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An Analysis of Organizational Concepts and Trends as Related to Team and Matrix Structures

Victor A. Finazzo

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Victor A. Finazzo, B.S.

An Abstract Presented to the Faculty of the Graduate School of Lindenwood College in Partial Fulfillment of the Requirements for the Degree of Master of Business Administration

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ABSTRACT

This thesis will focus on an analysis of organizational trends in the United States, and the move away from functionally based organizational structures toward team structures.

Increased domestic and international economic pressures have forced many U.S. companies to seek out new methods of operation in order to stay competitive and maintain market share. A major emphasis has been placed on organizational streamlining in an effort to become leaner and more productive. Many companies have taken the slow and cautious approach, carefully calculating the impact of organizational change, and others have leaped head first into new and innovation organizational structures. The most popular organizational changes involve the use of multidisciplined integrated product process team structures.

The purpose of this study is to evaluate the trends and issues surrounding organizational redesign, and to determine the validity and legitimacy of these

new organizational concepts.

As part of this project's evaluation process, a comprehensive literature review was conducted. Over seventy pieces of literature were evaluated to attain a database from which to draw conclusions. From the broad literature search, three pieces of research were specifically pertinent to the investigation. These pieces of research included; a discussion of Integrated Product Teams at McDonnell Douglas Corporation's aircraft company in St. Louis Missouri, an explanation of Self-Directed Work Team at Heath Tecna's Bellingham Washington production facility, and an article entitled "Cross-Functional Structures: A Review and Integration of Matrix Organization and Project Management" by Robert C. Ford and W. Alan Randolf of the University of Alabama-Birmingham and the University of Baltimore, respectively. The first two pieces deal with practical, real word implementation, and the third deals with team and matrix structures based on an academic analysis.

The research revealed overwhelming support for the team and matrix concepts. On the basis of the data

complied during the literature review and the detailed analysis of the selected pieces of research, the writer concludes that team and matrix organizational structures are viable and legitimate concepts and do ultimately support increased productivity.

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COMMITTEE IN CHARGE OF CANDIDACY:

Associate Professor Daniel W. Kemper
Chairperson and Advisor

Adjunct Assistant Professor R. Patrick Akers

Adjunct Assistant Professor Jan R. Kniffen

DEDICATION

This project is dedicated to my mother and father. They taught me that hard work and dedication are prerequisites for success; the difference from right and wrong; and the importance of family. Thank you.

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Preface

The face of corporate America is changing at a rapid rate. Many major companies are restructuring, down-sizing and rethinking the most fundamental aspect of how they operate. In many instances change is not a luxury, but a necessity. In these cases maintenance of the status quo equates to corporate extinction. In other cases, change is a tool voluntarily being employeed to fend off increased domestic and international competition and to satisfy an ever increasing consumer demand for improved quality.

A major target for change is the corporate organizational structure. The traditional, functionally based organizational structure has served the typical American corporation well for seventy plus years. The challenge to the functional organization is coming from new and innovative organizational concepts such as multi-disciplined integrated product teams, self-directed work teams and matrix organizations. These new concepts are touted as potential saviours to the declining U.S. productivity trends.

This project answers some of the fundamental questions surrounding the effectiveness and legitimacy

of these new organizational concepts and correlates their use and implementation to company and corporate performance trends.

Chapter 1

INTRODUCTION

Organizational Need

Traditional management organizational structure types and classical management theory are being challenged. New theories on how to survive in a more competitive economic environment are being developed and marketed by new age management gurus such as; Tom Peters, Peter Drucker, Charles Darwent, and Ed Lawler. The success and blind acceptance of these change agents is staggering. The rationale used to justify corporate reorganizations are as varied as the different types of structures being considered. Some of the more common reasons are; to streamline information flow, reverse declining sales, attack new markets, decrease development time spans, increase quality and worker morale, and in more than a few cases to hide or isolate the effects of poor management performance (Thackray 42).

In theory, a management structure is required to facilitate the process of management. In order to

clearly address organizational trends, successes, and failures: a common definition of "management" is required. For the purpose of this study, management will be defined as: the process of defining goals and making decision about the efficient use of organizational resources in order to ensure high organization performance. Hence, an organizational structure is the infrastructure which is put in place to facilitate the management process (Anderson 9).

To fully comprehend the impacts of organizational redesign, a fundamental understanding of management theory and the different types of and need for organizational structures is required.

An organization is the relationship which distinguishes 50 independent individuals from 50 individuals on a football team. When there are 50 non-related individuals, the sum output of the 50 individuals is at best, 50 times one of the individual's output. In the second case, the output of the organized group is something more than the additive effect of 50 individual outputs. In an organized effort, the synergistic effect results in an outcome which is greater than the sum of the individual parts (Galbraith 2).

Organizations evolve whenever there is a shared set of beliefs, and the activities required to achieve success can only be accomplished by more than one person. Organizations can be fixed, or transitional. A fixed, or stable organization has a sustained function and long term goals. Most of the traditional corporate organizations fall into this category (3).

A transitional, or synthetic organization, is temporary in nature with short term goals. For example, an organization which is established to handle a disaster such as a flood is transitional. The life span of the organization begins with the identification of the need, the flood, and ends when the need no longer exist, the retreat of the flood waters. In this example a temporary organization is established to handle an emergency situation. Transitional organizations can also exist in the corporate environment. In many corporations, "Tiger Teams" are established to address short term problems. After the immediate problem is corrected, the transitional organization, or tiger team, is disbanded (3). The scope of this report will be limited to fixed organizations and reorganizations which take place with the intent of long term incorporation.

The roots of Classical Management Theory are founded in the scientific management movement of the 1900s and the concept of "division-of-labor". Division-of-labor involves identification of a task and then subdividing that task into elements (Anderson 389).

A comparison of two concepts can best define division-of-labor. In the first concept a worker creates a product from the point of raw material to completion of the finished product. In the second concept, the production process is divided into separate tasks with each worker specializing in a different task. In the second case it is theorized that each worker can become more skilled and efficient at accomplishing a single task, thereby allowing an increase in the overall productivity level of the group (389-390).

A classical example of division-of-labor involves an observation by Adam Smith in 1937. He observed a factory where 10 workers were capable of manufacturing 48,000 pins per day. This was accomplished by dividing the work tasks into 10 subtasks. The division of task allowed each worker to be more efficient in their discrete task.

If a single worker had to fabricate a pin from the point of raw material to complete product, the worker could produce only 24 pins per day. Hence, the total plant output would be only 240 pins (389).

The drastic increase in productivity due to dividing the labor into subtask comes with some increased risk. If each worker is tasked with making a pin from start to finish, and one of the workers fails to show up for work, the loss of output is only 24 pins. If the task are subdivided, and one of the workers fails to show up, the entire plant output could be lost This interdependency highlights the importance and need for a management process and the supporting infrastructure (389).

To minimize the risk of division of labor, task management must govern the flow of material from operation to operation, assign responsibility for the tasks, set expectations, manage resources, and coordinate overall production activities. A conclusion can be drawn which states: as the individual operations become more discrete and greater in number, the interdependency criticality and the need for a management structure becomes greater (Galbraith 13).

Two other issues are related to the need for an organizational structure. They are authority and motivation. A principle of management which deals specifically with authority is "Unity and Chain of Command". "Unity and chain of command means that every subordinate should have one and only one supervisor, and, that each subordinate is accountable to and takes orders from a single supervisor" (Vecchio 505).

Authority can be centralized or decentralized. The concept of decentralization is becoming increasingly more popular due to the trend toward self directed, empowered work teams. A decentralized approach refers to a command structure were decisions are made and authority is delegated to the lower levels of the organization. This approach allows for decisions to be dispersed to those closest to the point of relevance (Weihrich 300-301).

Prior to the industrial revolution, workers associated their identity with their work and in some cases took their surnames based on the type of work that they did; Baker, Weaver, Smith and Mason are examples. This association provided a motivation for performing quality work and the fact that their

monetary rewards were a direct result of their efforts, further motivated their performance (Galbraith 15).

The division-of-work approach obsoleted this means of motivation. The entire output of the organization was now a function of the efforts of many. The ultimate responsibility for success has been diffused among the many workers. Ideally, all workers should work towards maximum productivity and share in the profits. Since this ideal situation seldom exists, a primary role of management is to define what rewards/motivation system shall be used and how that system shall be integrated into the organization to achieve optimum performance (15).

To summarize, the need for and role of an organizational structure is to provide an infrastructure which can be used to manage the direction and activities of individuals to achieve optimum performance toward the shared goals of the group.

Organization Types

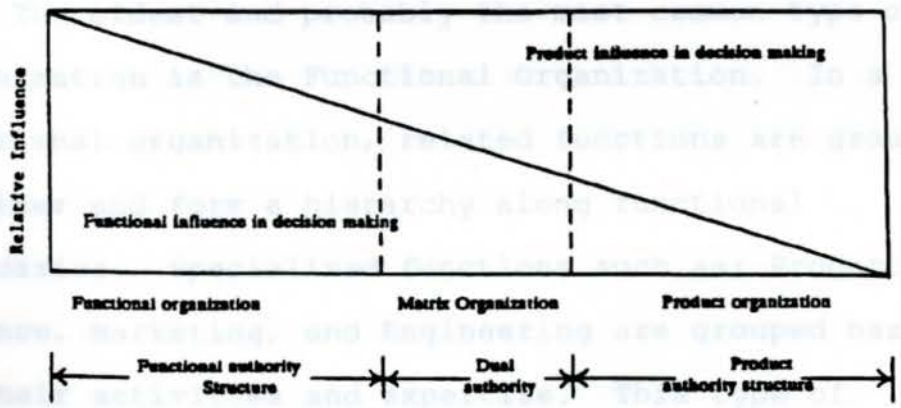
The three most common form of organizational designs are the functional, the product, and a hybrid

structure called a matrix. The first two types of organizations are relatively basic and simplistic in their design and operation. The matrix organization has evolved by mixing the attributes of the functional and the product organizations. The matrix is a cross functional organizational structure which will be covered in depth since many of its variations are relevant to the trends of the 1990s (Galbraith 25).

To better understand the three organization types; a simple continuum model (Figure 1) can be used.

Figure 1

Functional/Matrix/Product: A Continuum of Alternatives



Source: Journal of Management, 1992, Vol.18, No.2. As cited in "Cross-Functional Structures: A Review and Integration of Matrix Organizations and Project Management" by Robert C. Ford and W. Alan Randolf.

At the start, or left of the continuum, resides the functional organization where functional influence is greatest. This end of the model is dominated by functional responsibilities and supported by product teams and task forces. In the middle resides the matrix, with influence shared between product and functional desires. At the right is the product organization which is driven by product issues and supported by functional departments. The vertical axis represents the relative amount of influence exerted by the different types of organizational structures. From this model you can assert that the degree of functional or product influence are inversely proportional (Ford 271).

The oldest and probably the most common type of organization is the Functional Organization. In a functional organization, related functions are grouped together and form a hierarchy along functional boundaries. Specialized functions such as; Production, Finance, Marketing, and Engineering are grouped based on their activities and expertise. This type of structure is appropriate when technical expertise is critical, there are few products, and the organization is stable (Montana 153).

The functional organization has some disadvantages such as; it is slow to change, loyalty of the work force may lie with their area of expertise and not with the goals of the enterprise, support of multiple products is difficult, and individuals in a functional organization may tend to have a myopic view toward the enterprise.

An additional problem with functional organizations is the communication between disciplines. The lack of communication may result in a compromise in the performance and quality of the finished product.

Major advantages of the functional organization are: the inherent communication within disciplines, simplified training, clear lines of responsibilities and career growth, and it is a logical reflection of functional operations. The result is typically a high level of departmental expertise and technical excellence (Weihrich 268).

Typically a new company will organize based on functions. As the company grows and begins to develop multiple product lines, they will transition to a product based structure. The product, or project, structure groups personnel and activities by the products or projects that they produce. These

organizations are usually temporary in nature and begin with the development of a product and end with the product's termination (Young 269).

In a pure product or project organization, each product line must be staffed with all of the disciplines required to produce the product. For example, a product based organization would have its own marketing, finance, engineering and production personnel. The product structure is well suited to adapt to change, typically focused toward consumer satisfaction, and has clear goals (269).

Benefits of product based organizations are; they tend to focus on the needs of the consumer, they allow the use of specialized equipment and procedures. They promote interdiscipline coordination, and clearly focus the goals of the employees on the product. Product organizations are generally found in large companies with many diverse products (Weihrich 274).

Primary disadvantages of product based organizations are; the potential for inefficiency in areas of specialization, increasing or decreasing staffing, and the potential loss of horizontal integration and functional expertise. A secondary disadvantage is the potential for increased overhead

cost due to redundancy between product lines. If multiple product organizations share the same resources, the accurate allocation of overhead cost is difficult. For example, sharing of administrative personnel between product lines may be more economically efficient (276-277).

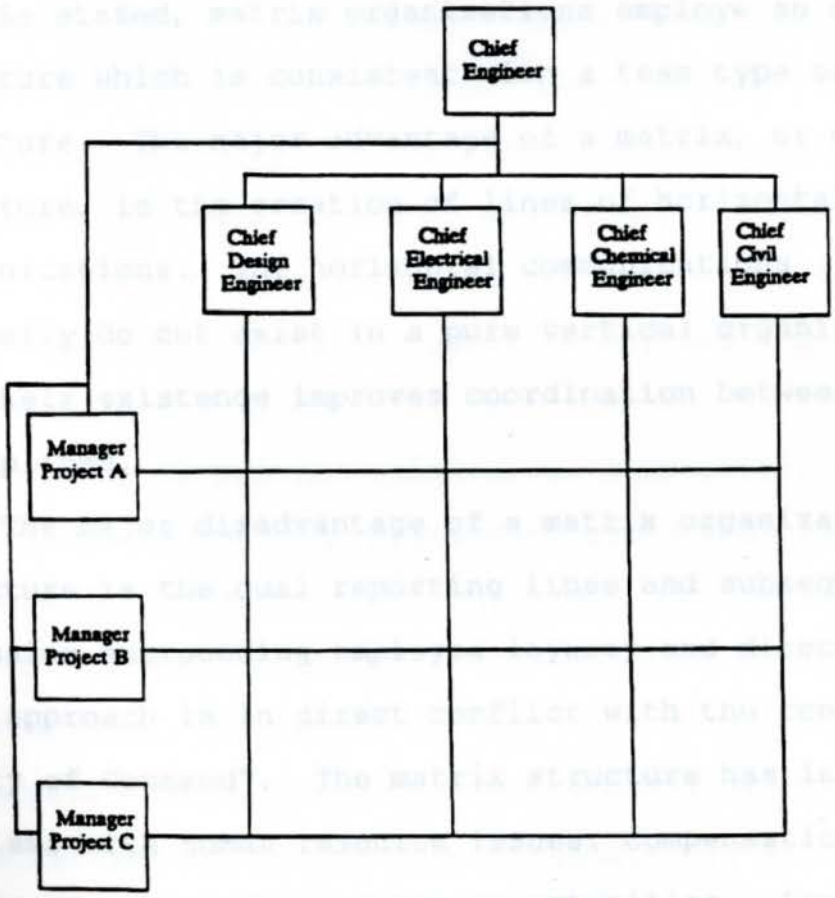
The matrix organization combines the attributes of both the functional and the product organizational structures. A matrix structure organization can be defined as "any organization that employs a multiple command system that includes not only a multiple command structure but also related support mechanisms and an associated organizational culture and behavior pattern" (Ford 268-269).

A common characteristic of a matrix organization is the "overlay" of a lateral organization on top of a traditional vertical organizational structure. The overlay imposes lateral communications, authority and responsibility based on different projects. Figure 2 depicts a typical matrix structure. As depicted above, the vertical lines of organization are traditional functional and the horizontal lines are usually based on products. The "overlay" creates a dual chain-of-command (269).

The matrix organization combines the benefits of coordination, inherent in a product organization while maintaining the functional linkage found in a pure functional organization (Ford 270).

Figure 2

Functional/Project Matrix Organization



Source: Journal of Management, 1992, Vol.18, No.2. As cited in "Cross-Functional Structures: A Review and Integration of Matrix Organizations and Project Management" by Robert C. Ford and W. Alan Randolf.

Matrix structures are common where large numbers of personnel work on highly complex products such as, engineering and aerospace firms. A distinction can be drawn between the product organization and matrix organizations in that product organization are focused on finite tasks, while matrix organizations typically address ongoing activities (Weihrich 277).

As stated, matrix organizations employe an overlay structure which is consistent with a team type of structure. The major advantage of a matrix, or overlay structure, is the creation of lines of horizontal communications. The horizontal communications typically do not exist in a pure vertical organizations and their existence improves coordination between disciplines.

The major disadvantage of a matrix organization structure is the dual reporting lines and subsequent confusion surrounding employee loyalty and direction. This approach is in direct conflict with the concept of "Unity of Command". The matrix structure has inherent problems with human resource issues: compensation, career growth, and promotion opportunities. From an operational stand point, additional operating cost may

have to be incurred due to the dual structures (Ford 275).

Organizational Trends

Flatter structures, self directed work teams, horizontal integration, decentralization, empowerment, and cross functional structures are terms found in many management "how to" magazines. These terms define what is happening in many businesses today. These trends will yield generally flatter structures with less levels of management, greater empowerment of the work force, increased demand for information, and a more productive and globally competitive corporate position (Howard 62).

Other more pointed opinions on corporate change are also prevalent. Articles such as Micheal Hammer's, "Re-engineering Works: Don't Automate, Obliterate", call for a drastic re-conceptualization of big corporations. His belief is that only a radical change in corporate structure and thinking can save them from financial demise. According to Hammer, "It is an all or nothing proposition; either corporate leaders invent something new or they are doomed" (Thackray 40).

Six trends are emerging as the guiding principles of corporate change. They are; to organize around tasks, flatten the hierarchy, use teams, focus on customer satisfaction, reward for team performance, and, maximize supplier and customer contact. Corporate organizations are being tailored to effectively and efficiently incorporate these principles (Byrne 76).

Summary and Statement of Purpose

As noted, organizations are created to allow management of tasks in order to effectively achieve the goals of the enterprise. Classical management theory began in the 1900s when it was observed that greater efficiency could be achieved by dividing a task into subtasks. The division allowed specialization which increased productivity, but also increased risk and interdependency of tasks. To manage the inter-dependency and risk, hierarchical organizational structures were created.

There are three fundamental organizational structures; product or project, functional, and matrix. The product organization focuses on a specific product or project. The functional organization is structured

around processes or specialties and is the most common structure. Variations of the matrix organization is emerging as the most common form of organization. The matrix structure overlays a functional organization on top of a product organization in an effort to achieve efficient horizontal communication and maintain a focus on the end product.

The traditional organizational structures are being modified in an effort to achieve greater efficiency. The trend is toward flatter organizations, teams, and decentralization of authority.

The purpose of this project is to evaluate the trends and issues surrounding organizational redesign, and to determine the validity of these new organizational concepts.

Chapter II

LITERATURE REVIEW

Organizational Trends

The purpose of this investigation is to evaluate the trends associated with corporate reorganizations, the move toward team based organizations, and to determine the benefits related to these changes.

Many reason are given to support the large amount of reorganizing taking place in the U.S. today. It appears that the saying of a famous Roman, Gaisus Petronius, who stated nearly two thousand years ago, that in his observations, when people had no real idea what to do, they would invariably reorganize their forces. Many corporations are faced with the same dilemma, not knowing exactly what to do in order to increase efficiency and maintain market-share (Sheridan 54).

U.S. companies traditionally have organized their operations around functions, or projects. It appears that this approach may no longer be adequate. Corporations must be willing to adapt in order to

survive. As corporation change and evolve in order to stay competitive, they must be willing to restructure their databases, systems and their organizational structure. Traditional structures based on division of responsibility by function are common, but do not have the reaction speed and flexibility required to succeed in today's business environment (Finkelstien 95).

A relatively new form of organizational structure, the matrix, is becoming common in many large technology based companies. The matrix organization blends the traditional lines of responsibilities between functions and projects, and in many cases incorporates team organizations. The goal of matrix and team organizations is to integrate activities in order to become a leaner, more productive company. In some sectors of the market-place, the changes in organizational approaches are as minor as having production employees comment on new designs. In other more extreme cases, the departures from traditional command and control structures are staggering. Engineers are operating production equipment, production workers are meeting with customers, and finance personnel are involved with design development (Schamisso 99).

Whatever organizational structure is chosen, a balance between functional expertise and improved horizontal communications must be achieved. In times where product designs are stable, and the product life cycle is longer, product success could be achieved through purely functional organizations. When rapid change is required, increased horizontal communications and concurrency of operations is necessary, hence the need for team based organizations (Clark 111).

The change movement is affecting both office and production workers. Moves away from the traditional method of manufacturing are becoming common. Experiments in craft based production are revealing increases in productivity of fifty percent or more. Craft based production is the process of having a worker, or a team of workers produce a product from beginning to end. The increased productivity is attributed to a reduced number of hand-offs and increased worker responsibility. Craft based production allows the production workers to produce at their own pace. In many cases, the non-dictated rates are higher than those directed by management (Williams A1).

Robert Ford and W. Alan Randolph's Article "Cross-Functional Structures: A Review and Integration of Matrix Organization and Project Management", is the most comprehensive individual piece of research found. It highlights many of the operating principles, and pros and cons surrounding matrix organizations. Ford and Randolph state that the largest benefit of matrix structures is the improved horizontal lines of communications, and the largest disadvantage is the confusion surrounding dual reporting chains of command (Ford 272).

Most of the new management structures equate to some form of team organization. It is therefore necessary to define the term team. Dr. Juran, one of the world's leaders in the area of quality management defines a team as, a group of individuals, each with specific skills, knowledge and interest, that enables the members to contribute to the accomplishment of a common purpose. The dissection of Juran's definition reveals the following key factors; the individual's skills support a common purpose, all members contribute and the goals of the members are common. The vast majority of change marketers profess these ideas as the

keys to improved productivity and performance (Baker 10.34).

John Peters' article, "On Structures" provides an overview on the benefit and disadvantages of different organizational structures. Throughout his discussion, the element of Juran's definition of a team are discussed.

As stated in Peters' article, the functional organization is based on specialization with its strength being the simplicity of operations. However, communications between organizational elements, or functions, can be a problem. Peters and Ford's opinions regarding matrix structures are generally consistent. Both state that the matrix organizations that evolved during the late 1970s and 1980s were established in large part to enhance internal customer satisfaction. By creating a dual reporting line, cross-functional communications were improved (Peters 60) (Ford 272).

In Tom Brown's article "Future Organizations", management consultants Ed Lawler and Jay Galbraith discussed organizational trends and provided opinions of what is required for today's corporations to survive. Lawler and Galbraith share a common vision,

generally flatter, less hierarchical corporate organization. The need to push decision making down to the lowest possible levels in the organization is required to reduce reaction times. The real key, as stated by Lawler is not how you draw the organizational boxes, its getting teams that work directly for the customer (23-24).

Both Lawler and Galbraith caution that one structure does not fit all situations. Galbraith provides a comparison between a brewing and an electronics company. The technology required in brewing is very stable, almost 500 years old. In this case, vertical integration and a functional organization is great. However, if one is managing Hewlett Packard, where fifty five percent of your revenue comes from products developed in the last two years, its a different situation. Hewlett Packard must be able to react to change, be aware of the customer's changing requirement, and be able to bring new products to market at a rapid rate. The critical element is the compatibility between corporate product lines and strategies, and the organizational structure. Incompatibility between these three is a shortcut to obsolesce (24).

Another area where Lawler and Galbraith agree is team participation. Lawler uses the term "mini enterprise" to define his vision of a team's operations. As stated by Lawler, the team should function, to the maximum extent possible, as a separate enterprise. With this approach comes responsibility, accountability and improved customer responsiveness. The team should be structured so they have end-to-end responsibility in work content. Carving out a portion of work and creating a team to complete the task allows for maximum autonomy and self direction (26).

An organization form which is gaining popularity due to its autonomous nature is called Strategic Business Units (SBU). SBUs take advantage of the philosophies noted by Lawler in Brown. An SBU is a stand-alone, decentralized organization which is becoming common in the U.S.. The SBU is an autonomous enterprise where all members are part of the SBU, and the member's success or failure is dependent upon the success or failure of the SBU. A characteristic of SBU is that more of the staff get involved personally with the customers. Peters believes that the SBU organizational approach is well suited for companies with multiple product lines (Peters 61-62).

An alternative approach to the SBU is one popularized by the Department of Defense, DoD, called Work-Breakdown-Structure or WBS. The WBS concept subdivides a product into smaller manageable pieces, and assigns tasks and budgets based on the subcomponent (Maher 2).

William Maher, Equipment Technology Manger for GTE Government Systems Corporation, discusses the relationship between WBS and organizational structure in his article, "Cutting a Path to Quality Through Concurrent Teamwork". Maher focuses on developing a team concept which is consistent with a product's physical configuration (2).

Maher believes that traditional functional stovepipe organizations have inherent flaws. Some of these are; they fail to define explicitly the hardware requirements, they limit horizontal communication, force management to manage communication between functional groups, and encourage independent functional silos. The results are poor processes, over-the-wall hand-offs, silos, and serial activities which lengthen the products cycle time (4).

A shift to a WBS product based organization encourages team participation. The goal is for each

team, or WBS element, to produce a portion of the product which meets the requirements. When this occurs, and all of the elements are added together, a high quality product is produced. WBS product based organizations utilized build-to-packages instead of traditional drawings. The build-to-package includes the part design, quality equirements and the manufacturing plan. The use of build-to-packages ensures compatibility between the manufacturing processes and the design. The WBS organizational approach results is reduced time to market, fewer changes, and higher quality (6).

The use of teams in a development environment allows the design and the manufacturing process to be defined concurrently. The concurrency of activities simplifies the transition from the design phase to the manufacturing phase of the program. As stated in Maher, the DoD has been a proponent of team structures. John R. Snoderly, Chairman of the Systems Engineering Department at the Defense Systems Management College (DSMC), and President of the Washington Chapter of the National Council of Systems Engineering expressed his beliefs in his article entitled, "How to Organize for Concurrent Engineering" (Snoderly 2).

Snoderly states,

> Concurrent engineering does not have a single definition; it is made up of several elements including multi-discipline teams, computer aided tools, and others related to systems engineering. The use of concurrent product and process development is the key ingredient in reducing DoD acquisition times. (2)

The term concurrent engineering puts a label on a move which has been developing over a number of years. As products became more complex, concurrent engineering became a means of achieving higher quality products and reducing development times. Snoderly's views are consistent throughout the writing of Byrne, Ford, Peters and Steurer. The goals of concurrent engineering as defined by Snoderly are; to provide a more effective design, simultaneous product and process development, reduced time to market, and to provide a linkage of highly producible designs to high yield processes (4).

Snoderly and Ford share common thoughts as related to the cons associated with traditional organizations. In traditional functional organization, interdepartmental communications are difficult,

departmental protectionism exists, rivalry between departments spawns bitterness, and the organizational goals are subverted by department goals (5).

Snoderly provided some examples of successful team organizations and concurrent engineering projects; Lockheed Aircraft's "Skunk Works" used cross functional teams to develop the SR-71 Blackbird in only 24 months as compared to the standard aircraft development span time of 42 months; General Motors developed the LT-5 engine in 4 years, rather than the usual 7, by applying simultaneous engineering in a team environment; Chysler produced the Viper sports car using teams and concurrent product and process development for a fraction of the cost and time typically required to develop a new car (13).

John Snoderly summarized his finding by stating, "the best way to organize for concurrent engineering is through the use of multidisciplined teams", further more, "concurrent engineering using good systems engineering practices can lead the way toward an eventual regaining of American dominance in world markets" (13).

Snoderly's statements support the rationale for team organizations as defined by W. E. Deming in his

book "Out of Crisis". Deming believes that the binding factor within a team is the commonality of purpose and goals. Deming states, "The aim of a team is to improve the input and the output of any stage. A team may well be composed of people from different staff areas, but a team should have an aim, a job, and a common goal" (Deming 89-90).

Dr. Jerome G. Lake, a professor at the Defense Systems Management College in Belvore Virginia, supports the urgency for improvement as expressed by Snoderly and the use of teams as defined in Deming. Lake states, "The U.S. must change the way products are developed and manufactured if we are to attain world-class producer status" (Lake 18). The use of team organizations is required if concurrency of design and manufacturing definitions are to be achieved. Increased product complexity necessitates improved communications between specialty disciplines. Teaming and collocating helps to remove functional barriers (Lake 19).

John Byrne's Article "The Horizontal Organization", discusses several new organizational concepts. One of the more extreme examples is Eastman Chemical's new organizational structure. They created

an organizational chart which looks like a pepperoni pizza. The president is represented by the pepperoni in the center of the pizza, with all of the other pepperonies representing self contained teams. The teams are responsible for managing a region, or geographic area, or a core competency. The white area is where interactions take place. The intent is to show that no group is more important than any other (80).

PepsiCo has also altered their traditional pyramidal organization by turning it up-side-down. Their CEO, Craig Weatherup, sits at the bottom or point of the pyramid. The intent of this organization is to show that PepsiCo's management is responsible for supporting the organization, not the inverse. Weatherup boosts that this approach represents a "right side up company" (80).

Two other theoretical organizations which represent departures from tradition are, the "Shamrock" and the "Starburst". The Shamrock is the brainchild of Charles Handy, a lecturer at the London Business School. The three leaves of the shamrock symbolize the employees, the external contractors, and part time staffers. The center represents the coming together of

the three forces. The "Starburst" is the idea of James Quinn of Dartmouth's Business School. The center of the starburst is the core company and all of the other spots represent shooting star spin-offs activities. As the core company develops new products or projects, they shoot-off from the center as if they were shooting stars (81).

As stated in Byrne, many of these new concepts are just experimental metaphors for company operations, and "are not pragmatic structures". They fail to address the real day-to-day problems and interactions that are required to function in a sustaining business. These new age organizations are not the norm and many corporations still have vertical structures with many layers of management between the worker and the CEO (82).

Byrne believes that the future lies in flatter organizations, where horizontal management is as important as vertical management. Horizontal organizations involve more than just the removal of management layers. The traditional functional kingdoms are being eliminated and departmental boundaries are being removed. The future state is envisioned as a few select executives responsible for the traditional

corporate functions such as; finance, operations, marketing, and engineering with all of the others working together on multidisciplined teams (77).

Douglas Smith, a management consultant, is quoted in Byrne's article in reference to organizational structures. Smith states,

> A review of the Conference Board's repository of organization charts, a collection of 450 corporations, will show that the vast number of organizational structures are traditional, and with good reason. Major cooperations such as Bank of America, Ford, General Electric, and IBM have step pyramidal organization. Only a few reflect the trends described here. A reason for having such a small number with progressive organizational charts may be that organization charts lack reality. Furthermore, many of the new structures complicate necessary everyday activities such as; career progression, personnel development and shared resources. (81)

Too often companies attempt to gain a competitive advantage by down-sizing, and are disappointed when the desired results are not achieved. They fail to realize that merely down-sizing ensures little in the way of attaining increased efficiency. Elimination of people must be accompanied by systemizing the process. For the true benefits of organizational streamlining to

be achieved, the supporting processes, information flow and responsibilities must be integrated (Moore 77).

Ray Suutari, a professor at Wilfrid Laurier University, supports Moore in the belief that blind reductions in the number of people on the payroll will not provide the optimum results. He explains in his article, "The Case For Strategic Thinking" how many attempts at improved performance through reorganizing fail. Suutari states, "We talk about trimming the fat, ignoring the fact that the fat is rarely at the edges, but marbled throughout the organization. The result is considerable loss of meat" (17). Rapid change and untried organizational approaches have burnt out and demoralized many companies. Recent large scale dismissals of CEOs indicate that many shareholders are frustrated, reorganizations must be well thought out prior to implementation (17).

Successful reorganizations come most often with the implementation of strategic thinking, not with merely reorganizing. The problems of many of todays companies are caused by strategies which are too inflexible and, or operating level managers having to implement unrealistic strategies. Reorganizing often does not address the root cause of poor performance.

If reorganization is the only change that a corporation implements, the results are usually less than optimum. The reorganization process often sacrifices the future for perceived improvement in the present state (18).

Suutari's position is that strategic thinking and delegation of power are keys to sustained successs. He provided three strategies which must be incorporated: maintain flexibility to evolving markets; empower to the lowest practical level; and base decisions on facts and sensitivity to expending resources. All three are consistent with the beliefs of Ford, Byrne, Snoderly and Lake. It should be noted that nowhere is it mentioned that companies must reorganize or implement team based structures to incorporate these strategies (19).

Suutari supports the concept of flatter organizations in order to move profit and loss responsibility downward closer toward the market, and a role change for managers from director of activities to mentor and facilitator (21).

Many of the giants of corporate America are leading the charge toward flatter, decentralized organizations. DuPont Inc. created a decentralized group to help them move toward a horizontal

organization. Chrysler has turned to a "process approach" to streamline the development of its new Neon subcompact in an effort to decrease development time and cost. Xerox has developed "micro-enterprise units" that have beginning-to-end responsibilities for a product's life cycle (Byrne 76).

Other companies joining the streamlining craze are; AT&T, who has recently reorganized its entire business around processes and set up budgets and awards based on customer satisfaction, Eastman Chemical, a division of Kodak, with over 1,000 teams, has eliminated the senior vice president positions for manufacturing, R&D and administration in favor of self directed work teams, General Electric who has scrapped their vertical organization in favor of a horizontal organization, and General Motors who has incorporated team structures within the U.S. and in Europe (78).

Based on General Motors' domestic success with involving team structures, they have begun to expand it to their to European facilities. GM has established a team organization at its Eisenach, Germany plant. GM's President, John Smith felt that team participation would improve productivity. Under his direction, teams of employees, called Brigades, were structured to

assemble the GM products. To the surprise of many, the Eisenach employees embraced the team concept and exceeded productivity expectations. The exemplary performance was a result of sharing task, improved communication and striving for a common goal. An off-shoot of the work structure was the development of friendships between the workers and management. This fact undoubtedly enhanced performance (Bennet C1).

At McDonnell Douglas Corporation's (MDC) aircraft division, McDonnell Douglas Aircraft-East (MDA-E), in St. Louis, the move toward Integrated Product Development (IPD), through the use of Integrated Product Teams (IPTs) has accelerated rapidly with the development of their newest military fighter aircraft program, the F/A-18E/F. IPD, as defined by John Steurer MDA-E's Vice President of Integrated Product definition, is "a philosophy that systematically employs a teaming of functional disciplines to integrate and concurrently apply all necessary processes to produce an effective and efficient product which meets the customers requirements" (Steurer 1).

The IPT process has allowed unprecedented success in the F/A-18E/F design process. At the most recent major design review, the program was on schedule, under

cost, meeting all of the technical performance parameters, and determined to be highly producible. New tooling and production concepts were also incorporated due to the fact that tool designers and manufacturing engineers were involved up-front in the design process (Anderson 1).

Many companies have moved toward team and matrix structures, but others have chosen to hold steady. Lincoln Electric Company of Cleveland Ohio, is a world leader in the manufacture of welding equipment. Lincoln Electric is known for their very basic approach to management, organizational structure, and employee motivation. Simply stated, Lincoln management believes that employees are motivated based on monetary reward (Wiley 86).

Lincoln Electric has pushed their production rates to two to three times the level of their competitors. They have accomplished this by maintaining a traditional functional organization and incorporating an innovative pay-for-performance incentive program. Lincoln's approach has allowed them to maintain a no layoff policy for the last 45 years and to pay their production workers an exceptionally high average annual wage of $45,000. The yearly production worker's wages

are on average 75 percent hourly salary and 25 percent bonus. The primary contributor to the bonus portion of their wages is each employee's productivity (88).

Lincoln's approach is in direct opposition to the newly evolving "team as a unit" approach. In a team approach, the production of the team determines the reward. Don Hastings, Lincoln's CEO, believes that competition is a motivator which manufactures should take advantage of. When he refers to competition, he is considering competition as a driver company to company, and as a driver employee to employee. The concept of having employees compete against each other is in direct opposition to the beliefs of Ford, Galbraith and Byrne (87).

Change and reorganization are not a panacea for all companies. Allen Liles, a Vice President of Southland Corporation when they went into bankruptcy in 1992, feels that a major contributing factor to Southland's decline was a failed attempt to reorganize. In 1985 Southland Corporation was the seventh largest retailer in the U.S. with profits growing 10 to 15 percent per year. Today, Southland is bankrupt and has sold off its most profitable sales segment, 7-Eleven stores (15).

Southland corporate culture was based on family values with a strong centralized organization. With the rapid growth and success that Southland was experiencing in the 1980s, their management began to question how far they should push their existing management and organizational approach. At that time many major companies and consulting firms were professing the benefits of reorganization (15).

McKinsey & Company, a consulting firm who was known to promote reorganization as a means to achieve growth, was hired by Southland to evaluate their corporate organizational structure. McKinsey said that Southland was in trouble. That they had to get lean, streamline, and flatten their organization (15).

Southland began to fix something that wasn't broken. They cut layers of management, decentralized operations, and laid off people. The change sent the entire company into turmoil. The employees got scared, stopped submitting new ideas, and felt threatened. The results were, a drastic drop in productivity and sales. Southland felt the full brunt of the failed reorganization and the consulting firm moved on and continued to profess the benefits of corporate reorganizations (15).

As one of the few individuals who have been involved with a reorganization from start to finish, Liles states,

> The restructuring mania has become the single most catastrophic trend in modern U.S. corporate history. We are witnessing the self-destruction of our most successful companies, like IBM and General Motors through this misguided strategy. I don't know if the re-structuring genie can be forced back into its lamp. But until people realize the destructiveness of the trend, the U.S.. is in for continued hard times. (15)

Change is a very difficult process and there is no one solution which fits all situations. A thorough analysis of the present state, and the desired results should be conducted before reorganizing. Streamlining may be the answer for mass production industries, but not for others. High technology based firms, where specialization is required for success, may be better suited to a traditional functional organization. Before a company marches off to "change", they should understand what environment they are operating in, what are the desired effects of restructuring, and how their customer base may be affected (Byrne 78).

Byrne provides a good summary of organizational trends in the U.S. today. The total elimination of the functional organization will not occur in most companies. Most certainly there will continue to be a need for the traditional functional organization. The question is; How far away from the functionally based organization will companies move?. Most companies will find a mix of the two extremes, with both functional and product line influences (81).

The trick, it appears, is to find the correct mix of influence between functional and product influences and to tailor the organization to fit the desired state. As stated in Ford's article, "Cross-Functional Structures: A Review and Integration of Matrix Organization and Project Management", "Matrix is an exceedingly complex form that is not for everybody. To put it bluntly, if you do not really need it, leave it alone" (279).

Team Structures and Operations

The evolution of the team concept is a result of the need for a focused effort toward accomplishment of a given task. The team organizational structure is

based on "a group of individuals having all of the resources required to accomplish a self contained task" (Galbraith 50). The team approach basically changes the way tasks are decomposed into subtasks. As illustrated by Galbraith, self contained units could be created around major sections of an aircraft-wing, fuselage, cabin, tail etc. Each group would have its own structural designer, production engineer, tooling personnel, fabrication and assembly lines. The team would be responsible for all aspects of the products production. The ultimate benefit is the elimination of hand-offs, thereby eliminating interfaces between activities (51).

The gain in efficiency theoretically comes from streamlined communications. The amount of information required to be processed is lessened, thereby reducing the amount of time required to process the information and minimizing the potential for misinterpretation. The team self-containment shifts the authority command from an input factor to an output. The authority, is in essence, a factor of the finished product's requirements (51).

Self contained team structure may necessitate that resources be shared. For example, three teams may

require the support of a tool engineer on a part time basis. If each team were to hire a tool engineer, an inefficiency would result. Each of the teams would be over-staffed in that specialty. In a pure functional organization, one tool engineer would be hired and shared to support the separate tasks. An alternative approach would be for team members to become proficient in several disciplines. This approach often results in a loss of specialization (51).

To successfully make the transition to a team based organization, a vision of the required group dynamics is necessary. An important factor in organizational transitions is the "change agent". Often a single person takes the lead and starts the transition. This individual is usually at middle management or above. The individual often chooses to not fight the battle of the organizational chart, but focuses on building a consensus of supporters. This approach eliminates the emotional battle of changing the organizational chart(Donovan 30).

When Chrysler wanted to radically change the way they designed and developed cars, they implemented a team concept. In 1992, Chrysler decided that they wanted to develop a sports car based on a concept car

called the Viper. Chrysler management gave the go ahead with strict limitations put on cost and development time. The Viper development team could only spend $100 million on development and testing, five percent of what is traditionally spent on a new car, and the project had to be completed in three years, half of the time traditionally expended on new car development (Lynch 59).

The program manager assembled a team of twenty people from across the company to work on the project. With only twenty people on the team, each was required to work in a multidisciplined manner. Functional disciplines were ignored, and teamwork was encouraged (61).

Development of the car took place in a "skunk works" type of environment. As the design evolved the team dynamics improved. Engineers and mechanics worked together to eliminate problems and everyone on the team shared risk. The car's design and production was completed on schedule and on cost. Roy Sjoberg, Chrysler Program Manager, gives credit for the success to the team concept (62).

In Andrew Schamisso's article, "Creating Team Work" he discussed how John Deere & Co., Moline

Illinois plant, transitioned to and operates as a team. Deere has successfully removed the functional silos which existed and has replaced them with a flatter, team based organization. Deere's old organization contained on average ten levels of management between the designer and the general manager. Their new organization contains only four. Their initial attempt at redesigning their organization was to have each function sign-off on a design. This failed to eliminate any of the barriers. Each function maintained a very narrow view of the product and focused only on their individual specialty. The turning point to the team transition came when Deere collocated all of the disciplines in the same area; communications improved, ideas were shared and teamwork started to develop (100).

Collocation is a critical element in efficient team operations. Schamisso discussed the problems that John Deere was having in collocating teams in a large diverse company. Deere's goal was to integrate a product development team with a production team. The two teams were geographically separated by 600 miles. To solve the problem, Deere formed an outpost engineering staff at the production facility. The

engineering staff spent three days each week working at the production facility and two days back at the main development facility coordinating with their core organizations. This approached reduced the production cost of the product by forty percent, the development time by thirty percent, while also reducing scrap and rework (103).

A first step in achieving the cultural change required to get individuals to act as a team is collocation. Collocation is most often referred to as physically locating individuals within the same work environment. An alternate form of collocation can be to electronically link the workers. The physical walls that exist between functions are representative of the emotional barriers which separate the functions (100). Ford supports Schamisso's position that collocation is critical to team cohesiveness. Ford states that, "managers of research and development project teams should encourage cohesiveness through minimizing physical distances between group members" (Ford 285).

The next evolution for Deere's product development team is to take the product from cradle to grave. In this concept, the team would be responsible for not only the design of the product, but also the

production, marketing and distribution aspect as well (Schamisso 100).

The team approach is credited with reducing product development time spans allowing companies to bring products to market in a shorter time frame. The underlying reasons for the reduced development cycle time is concurrency of development; tool and product design and production, and reductions in errors and rework due to multi-discipline involvement. Xerox and McDonnell Douglas are two companies that support this premise. Both use multi-disciplinary teams that work in a single process or on a single product, instead of the traditional functional or departments.

In an article entitled "IPD and the Role of the Team Leader", John Steurer, Vice President/General Manger, McDonnell Douglas Aerospace-East (MDA-E) discussed the implementation of integrated team at the Aircraft Company, in St. Louis Missouri. MDA-E utilizes Integrated Product Teams (IPTs) to streamline development times, improve the quality of their designs and to manage the production process. The IPTs include members of all of the functional disciplines required to design, produce, and support their product. IPTs are cross-functional teams formed for the specific purpose

of delivering a product or managing a process. The teams have a common goal, and are accountable for their performance and delivery of their product. A driving force in the implementation of the IPD concept was to eliminate errors and achieve first time quality (2).

As stated in Steurer's article, team organization have a better chance of yielding first time quality. Loss of first time quality in the design process often requires rework of designs and tooling. The cost of making these changes after production has begun can be staggering. Paul Strassman, Xerox's Vice President of Systems Application, studied the impact of change on a released design. A single change created a chain of 53, 220, and 423 events. These included telephone calls, memos and letters, which cost companies $1000, $2000, and $10,000 respectively. The interaction in a team environment has a positive effect on the reduction of errors (Boznak 77).

A 1988 survey of aerospace, defense, and textile companies revealed an average change rate of 330 per month. The aerospace contractors cost of change exceeded $50 million per year (77). Another study of the impact of change involved General Dynamics F-16 aircraft program. The F-16 was designed with a strong

functional organization and the aircraft's definition consists of 3000 drawings. In the first three years of production, there were 22,000 changes and 30,000 over the first five years of the program. Not all of these were a result of poor product definition quality, but many were. The move toward first time quality, through concurrent engineering in a team environment, can dramatically reduce the number of changes and the resultant cost impact (Ashton 150).

For example, some companies have successfully mixed functional organization with team structures. At Daimler Benz, they have maintained their functional organization, but have introduced teams as well. Over 900 of their employees are involved in 30 teams which span several departments and functions. The cultural change took time but almost all of their employees feel free to spend most of their time out on teams (Byrne 80).

A more progressive team structure and approach involves the use of Self-Directed Work Teams (SDWT). A SDWT is a team which is not only self contained, but is also self directed. SDWTs have minimal functional influence and maximum product influence. The SDWTs receive only general guidance from management

pertaining to the goal, mission and objectives of the company. In "Self-Directed Work Teams" by John Benson, et al, SDWT's are defined as, " self managed autonomous groups whose purpose is to collectively master different aspects of the production process" (Benson 79).

A survey by Development Dimensions International listed the reasons that companies transition to self-directed: thirty eight percent transitioned for improved quality, twenty two percent for increased productivity, seventeen percent to reduce operation cost and twelve percent for the sake of increased job satisfaction (Cauldron 80).

SDWT's are often a result of looking at the development or production process as a system. Warner Lambert Company decided to use SDWTs after they flow-charted their design process. The flow chart spanned thirty feet and listed activities under each task. This process highlighted the redundancies and inefficiencies. The analysis allowed them to partition tasks and allocate those tasks to discrete SDWTs (80).

The SDWT concept is based on the premise that, through intensive cross training where all of the group members master several interrelated skills pertaining

to specific production operation, the group will develop actions which will increase overall productivity. This approach is in direct opposition to specialization by individuals and the division-of-task theories. The concept of SDWT is relatively new and the full compliment of benefits is unknown at this time. Some of the perceived advantages of SDWT's are greater productivity, and improved worker morale, due to the increased, and shared team responsibilities (Benson 80).

SDWT were implemented at Heath Tecna at their Bellingham plant after several failed attempts at Total Quality Management, program-oriented teams, and quality control circles. Incorporation of SDWTs has resulted in a decrease in nonconformances from twenty four percent, to one percent while reducing the scrap rate from ten percent to .02 percent. The SDWT approach eliminated problems that Heath Tecna's management felt hindered earlier attempts to achieve increased productivity. The SDWTs consist of eight to eighteen workers, who have dedicated facilities, share common goals and skills, and have a well defined segment of work tasks (81-82).

The SDWT Team Leaders act as a role model, and motivator, who's responsibilities include resolving disputes, signing time cards, maintaining a vacation schedule and measuring performance. Liaison between the SDWT and management is handled by a different member of the team. The person responsible for liaison handles safety issues, tooling, manufacturing planning and scheduling. Through training and education, Heath Tecna is able to teach all of the team members that they are leaders. The team functions as a unit and assumes total responsibility for their actions (Benson 81-82).

Optimum team performance, be it SDWT, IPT, or matrix is achieved when all of the team members are focused on the end product. The goal of operating as a team is to get everyone focused on the business as a system in which the functions are seamless (Byrne 79). The seamless aspects of team operations is indicative of a well developed and operating team. A seamless operation minimizes the interdependency between operations. In order to accomplish tasks or manufacture products, many "hand-offs" between functions are typically required. A hand-off is where an activity, or task, transfers from one person, or

department to another. At each hand-off, there is a potential for error and delay. A seamless operation minimizes the interdependency, thus minimizing the management required to control the outcome (Galbraith 15).

An example of the impact of hand-offs and interdependencies is Ryder Systems. Ryder was looking for a way to streamline their operations, thereby reducing overhead cost. An analysis of their process for purchasing a vehicle for leasing showed that fourteen to seventeen hand-offs of documents were required. When they looked at the process as a paper flow, they were able to cut the number of hand-offs to five. Further redesign of the process allowed them to cut their cycle time by two thirds (Byrne 79).

The improvement was achieved by viewing the task as a system. No reorganization was required, but the underlying principles of team structures were incorporated; shared responsibilities, common goals, minimization of hand-off, and elimination of waste.

Byrne believes that most of the successful transitions to team organizations are based on seven key elements: organize around process, flatten the hierarchy, use teams to manage everything, let

customers drive performance, reward team performance, maximize supplier and customer contact, and inform and train all employees (77).

Different variations of this basic transition model are supported by other experts in the management field. In Sandra Donovan's article "Flowing Past Organizational Walls" a variation of Byrne's model is presented. It includes the following steps; assess the present state, solicit employee involvement, align rewards and recognition with the behavior desired, and build trust between management and the employees, obtain employee involvement (30).

In Donovan's discussion of team implementation at the Johnson & Johnson Corporation (J&J), an explanation of the implementation process is provided. The first step is to assess the existing organizational state and barriers to improved performance. This is accomplished by soliciting input from the employees. This approach to base-lining the existing organizational state provides a means of attaining early involvement and ownership by the workers. Next, the process of incorporating suggested changes is put in place. The employees are tasked with incorporating the changes, and as a result, self directed action teams are formed.

To support the team evolution, Donovan committed to incorporate the team's suggestions, and to carry their ideas to upper management. In this way, a sense of ownership, shared destiny, and dependence is created (31-32).

Getting employees to participate in team-based structures can sometimes be difficult. How managers act can significantly improve the probability of success. Gilda Dangot-Simpkin, of Dynamic Development, a consulting firm which specializes in team building, lists five behaviors which managers should use to promote change and streamline the transition process: focus on solutions, not on placement of blame; be open to bad news as well as good, keep an open door policy and be careful not to kill-the-messenger; share decision making to increase employee buy-in; be open and supportive of change; face problems head-on, don't shy away from problems (33).

A common thread throughout all of the discussions involving team operations is the increased communications between disciplines and the willingness to work beyond functional boundaries to achieve a greater degree of organizational integration.

Motivation and Morale

A motivator is a force which causes a particular action or behavior (Weihrich 716). Individuals can be motivated by a desire for goods, economic benefits, esteem, and sense of accomplishment. A claim of team involvement is that team members have a higher level of motivation which results in increased productivity.

In an attempt to determine what motivating forces drive team performance, Clotaire Rapaile, a cultural anthropologist and marketing researcher, conducted a study on team performance and interaction. Clotaire surveyed individuals to determine the root cause for their feelings about teams. The findings revealed that an individual's motivational factors, in a team environment, can vary greatly. The findings reveal that peoples experiences with teams are not always pleasant, their feeling about teams as an adult are impacted by their past experiences as children, teams can go against cultural Biases, and most of all, the individuals want to know how their participation will benefit them personally (Bemowski 40).

Rapaile states that each individual on a team must have their own goal, and must be rewarded if the goal

is achieved. This fact must be considered when a team is established. Teams which are formed solely for the sake of the company have a large chance of failure. The individuals must be able to visualize how they will personally benefit. The question, "What's in it for me?" must be answered for everyone. A balance between the employees needs and the company's must be achieved (43).

Maslow's Hierarchy of needs is based on the premise that human beings are motivated by first and foremost by physiological needs. These are things needed to sustain life; food, shelter, and sleep. Next are individual's security and safety needs, followed by affiliation and acceptance needs. The needs for self esteem and self actualization are last (Weihrich 469-470). Self esteem and self actualization are the last two needs and are most impacted by work and social interaction.

The motivational factors associated with different organizational structures can vary. An increase in motivation as a result of common goals is claimed by proponents of team structures. In a traditional functional or vertical organization employees tend to have a greater sense of loyalty to their functional

disciplines than to the organization as an entity.

Anytime change is introduced into an ongoing business, fear of the unknown can become a major factor. When a company changes from a traditional vertical organization to one which is team based, many traditional managers feel threatened.

Transitioning to teams often hits the first line managers hardest. As noted in Galbraith, team organizations tend to minimize interdependencies thereby reducing the management structure that is required to manage the interfaces (Galbraith 13). In many instances the first line managers are targeted for elimination. In these cases, the fear factor is real. Aware of the fact that the task which they are employed to manage will be eliminated, first line managers are the ones who resist. When Heath Tecna transitioned to SDWTs, twenty five percent of their first line mangers left the company (Benson 80).

In times of reorganization, the middle managers are seen as scapegoats with change coming at their expense. In hard times its the middle managers who have continued to produce, despite upper management's attempts at fixing the problems. An example of this is in the banking industry. With numerous failed attempts

at mergers and reorganizations, the branch managers are often credited with keeping the banks operating during difficult times (Sheridan 54).

Another method which can be used to increase employee morale is to solicit employee involvement. When developing new strategies and organizational approaches, management should strive to include the employees in the development of plans and direction. Seeking their opinion will enhance their sense of ownership and support. This approach will also serve to identify concerns early, when they can be most efficiently addressed (Donovan 30).

In George Weimer's article, "The Business of Idealism", motivation as a function of team involvement is discussed. He states that the single largest motivating factor is to let the members of the team know that each and everyone of their jobs is important and the teams results depend on their individual performance. Properly directed and motivated people can make a tremendous difference and all members of the team need to feel part of the contribution (Weimer 57).

Weimer uses an environmental clean-up company, CDM Inc., as an example of superior team motivation. CDM uses a matrix organizational structure. Their

structure is comprised of two components, a technical branch and a geographic branch. The technical branch drives the incorporation of new technology, and the geographic branch functions as the environmental clean-up unit. Each unit is dependent on the other. This type of relationship requires a sharing of resources and responsibility to achieve the goals of the company. Weimer believes that the interdependencies of each of CDM's branches aides in the motivation of the employees (57-58).

Martin Leshner, Ph.D., is the managing director of the national insurance practice. In his article "Increasing Efficiency Through Cross Training", Leshner discusses the benefit of teaming. He states that a primary benefit of team organizations is increased employee morale. Other secondary benefits are increased management flexibility, improved customer service, and increased productivity (Leshner 39).

Leshner uses Chubb Life Insurance as an example of how employee morale, and subsequently productivity could be improved through the use of teams. Using teams, and looking at the work activities as a system, allowed a single employee to accomplish multiple tasks. Having a single employee complete multiple tasks

improved through-put, thereby increasing the employees sense of self worth. Leshner states that a twenty percent increase in productivity was easily achieved without sacrificing quality. Leshner believes that through the use of team based organizations employees found their jobs more rewarding and they were observingly more committed to higher quality (40).

Compensation and Career Advancement

Establishing a compensation and reward system in a team environment is quite different than that required in a traditional functional organization. Employees who are assigned to teams are faced with satisfying their functional managers and also the team leaders. Generally the goals of these two are common but in some instances conflicts can arise when differences exist. In a matrix, employees may find themselves working across project lines, and trying to satisfy not only their functional mangers, but also several team leaders (Ford 276). This can put the worker in a no-win position. Compensation and award systems must take factors such as this into account to avoid mistreatment of the employee who serves several masters.

Many companies are seeking ways to tie rewards with TQM programs. Initiatives like pay based on skill set, pay based on team performance, and profit sharing for workers are becoming more prevalent. A survey of 130 companies conducted by the Council for Continuous Improvement showed that appraisals and rewards for team support in a TQM environment are changing. Twenty percent are adding skill based pay programs, and twenty three percent are planning on adding merit-pay programs to reward team performance. And approximately twenty percent are adding profit and stock-based awards tied to team performance (Laabs 17).

Many of the aspects of evaluating employee performance in a team environment are common with those of a traditional functional organization. One difference is the increased focus on customer satisfaction generally associated with team structures. In a functional organization, customer satisfaction may be second to the satisfaction of the functional management. Performance in a team or horizontal organization attempt to focus on the customers satisfaction first and foremost. Reward systems should include surveys from customers as a factor in the review process (Cumming 38).

Major companies such as AT&T and McDonnell Douglas have begun to set up budgets based on a team organization and award bonuses to employees based on customer satisfaction. Other companies, such as Motorola's Government Electronics Group, have redesigned its supply management organization as a "process" where the interaction of members of the team is critical for success. In the environment, the team members are now evaluating their peers performance. This form of evaluation often provides a more valuable assessment in that peers generally have a better perception of who the quality workers are when compared with the manager's evaluations (39).

A goal at General Electric was to create an allegiance to the process and not to the boss. To facilitate this goal they put in place a "360 degree appraisal routine". The "360 degree appraisal" requires that supervisors, peers, and subordinates have input into the review. In some cases at General Electric, up to twenty people have input into an appraisal (39).

In any organization where an employee is faced with a split chain of command, confusion and role conflict can exist. Apparently simple procedures

become very complex. The distribution of raises falls into this category. McDonnell Douglas Aircraft-East has split the yearly raise pool with thirty percent allocated by the functional organization and seventy percent distributed by the project or team (MDA-E Human Resource... 6).

The functional distribution is based on the employees base set of skills, technical abilities, and long term career planning. The distribution from the team is based on team participation and contribution, application of the employees skills, quality of performance, and team responsibilities. MDA-E's present merit adjustment process has evolved over the last ten years. Prior to that time, raises were distributed totally by the functional department. As team evolvement and decentralization of authority became increasingly more prevalent, the distribution switched to 100 percent team allocated. The pendulum has swung back toward the present approach which support both the team and the functional affiliations (6).

Additional changes to MDA's appraisal system involves the elimination of forced distribution. The forced distribution review process required that each

employee be assigned a ranking based on their performance. Employees were categorized by the top thirty five percent, middle sixty percent, and bottom five percent. MDA-E management realized that the forced distribution process did not support team goals and was de-moralizing to the work force and has eliminated the forced distribution practice.

AT&T has also modified their performance management program to improve their employee's morale. The company has stopped assigning performance rankings to their 37,000 U.S. managers. AT&T's five categories ranged from "unsatisfactory" to "far exceeded expectations" fostered internal rivalry and discouraged teamwork. Elimination of the rankings was done to align AT&T's review system with their new management approach. The new system provides for a descriptive assessment instead of a label. David Johnson, AT&T's Strategic Director of Marketing, states, "I can't see any downside to the new scheme." (Lublin B1).

While many companies constantly change and modify their pay distribution processes, Lincoln Electric has maintained basically the same rewards system for the last 45 years. Lincoln's pay policy removes most of the subjectivity that exists in typical payroll

systems. The employees are paid based on a combination of base salary and bonuses. The base salary depends on market value and work content. The bonuses are based on each employee's productivity and a merit rating. The merit rating takes into account several factors such as productivity, quality, dependability, and creativity. According to Lincoln's Vice President of Human Resources, this approach to employee compensation and motivation is credited with pushing productivity levels to two to three times that of other companies in similar industries (Wiley 89-90).

Effective reward systems must be aligned with the behaviors that they wish to see from their employees. If the goal is team performance, then the rewards should factor team performance into the equation. Utilizing a sports team as an example can clearly explain how team and individual performances can be rewarded. On a winning Super Bowl team, all of the players receive a Super Bowl ring and a equal share of the prize money. These are examples of team rewards. In addition to the team rewards, personal performance is recognized by providing a Most Valuable Player award. As shown, the team rewards and individual

rewards can be supportive and do not have to be mutually exclusive (Donovan 30).

Rewards do not have to be monetary to achieve desired results. They can range from public acknowledgment, peer recognition, special luncheons and dinners, and certificates and plaques. In a functional organization, rewards will typically be based on technical expertise. In a matrix or team organization, rewards generally are based on team performance. Distribution of rewards can be used to recognize and support a specific behavior. A secondary goal of reward distribution can be to create peer competitiveness. Competition between individual and teams can be very valuable and can result in new heights in organization performance (30).

Career growth can often be enhanced in a team organization by additional training. Often employees realize that they do not have the skills required to efficiently operate in a team environment. Cross training can facilitate team operation and open new lines of career advancement. When functioning as a team, an understanding of the all of the disciplines who are participating can be beneficial. Training

should not be limited to course and classrooms. Job rotation, and on the job coaching can be valuable (31).

Statement of Hypothesis

Review of the research in the area of organizational structures and trends reveals some common philosophies:

- Team and matrix organizations are becoming increasingly more prevalent in U.S. corporations.
- Team structures are put in place to increase the focus on quality and customer satisfaction.
- The reward systems for team organizations should take into account both functional and team performance and support the desired behavior of the employees.
- Decentralization of authority and team organizations employe a common theme, "allocate the responsibility, accountability and authority to the individuals can most dramatically effect the product's or system's performance."

Contrary to the vast amount of data professing change as the driving factor toward improved profits, change in itself does not guarantee improved performance. Improved performance is a result of commonality of goals, elimination of waste due to interfaces and hand-offs, delegation of responsibility, increased employee motivation, and a quality and customer focus.

Based on the research documented in this report, the following Statement of Hypothesis is presented. The ancillary attributes found in team organizations; common goals, decentralization of authority, shared responsibility, multi-disciplinary involvement, and an increased customer and quality focus are the stimulus for improved performance. As such, team structures generally lead to improved performance.

Chapter III

SELECTIVE REVIEW AND EVALUATION OF RESEARCH

The vast majority of the research which was evaluated in chapter two supported the team and matrix organizational structures. Three pieces of research literature specifically address the key elements of this project's Statement of Hypothesis. They are: Ford and Randolf's discussion of cross functional organizations entitled, "Cross-Functional Structures: A Review and Integration of Matrix Organization and Project Management"; Steurer's discussion of Integrated Product Teams (IPTs), "IPD and the Role of the Team Leader; and Benson's assessment of Self-Directed Work Teams (SDWTs), as depicted in his article entitled "Self-Directed Work Teams".

The first of these, Ford's discussion of cross-functional organizations, is an analytical evaluation of the subject from an academic standpoint. The article evaluates the advantages and disadvantages of matrix and team structures and provides an excellent foundation to build a comparative analysis upon.

The second two selections, Steurer's discussion of IPTs and Benson's assessment of Self-Directed Work Teams focus on real world implementations of team structures. Data from Benson's SDWT discussion will be supplemented by additional information pertaining to SDWTs as presented in Caudron's article, "Are Self-Directed Teams Right for Your Company?".

Ford's article is based on a search of the literature related to matrix and project organizational structures published between 1976 and 1992. Ford found that the popularity of these forms of organizational structures have been steadily increasing during this sixteen year time period. The data which Ford used in his article is generally empirically based and supported by input gained from practitioners of matrix and project organizations (Ford 268).

The use of SDWTs and IPTs has resulted in a significant improvement in the performance of some of the premier companies across the United States. For example, McDonnell Douglas Corporation's Aircraft Division has achieved a thirty three percent reduction in the number of parts required to build their newest fighter aircraft, the F/A-18E/F Hornet (Steurer 2); forty million dollars of cost reduction, fifty million

dollars of inventory reduction, and a fifty percent reduction in production cycle time have been achieved at Kodak as a result of SDWT performance (Cauldron 80); drastic decreases in rework resulting in decreased cost and improved quality have been achieved at Health Tecna (Benson 82); and several other major companies have credited the implementation of SDWTs with increases in productivity of up to fifty percent (80).

The improvements noted above are the results of a continuous transformation from the early matrix organization of the 1980s to today's team organizational form. The difference between the original matrix organizations of the 1970's, and the team structures that are being developed today, is that the original matrix structure kept in place the functional hierarchy and built the matrix around the projects. This role has now been reversed with the project portion of the matrix becoming the dominant factor. In addition, the early matrix organizations left the majority of the power with the functions and the decision making at the highest levels of that organization. This approach helped to increase horizontal communications, but did not eliminate the walls that existed between the functions. The result

was a strong functional organization which supported different projects (Byrne 79).

Ford's definition of matrix structures clarifies the matrix approach. He states that a matrix organization is,

> any organization that employs a multiple command system that includes not only a multiple command structure but also related support mechanisms and an associated organizational culture and behavior patterns. (269)

Furthermore, Ford provides a caveat relating to the transitional nature of matrix and project structures. He highlights this fact in the following quote, "The matrix and project organizations bring individuals of different functional backgrounds together, on a temporary basis, to achieve a common goal" (270). Matrix and team organizations are focused on specific projects and scheduled to be completed within some defined time, cost, and performance standard. Ford's definition and his further amplifying caveat provides a strong correlation to the "team" concept of the 1990s, as exemplified in discussions of Steurer and Benson (270).

The following definitions of Integrated Product Teams (IPT), and Self-Directed Work Team (SDWT) were provided by Steurer and Benson, respectively. IPTs are defined by Steurer as,

> cross functional teams formed for the specific purpose of delivering a product or managing a process for the customer; teams composed of people with complementary skills committed to a common purpose, performance goals, and approach for which they hold themselves mutually accountable. (2)

Benson defines SDWTs as, "an autonomous work groups responsible for the direction taken to accomplish a set goal" (79). An additional supporting comment related to SDWTs is provided by Cauldron,

> Teams performing process oriented work are inevitably self-directed. Within the boundaries of their obligation to the organization-agreed upon deadlines, goals, standards ... they decide how work gets done. (80)

Embedded in each of these definitions are the common themes of allocation of responsibility, commonality of goals, cross functional teamwork, and customer satisfaction. The similarity of content extends not only through these key selected pieces of

research literature, but through the majority of the pieces reviewed in chapter two.

The thought of a team organization is often received with skepticism due to the inaccurate preconceived notions of a large portion of the working population. Some common misconceptions about SDWTs were provided in Cauldron's article on SDWTs;

- Self directed teams do not need team leaders. The truth is that a SDWT needs some sort of leader, or coach. The leader's primary role is not to "run" the group, but to transition leadership responsibility to the other members of the group.
- Leaders lose too much power as a result of team participation. Leadership is not limited; the team leader should turn his or her efforts outward to pursuit of the elimination limiting boundaries, and should work toward improving coordination with management.
- Newly formed teams are automatically self-directing. Teams need to develop and grow

before they transition to being self-directed. Management coaching and support is required to nurture team development.

- Employees are waiting to be empowered. Not everyone welcomes empowerment. Consultants have estimated that up to thirty percent of working Americans do not want to be empowered; some prefer to be led and directed.
- Grouping employees together will result in teamwork. Team members need training and time before they begin to function as a team. (81)

As stated previously, the definitions of a matrix, IPT and SDWT all either, explicitly or implicitly, define the limitation in terms of time, or goal accomplishment, and are therefore temporary organizations. As such, a supporting organization or infrastructure is typically required to support staffing requirements. The supporting organization is typically functionally based, and supports the team organization by providing trained personnel. The existence of a functional organization and a team

organization creates a dual chain of command. The dual lines of reporting responsibilities create the single largest disadvantage of team and matrix organizations.

At McDonnell Douglas Aircraft-East (MDA-E), staffing of the IPT members is the responsibility of functional organizations. MDA-E maintains a traditional functional organization which acts as a core from which different programs draw support. The core departments are grouped into divisions. Departments which support the development and definition of a product, and its manufacturing approach, are grouped together and report to the Vice President of Integrated Product Definition. This recent change from MDA-E's past functional organization where engineering departments reported to the vice president of engineering and manufacturing departments reported to the vice president of manufacturing. The change in functional alignment was accomplished to gain consistency with the IPD philosophy grouping departments such as design, manufacturing engineering, and procurement into one organization (Steurer 2).

The staffing at Heath Tecna is accomplished in a similar manner. The members of the SDWT are assigned by their functional department managers. The SDWTs are

structured as a function of the task they are responsible for performing. Some of the production tasks which different teams are responsible for are; trimming, lay-up, and assembly (Benson 80).

Candidates for SDWT participation are screened for qualifications by the other team members. When an individual is being considered for team participation, the team members provide input during the selection process. Some of the attributes which the team members look for are: an acceptable skill set, good attitude, good communication capability and an affinity for teamwork. Likewise, if management is considering termination, the team participates as well (Benson 81).

A key element of the SDWTs and the IPTs is empowerment of the work force. The implementation of SDWTs and IPTs change the approach that employees must take in accomplishing tasks; it causes a fundamental rethinking of responsibilities. Team members are allowed and encouraged to make decisions on their own and the team member's roles transition from controlled to empowered (Cauldron 81).

At MDA-E the IPT is empowered to make decisions affecting their performance to plan and the technical performance of the product they are designing. This

approach is drastically different than that of the past when management dictated the majority of the decisions. The IPT leader is also tasked with teaching and empowering the members of their team (Steurer 2).

Both IPTs and SDWTs are focused at improving quality and customer satisfaction. Cauldron states that thirty eight percent of respondents to a survey on SDWTs stated that they incorporated SDWTs to improve the quality of their products (82). The increased quality focus through the incorporation of SDWTs at Health Tecna has resulted in a decrease in nonconformances from twenty four percent, to one percent, and reducing the scrap rate from ten percent to .02 percent (Benson 82). In addition to the quality benefits associated with SDWTs and presented by Cauldron and Benson, MDA-E's use of IPTs on the F/A-18E/F program has resulted in the incorporation of over 11,000 quality and product improvement ideas (Steurer 2).

A difference of note between the IPTs at MDA-E and the SDWTs at Health Tecna, or Kodak, is the task responsibility. MDA-E's IPTs are responsible for designing, tooling and planning parts of an aircraft, and as such, are part of the design and development

process. Heath Tecna's and Kodak's SDWTs are responsible for the production of products for market. The apparent success in both phases, development and production, of the product's life cycle lends credibility to the belief that product teams are effective regardless of the product's stage within its life cycle. The use of SDWTs is not limited to a production operation and can be of value in service industries. An example of how SDWTs can be used to improve customer satisfaction is included in Cauldron's article. Cauldron explained how the employees of the San Diego Zoo establish SDWTs to better evaluate how to improve the customer satisfaction of their patrons. The employees were grouped by area of the zoo and were allocated the responsibility for improving the customer satisfaction in their areas. By allowing the SDWTs the freedom to define the improvement approach, the overall customer satisfaction was markedly improved (Cauldron 78).

The success of SDWTs and IPTs is dependent on three factors; the organizational culture, the team dynamics, and the team leaders personal characteristics and attributes. The first of these factors, the organizational culture, refers to the nature of the

organization and the relationship of the organization's members. According to Ford, the organizational culture is the environment of beliefs, customs, knowledge, and adaptiveness. Companies with a progressive, adaptive nature are more willing to accept and embrace change and therefore are more conducive to team organizations. A company with a liberal progressive culture is less bureaucratic and rigid than typical corporations (Ford 282).

Both Heath Tecna and MDA have fairly adaptive and progressive organizational cultures, and in both cases represent companies who have evolved their organizational structure to its present state. The transition to the present state of the team structures at MDA-E and Health Tecna is a result of continuous organizational evolution.

Health Tecna's transition to team structures began in the mid 1980's with the incorporation of Quality Circles (QC). Heath Tecna's QCs had only limited success due the bureaucracy and the rigidness of their organization as it existed at that time. Their next stride toward SDWTs involved Employee Involvement Teams (EITs). The EITs were devised to increase the participation and involvement of the employees, the

employee's morale and motivation, and the product's end quality. The major difference between the QCs and the EITs was the level of authority and empowerment. When compared to the QCs, the employees in the EITs had a higher level of authority and influence when making decisions. The transition form EITs to SDWTs occurred in 1992 and allowed an even greater level of autonomy and authority to the individual teams (Benson 79-80).

MDA-E's transition to team organizations was similar to the evolution which took place at Heath Tecna. The transition began in the early 1980s with the implemen-tation of an initiative called the Peoples Express Program (PEP). PEP was initially implemented in MDA-E's product support division and quickly spread to the manufacturing division. PEP's goal was to get additional employee involvement in the suggestion of product improvements. The PEP program died due to lack of management commitment and was replaced with Quality Control Circles (QCs). QCs were implemented at MDA-E in the mid 1980s in support of the Total Quality Management (TQM) initiatives. The QCs also had limited success and gave way to an early form of product based teams in the early 1990s. This first attempt at IPTs was only partially successful due to the strong

functional affiliation of the team members. The downfall of MDA-E's initial attempt at IPT implementation was due to the overly dominant functional affiliation of the team members. The early IPTs were basically groups of functional representatives who were assigned to a product. The functional organizations owned the team member's budgets and performed the merit reviews.

Both Health Tecna's and MDA-E's adaptive nature and continuous organizational evolutions are indicative of companies who have attempted to adapt to changing business and economic environments.

The second factor, team dynamics, refers to the degree to which team members are treated as equals, and the relationship between the members. If all members of the team act as, and are treated as equals, the greater the chance for enhanced performance and overall team success. A true cross-functional team is participative in nature and allows all team members free and equal access to information (Ford 285).

Another aspect which effects the team dynamics is team longevity. Ford found that the longer a team stays together, the more the team members rely on one another. This mutual reliance promotes commonality of

goals and increases interdependency. In a study of thirty two project/team groups, it was found that group cohesiveness, innovation, and job satisfaction have positive correlation with group performance (285).

Optimum team performance, be it a SDWT, an IPT, or a matrix is achieved when all of the team members are focused on the end product. Operating as a team involves getting all of the team members to view the team's tasks as part of an overall business system. Viewing their task in this manner increases the probability that the linkage between dependent tasks will appear as if they were seamless. A seamless series of operations minimizes the interdependency between each individual operation thereby eliminating the waste associated with task hand-offs.

The third attribute which impacts team performance is team leader's character and capabilities. Ford believes that the personal traits of the team leader is one of the single most important factors affecting teamwork, cohesiveness and overall team success. The team leader must; resolve problems due to the team member's dual reporting lines, balance the need of the individuals and the needs of the organization or team, and resolve the political conflicts as a result of

shared resources. In all cases the team leader is one of the primary driving forces in team success (Ford 285).

Ford categorizes team leadership traits or skills under four categories of competency; technical, administrative, communication and political skills. Technical skills are required to maintain technical excellence in the many differing situations which arise in a team environment. Administrative skills refer to staffing, planning and executing to plan. And, communication and political skills involve being able to gain and retain support for the team, and to communicate the team leaders vision internally and externally (Ford 288).

Heath Tecna and MDA-E's vision of team leadership support Ford's assertions related to the importance of team leaders. A common theme through Steurer's and Benson's discussions involves leadership, empowerment and the acceptance of responsibility. Some of the responsibilities and expectations of team leaders at MDA-E and Heath Tecna follows.

MDA-E's IPT Leaders are responsible for the overall management of the team's activities; these include schedule and cost accountability, technical

performance, employee merit review assessments, and promotion recommendations. The Team Leaders act as managers, mentors and coaches. These roles represent a significant change from the traditional method of operations for McDonnell Douglas Aircraft (Steurer 3).

Steurer believes that a Team Leader must:

- Take time to instruct and train the team members.
- Develop, communicate, and ensure the achievement of the overall business plan.
- Guide the team members in the implementation of the business plan for their team.
- Encourage the team members to make decisions.
- Concentrate on solving issues, not assigning blame.
- Give and receive feedback.
- Create a positive environment in which all team members are valued. (4)

Heath Tecna's SDWT Team Leaders act as a role models and motivators, with responsibility for

resolving disputes, signing time cards, maintaining vacation schedules, measuring performance, performing and liaison activities between the SDWT and management. They are also responsible for handling safety issues, tooling, manufacturing planning and scheduling. Through training and education, Heath Tecna was able to empower and teach all of the team members that they are leaders and are capable of providing direction. Heath Tecna's SDWTs function as a unit and the team assumes total responsibility for their actions (Benson 81-82).

As reflected in Steurer and Benson, IPTs and SDWTs structures are based upon empowering team members, sharing and allocating responsibility, improving communications, and focusing on improved customer satisfaction. The results achieved at MDA-E and Heath Tecna support their continued application.

Chapter IV

RESULTS

The results noted in the three primary selected pieces of research examined in Chapter III reveal that the use of Integrated Product Teams and Self-Directed Work Teams have a positives effect on personnel, team, and company performance. As previously stated, MDA-E's implementation of IPTs is focused on the design and definition of a product, while Heath Tecna's SDWTs are responsible for the production of a product. The different responsibilities of the MDA-E's IPTs and Heath Tecna's SDWTs require that a different set of metrics be used to determine positive or negative performance trends.

Some key qualitative measures dealing with issues such as morale are applicable to both the product design and development phase, and the product build phase. Other metrics such as the quality of a drawing and the development of a design which meets a performance specification, are only applicable to the design and development phase. Likewise, metrics dealing with production such as, production quality,

and meeting production budgets and schedules are applicable to only the production phase. The relevant qualitative metrics which are discussed in Steurer's, Benson's and Ford's writings will be covered first. The quantitative metrics dealing with IPTs and SDWTs at MDA-E and Heath Tecna will be covered second.

Qualitative Results

Steurer, Benson and Ford all stated stated that improvements in qualitative performance measures were seen as a result of the implementation of team organizations. Ford's discussion included analytical data which support the results noted in Steurer and Benson. Table 1 summarizes the qualitative benefits noted in each of three selected pieces of research.

As noted in Table 1, all three of the selected works include data supporting improvements in the qualitative performance areas noted. The categories of the table where improvement is not noted; for example, Steurer's article and employee satisfaction category means that the item was not specifically addressed in the article, not that there was no improvement in that specific area of measure. On the contrary, the

measures noted in Table 1 are typically supportive of each other.

Table 1

Performance Improvement Due to Team Structures

	MDA-E's IPTs	Heath Tecna's SDWTs	Ford's Matrix & Team Structures
Communication	Improved	Improved	Improved
Morale	Improved	Improved	Improved
Worker Satisfaction		Improved	Improved
Career Growth	Improved		Improved
Employee Participation		Improved	Improved
Customer Satisfaction	Improved	Improved	Improved
Productivity	Improved	Improved	Improved

Improvement in these areas will generally result in improved company performance, but establishment of a scientific causal relationship can not be developed without dependent and independent variable analysis. Other factors such as: economics, business base

adjustments, and market changes could over-shadow the effects of improvement in these qualitative measures.

Quantitative Results

Qualitative metrics for determining performance in the development of a product's design involves assessing the quality as related to drawing defects or deficiencies, and the ability of the design to perform as intended. A measure of drawing quality used by MDA-E on its aircraft development programs is the number of changes per released drawing. Figure 3 shows a comparison of the number of drawing changes, or revision, for three MDA-E aircraft programs.

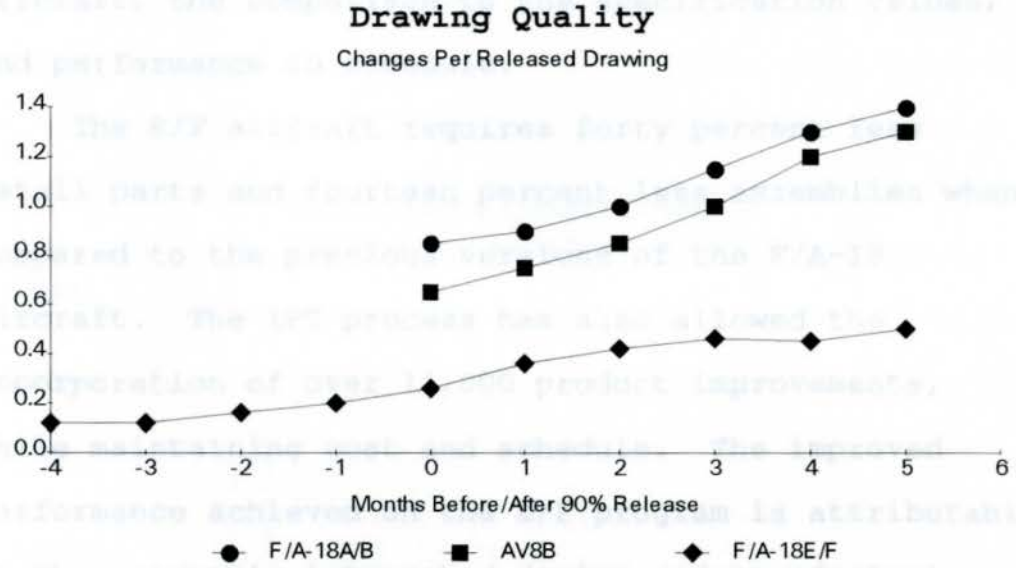
Development of the F/A-18A/B Hornet and the AV8B Harrier took place in the mid 1970s and early 1980s, respectively. The E/F version of the F/A-18 aircraft was begun in 1992 and is on-going. Both the AV8B and the F/A-18A/B programs utilized strong functionally based organizational structures, while the E/F utilizes IPTs.

A significant point for comparison is ninety percent drawing release. At ninety percent release,

manufacture of the first set of parts is well underway, and all major design decisions have been made.

Figure 3

Drawing Quality Comparison



Source: MDA-E, F/A-18E/F Drawing Quality Report, February 1995 McDonnell Douglas Aircraft-East.

As shown, the F/A-18A/B program had the highest rate of change, followed by the AV8B and the F/A-18E/F. The F/A-18E/F's rate of change is less than one half of that of the other two programs. The lower change rate is expected to improve performance to schedule and

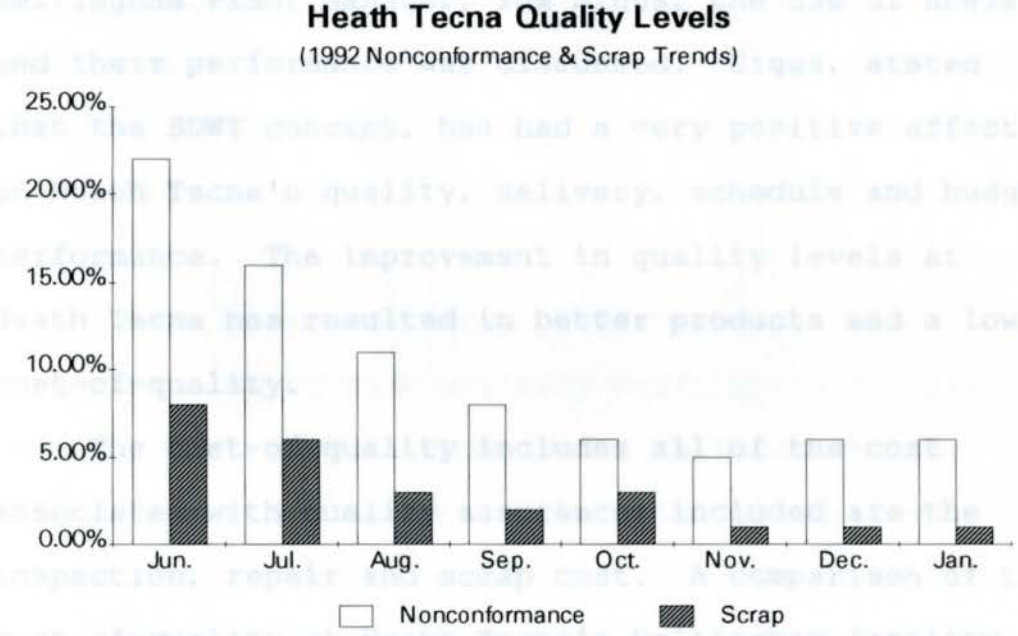
ultimately improve the finished quality of the product (MDA-E E/F Drawing Quality ...9-10). Other metrics which MDA-E uses for determining the quality of design and development efforts are the number of parts and assemblies required to fabricate and assemble an aircraft, the comparison to the specification values, and performance to schedule.

The E/F aircraft requires forty percent less detail parts and fourteen percent less assemblies when compared to the previous versions of the F/A-18 aircraft. The IPT process has also allowed the incorporation of over 11,000 product improvements, while maintaining cost and schedule. The improved performance achieved on the E/F program is attributable to the program's integrated design and manufacturing activities efforts and the use of IPTs (Steurer 2).

As stated, the metrics which are used to determine performance for design and development, and production can be different. Heath Tecna's SDWTs are responsible for completing tasks associated with producing a product. Heath Tecna uses quality, schedule, budget, and customer satisfaction as performance metrics. A primary benefit associated with team organization is the improvement in quality levels. Heath Tecna

implemented SDWTs in 1991 and has used scrap and nonconformance rates to measure quality levels. After the implementation of SDWTs, Heath Tecna was able to achieve drastic improvements in both of these measures. As depicted in Figure 4, their nonconformance rates have dropped from over twenty percent to a low of six

Figure 4



Source: Production & Inventory Management Journal, 1994, Vol. 35, Issue 2. As cited in "Self-Directed Work Teams" by Benson, John et. al..

percent in just eight months. The scrap rates have also shown a similar decrease dropping from eight percent to one percent. As a point of reference, the industry average for nonconformance is ten percent. Benson believes that the improvement in nonconformance and scrap rates noted in Figure 4 are directly related to the implementation of the SDWTs (82).

In a telephone interview with Heath Tecna's Bellingham Plant Manager, Tom Higgs, the use of SDWTs and their performance was discussed. Higgs, stated that the SDWT concept, has had a very positive affect on Heath Tecna's quality, delivery, schedule and budget performance. The improvement in quality levels at Heath Tecna has resulted in better products and a lower cost-of-quality.

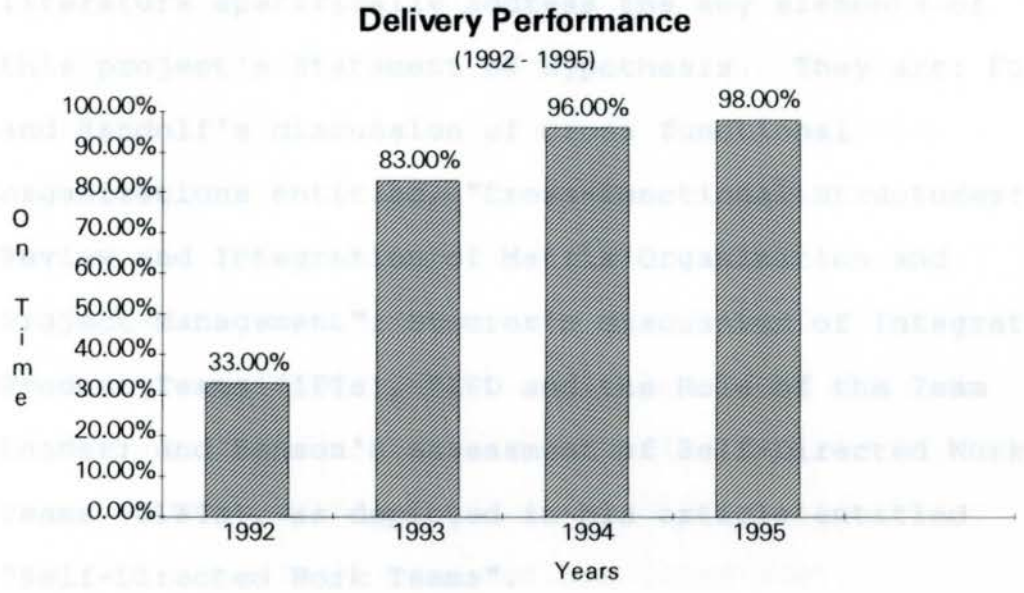
The cost-of-quality includes all of the cost associated with quality assurance; included are the inspection, repair and scrap cost. A comparison of the cost-of-quality at Heath Tecna's Bellingham facility and Heath Tecna's Kent Structures plant in Kent Washington reveals that the Bellingham plant's cost-of-quality is only a fraction of that at Kent Structures. Higgs credits the SDWT concept with the noted improvement in the cost-of-quality (Higgs).

The primary differences between these two facilities is their organizational structure, the use of teams, and the approach to inspection and quality assurance. The Kent Structures plant is organized in a functional manner with departments and a traditional production hierarchy. Training at the Kent facility is on-the-job and inspection operations are accomplished by inspectors after parts are completed. In contrast, the Bellingham plant uses SDWTs, the organization is flatter with fewer layers of management and each worker receives several hundred hours of formal training, and the workers monitor the quality of their own products (Higgs).

Heath Tecna's delivery performance has also improved. The on-time delivery performance for 1992 through March 1995 is shown below in Figure 5. As noted, there is a marked increase in the on-time delivery since the implementation of SDWT in 1992. Higgs estimates that the on time delivery percentage for 1995 will continue at or above the present rate of 98 percent. In addition to dramatic improvements in delivery performance, the performance to budget, or cost, has also improved. According to Higgs,

there has been a significant and steady improvement in direct labor budget performance since we implemented SDWTs in 1992. All of the programs presently at Heath Tecna or on, or below, their allocated budgets.

Figure 5



Source: Tom Higgs, Heath Tecna, Production Operation Manager Interview, March 1995..

The qualitative metrics expressed in Ford, Steurer and Benson, and the and quantitative results noted at MDA-E and Heath Tecna are positive in nature and supportive of the hypothesis noted in Chapter II.

Chapter V

DISCUSSION

Summary

From the research cited in this project and the substantial body of additional research evaluated, it can be concluded that team and matrix organizational structures generally improve performance. Specifically noted are three pieces of research which support this assessment and are included within Chapter IV. The noted results of the three pieces of research are divided into two classifications of metrics; those which are qualitative and those that are quantitative. The results identified as being qualitative are somewhat intangible, difficult to measure, and are therefore subjective in nature. The quantitative performance metrics are measurable and can be associated with an increase or decrease in a numeric value.

Ford's discussion is academically based and analyzes the benefits and disadvantages of matrix and team organizational structures based on a comprehensive

literature review. Steurer's discussion of IPTs and Benson's discussion of SDWTs presents data related to the actual implementation of the team concepts.

The quantitative metrics discussed in Chapter IV are: communication, morale, worker satisfaction, career growth, employee participation, customer satisfaction and productivity. All of these items are difficult to measure and assessment on performance is generally subjective. Improvement in almost all of these qualitative areas were claimed by Steurer and Benson. For example, Steurer and Benson believe that communication was improved through the use of IPTs and SDWTs. The improvement in communication is qualitative and subjective because there is no practical method to assess or rank an improvement in communication. When Steurer, Benson or Ford stated that team organizations enhance communication, and improved communication improve overall performance, they are making that statement based on observation and opinion. All of the qualitative metrics noted in Chapter IV are based on expert opinion which may or may not be correct.

Another one of the more difficult to assess qualitative metrics is worker morale. None of the three pieces of selected research attempted to

establish a scientific link between the team organization and the improvement in morale. A means of establishing a scientific linkage could have been through the use of a worker survey which evaluated morale before and after team implementation. In lieu of this scientific approach, all of the pertinent pieces of research made the assumption that there was a relationship between team organizations and worker morale, and that it was in fact positive.

The qualitative metrics referenced in Steurer which relate to IPT implementation are: drawing quality or changes per released drawing, number of parts, cost to design, and performance to schedule requirements. All of these showed either an improvement over the performance of past programs, or that the program goal was being met.

The drawing quality metric appears to be the most relevant to IPT performance at MDC. The data shows that the E/F program's drawing change rate is less than half of the F/A-18A/B or AV8B programs. The drawing change rate comparison is somewhat questionable due to the large time spans which separate the design of the three programs. The F/A-18A/B aircraft was designed in the mid 1970s and the AV8B in the mid 1980s. The F/A-

18E/F aircraft is being designed in the mid 1990s. The credibility of the comparison between programs whose designs are separated by ten and twenty years, and then crediting the improvement to the team concept is questionable. Other factors besides the organizational concept can impact program performance. For example, there have been significant advances in the design tools and techniques used in aerospace design over this time span. The improvement in drawing quality and the lower number of required changes could be at least in part attributable to these other advancements.

The second metric used to compare the effectiveness of the team concept is the number of parts required to build and assemble the aircraft. The E/F aircraft requires thirty three percent fewer parts when compared to the A/B model. A lesser number of parts generally equates to improved cost and quality. Considering the fact that the E/F is twenty five percent larger than the A/B aircraft, the lower number of parts does represent an improvement in the design. Steurer's belief is that the lower part count is due to the fact that a multi-disciplined team produced the E/F design. Other factors, in addition to the team concept, may have contributed to the lower number of

parts required. Some of these are design-for-manufacturing-and-assembly techniques and the application of advanced manufacturing initiatives. It is unknown how much of the improvement is solely attributable to the IPT concept.

The other qualitative results, noted in Chapter IV and relating to IPTs, are schedule, budget, and compliance to the design specification. As stated, the E/F program is on schedule, on cost and meeting the technical requirements. The question as to whether the IPTs are the cause of the superior performance, or a contributing factor is debatable. It is the opinion of the writer that in the use of IPTs during the F/A-18E/F design is one of many contributing factor toward improved performance

Another issue which impacts the results and the ability to objectively compare the three aircraft programs is the fact that the E/F aircraft is a derivative of the A/B aircraft design. The E/F design utilizes the same basic concept, technology, and configuration as the A/B aircraft. This fact alone may have had a greater impact than the implementation of IPTs.

When points of reference such as major aircraft development programs occur only once a decade, it is suspect that the individual programs can be compared and a specific attribute credited with the credit for driving the level of performance.

In the case of Benson's discussion of SDWTs at Heath Tecna, it is easier to draw a cause-and-effect relationship. Heath Tecna's SDWTs are responsible for completing specific activities in support of the production process. With discreet activities, it is easier to measure, assess and attribute performance improvement to the SDWTs concept.

As with MDC's IPTs, Heath Tecna uses quality as a performance metric. Within six months after SDWT implementation, the nonconformance rate dropped over seventy percent and the scrap rate dropped over eighty percent. The drastic change in quality levels, in such a short period after SDWTs implementation, implies a strong correlation between the SDWT concept and improved quality.

The second qualitative measure used is delivery performance. Heath Tecna's on-time delivery performance has jumped from a low of thirty three percent in 1992, shortly after SDWT implementation, to

a present high of ninety eight percent. Again, a scientific cause-and-effect relationship can not be explicitly stated, but is strongly implied.

Another comparison discussed in Chapter IV is between the Heath Tecna's Bellingham plant and their sister plant in Kent, Washington. The Bellingham plant uses the SDWT concept and focuses on formal worker training, while the Kent facility has a functional organization and traditional on-the-job training. The cost-of-quality at the Bellingham plant is only a fraction of that at the Kent plant. The better performance at Bellingham is probably a function of the combination of the following factors, an enhance focus on quality, the formal training, the worker self inspection process, and the team organization (Higgs).

After the implementation of team concepts at MDC and Heath Tecna, there was considerable performance improvement. The question as to whether the improved performance is a function of how people draw the organization chart, or other factors common to the team concept and philosophy such as; common goals, shared responsibilities, multi-disciplinary involvement, and an increased customer focus, is debatable. To establish the linkage between team organizations and

improved performance, there must be a belief in the implicit relationship between team organizations and the factors noted above.

Based on the data evaluated as part of this project and personal experience, it is the opinion of the author that these attributes are definitely related to the use of multi-disciplined teams and do in fact improve overall company performance.

The Statement of Hypothesis noted in Chapter II reads as follows,

> The ancillary attributes found in team organizations; common goals, decentralization of authority, shared responsibility, multi-disciplinary involvement, and an increased customer and quality focus are the stimulus for improved performance. As such, team structures generally lead to improved performance.

Team organizations inherently, by the nature of their operation, minimize data hand-offs, support shared goals and responsibilities, provide an opportunity to improve quality, and enhance the worker's ownership, and in doing so improve performance. Based on this belief and the data included throughout this writing, the Statement of Hypothesis is accepted.

Organizational change is ever present in companies which are growing and evolving. The move toward, or away from team and matrix organizations must be made based on the specifics on the individual company's product mix, competitive position and corporate culture. The team concept is not a short term fad; its a legitimate organizational concept and is supported by vast amounts of literature.

Limitations

There were two major limitations in conducting this research project. They are; the team concept is relatively new and the overwhelming desire is to claim that "new" equates to "good", and, the inability to establish a true scientific causal relationship between the implementation of team organizations and improved performance.

The first of these, the newness of the team concept, pertains to the fact that todays concept of a team organization; with its autonomous nature, accountability, responsibility and self direction, is relatively new. Classical management theory is almost 100 years old and started in the 1900s. The team

concept is a relatively new one, with its introduction occurring in the late 1970s. Today's modern team concept takes the 1970 concept and assigns a higher degree of authority and self-direction and is relatively young when compared to the evolution of management as a science. As an amplification to this point, over fifty nine percent of all SDWTs are less than one year old, and McDonnell Douglas's IPTs, in their present state, are only three years old. The young life of these organizational concepts raises two questions, "Can SDWTs and IPTs sustain the improved results noted herein?" and "Are the results professed in the literature tainted by human nature and the desire to be on the leading edge claiming only positive results?". Both of these questions are extremely difficult, if not impossible to answer. Only time will tell if the SDWT and IPT concepts can sustain the benefit claimed and achieved to date.

The second limitation is the lack of a true scientific causal relationship. Many external and internal factors can affect worker and company performance. External influences such as increased domestic and international competition, economic conditions, legislative and market changes, consumer

perceptions, and technology advancements can all have a drastic affect on a company's performance. Internal factors such as management philosophy and approach, union labor discontent, leadership and innovativeness, also impact a companies ability to perform. With all of these factors potentially impacting performance, the absolute affect of an organizational concepts cannot be discreetly segregated. The assessment of the benefits associated with team organizations is subjective. The implementation of a team concept can not be undertaken based on an economic break-even analysis. Justification for transitioning to a team concept must lie in the belief that the team concept, and the ancillary attributes thereof, will improve overall performance.

Suggestions for Future Research

This research project generally progressed per plan. The one change which would have increased the benefit and enhanced the results of the study is the increased use of interviews as a source of information. In the interview with Heath Tecna's Plant Manager, additional insight was provided above and beyond what

was noted in Benson's article on SDWTs. The interview process provided a means of additional information and allowed for questions and answers. Additional interviews with other individuals who are involved with team organization would have been helpful.

The possibilities for future research projects in the area of organizational trends, team and matrix structures is plentiful. An empirical study of any of the qualitative metrics such as, worker morale in a team environment, and as discussed in Chapter IV could be undertaken and of value to the researcher. This analysis could include development of a survey to statistically assess whether morale is in fact improved as a result of team implementation. The focus of a study of this sort would be on eliminating the subjectiveness of the qualitative metrics.

Further validation of the team and matrix concept could be achieved in a study of companies who have implemented team organization and the impact on their overall staffing levels. If team structures are more efficient, do companies reduce their staffing levels after the implementation of the team concept?

Additional research could be done to determine the effect of leadership and leadership traits, as related

to team success. Leadership is a key ingredient in a successful organization, regardless of the structure. The attributes and capabilities of the team leader can have a significant impact on performance and warrants further investigation.

Another area of potential investigation involves an assessment of the personality traits which support or detract from team participation. Are there basic personality types which better fit into a team organization, or are personality traits independent of team success? What are they? Can they be taught?

Another supporting area of investigation is team make-up. What are the benefits, if any, of having a diverse team make-up? Do racially, ethnically, experience, age, and gender mixed teams perform better than teams comprised of similar type individuals.

Results from any of these potential areas of investigation would be helpful in determining how best to achieve improved performance in an ever increasing competitive environment.

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