Designing Organisations to Survive in the Global Economy: An Insider's Account

ROBBIE O'CARROLL*

INTRODUCTION

There seems to be a general recognition that continuous increasing productivity is an absolute necessity if an organisation is going to survive in the global economy. Towards that end, many companies have initiated large-scale downsizing of their workers. The jobs are either being shipped overseas or just eliminated. The objective is to do more with less, so they try to squeeze more work out of their remaining workers by compelling them to work additional hours.

However, these policies will not be able to continue to make significant improvements in productivity. The workers are reaching their physical limits. There are thousands of studies over the last 60 years that show that the quality of the output of a worker significantly degrades after 40 hours per week. As early as 1926 Henry Ford (1926) recognised this when he said that we can get at least as great production in 5 days as we can in 6. Studies as recently as the late 1990s show that working over 50 hours per week reduces productivity by 10–17 per cent and that working 60 to 70 hours per week reduces productivity by 15–44 per cent.

What is required to sustain significant continuous increases in productivity is an organisation designed to replace the traditional organisation with its steep hierarchies, rigidly divided functions and bloated bureaucracies. This new organisation must be lean, flexible and designed to support, motivate and

Robbie O'Carroll, 5983 N 83 Street, Scottsdale AZ 85250, 480-998 4119, a high performance team consultant based in Scottsdale, Arizona, has an extensive background in manufacturing and project management. He is a graduate of Harvard University and has published over 25 papers and book chapters and given numerous lectures on technology, organisational design and high performance/self-managed work teams. As a professional sculptor, he is a member of the Copley Society of Boston and the Arizona Artist Guild.

enable its employees to contribute maximum energy and ability to the success of the organisation. The problem has always been how you change these organisations.

This paper describes how the author, when employed as a section manager, helped to lead his division to the kind of lean, empowering organisation required to survive in the global economy. He used short-cycle manufacturing combined with Japanese product and quality improvement strategies wonderfully described by Masaaki Imai (1986) to create sociotechnical systems autonomous teams outlined by Trist (1986), Pasmore (1988) and Cummings (1978)

These autonomous, self-regulating work groups – called self-managed, self-directed or high-performance work teams – are cross-trained, empowered workers who progressively accept, as a team, the total responsibilities and duties necessary for completing a well-defined segment of work. These teams differ from traditional work teams in that they progressively assume increasing control of their operation. Management sets the goals and boundaries for these teams. The team then develops the methods, measurements and strategies to achieve these goals. As the team meets these goals, they take on more of the responsibility for the management of their activities. As these teams take on more of the management activities it allows the organisation to reduce organisational structure. The result of this process is a lean, empowering organisation that realises a level of organisational effectiveness that previously did not seem possible.

The development of these teams, like the development of a manager, requires a process where training is strategically combined with increasingly more responsible tasks and the guidance of a manager who will champion the developmental process (for greater detail see Carroll, 1998; 2001).

This paper starts by describing how the section manager slowly developed his first self-managed teams and the changes he championed in the organisation to support those teams, including his participation in a major organisational change. These changes resulted in the elimination of three layers of management and a significant improvement in organisational effectiveness.

Finally, the paper describes a model the author developed for a high-performance knowledge team, a product design team. The section manager had always wanted to combine his seven years' experience in developing high-performance production teams with his many years working on product design teams (Carroll, 1999). This model is significant since almost everyone who has tried to create high-performance knowledge teams has failed. They failed because they assumed that knowledge teams were essentially the same as production teams and designed these knowledge teams to fit the standard production self-management model. Unfortunately this did not work – knowledge teams are different to production teams both in the nature of the tasks that are to be accomplished and in the skill required to accomplish those tasks. These differences mandate that a different empowerment model be developed for each type of knowledge team and if a model can be developed for a product design team, probably the most difficult type of knowledge team, a model can be created for any type of knowledge team.

Background

When he started the team process, the company with which the author worked as a manufacturing section manager employed about 3,000 people, including approximately 2,000 electrical, mechanical, software, manufacturing, test and quality engineers. The company was organised into two divisions, each with three main functional departments – engineering, operations and business (program management) – along with various support departments, such as financial, human resources and facilities. Work was organised into projects of 10 to 200 members.

The division that the author worked for designed and manufactured unique computerised communication equipment. This equipment was designed to unique customer specifications. The contracts were usually for quantities from one to four or five hundred units and they were very competitively priced. This resulted in very tight budgets for both the design and manufacturing phases of the programs. The section manager had one hundred and sixty-five individuals and ten major projects in his section. At the start of the process, in the operations there were six layers between the assemblers and the division manger; at the end of the empowerment process there were three. This paper will describe how this was achieved.

Developing High-Performance Production Teams

The section manager started the process of developing high-performance teams out of desperation. His most important project was in trouble. The team was in disarray, behind schedule and over budget and it did not appear that it could be fixed without some major changes in how the work was being accomplished. The company had sent him to a number of lectures on using cycle-time reduction to reduce inventory and improve overall performance.

The process is quite simple. Each reduction in cycle time exposes obstructions to that reduction. These obstructions can be design or process deficiencies, organisational impediments that add cycle time for no good reason or simply additional steps that have been put in place for a reason that nobody remembers and now have no obvious value.

Correcting the deficiencies in the design or process results in a more reliable product. Removing the non-value steps and structural impediment results in fewer hours per unit and quicker cycle time, with all the benefits that result from that. As each obstruction or non-value step is identified, the team must decide how to remove it. He was not sure if cycle time reduction really worked, but at the very least it might pull the team together and thus improve the project's performance.

The team made significant progress reducing the cycle time but after a year or so they seemed to hit a wall and could not make any more progress – they even seemed to be losing ground. The section manager realised that further process would require a more cohesive, cooperative team willing to share tasks and responsibilities. This led him to try to develop the team as a self-managed work team.

A comparison between a traditional production team and a self-managed production team are shown in Figure 6.1.

Figure 6.1: Comparison between a Traditional and a Self-Managed Team

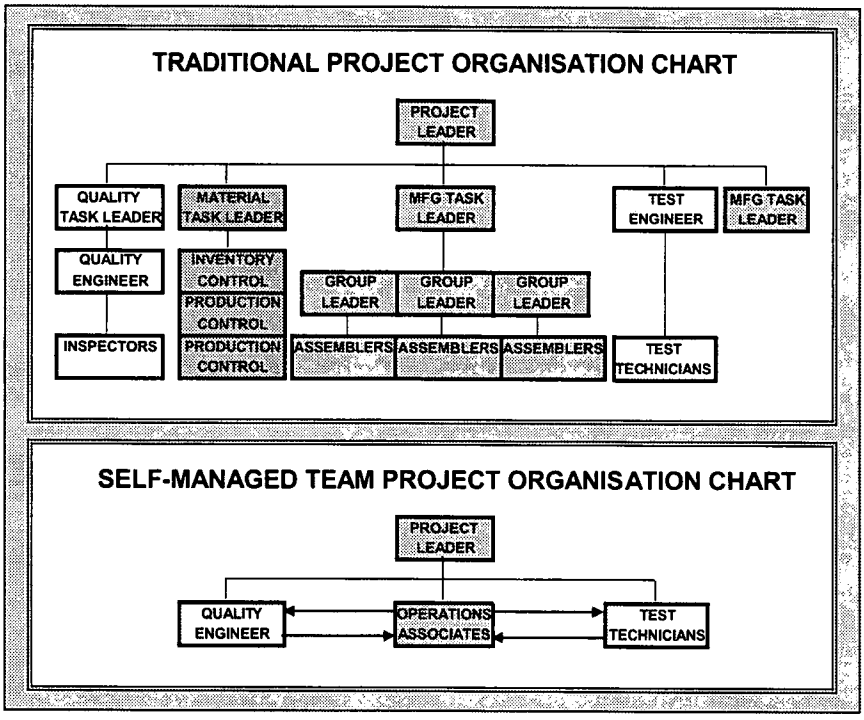
Traditional Production Design	Self-Managed Production Team Design
Specialised, simple task	Whole, complex task
Training limited to accomplishing simple task	Cross-trained to do all tasks
Segmentation of activities	Team completes whole segment of work
Individuals' input to process minimised	Individuals' input to process maximised
Individual measured on own performance	Individual measure on team performance
Tightly hierarchical management	Lean, empowering management
Centralised authority	Delegative authority
Humans considered problem	Humans considered solution
Accomplishes supervisor-directed activities	Accomplishes team-directed activities

As these teams take on more of the management activities it allows the organisation to reduce its levels of management. This is exactly what happened over a five-year period. Figure 6.2 shows the project as it was originally organised in the traditional manner and then the way it was finally organised, as a self-managed team. As can be seen, support labour was reduced from fourteen people to two.

The results of this evolution were way beyond the section manager's original expectations. The team not only caught up with the original schedule and productivity targets, it far exceeded them.

The system cycle-time was reduced from 22 weeks to 5. Quality improved more than 30-fold, going from 750 defects per million opportunities to 22. The cost of the product was significantly reduced, primarily by reducing support labour, as the hands-on people took on the support (hands-off) people's tasks in addition to their own. The project's space needs were cut from 8,000 square feet to 3,500 square feet, while more product was produced. The contract was completed a year ahead of the original schedule and under budget. This proj-

Figure 6.2: Change in the Project Organisational Structure



ect was so successful that the section manager developed his other production projects into self-managed teams.

This one change on a single team eliminated two layers of supervision and fourteen support people, who now worked as direct contributors. The section manager then started to expand this to all the other projects in his sections. Early on in the development process the section manager started the process with his other manufacturing projects.

Changing the Organisation

However, to make these teams work, the section manager was required to champion major organisational changes. The first was job descriptions.

About two years into the development of self-managed work teams, the section manager started to run into the first of many organisational obstructions. As the teams advanced, the need for cross-functional task sharing increased but the teams kept encountering people who said they could not do tasks outside their job description. When he started to look into the problem he found out there were 106 separate operations job descriptions for the direct employees. Each job description specified in detail how the task was to be accomplished and did not

allow that individual to do any task not listed in their job description. The section manager had read about other companies who had encountered the same problem and solved it by creating cross-functional positions called "worker one", "worker two" and "worker three", and the only thing the job description listed was to just do whatever was required to build the product.

The section manager talked to the division compensation person about changing the job descriptions. She recommended that the two of them meet with the company's compensation person and propose changing the job descriptions. This person was, at this point in time, trying to handle the numerous requests for new job descriptions. These increases in job descriptions would have more than doubled the job descriptions for the direct people, from 106 to 225. He was overwhelmed with the task and jumped at the idea of significantly reducing the job descriptions. The final result was five "operations association" positions replacing the 106 job descriptions. The assemblers, inspectors and production control personnel now all had a common title that eliminated functional barriers, promoted team cohesion and removed the organisational restrictions on performing cross-functional tasks. The new job descriptions were well received by the associates because the new descriptions gave them two additional grade levels they could reach if they mastered additional skills. In addition, the team members now felt that they were all one team with a common purpose and since the workers could do multiple tasks it reduced the total number of people required on every project.

Although these new job descriptions helped, they did not eliminate the problem. The associates were now cross-functional but their managers were not. The department managers ran their department like separate fiefdoms, each with their own agenda, which was often in conflict with the other department managers and even the company's overall objectives.

A Threat to Teamwork

The teams had developed a system for scheduling all the hardware that had to be built each week on weekly requirement sheets. These sheets gave the team the flexibility to change instantly how the work was accomplished as long as they met the shipping schedules. With this system the team members were starting to make the day-to-day decisions on how the work should be accomplished. In the past the shipment goals were rarely met; now they were always met and very often exceeded.

This system had been working very successfully for about a year when the material manager decided to have his department develop detailed schedules for each of the projects, breaking down all the activities into fifteen-minute intervals. He did not understand why anyone would allow the associates to participate in the management of the projects. His most important objective was to effectively take the management of production projects away from manufacturing by allowing his people to schedule all the projects.

When the material manager described his schedule to the section manager, who was now the manufacturing manager, he became very upset. He knew

that the system the associates had developed was very successful and that the new schedules would destroy the whole team empowerment process and wipe out two years of work. He described to the material manager how the weekly requirement sheets worked and how imposing a schedule would disempower the teams. But the material manager did not understand how the operators could work without being told exactly what to do and when to do it. He concluded by saying that the new scheduling system was not open to discussion and would be used for all projects. The manufacturing manager said that manufacturing had the responsibility for managing the production projects and the detail schedule would not be used.

The next day the two managers were invited to the operations manager's office. The material manager had gone to the operations manager after his meeting with the manufacturing manager requesting that the operations manager direct the manufacturing department to use the detail scheduling system and complaining that the manufacturing manager was difficult to work with.

The operations manager asked the manufacturing manager why he refused to use these schedules. Repeating his previous argument, the manufacturing manager tried to convince the operations manager that the new system would destroy the self-managed teams. The operations manager was not quite sure why the detail schedules would destroy the self-managed team but, since he had received numerous kudos for this team's outstanding performance, he was reluctant to do anything that might hurt them.

Division Reorganisation

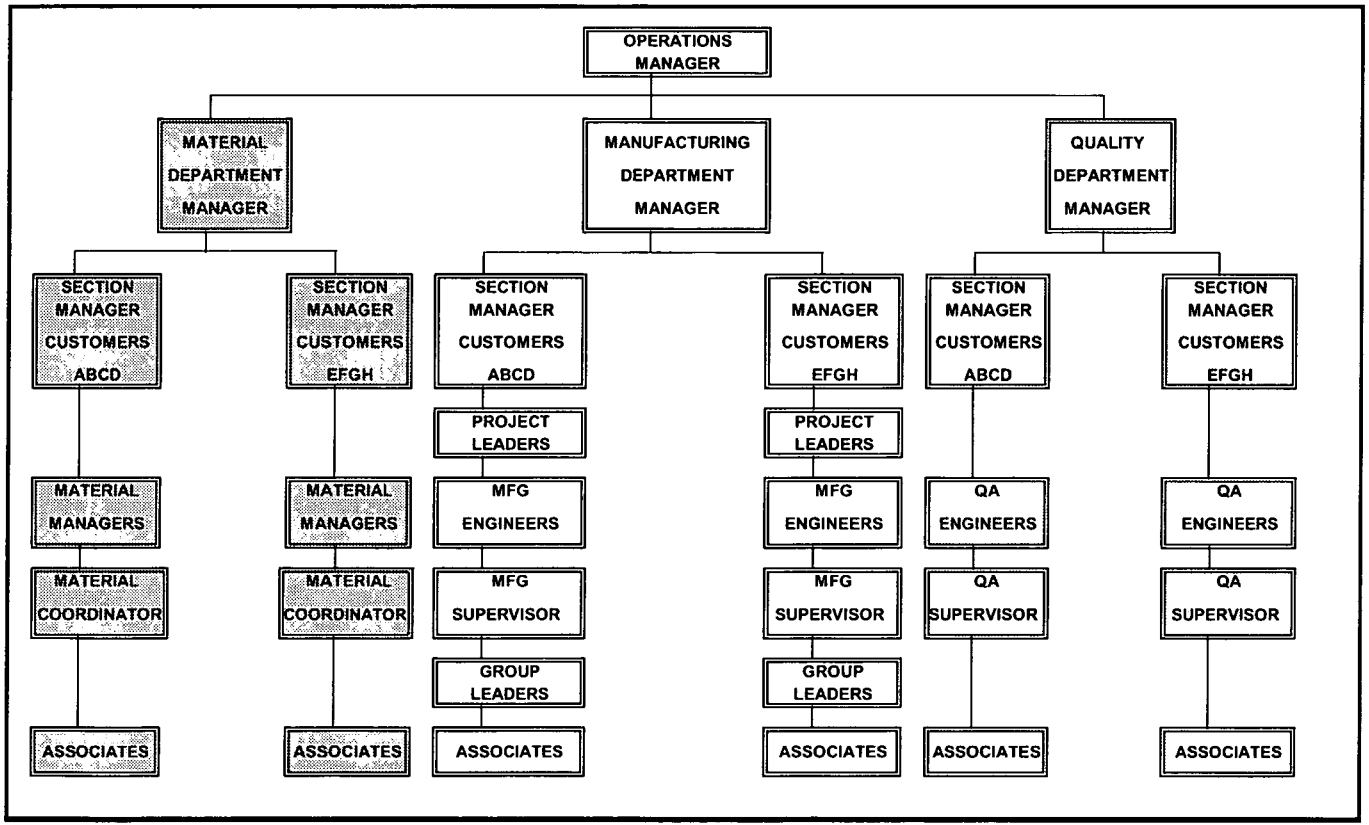
This experience showed the operations manager that a major reorganisation was required. For some reason, the present organisation was not working; there was too much conflict between department managers.

He set up a meeting with his three department managers and described some of his ideas about how he wanted to change his organisation. The manufacturing manager quickly realised that these ideas would not support teams. He suggested to the operations manager that they hire an expert in redesigning organisations just to get them started. The operations manager reluctantly accepted the idea.

The consultant's presentation on how to conduct reorganisation was so persuasive that the operations manager hired her to give technical assistance to his managers in their reorganisation effort. The operations manager's only requirements were that there should be no increase in the layers between him and the associates (and preferably one less layer) and that conflicts between departments should be eliminated.

When they started the reorganisation, operations was organised in a very traditional manner. There was an operations manager at the top of the pyramid and beneath him were the manufacturing department, material department and quality assurance department. Under each of these departments, there were two to three sections that contained all the personnel required to support the projects (see Figure 6.3).

Figure 6.3: Original Organisation



During the first week the consultant concentrated on training the operations reorganisation design team (the three department managers) on how a major organisational design should be conducted. She spent the next week helping the organisational design team to establish their expectations and objectives for this reorganisation, as well as its boundaries. From this, she helped them generate a preliminary vision statement on the organisational redesign's purpose and objectives. They used this to craft a preliminary concept for a new operations department. They spent the next eight weeks developing the new organisational design. Figure 6.4 shows the major steps in the reorganisation.

The new organisation eliminated the separate manufacturing and materials

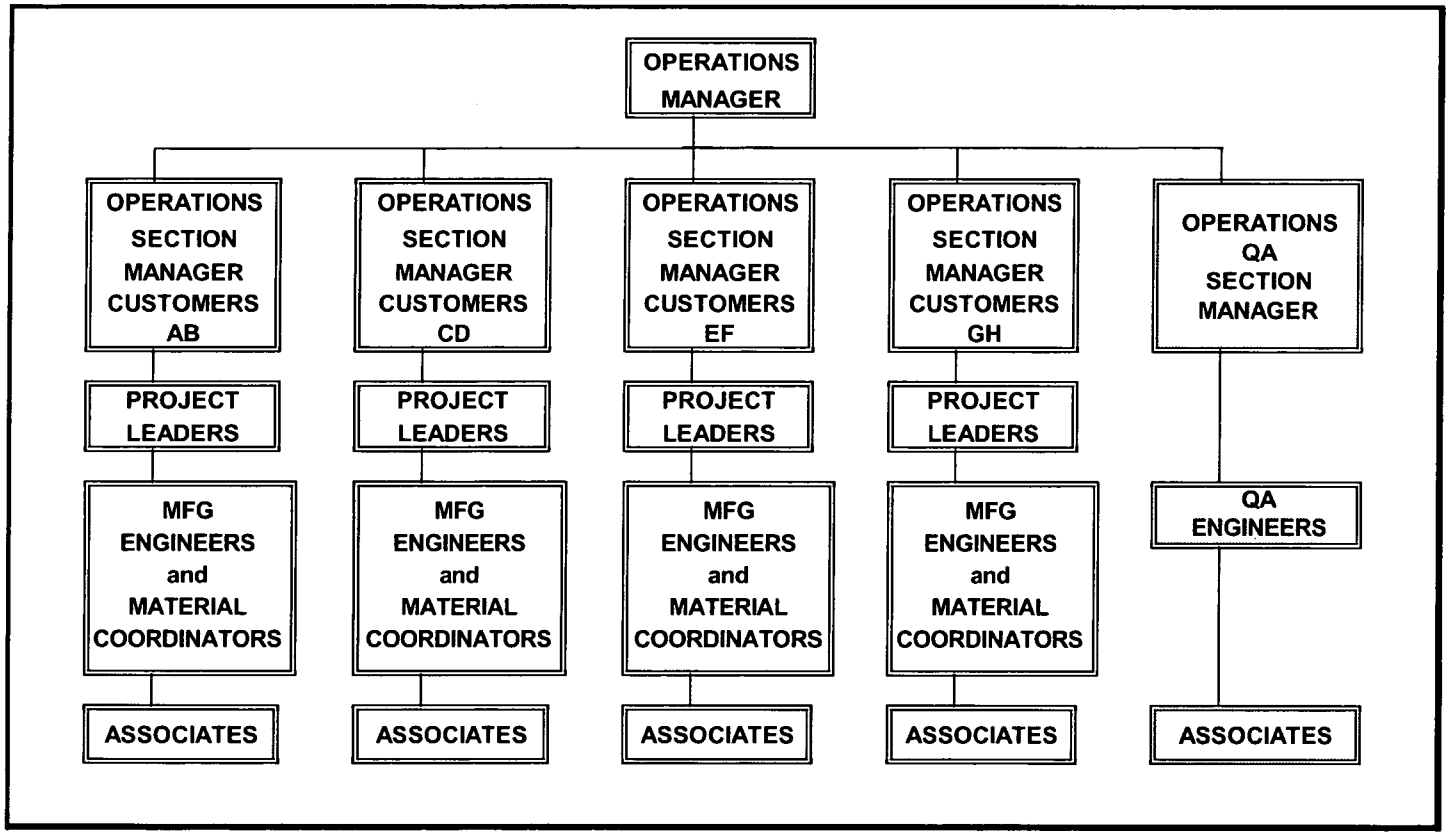
Figure 6.4: Reorganisation Steps

Step	Activity	Time
1	Consultant educates the reorganisation design team	1 week
2	Define purpose and objectives of reorganisation	1 day
3	Define the boundaries of the new organisation	1 day
4	Identify those groups who will be affected by the reorganisations	2 days
5	Generate a preliminary vision statement	1 day
6	Interview groups directly affected by the reorganisation	2 weeks
7	Design the new organisation	1 week
8	Show the new organisation to the groups interviewed	1 week
9	Modify the organisation to reflect any new inputs	1 day
10	Generate final vision statement	1 day
11	Present new organisation design to senior management	2 days
12	Modify the organisation to reflect any new inputs	1 day
13	Present the new organisation to the entire organisation	1 week
	Total	**8 weeks**

departments and all three department managers. It also eliminated the supervisory and group leader levels. Where there were six levels between the operations manager and the associates, there were now three. It created four operations centres at the section manager's level, as well as a quality assurance section (see Figure 6.5).

These centres combined the material and manufacturing people into a

Figure 6.5: New Organisational Structure of Operations



common operations group. This eliminated the conflicts that existed between these two groups, gave them the same common purpose that the associates had and reduced the staff required for projects, since, in many instances, a single individual could do both tasks.

The three department managers and one of the manufacturing section managers filled these four positions. The quality assurance section spot was filled by one of the quality section managers. The rest of the section managers became project leaders with no loss of salary. The operations centres served fewer customers, so they could provide better customer focus. The centres were aligned with the design engineering and program manager sections so all three sections had a common purpose and served the same customers. This again provided better customer focus. The primary mission of the operations centres was to hire and develop the people required to staff the projects and to develop the manufacturing technologies required to build the new designs developed to meet the future needs of the customers.

Recognising that all production teams would be self-managed, the new organisation eliminated the supervisory and group leader positions. The self-managed teams would be managed directly by the project leaders, who would do essentially as they had done before – handle customer interface and overall project planning and responsibility. The self-managed team would manage the floor activities, take care of the tasks that the supervisor and group leaders had performed and be responsible for making sure the project goals were met. Self-managed projects had already produced significant improvements in their project's performances and with these organisational changes this improvement in performance accelerated. The teams now were truly self-managed and felt a greater commitment to the success of their projects and their company. The supervisors and group leaders were given an equivalent grade in non-supervisory job positions as direct contributors.

The new organisation eliminated the functional conflicts that were draining peoples' energy, significantly reduced the staffing requirement by job combination and, most significantly, eliminated three layers of management between the operations manager and the associates. This improved communications and substantially improved the *esprit de corps* of the people at the lower levels of the organisation. They now felt that they were full partners in the success of the business.

Reinforcing this feeling of partnership was the way the reorganisation was conducted. In the past all reorganisation was handled by senior managers in secret and it was kept secret until an announcement was made. In contrast, this reorganisation was done in the open by the level of management directly affected by the changes, i.e. the managers whose jobs would be altered. The whole organisation was asked for their input and the room where the reorganisation planning was taking place was kept open so anyone could walk in anytime they wanted to see what was being done. Since the reorganisation was open and all groups participated in it, they all felt committed to making it work.

By designing an organisation that trusted people to manage themselves, these managers significantly improve the productivity of the division and later the company.

Developing a Model For a High-Performance Product Design Team

After he had successfully developed high-performance production teams and become the driving force behind the reorganisation of the division, the operations section manager was looking for new ways to improve productivity further. The area that seemed the most promising, and interesting, was the product design teams. About one-third of the company employees were on product design teams at any one time and they were the highest paid group in the company. So a small improvement in the efficiency of these teams would result in a significant improvement in productivity. The design teams were organised as traditional product design teams when he started thinking about developing a model for them.

Traditional Product Design Teams

The traditional product design teams were organised with a senior electrical design engineer as the project leader. They were responsible for the total design. Under this person were various design task leaders. Each task leader was given a major segment of that design and had a number of design engineers assigned to them to complete individual tasks. Each individual accomplished their assigned task in relative isolation. The task leader integrated their effort and the task leader's integration was integrated again by the design leader to produce the total design. The quality of the output of this design team was determined by how well that design leader could integrate those individual efforts into a coherent single design. This meant that the quality and success of the total design were dependent on the ability of a single or at most a few individuals.

Compounding this problem was the sequential processing of the design. Each discipline handed off their portion of the design to the next discipline in line: electrical design engineers handed off their effort to the mechanical engineers; mechanical engineers handed off their effort to configuration; configuration handed off their effort to the production, test and quality engineers. The various engineering disciplines were time phased to join the design team when their expertise was needed. While this information flow varied from team to team, it was essentially a one-way flow of information – downstream. Each group had to accept what was given to them unless they could show it was wrong or that a change would result in a major improvement in cost or performance. Any change that did not result in a major improvement was considered too late in the process. It would delay the design and cause significant cost increases. So each person accepted what they were given and did the best they could. This very often meant that producibility problems were not found until they were at the most costly point in the process – production. This caused the production cost to be higher than it should have been.

Over time the company found that they were no longer cost-competitive. To correct this, the company heavily invested in automated manufacturing equipment, believing that it would help the company become cost-competitive. However, the company soon learned that it could not use this equipment to build the existing designs. The automated equipment required that all products be designed to very precise design rules.

Up to this point, there were no company-wide design rules; each design team tended to produce a unique product design. Since everything had been hand assembled almost any design could be built, albeit at a high cost. Once the company realised that all products had to be designed to these very precise rules, it established company-wide standardised design rules. This did not work; the design engineers did not like their creativity being restricted by rules that made their tasks difficult so they continued to design as they always had. Realising that the rules were not enough, the company mandated that all product design teams would be concurrent product design teams. On a concurrent product design team the operations project leader, the manufacturing engineer, and the other support engineers are on the team full-time from the start of the design to ensure that the product is designed to use advanced manufacturing technologies and meet all the design-to-cost goals.

Concurrent Product Design Teams

Although the intention of these changes was good, the goal was never achieved. The problem was that the cost to produce a concurrent design was significantly higher than that of a traditional design. The reason that the traditional design teams only brought on people as they needed them was to minimise design costs. Concurrent teams were very expensive; the manufacturing and other support engineers had to be paid for a full week at the early stages of the design process when they only had a day or two worth of tasks. This extra design cost should not have been a problem, since the total cost to design and then manufacture a product with automated equipment was significantly lower than the total cost to design without concurrent design teams and use hand assembly.

Knowing that it would be less expensive to produce products that were designed to utilise the automated equipment, the company reduced all its manufacturing bids but did not add in the additional design time required to produce concurrent designs. No one wanted to admit that concurrent design teams cost more. Because of this, the engineering project leader had to try continually to balance the management directive to have a concurrent product design team with a budget that only allowed for a traditional team.

Since the project leader was measured each month on how well they were doing relative to the budget and not on how well the concurrent the design team was doing, they would tend to budget the manufacturing members and other support departments for only the actual tasks that were required of them. This meant that that the manufacturing people would be budgeted for

one or, at most, two days a week. Because of this, the manufacturing and other support engineers would have to be on three or four product design teams to be fully budgeted. This did not allow them to be around the design engineers when they were making critical design decisions. As a result the design engineers repeatedly designed hardware that could not be built on the automated equipment. Unfortunately for the manufacturing people, when this occurred they were blamed for not finding the design errors. If this occurred several times, it adversely affected the operations department because the operations project leaders were being blamed for something over which they had no control.

At that point, the section manager knew that if he wanted to continue to survive, he had to find a way to get his project leaders on a single product design team full time. The only way he could do that was to use his expertise to develop a high-performance concurrent product design team model and then implement it.

Model for High-Performance Product Design Team

A self-managed production team solves the problem of ensuring that everyone on the team always has work by cross-training the entire the team so each team member can perform all the tasks required to produce that product. That way, if an operator completes a task, they can start whatever task is required next to complete that segment of work.

Cross-training is usually not possible on a knowledge team and it is never possible on a product design team. Each design task must be accomplished by an engineer who has spent many years acquiring the specialised education and skills required to accomplish that task. It is difficult to imagine a digital electrical engineer designing a complex piece of mechanical hardware or a chemical engineer designing a digital circuit.

When the operations project leader reflected on the limitation of specialisation, he realised there was still the potential of using a form of task sharing to improve the design process significantly. The team could take the collective responsibility for the final design and support each other by sharing the tasks that are common to all engineers.

Probably 40 per cent of an engineer's time is consumed in doing tasks that are common to all engineers: researching information, contacting outside suppliers, ordering material required for the design, setting up design reviews or doing business tasks such as generating budgets and schedules. On a high-performance product design team, as each discipline hits its peak activities the other members of the team who were not fully engaged could pitch in to do these common tasks. This would enable the engineers who had too much to do to spend most of their time doing the portion of their tasks that only they can do.

This model would significantly increase organisational productivity firstly, and most importantly, by improving the quality of the design and secondly, by reducing the cost to complete the design.

Improved Designs

In the traditional product design teams each individual accomplished their assigned task in relative isolation. In a high-performance product design team the final design is the result of the whole design team and if the entire team is involved in the process, it brings a collective seeing and knowing that far exceeds that of any individual. This collective seeing and knowing will result in a superior final design. When an expert is working in isolation there is a tendency to optimise their portion of the design, but the sum of these optimisations may not equal the best design; in some cases, it does the opposite. By working as a team the team members learn how to optimise their portion of the design in a fashion that optimises the total design.

In addition, when all the team members are engaged in all aspects of the design, they increase their own knowledge of the design itself, the total design process and each other's activity. This results in individuals who are continually expanding their individual knowledge and continuously improving the design process. As future high-performance product design teams are staffed with individuals who have gone through this process, design cycle times will continue to be reduced and the quality of the final designs will improve.

Cost Reduction

The cost for a high-performance product design team effort is reduced in two ways: by reducing the staffing required and by reducing the time it takes to complete a design.

On traditional product design teams, as each discipline hits its peak activity more people from the particular functional area are added. When a function requires only a portion of some person's time to meet that function's peak activities, the individual is paid to be on the team full-time or the team suffers delays while it waits for that person's time. Either way, any time people are added to a process it increases confusion, creates delays and adds cost. With all the engineers sharing common tasks, all the part-time personnel could be eliminated, creating much smaller, tightly knit teams. This significantly reduces the cost to design a new product.

These smaller cohesive design teams, where all the members are engaged in all aspects of the design, eliminate most of the delays associated with functional hand-offs. The elimination of these delays means the product design cycle can be reduced. Reduced cycle time equals reduced cost and quicker time-to-market with new products.

It is difficult for most managers to consider that a different organisational model might be required. The traditional management model is very powerful; it has order with its clear lines of authority, well-defined tasks and tight control from top to bottom. Most managers grew up in this model, they feel comfortable with it, it is all they know. Because of this, they assume that they can form the workers into high-performance teams to achieve the required productivity without disturbing the existing top-down, command-and-control organisation.

Unfortunately they are wrong: the underlying assumptions and structures of the traditional organisation work against, and ultimately prevent, these teams from ever becoming self-managed. High-performance/self-managed teams require an organisation that is lean and flexible, that facilitates and enables instead of commands and controls, and that maximises cooperation across all functions and levels; an organisation whose policies and structures are minimum in number and have been designed to support empowered people and teams. When organisations are designed to trust people to manage themselves, they will achieve an organisational effectiveness well beyond what they ever imagined, and that organisational effectiveness will ensure their long-term success.

REFERENCES

Carroll, B. (1998) "The Role of Management Intervention in the Development of Empowered Work Teams", *1998 ASTD Training and Performance Yearbook*, New York: McGraw-Hill.

Carroll, B. (1999) "Leadership in a Lean, Empowering Manufacturing Organization", *Journal of Organization Excellence*, spring 2001, New York: John Wiley and Sons.

Carroll, B. (2001) "Self-managed Knowledge Teams Simply High-Tech Manufacturing", *National Productivity Review*, spring 1999, New York: John Wiley and Sons.

Cummings, T. (1978) "Self-Regulating Work Groups: A Socio-Technical Synthesis", in Rollin Glaser (ed.) (1992) *Classic Readings in Self-Managing Teamwork*, Pennsylvania: Organization Design and Development, Inc.

Ford, H. (1926) "Why I Favor Five Days' Work With Six Days' Pay", *World's Work*, pp. 613–16.

Imai, M. (1986) *Kaizen: Key to Japan's Competitive Success*, London: Random House Business Division.

Pasmore, W. (1988) *Designing Effective Organizations: The Sociotechnical Systems Perspective*, New York: John Wiley and Sons.

Trist, E. 1981 "The Sociotechnical Perspective", in A. Van de Ven and W. Joyce (eds) (1981) *Perspectives on Organization Design and Behavior*, New York: John Wiley and Sons.