWTs are for other groups of people rather than for them. For example, the manufacturing engineers at

the Satellite Plant think that SDWTs were instituted for the benefit of the shop personnel rather than for them. This was due to an action taken by top management that demonstrated (in the eyes of the manufacturing engineer) that there was no commitment to them.

The specific action was taking the responsibility for ordering tooling from the engineer and instituting a signature process where the engineers now had to get all three area managers and the plant manager's signature to obtain authorization to order a tool. As stated by a manufacturing engineer:

> Management does not trust the MEs. We need three area managers and the plant manager to sign for a new fixture. They need the tool in order to run the job, it is a new part. They have to spend the money on it.
>
> This change occurred about a year ago. Now, every manager calls me up and asks "Do you really need this, and do you really need that?" I used to be able to order the fixture or the tool without having to get anyone's signature. I think I am in the best position to determine whether we need a tool or not.
>
> They have not told me if there is a budget constraint on tooling or anything. The ME's do not have that type of information. They trust the shop floor but they don't trust the engineers anymore. They are sending us two different signals.

The enabling function that plant management performs is following through on verbal commitments, such as trusting the teams. From the manufacturing engineering example one can see that even with verbal plant management support, lack of follow through with regards to trusting the worker can negate all verbal and written communiqués.

6) Little Interference From Corporate

Another enabler is having corporate officers trusting the implementation of SDWTs by the plant sites, or alternatively being separated from the direct control of corporate officers and possessing some degree of autonomy. This is important because the transition to SDWTs is not an easy task and performance metrics may take initial downturns during the transition period. If there is a slight slip in performance and this is deemed to be the result of the movement to teams, the effort may be scuttled by the corporate office. As one person interviewed stated:

> Being separate from corporate was a big plus. We were left alone and did not undergo micro-analysis of every decision being made.

The corporate officers need to, as little as possible, interfere with the plant sites as they undergo the transition to SDWTs. There may be some difficulties while teams are first forming. Utilization metrics and cost metrics may in the short run take a wrong turn. However, interference by corporate would show a lack of trust in the workers and the SDWT effort, and end up harming the transition effort.

6) Economic Climate

One item identified quite prominately in the literature has been the effect of the business climate on the transition to SDWTs. The literature points out that a positive growing business climate aids the transition to SDWTs by providing job security and thus alleviating some of the fears that workers have with regards to being displaced.

However, in the plants studied, there was a negative business climate. The plants managed the transition to SDWTs by communicating with the employees frequently and reinforcing the positive benefits of the transition to SDWTs. The downturn in the

aerospace industry also allowed the plants to surplus workers who were blocking the change or may have been having some difficulty in accepting their new role. It gave management an opportunity to cull these people out.

On the other hand, even in the downturn those management employees who were displaced from their respective supervisory capacities and were also deemed to be supportive of the change were allowed to remain with the company. They were generally moved into a support professional role with no loss in salary. In some cases, those who moved from first line supervision were in effect given a promotion as the salary class into which they moved had a higher upside potential. For example, a first line supervisor moving from assembly into manufacturing engineering could potentially earn a higher salary as the salary cap for first line supervision is lower than that for a manufacturing engineer.

VII Lessons Learned

The lessons learned are concerned with areas of improvement that could have been taken advantage of by the aerospace company in the introduction of SDWTs, but were not.

Understand the Nature of the Professional Employees Engaged in Support

First one must consider two types of professional employees, those that are outwardly supporting and those that are inwardly supporting. Outwardly supporting professionals are generally engaged with procuring or obtaining support from outside the company, for example, procurement people. Inwardly supporting professionals ply their chosen trade within the boundaries of the corporation, generally in support of the production of the company's main product or service, for example, manufacturing engineers or quality engineers.

Outwardly Supportive Professionals

The first area that the aerospace company could have improved upon was the introduction of SDWTs into the outwardly supporting professional workplace. Specifically this was a group of professional employees engaged in the procurement of components and materials from outside suppliers.

As one professional employee stated:

> Historically our employees were not team players. There was competition for the next job. With SDWTs there was fear of losing one's identity as a super achiever. Other people will get credit for my achievements. The SDWTs were not seen as a good thing.

In fact, during the interview with the employees, there was an overall negative feeling towards the SDWT program. The main reasons cited were:

1) The elimination of the upward career path. The employees now believe that this is the job they will have for the rest of their careers at the company. This is unsettling as in the past the reward for doing an excellent job and standing out as a super achiever was a promotion into management (with higher compensation and more perks). Some people have left the company due to the loss of the upward career path.

2) There is more work and less people. The workers perceive a lot more work by taking on that work which was once in the domain of the supervisor, but without any additional responsibility. They were a relatively autonomous work group to begin with. They feel pressure to get work accomplished under a time constraint and to compound that, they do not have time for discussing much as a team.

3) Not all the professional teams work well together. Some of the teams share work across the team because they all have approximately the same skill level. For example, obtaining a quote on a metallic commodity is about the same no matter what the type of metal is. The plastics or polymer commodities are much more specialized. In plastics, if a buyer is swamped with work he or she can not shift some of that to another person. This particular buyer does not see SDWTs as a benefit at all.

4) They feel that individualism has been lost. They do not have a personal identity any longer, which used to be important for compensation issues. Even barring the effect of

compensation, the effect of losing ones self identity in the professional environment was very strongly felt.

One may question the benefits of introducing SDWTs into an outwardly supportive professional environment. There has been little evidence so far that this has been an effective program other than cutting a layer of management and downsizing. There does not seem to be any synergy's or benefits to the use of SDWTs in this particular professional arena.[26]

Inwardly Supportive Professionals

The second area of opportunity concerned the handling of the manufacturing engineers (ME) at the Satellite Plant. Rather than have a representative of the function participate in the formation of teams (which would be prescribed by the STS approach to organizational design), management only asked for dissenting viewpoints. Then MEs were assigned to manufacturing teams. In the words of an ME:

> We had no input into putting ME on the manufacturing teams. We also had no input on them going back to an ME team. Management asked for their opinion, or rather, do they have any objections to doing any of this. This has fostered a lack of trust in management. We don't believe that management knows what they are doing. We don't understand what they are doing.

The MEs also do not feel that their job responsibilities have changed much, but the primary problem has been communication within the teams. As an ME noted:

> I've been to team meetings and listened to their problems, but that is all. But the problem is communication. The team

[26]It should be noted that this generalization should not be carried to far. In the case of design engineers, where they have both an outward and inward focus, one can argue that they themselves provide a product should not be classified as support professionals. They definitely benefit from SDWTs. In fact, an Integrated Product Team would make an ideal SDWT.

> meetings are focussed on the cell (problems particular to the area). I have told the team leaders that unless there is some specific problem the team wants me to work on I don't want to go to the meeting. I don't want to hear about stinking coolant or the benches being in the wrong place. There is no ME specific information being passed on.
>
> I miss the supervisor of the ME group. He would pass on big picture information such as new programs the company is bidding on, new work successfully obtained, new part packages that will be coming in and so on. There is no vertical communication anymore for the MEs. I basically don't feel part of the manufacturing teams. I just have work to do and I do it.

Although the ME interviewed stated that the SDWTs are not seen as a threat to the ME's job security, many comments by the ME as well as other persons who have daily contact with the MEs run counter to this. First, there was a feeling on the limits that should be placed on the Renta-ME function (the function that effectively competes with the regular MEs). As the ME said:

> I question the effectiveness of the training. Having an ME train a trainer who then trains a trainer may yield a poorly trained Renta-ME. I am also concerned with control over processes and programs. I am worried about consistency and standardization with the Renta-MEs. There are a lot of changes going back and forth. I think they (Renta-MEs) will come in handy for small quick jobs.
>
> I also don't think that the Renta-MEs should program. If there is an engineering change that comes down, and it is a "must conform" change and they miss it, well.....

The Renta-ME, when asked about the feelings that he perceives with respect to the MEs, responded that he at minimum felt very little acceptance by the ME community

and at most some hostility. His perceptions were based on verbal and non-verbal communication between himself and others around him.

There is also a "culture" of the engineer. The culture is dominated by individuality which is reinforced by the individual's performance based compensation system. As the ME said:

> I think that there is an engineer culture that respects individual performance. The individual performance based compensation system somewhat plays into this also.

As also noted in a previous section, there has been a demonstration of a lack of trust in the MEs as evidenced by the taking tool order responsibility from the MEs. There is also a lack of understanding of the culture of an engineer. Engineers tend to be individualistic. By putting them on to a manufacturing team, they lose their sense of identity. Additionally they lose a tremendous amount of stature by being placed on a manufacturing team. This was a problem brought up by some of the people interviewed who had experience with the MEs and the ME function. Some of the MEs, while being part of a team, did not attend the team meetings, rarely ventured on to the shop floor and did not wish to lose their individuality.

One final point is that during the transition to SDWTs, the quality engineering function was rolled in to the manufacturing engineering function. It was the feeling of one manager that this may have also caused some disruption in the change process.

It seems in retrospect that the Satellite Plant had made an error with respect to the MEs. The plant management has agreed that the placement of the MEs on to the manufacturing team was a mistake and that the entire handling of the MEs may have been characterized by a lack of insight into the nature of the MEs and a lack of involvement of the MEs into the formation of the teams.

The negative feelings of the MEs can be understood. ***Exhibits 3 and 4*** show the relative changes in stature that can occur when an organization undergoes a change to SDWTs. In this case it seems that the MEs may feel that their stature has dropped below that of the machinist. As the ME said:

> Engineers used to think that they knew the best way to process things, now the operators think they do. They bend management's ear and the word comes back do it the operator's way. This bothers a lot of engineers. Management does not trust us anymore.

The vertical communication has also disappeared, and from the comments of the ME who was interviewed, the horizontal communication has not improved from what it was before the change to SDWTs.

> Horizontal communication has not gotten any better. Vertical communication has gotten worse.

A way of correction, or avoidance, of the problems encountered with the ME transition to SDWTs, especially these problems related to change in stature, would be to involve them in the team design process. The issues of stature and individuality would have been encountered and they would have been dealt with. As it remains, the formation of a SDWT entirely made of MEs operating in a manner similar to other teams that support a broad range of manufacturing teams seems to be an arrangement that will work.

The vertical communication issues will be resolved with the appointment of a team leader to be a communication focal in a similar manner that the supervisor was, and the team meetings will act as a clearinghouse for ideas that the MEs have tried or would like to share with regards to their functions.

Use Clear Goals and Metrics

The final lesson learned was that of establishing clear goals and metrics for the plant, and helping the teams to establish theirs. Time and again, the lack of clear goals was seen as a hindrance to the team's effectiveness. As the Satellite Plant manager stated:

> Performance Goals are a good mechanism for control. We tried to let the teams set the goals but this failed miserably. The feedback from the workers was that the plant manager should know what the stockholder wants and what the customer needs are. The plant manager then sets the goals. This year I literally dictated the goals. Not one person complained. This is what the workers expected me to do.

As stated in the section on STS organizational design, the goals should flow down from top management and the teams should establish metrics or goals based on the overall organizational goals. Nearly every person interviewed said that allowing the teams to develop their own goals, essentially in isolation, was a poor practice.

To rectify this, the goals should come from top management. Additionally the goals should not be too many in number and easily understood and measured. As a plant manager said:

> You can't overwhelm people with information. You need to pick a few critical things and beat those things to death.

It should be noted that goal setting by management, or by the teams is not a trivial task. For support organizations it can be extremely difficult due to their performance not being strictly representative of overall plant performance. As one support manager stated:

> Our metrics are not good. We are using the amount of hours that machines are not available to cut parts in chip

cutting areas. This was a manual collection effort however. We would rather use those as outlined in my thesis[27].

There are no explicit goals for the teams. The short term goals are specific such as move a department from point A to point B over 3 months. But the long term goals are rather nebulous. One team is measured by the amount of trouble calls. This is not a good goal, it is too nebulous. A trouble call can be a 10 minute job or a 3 day job.

[27]Overall Equipment Effectiveness, which is the product of equipment availability, operating efficiency and production rate of quality. Johnson, 1994

VIII Summary

The major points that can be learned from the case study are to use the STS organizational design approach, if workers are represented by a union, involve the union form the very beginning in the transition effort, establish clear goals and metrics for the teams, institute SDWTs where they make sense, deal with blocking issues and finally, possess a clear understanding of what SDWTs are and what they are not. The major points are explained more fully in the following pages.

Use the STS Organizational Design Approach

It can not be emphasized strongly enough that the STS design approach should be followed for any organizational redesign. This is especially true for a change to SDWTs as they are an extended and more dynamic form of STS. The use of the STS design approach will instill within the SDWTs some of the STS concepts and allow them to continuously improve and optimize their own organization.

The use of the STS approach, with its emphasis on stakeholder participation, will also negate any ill will or problems with adversely affected personnel. The affected personnel will have had a chance to voice their opinions. When a design is reached by consensus it follows that all affected parties are comfortable with the new design. This will help to avert problems such as those discussed earlier concerning the MEs at the Satellite Plant.

STS, while seemingly focussed on internal stakeholders is also focussed on external stakeholders. To this end, one must also involve one of the larger institutions of stakeholders, the labor unions.

Union Involvement From the Beginning

Following the STS approach, if workers are represented employees, the unions must be involved from the beginning. It further follows that the unions and management should be jointly engaged in the change process rather than separately. If there are multiple unions then negotiations should be between management and the two unions.

Consider a company that has two unions. One union represents manufacturing workers while the other union represents engineers. The negotiations concerning SDWTs should not be between: management/manufacturing worker's union and management/engineer's union but rather amongst all three concurrently. The divide and conquer strategy would not work well as it is in conflict with the consensus building approach that is an underlying tenant of STS.

However, there will be conflicts between the unions as each tries to keep their respective members from being negatively affected by the changes proposed. Each union may see management as taking away responsibilities from one group and giving them to another, or each union may see this as an opportunity to expand the responsibilities and aggressively pursue this. In either case, this would place management in the awkward position of being in the middle of the two unions.

Without the full backing of the unions though, the change process will not succeed. Job descriptions and a job description change process must be agreed upon and ratified by the unions as this is undoubtedly a contractual provision. The effort is doomed to failure without the unions full participation.

Clear Goals and Metrics

For SDWTs to function at an optimal level, the goals and metrics must be clearly understood and readily measurable. The goals and metrics should be translated by

management from the basic metrics of the company, such as increasing shareholder value, and translated down until they are representative of what a team has control over. Rather than being a trivial task, for support groups this can be extremely difficult.

The goals and metrics should then be used to focus the SDWTs and as indicators of performance problems. The goals and metrics should also be few in number so as not to overwhelm the teams and also to get them to focus on the vital few.

Institute SDWTs Where They Make Sense

Teams are not suitable for every function. The case study has shown that one plant has formed a "Not Team", or a loose group of individuals and functions who do not really fit into a team environment. Using the STS approach, these types of situations should present themselves quite readily. SDWTs are not fitting for every person and purpose.

For manufacturing, the SDWTs are very beneficial. This is also true for Integrated Product Teams or Design Teams. However, in each teams case, the team leader is a communication focal and meeting facilitator rather than having some type of authority over the team members or the outcome of the team's efforts. This is in contrast to one large aerospace companies use of design teams. In this particular instance there may be representation by manufacturing personnel but the ultimate authority and decision making power still resides in the hands of the design engineer who can veto any proposed manufacturing change with manufacturing having no recourse.[28]

The teams must be in areas where they make sense, where they will have a net positive benefit. They must also be true STS designed SDWTs who reach consensus and

[28]Conversation with Paul Lagace, MIT professor of Aerospace and Aeronautics.

use a team facilitator rather than teams with a leader who gathers input and reaches an individual but binding decision.

Deal With Blocking Issues

Management must be ready to deal with blocking issues, especially those that will be created by members of their own group. In a declining business environment, one option is to lay off the blocking employees while in a growth environment the blocking employees may be transferred to positions or functions where they are individual contributors and are somewhat isolated from the mainstream environment. Either way, those employees who will block the change need to be dealt with.

When an employee is transferred to another position, their salaries should not be lowered but remain the same. The existence of a salary cap may mean that the maximum a specific employee may earn has changed, but at least in the short run, they do not take a pay cut due to the organizational change. This may mitigate some of the hostility that these employees may feel towards the organizational change, and the organization itself.

The union represented employees are a separate manner. Management generally does not have the right to lay off employees at their own discretion. When management decides that an employee must leave the company it is a case of termination and occurs in extreme cases. Union represented employees are generally laid off in reverse order of seniority so the employees with the lowest seniority are the first to go. In dealing with blockers from these groups management does not possess a tremendous number of options, in fact their hands are tied by the respective union contracts. It is doubtful if management will be able to cull out blockers with layoffs without a major change in the rules governing lay offs.

The same can be said for transferring union represented employees to positions where they are individual contributors. For manufacturing or engineering employees at an aerospace firm, there may be very few positions within the bargaining units that would qualify as isolated positions where they would act as an individual contributor. There is not much that a company may be able to do for blocking employees who are represented by a union.

Finally, within the union leadership itself there may be blockers. Union leaders with a "traditional" viewpoint of labor management relations may see the progression towards SDWTs as being negative and effectively block or hinder the transition to SDWTs.

There may not be anything that can be done in the short term with regards to union blockers, but in the long run, the democratic process of electing union leaders by the bargaining unit members may change this. The election process will allow the union leadership to reflect the feelings of their constituency. If SDWTs are a positive benefit to the union members, the leadership will change their opinions to those of their union members.

Clear Understanding of SDWTs

There must also be a clear understanding of what SDWTs are and what they are not. The understanding of the SDWTs must start with the top management of not only the company but also of the unions. The plant managers, chief engineers and their respective union counterparts must also clearly understand SDWTs. They all must share the same understanding and vision of what SDWTs are and how they will transform their particular workplace. This vision must then be communicated to the workforce at every chance and be foremost in their thinking and actions.

Finally, one must also understand that SDWTs may not lead to a quick change in profitability or productivity. There seems to be anecdotal evidence that there is a loss in efficiencies as people adjust to their new responsibilities and new roles. The improvements come later, with a plant reaching it's former efficiency levels somewhere around a year after the introduction of SDWTs. It should also be recognized that as a simple metric efficiency, like equipment utilization, can be misleading. Instead, newer metrics such as customer satisfaction, cycle time and work in process inventory may be a better measure of the companies performance.

Summary

In summary the Self-Directed Work Teams (SDWTs) are a logical extension of the Socio-Technical Systems (STS) approach to organizational design. STS seeks to balance the business environment, technical aspects of the firm and the social aspects of the worker to achieve an optimal balance. SDWTs, if operating effectively, strive to achieve this balance, evolving as the technical, social or business conditions change. The SDWTs are a continuously functioning STS design team.

The introduction of SDWTs at the Mature Plants and the Satellite Plant were helped by the existence of manufacturing cells, team training, the backing of the labor union which represented the employees at the Mature Plants and the identification and elimination of blockers in the management ranks. In fact, without the union's support, the effort would not have succeeded at the Mature Plants.

Additionally, the negative economic climate, while seen as a hinderance, did provide some benefit. It provided management the opportunity to cull out those that were identified as being blockers and sent a strong signal to the other employees that management was committed to the change.

The team boundaries have evolved over time, as the teams matured and as conditions changed. The manufacturing engineering function, never envisioned to belong to a machinist, is beginning to be absorbed by manufacturing personnel. Teams are also making recommendations about the hiring of new employees by participating in the interview process. The evolution is continuing and will never be finished.

There is still some concern about the evolution of the union represented plant with respect to job descriptions. With the exception of the transference of inspection duties to operators (Certified Operator Program) there has been a low amount of significant responsibility shared by manufacturing workers or transferred from other functions. This lack of significant responsibility transfer may be due to the young age of the SDWTs at the Mature Plants but it may also be due to the Job Classification Evaluation Plan (J.C.E.P.) Only time will tell whether or not the J.C.E.P. slows the migration of responsibilities to the shop floor or acts as a robust process outlasting the ad-hoc process of the Satellite Plant.

The handling of the inwardly and outwardly focussed support professionals could have been improved. The use of the STS approach may have helped the company to integrate the professionals into the SDWT environment better and to have reached a more positive outcome.

In general, the employees and the managers interviewed would not return to the traditional management style. The manager of the Satellite Plant feels that the gains the plant has made have been helped by the SDWTs. He can not say that 100% of the gains were the result of SDWTs but he feels that the majority of them were. The key to the improvements were the use of management specified, clearly defined goals and metrics for the SDWTs.

While SDWTs have not yet clearly shown themselves to be a better organizational form in rigorous controlled experiments this may have been due to uncontrolled environmental factors. Anecdotal evidence is positive but it is clouded by uncontrolled technological innovation introduced at the same time the SDWTs were introduced.

Perhaps the strongest argument for SDWTs comes in the form of yielding responsibility to those whom know their jobs the best, and allowing them the freedom to improve their processes. This will undoubtedly speed up the rate of continuous improvement and should, in the long run, lead to a more profitable firm, and one that is enjoyable to work for.

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