IMPLEMENTING CHANGE THROUGH A SUPPLIER EVALUATION PROCESS

By Nitida Wongthipkongka

Bachelor of Science Chemical Engineering, 2001
University of Illinois at Urbana-Champaign

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Signature of Author ________________________________ May 7, 2010

MIT Sloan School of Management and Department of Civil & Environmental Engineering

Certified by ________________________________

David Simchi-Levi, Thesis Advisor
Professor, Engineering Systems and Civil & Environmental Engineering
Co-Director, Leaders for Global Operations Program

Certified by ________________________________

Donald Rosenfield, Thesis Advisor
Senior Lecturer, MIT Sloan School of Management
Director, Leaders for Global Operations Program

Accepted by ________________________________

Daniele Veneziano
Chairman, Departmental Committee for Graduate Students

Accepted by ________________________________

Debbie Berechman
Executive Director, MBA Program, MIT Sloan School of Management
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ABSTRACT

With increased global competition, companies find that they must adjust and adapt to a supply chain model that incorporates more strategic suppliers. Pratt & Whitney, a division of United Technology Corporation, is no different as it seeks to streamline selection of suppliers to satisfy their business and manufacturing needs. In addition to improved product costs, low cost sourcing also expands its global footprint as emerging markets, such as China and India, continue to grow at phenomenal rates compared to Western markets.

This research focused on development of a supplier evaluation process for Pratt & Whitney to meet its business goals. This introduces a change to the way that the company has historically operated. The first focus is to understand how to implement change within the company setting by introducing a formal supplier evaluation process. The second is to understand develop and refine the process to be utilized within Pratt & Whitney.

This thesis focuses first on how to implement change within a company. The existing culture of the company must be evaluated to determine the approach to be taken. Within Pratt & Whitney’s culture, research indicates that support from management and key influential personnel within the company are critical in producing a true change in the way the company conducts itself. Three different case studies are discussed that highlight the impact of this support on the successful implementation of change within the corporation.

Secondly, this thesis researches the design and development of the supplier evaluation process. The most important aspect is to interview and listen to the needs of the customer. The success and failure of the system rests on being useful, intuitive, and simple. Through constant feedback, the tools were continually improved. In addition, information technology can be an enabler for business processes. With a well-designed system, IT can provide a secure, robust, scalable system for use in large corporations, like Pratt & Whitney.

Thesis Advisors:
Don Rosenfield, MIT Sloan School of Management
David Simchi-Levi, Department of Civil and Environmental Engineering
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CHAPTER 1: INTRODUCTION & PROBLEM STATEMENT

1.1 Introduction

This thesis is a joint effort between United Technologies Corporation (UTC), Pratt & Whitney (P&W) division, and the Leaders for Global Operations (LGO) program at the Massachusetts Institute of Technology (MIT). The data collection and research was conducted during a six month internship in the Strategic Sourcing group at Pratt & Whitney in East Hartford, CT. The main goal of the research is to help develop a supplier evaluation tool to help Pratt select lower-cost sources for outsourced manufacturing work in a consistent, quantitative process.

1.2 Problem Statement

Global sourcing, especially to lower-cost countries, is of concern to most corporations today to increase the company’s global footprint and to minimize manufacturing costs. United Technologies Corporation (UTC) has recently launched an initiative to significantly increase its spend with international suppliers, with a commitment to Wall Street from CEO, Louis Chêvront, to be at 35% by 2012. Pratt & Whitney, a division of UTC, is charged to meet an internal target to help achieve the corporate goal.¹

Pratt has been sourcing from international suppliers such as Western Europe, South Korea, and Singapore for some time. Within the past 20 years, Pratt has increased its focus on lower cost areas such as Eastern Europe, China, and Russia. However, the percentage of total spend in these countries has been minimal compared to other industries, such as the semiconductor industry. Aerospace has not ventured far from domestic suppliers mainly due to intellectual property to military export restrictions. This has resulted in a limited number of

qualified aerospace manufacturers internationally, especially in lower-cost sourcing (LCS) regions. Most aerospace companies now are pressing to expand into the LCS markets to take advantage of lower labor costs and to respond to the growing international demand for increased air travel in countries with rapid economic growth, such as China and India.

The corporate initiative, pressure to lower cost, and demands to expand internationally has challenged the strategic sourcing group within P&W to work more efficiently in identifying qualified suppliers. This prompts the need for a means to quickly evaluate suppliers for specific manufacturing work in a consistent, qualitative way to help make decisions in a timely manner. The goal of this project is to implement a tool for P&W to standardize the supplier selection process and to help the organization better understand the risks and gaps that it will encounter when engaging in business with a new or existing supplier. This tool is also an example of how P&W has to think and work differently in the new global environment to remain competitive.

This problem presents an opportunity for the company to change the way it works. In the past, some decisions were made in an ad-hoc way and information was sometimes not communicated in a timely manner. Often large organizations suffer from slow communication processes as groups are disjointed and groups are in information silos. However, this tool, as well as other process changes, in the sourcing decision will challenge employees to communicate and collaborate more than they have in the past. The company has been accustomed to having time to make decisions due to how slowly the industry moved in the past. However, P&W now finds that it needs to continuously have internal groups talking and debating to make decisions quickly. As the market continues to move faster every day, P&W is being forced to adapt itself to the new reality and must abandon some of the old ways of doing work to survive.

1.3 Research Methodology

Many sources were used for the data and support of this thesis. The most notable is the internship performed at United Technologies Corporation within the Pratt & Whitney Strategic
Sourcing group. Data was collected here by observing the culture within the organization and by actively trying to complete the project discussed in Section 1.2. Through interviews and observations, primary data was collected to support the thesis. In addition, secondary information was also gathered through a literature review that will be used throughout. This thesis focuses on the process of enacting change within an organization. In addition, the thesis also touches upon the design, development, and implementation of a tool to aid in the supplier selection process to help meet P&W’s immediate needs.

1.4 Thesis Outline

Chapter 2 – This chapter opens by introducing background information on supply chain and sourcing. Then the aerospace industry and the company are introduced. And finally, an introduction of the industry and company in regards to sourcing is discussed.

Chapter 3 – This chapter discusses some of the organizational structure of Pratt & Whitney and how this influences approaches to successfully implement change. A framework for analysis is introduced and applied specifically to the P&W culture.

Chapter 4 – This chapter applies the framework used in Chapter 3 to three case studies.

Chapter 5 – This chapter introduces the supplier evaluation process at Pratt & Whitney as well as the project history. Then the tactical approach to continue development of the tool is discussed.

Chapter 6 – This chapter outlines the actual details of the supplier evaluation tool. The main parts of the tool are the business evaluation, technical evaluation, and scoring. Then case studies are discussed outlining how the tool will be used.

Chapter 7 – This chapter discusses the development of the information technology (IT) system to implement the tool. First, the reasoning for the IT system is discussed. Then, the design of the system and usability purposes is described.

Chapter 8 – This chapter summarizes the findings of this research report as well as next steps for the project.
CHAPTER 2: BACKGROUND

2.1 Supply Chain and Sourcing

As noted by Fine, “supply chains are the next source of competitive advantage.”

Manufacturing has changed significantly in the past 20 years as corporations adopted outsourcing and lean manufacturing techniques to remain competitive. Full ownership and vertical integration has many risks and corporations have moved away from this strategy. Competitive pressure has pushed companies to view outsourcing as a “strategic necessity to preserve parity with competitors on cost and/or quality.” The biggest risk is that being broad in a number of competencies results in a loss of company focus and expertise and reduced available investment capital as assets are tied up in peripheral activities. These risks often result in loss of competitiveness in the new global market. Many companies have thus turned to outsourcing and other collaborative partnerships with suppliers to remain competitive and cost effective. Effective supply chains are now a necessity and a competitive advantage for many firms. However, as with other business tools, no two companies are identical and thus strategies for different companies cannot be exact duplicates of each other. It should also be noted that each firm must develop a global sourcing strategy that complements its own business needs and industry requirements.

An example of this management shift can be seen in the automobile industry. Twenty years ago, U.S. automakers were highly vertically integrated, maintained arms-length supplier relationships, and forced suppliers to compete for lowest cost. On the other hand, Japanese

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automakers utilized a multi-tiered supply base, and promoted communication and collaborative relationships using the principles of modern supply chain theory. As can be seen with the recent bankruptcy filings of U.S. automakers, General Motors and Chrysler, the former method is not competitive in today’s market. As Dyer argues, firms should increase their use of partnerships with supplier and decrease their vertical integration and arms-length supplier relationships. He notes that GM’s former supplier policy was outdated. Instead of being a strategic advantage, it actually served to be a “semi-disadvantage”. Today, virtual integration is replacing vertical integration. Therefore, a company’s strategy toward supplier relationships will play a critical role in its success or failure.

“The ultimate objective of global sourcing strategy is for the company to exploit its own and its suppliers’ competitive advantages and the comparative location advantages of various countries in the global competition.” It is well documented that purchasing is now a critical competency requiring cross-functional collaboration. As Kotabe notes, companies historically have competed on cost and delivery. But as sourcing has shifted from domestic to international suppliers, the risk level is heightened due to distance, cultural differences, experience levels, etc. Managers are thus investigating long-term commitments and partnerships to help hedge these risks and share the financial burden. If outsourcing and supplier collaboration is done well, a company, such as Toyota, or an industry, such as semiconductors, can benefit greatly from a manufacturing and logistics point of view. However, it will be seen that not all companies and industries share the same success. Developing and executing an effective plan is often difficult and painful.

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2.2 Aerospace Industry Overview & Sourcing Background

The aerospace industry is a slow clock speed industry and products have a life cycle of over 30 years. Clock speed is defined as the rate an industry evolves based on product, process or organizational change. The aerospace industry is a global economic force, yet manufacturing and aircraft sales are still dominated by the U.S. and Europe. In many ways, the power or influence structure is dictated by the hierarchy of the industry, which is represented in Figure 1. The figure also indicates the industry interaction. Players typically only interact with the level above and below itself. For example, a jet engine manufacturer typically interacts with airframers, other engine manufacturers, major sub-system suppliers, and tier-one suppliers.

![Basic Aerospace Supply Chain Pyramid](image)

**Figure 1 – Basic Aerospace Supply Chain Pyramid**

Another key to the dynamic is that the aerospace industry and the jet engine market both have a limited number of key players. A listing of major players can be seen in Table 1. This has obvious effects on interaction as the products are not commodities, like semi-conductors, and the

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barriers of entry are high. The high cost of development has prompted many of these players to form collaborative ventures to reduce risk and investment into new technology. This produces a complex web of competition where an ally on one engine is a competitor on another engine. Therefore, protection of intellectual property is of critical importance as all players diligently protect any competitive advantage.

**Airframers:**
- Boeing
- Airbus
- Lockheed
- BAE

**Engine Systems:**
- Pratt & Whitney Aircraft Engines
- General Electric Aircraft Engines
- Rolls Royce

**Major Sub-systems:**
- Carlyle Group
- BAE Systems
- Eaton
- Finmeccanica SpA
- Hamilton Sundstrand
- Kohlberg Kravis Roberts
- Goodrich
- Smiths Group
- Harris Corporation
- Thales
- Honeywell International
- Volvo Aero
- Parker Hannifin Corporation
- Rockwell Collins

**Table 1—Some Key Players in the Aerospace Industry**

Even though United Technologies Corporation has diversified investments in the aerospace and commercial markets, this research will focus on the jet engine manufacturer, Pratt & Whitney, as this is where the research was conducted. There are several players in the jet engine market. However, there are three dominant players: General Electric, Pratt & Whitey, and Rolls-Royce (in order of market share). Within the aerospace industry, there are typically three categories of the business: commercial, military, and space. Figure 3 is a representation of the breakdown. The commercial side typically has higher volumes, but since the deregulation of the airline industry in the 1970s has become much more cost competitive. The military side is lower

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volume, but is greatly beneficial for a company due to the amount of intellectual property (IP) produced and the steadier volume compared to the commercial business. Space is a relatively small part of the game. There is typically some, if not complete, intermingling of the two businesses in terms of manufacturing. The U.S. government has restrictive conditions placed on where military parts can be sourced and by whom they can be sourced. This can often cause logistical difficulties in determining what international supplier can be utilized for parts.

Figure 3- U.S. Aerospace Industry Structure

In the past, the aerospace industry has had limited exposure to manufacturing outside of the United States. This has primarily stemmed from several reasons as explained by Bedier, et al. The first reason is the high regulatory, quality, and safety requirements which produces high

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barriers for entry. The second is the technology and monetary investment involved in producing a jet engine. In general, aerospace is considered a slow clock speed industry and thus changes take a long time to implement as some engine programs are in existence for over 30 years. The technology used to produce a jet engine is complex and it takes a new manufacturer a long time to gain the experience needed to be competitive. Another reason is the intimate bond between commercial and military divisions and the restrictions imposed by military contracts as discussed earlier. And a fourth reason is the relative low product volume and high customization required. It makes it difficult for a new entrant to be successful. These reasons have kept the aerospace manufacturing mainly in the United States. Even though global manufacturing has existed for over 20 years, aerospace companies spend in the United States is approximately 80-100%.

There is no doubt that the aerospace industry’s push into emerging markets has been slow and most experts note that “the industry’s globalization remains in its infancy”. It is documented that there has been increased expansion into the global arena in order to maintain profitability as competition increases and globalization occurs. One main driver often cited is to take advantage of lower-labor markets. However, this benefit is only temporary as the emerging market develops and labor rates rise. The bigger driver is the potential for immense growth prediction in markets such as China and India as the middle class grows and income levels rise.

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Aerospace is currently one of, and will become even more so in the future, the most international sectors.\textsuperscript{19}

\textbf{2.3 Company Background}

United Technologies Corporation, UTC, was originally a company called United Aircraft which was founded in 1934 by the legislatively mandated break-up of a larger conglomerate at the time. United Aircraft concentrated mainly in aerospace and the defense industries until the 1970s. Up until this point, Pratt & Whitney, the main focus of this thesis, was a noticeable majority of the corporation’s earnings. By the end of the 1970s, UTC had diversified its portfolio by acquiring commercial elevator and refrigeration companies. The two major parts of the corporation today are aerospace and commercial. UTC prides itself on its diversified portfolio which has allowed it to perform in most markets as the cycles of the different divisions often balance each other. Today, UTC is comprised of seven major divisions: Carrier, Hamilton Sundstrand, Otis, Pratt & Whitney, Sikorsky, UTC Fire & Security, and UTC Power. Pratt & Whitney represented 22% of the corporation’s revenues in 2008.

Pratt & Whitney was founded in 1925 and dominated aircraft engines in the 1930s with piston-driven aircraft engines then maintained the position during the switch to jet engines in the 1950s. This position was upheld through production of various commercial (i.e. Boeing 747 and 757) engines and military engines. Competition and regulation drove the industry into unchartered waters as once substantial margins ceased to exist. By the late 1980s, Pratt found that it was passed by General Electric and lost its lead position. In many ways, the management and employees at P&W had an epiphany that change was needed.\textsuperscript{20}


\textsuperscript{20} Pratt & Whitney – Company History. 16 July 2009. \textless http://www.fundinguniverse.com/company-histories/Pratt-amp;-Whitney-Company-History.html\textgreater
Due to the pressure to stay competitive, the company has had to since focus on implementing lean practices and other strategies to survive. This has involved aggressively pursuing outsourcing and off shoring opportunities to move from a vertically integrated enterprise to a virtually integrated one. In the late 1980s, the ratio of internal/external sourcing (make/buy ratio) was about 80/20. Today, that ratio has changed so that the internal/external ratio is now 20/80 by shifting to a supply chain model. This has introduced shifts in cultural norms and work practices. Even though the journey has lasted almost 20 years, most within the company would say that there are still plenty of opportunities for improvement. An added stress is the aging workforce on the brink of retirement. Management is presented with the challenge to transfer this knowledge to younger employees. However, the outlook is not grim. Management and most in the company are still optimistic that P&W will find a way to overcome these challenges and utilize its strengths to design and delivery a product that its customer wants and needs. An example of this focus on change is the implementation of UTC’s continuous improvement program, Achieving Competitive Excellence (ACE). This lean system is not only being emphasized for use on the shop floor, but it being applied in all aspects and in every business group within the company. In a world of uncertainty and change, P&W is another example of a company where it is trying to balance its history and culture of 85 years and adapt to the new global realities of doing business today to survive in the future.

2.4 History of Low Cost Sourcing at Pratt & Whitney

As an industry, aerospace has placed much emphasis on product costs due to increased commodity and labor pricing, increased transportation costs, and customer-demanded reductions. Researching other work done at UTC and peer companies, the concept of reducing price and maximizing annual part savings to suffice management and shareholders is evident. There are several ways to reduce costs. One commonly used practice is to utilize the supply chain model
and outsource production to suppliers. This enables a company to gain specialization and world-
class technology through a supplier, reduce operating costs and capital required, and allows a
company to focus on its core competencies rather than being spread too broadly. An added
benefit is that a company is able to share development risks with suppliers. However, the supply
chain model does introduce other risks such as quality and potential logistics issues with delivery
delays and stock-outs as the company no longer has full control of production.

In particular, the sourcing researched in this thesis focuses on lower-cost countries such
as China and India. It is no secret that all of the world governments and businesses are closely
watching developing countries as of late. In particular, the BRIC countries (Brazil, Russia, India,
and China) are of particular focus. However, due to the military restrictions of the aerospace
industry, there has also been much focus on countries such as Israel, Poland, and Turkey due the
less restrictive nature of military manufacturing in these countries versus Russia or China.
Another benefit not often mentioned outside of lower labor costs is the increased footprint by
outsourcing to these countries. By establishing relationships with suppliers, and often joint-
ventures and partner agreements, a company like P&W is able to increase its presence within
growing markets at a reduced cost and in with short lead times. As the economies and demand of
these countries grow, local governments expect and demand economic benefits by requiring
manufacturing within it borders. There is no doubt that these development countries will become
formidable forces that cannot be ignored. Fostering and establishing relationships in these key
markets will be critical to any company’s success.

Cost is typically a major concern for any corporation. The focus on cost has increased at
P&W as commodity prices have increased and customers continually pressure P&W to keep
product costs low. Therefore, P&W must closely monitor and control costs, including value-
added labor, which can be a large expense. In addition, there has been an increase in competition
as new players have entered the industry and existing players broaden their businesses to capture
more of the value chain. For example, P&W is expanding into other areas of the Aerospace
Supply Chain pyramid presented in Figure 1 by producing parts that Tier 1 suppliers may have historically provided. All of these factors contribute to the increased focus on cost and delivering maximum profits for the corporation.

Global Strategic Sourcing at Pratt & Whitney has existed in some form for decades. The Canadian part of the P&W, Pratt Canada, has owned a joint venture (JV) in Poland for some time P&W has also been involved in a JV in China for more than 10 years. Typically, the company historically employed partner agreements with risk and reward sharing. Within the aerospace industry, the total amount of international sourcing is still small, typically between 10-20%. It has only been recently that there has been an aggressive push to increase this percentage as many international suppliers offer lower labor costs as well as the increased global customer base with increased air travel in developing countries. There are three main reasons that international expansion is important. The first reason is the war on cost and attempt to make step changes in part cost. Customers demand lower cost for new engines as well as lower prices for replacement costs. As commodity and labor prices rise, companies must find ways to control costs. The war on cost has been ongoing for years and there is always a strong emphasis on sustaining or lowering product costs in not only aerospace, but all industries. The second reason is spectrum of relationships with incumbent and domestic suppliers. Some relationships have prospered and have evolved into highly collaborative partnerships. However, there are suppliers where the relationship is strained due to various reasons such as disputes over pricing, quality issues, etc. P&W has found that it sometimes finds that needs to find alternatives for these suppliers. And with strained relationships, the cost to maintain these ties may be excessively high. In addition, P&W has found that it sometimes only has one source for a part and this leaves it at a disadvantage during contract negotiations. Therefore, low cost sourcing also provides the company an ability to develop alternative suppliers, which in turn gives it more leverage in contract negotiations moving forward with its supply base. The last reason, and probably most important reason, has already been touched upon earlier about expanding the global footprint to
take advantage of growth in emerging markets. A significant number of images and verbal
messages in the 2008 UTC annual report emphasize the global scope of the corporation, and in
particular in China. The management of UTC and P&W are setting its eyes on being successful
in these markets. Part of operating there means manufacturing and sourcing from these locations.
In addition, the greatest growth markets for jet engines is countries like India and China. There is
thus a push to invest heavily in these emerging markets as investing in the local economy will
help build relationships with the governments and corporations.

2.6 Addressing Supplier Risk

By embarking on supplier relationships, a company is always taking on additional risk as
it relinquishes some control of its supply chain to suppliers. In the late 1980s, Pratt & Whitney
still directly produced most of its parts. However in the past 20 years, P&W had made significant
changes to rely more on suppliers for production and has an array of relationships that range from
arms-length to highly collaborative relationships.

There is additional risk to relying on international, lower-cost suppliers. The main risk is
compromised quality, especially with new, unproven suppliers. P&W has mainly focused on
developing joint ventures and partnerships to mitigate this risk. With these stronger relationships,
P&W is incentivized to share its knowledge and has deeper access into production and inspection
procedures. However, in the future, P&W will also need to utilize some arms-length supplier
relationships as well. P&W has already learned how to segment its suppliers to mitigate this risk
through its experiences with domestic suppliers. Traditionally, more critical, complex parts are
awarded to partners to ensure quality and protection of intellectual property rights. P&W will
utilize this same methodology as it expands production internationally by utilizing its experience
with domestic suppliers in the past. In addition to quality risk, supply chain or logistics risk is
introduced, as there may be longer lead times for production and shipment and parts will be
moving in and out of more countries.
In addition to the two risks mentioned above, there is financial risk associated with supplier relationships. P&W will perform due diligence to attempt to mitigate this risk. However, most suppliers are not willing to share detailed information. The use of joint venture and partnership relationships may help make financials more transparent. However, P&W will need to closely monitor financial risks as relationships develop in the future and credit history is gathered over time. Therefore, P&W will have to actively monitor and mitigate the additional financial, quality, and supply chain risk introduced by developing more relationships with these less established suppliers.

2.6 Organization of Strategic Sourcing within P&W

The P&W Strategic Sourcing group, as it currently exists now, was established in late 2007. The personnel were formally reporting to different organizations and physically located throughout various parts of the facility. This new organization is tasked with transitioning work from an incumbent supplier to the more strategic and potentially lower-cost regions. It should be noted that this group is separate from the traditional purchasing organization of buyers who run the day-to-day operations. This in itself has caused issues as the organizations find themselves in silos, or lack of communication between different groups within the organization. However, the problem has been recognized by upper management and is being addressed by promotion of collaborative projects and decisions. There is no doubt that a new process is being established and that the learning process is constantly changing the way things are done as roles and responsibilities are being established.

Within the Strategic Sourcing group, there are two main groups: Program Management (PM) and the Technical Team (TT). The program managers are charged with project management and the strategic focus of transitions, working mainly on the front end process to determine where parts are placed, and overseeing the project management throughout the process. The Technical Team’s role is mainly focused being tactical and on executing the transition itself.
Its main purpose is to provide guidance to the new suppliers to help bridge the technical gap that
the supplier may have and manages the process of gaining approvals from various stakeholders
until the new supplier is fully qualified and delivering parts. These two groups have faced
communication challenges as they are organizationally separated, report to different middle
managers, and were, until July 2009, located in two physically different locations. Much work is
being done by management to bridge these gaps and foster better communication. However, at
the time of this research, the strategic sourcing team suffered similar work process difficulties and
unclear roles and responsibilities as seen between purchasing and the sourcing team as each
worked in a silo, or slight isolation from other groups.

The reason for the separation, or slight isolation, of each group stems from the fact that
the skills needed for transitioning parts to new suppliers is not formally developed in the
organization. By concentrating the personnel together, the skill set will be developed and shared
amongst individuals with similar job functions. More than 50% of the organization has less than
2 years of experience in sourcing. By concentrating them within an organization, learning and
teaching by proximity occurs. If the personnel remained decentralized, each individual would
continue to struggle and could not easily access the necessary resources and/or knowledge. As
these competencies develop and roles and responsibilities are better defined, a change in
organizational structure can be considered. Skills development is necessary for the overall
Strategic Sourcing team as well as within the project management and technical groups.

It is widely accepted that the Strategic Sourcing group is still on a journey to maturity.
Outside of time, there are two activities in particular that will help aid this process. The first is
the development and implementation of a new Transition Standard Work (TSW). This is a
mapped and gated process with roles and responsibilities for all stakeholders in the transition
process. TSW will make the process clearer with instructions and expectations for all aspects of
the process. However, the current version of TSW has only been in place for a few months and is
constantly evolving and improving. With management support, TSW aids in ensuring that
relevant stakeholders are engaged at the appropriate stages of the process. The second activity is cross training of various members within the Strategic Sourcing group. Many of the technical team has become involved in the program management side and vice versa. This helps members of the organization understand the responsibilities and impact of others to the transition.

2.7 Chapter Summary

This chapter provides background information for the thesis research. First, a brief summary of the widespread adoption of supply chain is explained in the past 20 years. The shift from vertical integration to a supply base has many benefits such as risk sharing and concentration of competencies. Then the slow-clock speed aerospace industry is introduced. In particular, the history of international sourcing and how the dynamics of strong domestic manufacturing preference in the past has impacted the industry. Then the company, UTC and Pratt & Whitney, is discussed. Background is provided into the new sourcing organization that was formed less than two years ago and the setting for the research and change is explained.

CHAPTER 3: ORGANIZATIONAL DESIGN AND CHANGE

3.1 Basics of Organizational Design & Change

The structure of any organization affects the effectiveness of the organization to adapt and execute work. With large organizations, it must be recognized that organizational design is not often something that can be changed easily. “Culture is so stable and difficult to change because it represents the accumulated learning of a group—the ways of thinking, feeling, and perceiving the world that have made the group successful.” Pratt & Whitney, a company with over 80 years of history, is an example where a strong company culture already exists and change

must happen within this structure. It is not to be said that the cultural norms cannot be changed. However, these changes are a slow evolution through its more than 30,000 person workforce. As an executive was quoted in *True Change*, “If you really want to, you can really make a difference. But you have to understand the system. Then you have a chance to do what you really want.... You just have to figure out how to do it within the system.”

A challenge is a perfect opportunity to introduce change. For P&W, this challenge is to identify and expand to more strategic sources quickly. The organization is mandated to significantly increase the number of strategic sourcing suppliers in two short years necessitating a change in the way it works. It is during these types of challenges that the organization is often most willing to try new ideas and processes.

As noted by Klein, as counterintuitive as it may be, the organization’s culture is strength. Culture is a “residue of past successes” Kotter recommends building on cultural strengths rather than focusing on cultural elements that are weaknesses. It is a lever that must be utilized to initiate change. However, change cannot be pushed completely from top management down. There must be pockets of supporters, or insider-outsiders, who also believe in the change within the organization to truly enable it to happen. The first step to change is to understand the organization. Klein offers a framework to evaluate a corporation and will be discussed in the next section.

P&W is a company where experience and authority are still highly valued. This may be heavily influenced by the military affiliation as team leadership there often refers to people in command showing the way. Therefore, a proposed change needs to be endorsed and supported by either upper management and/or experienced, respected individuals within the organization.

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The key to implement sustained change in this organization is to get this support and then prove that the change works.

### 3.2 How to Approach Change at P&W

The culture of a company dictates how things get done and how information is spread. It is essential to perform an analysis of the organizational interactions to facilitate change management. However, it should also be noted that no two companies are exactly alike. Even within a company, there may be distinctly different cultures between different groups or departments. Therefore, it is imperative to perform this organization analysis to best understand how to navigate company politics and increase the probability of producing true change.

P&W’s culture unique in many respects, but it shares similarities with other large, long-established, heavy industry companies like automakers. Using Klein’s framework to analyze P&W, the basis for legitimacy, relationships, and support must be understood in order for a change agent, or insider-outsider, to make an impact. A synopsis of this framework is below:

![Figure 4.1. Context for Pulling Change](image)

*Figure 4.1. Context for Pulling Change*

![Figure 5. Framework for Change](image)

*Figure 5- Framework for Change*

The basis for legitimacy is based on either data or experience. Due to the bureaucratic nature of P&W created by its history and military affiliation with the military, this pushes P&W toward the experience-based side of the framework. P&W culture also heavily relies on personal relationships.

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networks to navigate the organization, thus supporting the conclusion that it is an experience-based culture. Therefore, veterans and influential figures need to be sympathetic to the need for change and support the proposal. By identifying the key people who have the reputation and pull within the organization and gaining their support, a change will be considered and will gain attention.

The basis for relationships is critical at P&W. P&W is a combination of the two extremes of this spectrum. Networks are often the way information is disseminated within organizations. Throughout several interviews and through observations at P&W, the most effective way to get things done is through relationships. As in many large organizations, the use of formal communication methods does not often yield desired results as people are busy and their available time and attention is scarce. But the utilization of an informal connection through a phone call or email will readily speed up a response or decision within P&W. It should be noted relationships are an important way to get work accomplished in any large organization. Therefore there is strong support for lateral basis for relationships. However, P&W also values top-down initiatives. It has been observed on many occasions that decrees or requests from management cause the organization to stop in its tracks and change direction. As a large organization with military affiliation, this hierarchal basis for relationships is almost unavoidable. Therefore support from management and influential people are both necessary to pull change.

The basis for support in P&W is focused more on authorization rather than merit for this type of organization. Even if an idea proves itself useful, the support of an executive champion is useful.\(^27\) This support is needed for both ideas and people. This support does not need to be from an authority figure, but can be from an influential person. However, all ideas and proposals must be sanctioned, as people do not want to “go out on a limb” or perform “unproductive work”.

Therefore, the right people must show support of an idea for the organization to feel that it is worth working on.

In conclusion, the need for change in P&W comes from finding the right people to support an idea to give it legitimacy and direction. In addition, the “right people” can provide access to lines of communication that would otherwise be difficult to transverse. During an interview, it was noted that newcomers to the organization are like a small gear spinning quickly. As it tries to engage with the big gear, P&W, it finds itself in conflict with the slower moving gear. Until the small gear adjusts to the speed of the big gear, it will be frustrated. In order to make the big gear turn faster, mechanics need to be understood and legitimacy, relationships, and support are all things that can add grease to the wheel to get it to turn faster.

3.3 Task At Hand at P&W

The change at P&W that needs to occur is a shift in the way that P&W works to help the organization meet its international expansion goals. It is not so much the mechanics involved, but the cultural acceptance that the current process does not work and that the organization can adopt a new way to doing things successfully. P&W, like many other companies, often has the mentality that “this is the way we always have done things.” As Schein noted, companies have shared mental models. There is no better or worse culture except “in relation to what the organization is trying to do and what the environment in which it is operating allows.”28 For strategic sourcing in particular, it is accepting that the process to identify, plan, and implement transitions can be done at a faster pace compared to the past. In particular, cross-functional communication and collaboration is necessary to facilitate this change. Even though almost everyone within the organization accepts this fact, actions do not reflect this belief. Therefore,

P&W is charged with the challenge to change the way things are done and to adopt this change into standard practice.

3.4 Focal Point for Change

As stated in Section 3.1, a challenge that appears to be impossible to achieve is the opportunity to introduce change. The strategic sourcing decree presents the organization with a challenge to find new ways to do things. This type of challenge is often referred to in literature as a “burning platform”. As stressful as it may appear, Kotter notes that this “burning platform” or need for change may actually be required as it forces complacent or change resistant companies to act and adapt.29

Since the 1980s, Pratt & Whitney has experienced several of these “burning platforms” causing it to change. The first was the need to abandon its tradition of vertical integration and adopt the supply chain model to help focus its efforts and minimize costs. In addition, the company had to adopt lean manufacturing and standard work to streamline processes. Most interviewees note that P&W has learned and changed in many ways, but changing culture is not easy. However, P&W needs to understand how these changes were implemented in the past to understand how to implement a solution for the challenge at hand today.

3.5 Support from Case Studies

As discussed in this Chapter, it is noted that a clear understanding of the existing cultural is essential before embarking on any change. The framework presented in True Change, can be utilized to evaluate how to implement change necessary in the problem at P&W: changing the way that things are done. As a summary of Section 3.2, gaining support from the “right” people is the most important aspect of influencing change in P&W, an experience, hierarchical, and authoritative organization. The effects of varying support from management and influential

people can be seen by discussing three case studies within the company which are discussed in Chapter 4.

3.6 Chapter Summary

In this chapter, the idea of organization design and change is discussed. Specifically, the framework offered by Klein in True Change is explained. The basics of the framework center on evaluation of the basis for legitimacy, relationships, and support within an organization. As discussed in literature sources, the first step of change is to understand the underlying culture and how to go about proposing new change. From this chapter, it is seen that P&W is an experienced and relationship-based organization. In order to evoke major change within the organization, it needs a focal point for change with support from management and influential individuals to evoke successful change.

CHAPTER 4- CASE STUDIES & ANALYSIS

New systems can be viewed as a way to implement change in a corporation. In this chapter, three different types of change at Pratt & Whitney are discussed. These case studies will help to explain why some initiatives take-off and are incorporated into the daily life of the company while others remain a good idea with little traction on the road. As discussed in Chapter 3, it will be seen that the appropriate pulls of change are required to make change real.

4.1 Achieving Competitive Excellence (ACE)

As discussed in the Section 2.3, UTC and P&W was faced with the challenge to change its old manufacturing style to the new lean thinking revolution. The aerospace industry has been shielded from this pressure, as competition was limited to a small number of players. However, this is changing as new competitors are entering the market and changing the rules of the game. The corporation has adopted continuous improvement in pockets throughout the organization, but
concerted efforts to implement such a system were few in the past. This has been changing with examples such as the program known as Achieving Competitive Excellence (ACE).

ACE is a continuous improvement and lean program is often referred to as UTC’s “operating system”. The intention is for employees to work, live, and breathe the tenets of the philosophy every day. UTC is dedicated to implementing lean across all of its business processes, not just manufacturing. The system started at Pratt & Whitney in 1996 as a combination of the effort to improve quality and productivity. As discussed in the Company background, P&W recognized that it needed to change in the 1980s and realized that lean and productivity were a requirement to survive. The system slowly gained support through demonstrated improvements at the local level and management began to notice. By 1998, the system’s success reached corporate UTC. UTC executives then decided that the system should be applied across the corporation by 2003. Since then, the priority of the system has been highlighted in communication on all levels. It is so important that each person is expected to have ACE on their annual performance goals. UTC has not only made the program internally significant, but has communicated its important to market analysts. Every update involves reporting on the progress toward the whole organization achieving the highest level of standing, ACE Gold. In many ways, the acceptance and adoption of ACE is a change to be investigated as a success story within the organization.

ACE is an example of how gaining support from management and influential people can evoke change. The initiative started at Pratt & Whitney in 1996 was adopted by small groups of cells first. Support from management grew and success was communicated and noticed at higher and higher levels including executives in P&W that eventually became executives for UTC. It slowly gained favor amongst the management by being presented through influential and knowledgeable people until it became a corporate initiative in 2003. Today, ACE is a term used often, if not daily, by most employees and its physical presence is apparent in every part of the office and shops.
ACE is also an example of how the bureaucratic and hierarchal structure at P&W works. It is doubtful that the system would have been implemented enterprise-wide without support from the top down with milestones for the organization. Due to the silo nature of the corporation, the transfer of the system from one division to the other would have been difficult and momentum would have been difficult to gain. However, having influential people sell the concept to the upper management, change was seen. The momentum was gained through various levels of P&W with small successes. Then peers at the executive level communicated support and success of the program to peers at other divisions and at the corporate level. Once these managers agreed on the vision, the message was communicated back down to the lower levels of each division. In many ways, due to the bureaucratic and decentralized nature of UTC, this was necessary to make an enterprise-wide change. True change will have been implemented at the corporation as it continues its journey from mid-20th century to 21st century manufacturing when ACE becomes part of every employee’s daily work.

4.2 Supplier Evaluation Tool

The supplier evaluation tool, the purpose of this project, can be considered another change within the P&W organization. As discussed in Section 2.4, sourcing to some strategic countries is still in its infancy. In the past, a small group worked with the suppliers and there was limited documentation of the capabilities of some suppliers. For example, reports written by various personnel after a supplier visit were not stored in any central location and distribution was not wide-spread. Sourcing decisions were sometimes made informally where some stakeholders were consulted late in the decision-making process. In this informal process, decisions could be made without an advanced gated process that included all stakeholders. Therefore, the input from less experienced or soft-spoken members may not necessarily be heard or incorporated. This had lead to some non-ideal decisions in the past and the organization has suffered. There are some transition projects where the scope was not properly assessed upfront and the organization has to
struggle with resources to remedy the situation or has wasted time changing the sourcing decision. Overall, the penalty for this ad-hoc, informal process has been significant as it has resulted in frustration, confusion, and hours of rework and lost time.

It was recognized before this project that the process needed to be defined and standardized. As the number of transitions increases, the problems associated with this informal process will be exacerbated. Humans do not understand that they may be creating the instability in itself. Stepping back and approaching the problem from a system-level view is sometimes what is necessary to understand the problem. Previously, two key ingredients missing from P&W’s process were 1) documentation of the capabilities of suppliers; 2) qualitative data in the sourcing decision making process. Further details of the tool are discussed in Chapter 6. However, note that P&W, as an organization, needs to accept the need for change and find a way to change the process to meet its needs. At the time of this writing, P&W was working to find solutions to improve the process.

From the challenge presented to the organization from the CEO, sourcing personnel recognize the need to do things differently. Through interviews, there are a plethora of comments about miscommunication and a lack of understanding on how the process should work. The development and implementation of Transition Standard Work (TSW) discussed in Section 2.5 helps. The success of TSW was accomplished by having a handful of advocates who recognized the need and convinced management that the idea was worth investing in. Therefore, a team was charged with the task and the process was implemented. This again further emphasizes the framework and conclusions of Chapter 3 where support from management and influential people is necessary to successfully make a change.

The supplier selection process is probably the least developed part of TSW. For various reasons, no clear process was ever defined. As projects grew in size and scope, the need for

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timely and accurate supplier and technical information increased. Additionally, the need to make decisions quickly to develop a process to incorporate all pertinent inputs became apparent. The concept of a supplier evaluation tool was founded to help collect information about the suppliers and provide qualitative, consistent, and objective data to the team. In a world of limited resources and time, this streamlines the data collection process and allows for the focus to shift to the analysis of the decision.

However, throughout the design and development of the supplier evaluation tool, it has been difficult to gain the dedication of the group. There is an overall cursory support of the tool, but it has been difficult to get concrete help as the project is viewed as “lower” on the priority list. The project not been advocated by members of the organization whose opinions “carry weight”. In addition, management has expressed support, but the advocacy has been limited. These two points have resulted in lack luster support of the tool. In retrospect, if support from these two parties was gained and vocalized at the beginning, theory and the past experience indicates that the progress of the project would have been expedited. It should also be noted that with the support of management and a few influential people there has at least been notable progress, albeit slow, toward the direction of change.

4.3 Corporate Collaboration Project

The last case study looks at an internal example of where change has thus far failed to occur. UTC prides itself on its decentralized organization of its divisions. This means that each of its divisions runs its own P&L, has its own strong divisional culture, and some may say run as separate companies. Corporate UTC remains very small and typically only engages in areas where sharing or greater economics of scale benefits the whole like travel services. However, many years ago, UTC recognized that its aerospace divisions, roughly 40% of its revenue, could benefit from sharing information about international suppliers. As stated in Chapter 2, the aerospace industry internationally is still in its infancy. One division may have discovered a
promising supplier that could benefit its sister divisions. Therefore, a corporate collaboration project was launched to aid in this endeavor. One of the desired outputs was the sharing of information about suppliers that each division worked with and identification of suppliers that may be promising to one if not all of the divisions.

As with the other case studies discussed in this chapter, this was a change that most in the organization would agree was a good idea. However, the impact of this group has been limited and the visibility of the group has been minimal with divisional sourcing and purchasing personnel. In many ways, the group has not clearly conveyed its mission to the divisions. From interviews, some sourcing managers were not even aware that this group existed even though the mission of the group was to help them do their job.

Despite elevated priority from the 2012 goal, the group made slow progress in the six months of this research. An attempt was made to rectify this situation by gathering a group of representative stakeholders to brainstorm how to improve the situation in May 2009. Momentum and excitement was built at this meeting as participants saw the value of collaboration. However, in less than a month, the focus group members had lost connection with the cause and work stagnated. The corporate group failed to maintain interest from divisional management and influential people. In the past, no emphasis was given to the divisions to work with the corporate group. The group did not receive much response to requests for input and realized that it needed to work with divisional management to advertise its mission, elevate its importance, and convince divisions to engage. Until the key divisional people see value and voice support for the project, progress will be slow or non-existent as discussed in Section 3.2.

At the end of the internship, corporate management began to emphasize the main goals for the group. With this support and funding, the corporate group was able to successfully launch an IT project to consolidate information about suppliers with some support and input from the divisions. At the time of publication, an initial system was launched. Thus, the support of management was able to evoke the change to work as a corporation rather than as a division.
4.4 Chapter Summary

In this chapter, three case studies of organizational change within P&W are discussed. It is clear that a focal point or reason for change is always necessary. However, the first step to the change process is evaluating the existing culture and understanding how it works. As discussed in Chapter 3, support from management and influential people is necessary for successful change within P&W. The level of management and “key” support varied in the three cases presented and the success of the cases were drastically different. The first case of ACE with strong support has yielded results and is becoming part of daily work. On the other hand, the UTC collaboration case has limited support and has struggled for years.

CHAPTER 5- DEVELOPING A SUPPLIER EVALUATION TOOL

5.1 Making Decisions in the Past

The P&W process for sourcing decisions has never been documented. The method previously used at P&W involved an undefined process where a sourcing manager, purchasing manager, and executive would communicate about a specific list of parts and some suppliers to make a decision. A pictorial representation of the old process is below.
Many companies suffer from a sourcing process that was haphazard and ad-hoc at best as it learned by doing. As noted previously, there was no strict gated process to approve decisions. However, it should be noted that P&W never compromised quality and/or export requirements and followed its procurement manual. The sourcing organization before 2007 was not even a formal structure. Since then, roles and responsibilities are being defined and clarified. “Veterans” are accustomed to “just getting the job done” and are frustrated by the attempt to place rules around things that used to be “easy to do”. However, no one, including “veterans”, claims that the process was perfect. There are countless stories of miscommunication and confusion. With more players and actors in the process, these problems are only exacerbated. An added stress to this situation is that the sourcing organization now does not have time to fix problems and new members do not know where to find the resources. The group is tasked with aggressive timelines and is under the scrutiny of many within the company. Some of this scrutiny stems from headcount and resources that has been shifted away from other groups to strategic sourcing to support the effort.

Organizations are faced with challenges on a daily basis and often fire fighting methods are used to mitigate them. However, time will come when there will not be enough resources to

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put band-aids on the situation and the challenge will become "the important one". In this case, the sourcing decision process was not effective and sourcing managers had always found a way to get the work done. Now, with the magnitude and accelerated pace of the sourcing challenge, the source selection process must change since fire fighting methods are no longer acceptable to meet the business objectives. The organization now realizes that sometimes the suboptimal decision was made.

Now that it is clear that a process is required, the next question is why the data was inaccurate or incorrect. As noted in Section 2.5, there is no designated location for information about suppliers. Instead, the organization relied on specific personnel to understand the supplier (both work practices and capabilities). Therefore, in a meeting, certain sourcing managers would lobby for work to be placed into certain suppliers. As one can imagine, this introduced subjectivity into the process. Credibility, experience, personalities, etc. all influence the weight of a person's argument or support for one supplier. There were examples where senior or powerful managers could influence the group within certain boundaries. As Chang noted in her work at Honeywell, low cost sourcing decisions should not be made by emotions and/or objectives alone, but should consider other risk factors involved. Instead, “fact-based management means effective decisions are based on analysis of data and information rather than guesses or gut feelings." P&W needed to break this cycle of behavior in order to fix the process. Cost is not the only driver for decisions. The need to place projects into certain countries for strategic reasons also influences the final decision, hence subjectivity is introduced into the decision-making process.

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For organization to accept change, it must first realize that the current system does not work. "Socialization processes can easily keep people from being able to step back and be objective about why they do what they do. New employees are schooled in the company's standard operating procedures soon assume that is the way that the world works." 35 A catalyst for the realization that P&W needed to change this process was by the introduction of new members at an impressive speed. Since 2007, the organization has grown from a handful to almost 40 in number. Past behaviors are being challenged and a strong desire for improvement became evident, as newer members were frustrated. As noted by Klein, personalities of people directly involved can influence behavior and provides resistance to change. 36 This is especially true with some members who are "veterans" are resistant to a new way of doing things. The management has been working to change this mentality. At the time of this writing, a majority of the organization wants the change. However, wanting a change is not enough. The organization must act and work toward a change.

5.2 Reasoning for Supplier Evaluation

As literature states, "a company must identify, evaluate, rank, and manage its supply risk to thrive in today's economy." 37 There is no argument that a company needs to fully understand a situation before signing the agreement with new suppliers or engaging in more work with existing supplier. Especially with the financial crisis of 2008, it is imperative to understand whether a supplier is viable and reliability in the foreseeable future. A company also needs to understand if a supplier can perform reliably against its standards for quality, logistics, cost, and

innovativeness. Working with suppliers does bear cost in terms of developing and maintaining the relationship. Resources, such as money and time, are required to make the relationship work and thus the decision should be strategic and well-informed. In addition to resources, the cost of poor quality is estimated to be an average or 10-25 percent of sales, with cost of poor supplier quality being 25-70 percent of this. With the cost of expensive raw materials in the aerospace industry, the cost of a mistake and scrapping of a part is always significant.

One noticeable benefit of supplier evaluations is a clear understanding of where the supplier stands with the task at hand. As Gordon mentions, supplier development is defined as “a systematic effort to create and maintain a network of competent suppliers, and to improve various supplier capabilities that are necessary for the purchasing organization to meet its competitive challenges.” It is rare that an aerospace company will find a supplier who can instantly take a list of parts and produce it perfectly. Even with experienced suppliers, some guidance is needed. According to Kotabe and Murray, studies have shown that where to source seems less important than how to source due to operational issues that have occurred in the past. A sourcing manager is trying to identify the supplier that best fits the purposes of the project and then must identify a plan to bridge the gaps that are identified. The supplier evaluation is critical to providing this input early in the process.

Buyer-supplier relationships are critical to success for both sides and are unique to each circumstance. An important criterion for supplier selection is supplier willingness to integrate,

share knowledge, and invest financially. As supply chain management moves toward more integrated relationships and away from arms-length relationships, a willingness to work together is priceless. Expectations also need to be set. Supplier evaluations can be used a method to start conversations about what is expected to do business with the company. This is especially true for young, international suppliers with limited experience with large multinationals and/or the industry. “When evaluators were assessing the amount and type of technology required, it was not sufficient for the suppliers to have their own version of the “system” in place; the suppliers had to have “the” system as deemed appropriate by the customer.” Supplier evaluations help to assess all of these “soft” issues in addition to the data.

The argument for a supplier evaluation is strong. Literature also notes “selection of suppliers is one of the most important aspects that a firm must incorporate into their strategic processes.” Often the determination of how is do something is where organizations fails. “For true change to occur, the procedures and routines, both formal and informal, must be revamped” to properly reflect the new change. Therefore, in addition to gaining support for the idea, it is essential to develop and document the process and tools to be used in the new way to make sourcing decisions.

5.3 Journey at Pratt & Whitney

As mentioned, the Strategic Sourcing group has only existed for less than two years and is evolving. As part of this evolution, the need to develop a supplier evaluation process was identified. P&W thus partnered with MIT Leaders for Global Operations program on this project.

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The project was initiated in June 2008 with the first intern, Drew Corum. Corum worked to define the specifics of the project from a blank piece of paper. In his seven month internship, he was able to develop a questionnaire and process to meet the needs of the organization. The research of this thesis was then started and lasted another six months. The intent of the second half of the project was to finish development and then implement the process. The intent of this section is to explain the vision and methodology of the project as whole throughout the one year journey.

5.3.1 Overall Vision

As suggested from sourcing work at Boeing, “a tool should be useful for decision makers to clearly recognize and understand the reasons for each sourcing alternative.” This was the intent of the project at P&W. Below is a pictorial representation of the strategic sourcing tool.

Figure 7-Future State Map

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The figure helps to explain the intent of how the parts of the system interact. First, looking on the left side of the system, supplier data is collected and stored for future use. In the past, supplier information was disjointed in email and trip report files. The new system places the information in a centralized location. Both operational or business competencies (such as quality, logistics, experience, etc) and technical capabilities are recorded. Directly from this information, a “business” system evaluation can be seen through the supplier summary report.

On the right side of the figure, the connection is made between the capabilities of the supplier and the needs of P&W so a sourcing manager can see if a supplier has the technical knowledge necessary to deliver. For each set of parts to be moved, technical requirements are specified. A supplier must be able to meet all of the requirements in order to successfully produce this set of parts. A supplier’s documented capabilities (from the supplier evaluation) are then compared to these requirements. A supplier capability report and comparison report between the selected suppliers then allows the sourcing manager to see gaps and risks if the project if work was awarded to specific suppliers.

The overall goal of the tool is to provide guidance and data for the sourcing decision. It is not expected that the tool will output the final answer. There are other factors to be considered, most notably strategic reasoning for pursing a new supplier and/or region. However, the goal is that the data will force the decision makers to evaluate the risks and gaps associated with each option. An added benefit is the use of this information to help support planning and allocation of resources for the project.

5.3.2 Research Methodology for Supplier Evaluation Development

The DIVE method, a tool in the ACE system, was utilized for the development of this project. A pictorial representation is shown below with a brief summary of each step,
- **Define project**
  - Determine current state strategic sourcing process
  - Benchmark supplier evaluation “best practices”
  - Create future state supplier evaluation process vision

- **Investigate**
  - Meetings with stakeholders
  - Field trials
  - Team evaluation of query/evaluation tool results
  - Incorporate into Transition Standard Work

**Figure 8- DIVE methodology**

In Corum’s work, the project focused on the Define and Investigate phases. Through interviews and evaluating the business needs of the organization, the scope of the project was defined. The first step of the Investigate phase was performed through benchmarking where different tools were gathered and assessed. The best and most useful aspects of these tools were then incorporated into the project. The tool was then “designed”. In addition to the overall design discussed in the previous section, the specific physical tools were developed: Supplier Evaluation Questionnaire and Part Matching Algorithm.

The second part of the project and research mainly covered the Verify and Ensure steps of the DIVE process. The beta version of the supplier evaluation tool was deployed for widespread use in the Strategic Sourcing group to gather data and user input and recommendations. After data was submitted, interviews were conducted to understand what improvements could be made and perceptions toward the tool. Further design modifications were made from this feedback. A second step of the verify step was to run case studies to validate that the accuracy of the qualitative data. In addition, the information technology (IT) solution was launched for scalability and data integrity purposes. With the Excel sheets, the information was susceptible to corruption and confusion with an ever-increasing number of evaluations.

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Access database was created to house the supplier information and the automated part matching of the system. In addition, documentation, such as a user manual and work instructions, was written and incorporated into standard work so that the process could be documented to complete the Ensure phase of the methodology.

5.4 Tactical Approach for Research

5.4.1 Interviews

According to Beckhard and Harris⁴⁹, change management involves defining the future, assessing the present, and managing the transition. Therefore, this research began with interviewing customers to understand the present as well as their hopes for the future of the supplier selection process. As mentioned earlier in this thesis, culture matters. Without understanding the operative cultural forces, there may be unseen consequences.⁵⁰ These interviews were of particular interest as the intentions of the people within the organization were revealed. There were supporters and roadblocks. However, a majority of people expressed the desire for change. Many could not express what the future process would look like, but there was an acknowledgement that the present was non-ideal and an openness to try something new in hopes of improvement.

When taking over the project, it was realized that many key stakeholders were not aligned or there was a varied understanding of the tool development. As suggested in literature, one cannot simply think support for a new idea is easily gained. Instead, a change agent must help an organization come to understand and believe in the need for change by understanding assumptions and concerns of the organization and directly addressing them. Therefore, initial interviews at the beginning of the research were critical to understand how to “sell” the tool to

each stakeholder and to understand the cultural dynamics. It was important that the tool was not seen as a “pet project” that will go away. It needed to be sold as real strategic change. Through interviews, it was evident that the objectives for the program managers were different than the technical team members. Each was excited about the functionality that would most aid in their respective work responsibilities. It should be noted that almost every one of the interviewees saw benefit which is a critical ingredient for implementing change.

Input from the organization was also used to determine the importance of evaluation categories. As part of the business evaluation, there are several categories (experience, logistics, quality, etc.) discussed in Section 6.1. Each organization values these categories differently as it is unique to the organization and its processes. The weighting for each category into the overall score was determined by surveying different functions of the source selection decision (commodity, quality, materials, etc) and asking them to weight the categories as they saw fit. The inputs were then averaged across the survey respondents and used as weighting in the tool.

As Henkle mentions in her work with Honeywell that the “more effective way to get weights would be via a team with members across several areas to gain a broad perspective.” Different companies have elected to evaluate suppliers have utilizing this type of multi-variable survey. Two examples can be seen in the projects by Henkle and Feller. It was important to incorporate the qualitative and quantitative input of the different functions within the organization. A commonly used tool is based on multi-attribute utility theory (MAUT), which is

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considered a “scientific” approach to decision making.\textsuperscript{56} MAUT is based upon determining what is important, applying relative importance or weights on each criterion, and then evaluating how each alternative performs against guidelines. The Supplier Evaluation Tool designed by Corum was based upon this methodology.\textsuperscript{57}

5.4.2 Listening to & Thinking of the Customer

Interviews were also used to gain feedback from the customer. With any system, a designer can believe they have the best system, but it is the customer and user who validate or correct this belief. Therefore, the Beta version of the questionnaire was sent out to all Strategic Sourcing members to 1) allow the users to test the tool and 2) to obtain the initial data population for database. After each person completed an evaluation, a post-use interview was conducted to collect feedback and suggestions. As was stated earlier, the questionnaire was well received. However, some conflicting comments were received concerning too much or not enough detail, and too long or too short. Compromises to the questions were made to accommodate the average user. Questions were added, delete, and modified accordingly, however, the basic design of the questionnaire remained intact.

The original design of the tool was 81 business questions and a technical questionnaire. The intention was to have a P&W employee complete the survey as to have validated responses. The business section is based on numerical scores from one to five. An explanation for the scoring is provided to allow the responses to be more consistent and quantitative. The technical portion of the tool documents the technical competencies possessed by the supplier. Then the tool evaluates what percentage of technical requirements the supplier can meet, but weights all technical requirements equally. The intention was for the tool to be used as a guide, but was

\begin{itemize}
  \item Donald Olson, Olson’s Home Page, 9 2 2010 <www.ait.unl.edu/dolson/mcdm.ppt>.
\end{itemize}
never intended to be used as a final decision. Corporate strategy is not incorporated into the tool due to the sensitivity and timeliness of the information. The intention was for a group of sourcing managers to use the numerical scores from the tool as an objective input, but that the sourcing managers would make the decision.

The first trial of the tool revealed three improvements in the tool. The first being language. User feedback indicated that one option to deploy the system would be to allow the supplier to provide the initial responses so that information would be obtained more quickly rather than waiting for a P&W employee to physically visit the site. The language needed to be changed slightly to reflect the international, non-native English speaking, non-UTC demographic of low cost suppliers. This reinforced literature recommendation that questions must be clear and concise.\(^{58}\)

The second improvement for the questionnaire involved survey length. The sheer length of the questionnaire can adversely impact participation.\(^{59}\) From user feedback, user fatigue was often mentioned when filling out the survey. From the interviews, priority was placed on the technical portion of the questionnaire due to strategic and operational concerns of the company. As discussed in Section 2.2., the international aerospace technical competency is still limited, but of critical importance for companies like P&W. Therefore, fully understanding the guidance and resources required to develop a supplier is critical at this stage. Sourcing personnel commented in interviews that the business aspects were easier to teach to a supplier, but the technical knowledge was often more critical.

With this knowledge, the business assessment questions were divided into two categories based on what P&W’s intended relationship would be with the supplier. The questions were categorized through a meeting with experienced members. The criterion used was to separate the


questions into criticality: Which ones needed to be answered immediately at the initial visit and which ones could wait until a second or third visit? From the meeting, the group determined 25% of the questions fell into the high priority group and mainly focused on experience, logistics & delivery, and capacity. In addition to address user fatigue, it addresses the concern in literature that a flexible evaluation process for different types of suppliers (varying levels) is required. Additionally, changes were made to the technical part of the project due to customer feedback. Specifics will be discussed in Section 6.3.

The third major improvement pertains to the completeness of a technical evaluation. Due to the systems at P&W, there is internal, undocumented knowledge missed when relying solely on blueprint and quality specifications. This mainly pertains to manufacturing prowess. In the current systems, there is no easy way to access this information. Therefore, a “user-defined” specification is introduced as a stop-gap measure. In order for the importance to be raised, this “user-defined” specification which encompasses basic manufacturing requirements was populated from input from experienced operations personnel for major part groupings and will be a third score provided to the user. The details of this will be discussed in Chapter 6 when the overall system is explained further.

As seen in this section, interviews and focus group testing is critical in development of any supplier evaluation system. Continuous improvement is a goal at P&W. It is expected that the process will continually improve and a key input into this cycle is feedback from the user about what both works well and poorly.

5.4.3 Validation of Results

"Unclear surveys may result in respondents abandoning the process. Also the results may be less useful."\(^6\)\(^1\) Therefore, it was imperative to run case studies to validate the results of the tool. The first case studies are discussed in Corum’s research.\(^6\)\(^2\) However, more case studies were performed to continue validation of the system. This was imperative with the modifications and introduction of the third part of the project, evaluation of basic technical capabilities, was newly added in order to validate the new system. Data from current, domestic supplier was also utilized in the validation. This also addresses concerns from the users about how incumbent suppliers would perform in the evaluation and would provide a point of reference for users to better understand how to interpret the scores from the tool. The case studies are not specifically part of the tool, but part of the due diligence to guarantee that the tool produces useful, quantitative data that can be used by the organization. Discussion of the case studies is discussed in Chapter 6.

5.5 Chapter Summary

Supplier evaluations are beneficial and necessary. However, as discussed in this chapter, there are many aspects that must be considered in the design. This chapter delves into the overall vision and methodology utilized by Corum in his research. This involves interviewing and understanding the needs of the organization, then designing a system to meet these needs, and using a continuous improvement process to ensure the system is robust and relevant. In addition, a tactical approach needs to be developed for any project. For this research, interviews and customer feedback was essential to success.


CHAPTER 6- HOW THE TOOL WORKS AND HOW IT WAS IMPROVED

6.0 Basis and Basics of the Tool

Companies should consider many facets, not just cost, in developing viable global sourcing strategies and in selecting suppliers. These facets include willingness of the supplier to collaborate with the company, political stability, logistics systems, and quality. Corum noted that a common mistake is to evaluate suppliers in a few specific areas and thus created an evaluation that consisted of 8 categories across business and technical areas. The tool was designed so that input from other groups (i.e. quality, purchasing, etc) could also be incorporated as various P&W personnel visited the supplier. As Gordon suggests, the supplier evaluation should be a cross-functional activity where sourcing is the focal point for the supplier relationship, but other interested parties and stakeholders should be involved.

6.1 Supplier Evaluation

Up until this point, discussion has mainly been theoretical and strategic. In this section, the specifics of the tool are discussed. The intent was to provide consistent documentation of supplier visits and information. The questionnaire consists of two portions: business and technical. The part labeled “business” refers to the operation of the company whereas the technical portion asks specific questions about the technical capabilities of the supplier.

The business portion of the supplier evaluation consists of 7 categories totaling 81 questions:

- Experience
- Environmental, Health, and Safety
- Logistics and Delivery
- Quality
- Operations

As discussed earlier, these answers to the questions in these categories are generally qualitative. However, Corum designed the system to be quantitative by introducing a scoring system of one to five for each question. He then provided a descriptive explanation for each score to provide consistent answers between different evaluators thus making the evaluation more quantitative.\(^{66}\)

As mentioned in Section 5.4, feedback from trials and interviews were critical for development as the experience of each sourcing member added a different perspective. In addition, the biggest difference was the categorization of questions into priority 1 and 2 questions to address user-fatigue comments. Even though understanding the supplier’s operational system is important, the understanding of a supplier’s technical competency is an absolutely critical input into making a sourcing decision for aerospace manufacturers. Screenshots of the supplier evaluation can be seen Appendix A through E. Additional detail can be found in Corum’s thesis.\(^{67}\)

### 6.2 Technical Evaluation

Within the survey, there are also extensive questions about the technical experience of the supplier. The technical portion consists of 16 technical categories. The primary level questions involve whether the supplier has knowledge and capability for each category. A sample of these categories is listed below:

- Assembly
- Castings
- Composites
- Machining
- Heat Treatment
- Surface Treatment

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Within each of these categories, more details in the form of secondary-and tertiary-level questions are also asked to document what the supplier can do. The questionnaire also asks about the supplier's experience with different materials, such as titanium, aluminum, and nickel, and the size of part it has worked with. This is important for P&W as they build large jet engines and the parts may be 36” or greater in diameter which requires specialized skills compared to automotive or smaller jet engine parts. This technical information is then used in the part matching tools described later in Section 6.2.

6.3 Technical Competence & Part Matching

From interviews, technical competence was identified as an improvement opportunity in the source selection process. In the past, the decision making process was dependent on the technical proficiency of the sourcing personnel tasked to determine the capabilities needed to manufacture a basket of parts. This posed a risk as the appropriate people may not be involved to make an informed decision of gaps and risks associated with a supplier. To address this concern, a portion of the supplier evaluation tool allows the user to calculate a technical competence score for the specified basket of parts.

The part matching portion is based upon gathering a list of technical capabilities required to make parts and then assessing the percentage that each supplier was able to meet. The main output of part matching was a list of capabilities required, a gap analysis of capabilities the supplier did not possess, and a numerical score for decision makers to quickly compare several suppliers. The first version of the tool gathered specifications from P&W’s various electronic databases. However, from customer interviews, it was discovered that these electronic resources missed basic manufacturing requirements. Unfortunately, there is no easy method to gather this information outside of interviewing experience manufacturing personnel.

To address this concern, interviews were used to document basic manufacturing capabilities required to produce general categories of parts such as blades and shafts. The user
can then go and create a “basic manufacturing score” for suppliers by specifying the category. For added flexibility, a “user-defined” option is also provided in case there is a special case and/or missing category. The decision was to make this a third score on the report so that the importance of the basic versus specialized technical requirements was differentiated. Here is a summary of the scores that result from the tool:

- Business supplier score
- Specialized Manufacturing Capability Score (from electronic databases)
- Basic Manufacturing Capability Score

With the addition of this functionality, users believe that the tool can provide an acceptable high-level evaluation of a supplier for a basket of parts to help make sourcing decisions.

**6.4 Supplier Evaluation Scoring**

In summary, the tool has the ability to give the user three scores for a supplier for each basket of parts:

- Business supplier score
- Specialized Manufacturing Capability Score (from electronic databases)
- Basic Manufacturing Capability Score

An example can be seen below. This data shall be used a quantitative input into the sourcing decision process. It should be noted that these scores are only guidance to the decision making process. Many other aspects, most notably strategic issues, should also be considered when selecting suppliers to be considered. The first reason that a strategic score was not included was due to the sensitive information involved. The tool would be available to many people within the organization and management did not feel comfortable giving access to strategy to all parties. In addition, the strategic initiatives could change quickly. Incorporation of a strategic score would introduce the possibility of inaccurate or out-dated information for a critical variable. Thus, for these two main reasons, strategy was not included as a category for the tool. An example of the output scores is seen in Table 3.
There is concern about the use of the scorecard because it is often taken at face value without further investigation. However, it has been actively communicated that the overall score needs to be investigated further to understand whether the supplier is weak in all areas or just one. That is the purpose of having the overall and category scores on the same report. The scorecard’s ultimate purpose is to find opportunities for improvement.  

The goal is to utilize the face-to-face meeting time to discuss strategy and reasoning for decisions and to provide relevant, quantitative data through the tool.

### 6.5 Case Studies

This section will discuss two cases of how the tool is utilized within P&W. These case studies were also used to validate the numerical scores against the organizational knowledge of the different suppliers and parts. The first case study is simple set of parts.

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Business</th>
<th>Specialized Technical</th>
<th>Basic Technical</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCS A</td>
<td>39%</td>
<td>54%</td>
<td>91%</td>
</tr>
<tr>
<td>LCS B</td>
<td>33%</td>
<td>0%</td>
<td>41%</td>
</tr>
<tr>
<td>Domestic A</td>
<td>92%</td>
<td>62%</td>
<td>97%</td>
</tr>
</tbody>
</table>

Table 3 – Example of Report

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Business</th>
<th>Specialized Technical</th>
<th>Basic Technical</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCS 1</td>
<td>33%</td>
<td>10%</td>
<td>34%</td>
</tr>
<tr>
<td>LCS 2</td>
<td>69%</td>
<td>58%</td>
<td>58%</td>
</tr>
<tr>
<td>LCS 3</td>
<td>72%</td>
<td>68%</td>
<td>92%</td>
</tr>
<tr>
<td>LCS 4</td>
<td>79%</td>
<td>68%</td>
<td>83%</td>
</tr>
</tbody>
</table>

Table 5 – Case Study I Results

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As seen in the results, the most appropriate source would be LCS 3 with LCS 4 as a good alternative. However, LCS 1 and LCS 2 are considered due to strategic market entrance opportunities. In the meeting, the sourcing personnel discuss the pros and cons of choosing the suppliers. It is clear that choosing the LCS 1 or LCS 2 will require extensive P&W resources to train the supplier. Therefore, project timeline may be less aggressive compared to the selection of LCS 3 or 4. In addition, the quantitative data is used to prepare a longer transition period as the inexperienced supplier moves up the learning curve. In the past, there was no way to clearly bring this information to the discussion and it was difficult to quantify the risk and gaps associated with choosing an inexperienced supplier such as LCS 1 or 2 over an experienced supplier such as LCS 3 or 4.

The second case study included an incumbent, domestic supplier. The results can be seen in Table 6. The domestic supplier is a preferred P&W partner. As expected, this supplier performs well in the business and basic technical categories as it has the foundation to be an aerospace supplier. However, Domestic A is not normally a supplier for this type of part and thus does not perform well in the specialized technical section.

LCS A is a P&W joint-venture in an international location and was established approximately 10 years ago. Hence, it has the foundations of aerospace manufacturing, but still needs to gain experience in the business practices such as logistics and quality. However, LCS B is a new supplier for P&W and is new to the aerospace industry. Thus, the results quantitatively indicate this lack of experience on both the business practice and technical requirements.

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Business</th>
<th>Specialized Technical</th>
<th>Basic Technical</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCS A</td>
<td>72%</td>
<td>44%</td>
<td>94%</td>
</tr>
<tr>
<td>LCS B</td>
<td>33%</td>
<td>16%</td>
<td>45%</td>
</tr>
<tr>
<td>Domestic A</td>
<td>92%</td>
<td>40%</td>
<td>91%</td>
</tr>
</tbody>
</table>

Table 6 – Case Study II Results
This second case clearly shows the different type of suppliers that P&W interacts with. The evaluation of an experienced domestic, developing international and brand new international supplier is common within Strategic Sourcing. These results of this tool will help foster conversations between sourcing personnel and the general procurement organization as it develops strategies to achieve its cost reduction and international expansion goals.

6.6 Chapter Summary

This chapter summarizes the nuts and bolts of the supplier evaluation tool implemented at P&W. The system utilizes a questionnaire of business and technical aspects of a supplier to collect information. A list of required competencies is collected for parts of interest and then these competencies are then compared to the capabilities available at the supplier and a quantitative score. The business and technical scores are used as inputs into the sourcing decision. The main benefits of the tool are consistent documentation of each supplier and a quantitative input into the sourcing decision process. This system will help P&W to make better, more-informed decisions at a faster rate than in the past.

CHAPTER 7: INFORMATION TECHNOLOGY (IT) SOLUTION

7.1 Why is an IT Solution Needed?

As stated in literature, “Information technology has become a key enabler in supply management.” There is no doubt that information technology has facilitated major changes in the way that business works today compared to 5, 10, or 20 years ago. The impact and power of IT has only grown with the number of information and communication technologies have advanced themselves. In fact, well utilized information technology is being viewed as a

competitive advantage. View the system built by Corum, it was clear that the process could not continue to use Excel. The main concerns were data integrity, scalability, and ease of use.

The first concern was data integrity and access to information. Individual Excel files were utilized for each supplier from each evaluator. This introduced a large potential for inaccurate information to be used mistakenly. In addition, there was a high probability for data corruption whether by a user who accidentally changed information within a file or potential to misplace or delete files. The original system hindered the ability for a large number of users to easily access information at the same time. It is documented that sourcing is hindered as files are kept in e-mail and hard drives of 10 different people working with the same supplier and/or project. The proposed IT system is a centralized, easy-to-access depository of information.

The second point to address is scalability. As Gordon notes, "technology can enable and scale supplier performance management." An organized system can be used to expand for working with 20 to 150 suppliers easily. As discussed in the previous paragraph, the Excel system would quickly become cumbersome with more evaluators and suppliers. The advantage of using technology is the ability to scale the evaluation process that is not possible through manual means. Even though it takes time to develop a IT system, investment in IT often has a fast payback period.

The IT system can also automate the process. The original system required manual manipulation for the part matching by copying and pasting information which introduces opportunity for analysis error. One of the requirements of the IT system is for automated matching and reporting once a list of parts and suppliers is inputted from the user. Since

opportunities for error are introduced, and almost inevitable, when information is manually manipulated, the IT system is a simpler and more accurate method.\textsuperscript{75}

For all of these reasons and more, it was determined that an IT system be created to meet the needs of the user and customer. The goal was to make a system that was user-friendly, intuitive to use, and would be able to support multi-users at the same time. IT/online versions can become very powerful as information is provided in a timely manner.\textsuperscript{76} Below are the main criteria for success of the IT solution:

- User-friendly
- Intuitive
- Scalable
- Stable with multiple users
- Easy to modify questions and/or logic in the future

7.2 Planning & Communication is Critical to Success

The design and planning of an information technology solution was found to be more critical than originally anticipated. Limited research was done into the process and management of IT project and this hindered the research progress. Like many companies, P&W has outsourced much of its IT resources while keeping a core group of highly knowledgeable people in-house. Due to the relative simplicity of this project, the decision was made to outsource to a preferred vendor and manage the project within Strategic Sourcing rather than utilizing P&W IT.

The researcher had limited knowledge and experience with IT projects. The first attempt at producing an IT system was not successful as objectives and expectations were not clear to the outsourcing company. Many lessons were learned and applied in selection and execution of the second attempt of the IT system. A list of the major lessons learned is below:

- Experienced programmer - With inexperienced project managers, it is imperative that the programmer is experienced so that he/she can translate the vision into programming code

and propose solutions for the customer, P&W. The first project used inexperienced programmers who had limited knowledge of application features and thus resulted in poor design and functionality.

- Frequent updates and communication – The original project held weekly update meetings and communication was relatively limited outside of these meetings. Input and changes from the customer were not requested early in the process and was not incorporated into the project until late in the design, resulting in rework. Moving forward in the second project, a weekly update meetings and a design meeting was held each week. The intention was that the whole group (multiple programmers involved) met at the update meeting. To streamline discussions, the design meeting involved the project manager and programmer to work on specific aspects and details.

- Proximity – The first outsourcing contractor was located remotely and meetings could only be held through web-collaboration methods. The second contractor was located locally and meetings were always held in person. There was a significant difference in interaction. If close proximity is not possible, it is recommended that the team meet face-to-face at the beginning and a regular time intervals throughout the project to ensure alignment.

- Use “case-methods” - In the planning phase of the project, the customer needs to explain the different ways and who will use the IT system. This means scripting scenarios to outline what inputs the user will give the system, what the system will do internally, and what results are expected as an output. By developing these scenarios, the programmer is better to understand the intent of the system and can then design the system. Therefore, the system meets the needs to the customer.

As discussed in this section, planning the project and selecting the right IT resources are critical to success. Many IT systems have been developed and deployed with limited or no
success because of failure of the planning and design phases. Like most systems, spending more time in the beginning of the process will avoid rework and mistakes later in the development.

7.3 Designing for the User

Architecture is not the only important thing for an IT system. Designing something that is user-friendly and intuitive is also important. This is especially pertinent as some users may be reluctant to new systems and will take any defect as a reason to reject the whole project. Most users are busy and have limited time to test a new system. Therefore, if the first experience is frustrating or disappointing, it is difficult to convince these users to try the system again. Hence, much discussion and development time was devoted to ensuring the first launch of the system was user-friendly, easy to use, and intuitive. This required interviewing users about flow and understanding how the user would approach the system and interpret instructions. Design could require endless months of development. With the time pressure to launch the system, prioritization was made on which items could be addressed before the Beta launch. These items were documented on a punch list and worked accordingly. As improvements are made to the system, there will be fewer improvement comments and the system will be launched for full release.

7.4 Planning for Data Integrity & Security

As with any other system, user access and system security has to be considered. The key to control what information and functionality can be accessed by a user is triggered by their computer ID. Table 8 explains the four levels of security. The default access level is 4 unless the user ID is recognized in the system.

<table>
<thead>
<tr>
<th>Level</th>
<th>Level of Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Admin rights</td>
</tr>
<tr>
<td>2</td>
<td>View, submit updates, approve updates</td>
</tr>
<tr>
<td>3</td>
<td>View and submit updates</td>
</tr>
<tr>
<td>4</td>
<td>View only</td>
</tr>
</tbody>
</table>

Table 8– Access to System
Another large design issue was the process to store the supplier information and how to update existing supplier data. The solution was to utilize a reference record for each supplier. All the views of the supplier information, part matching, and scoring would be based on the reference record for the supplier.

Once a P&W employee visits a supplier, the expectation is that he/she will be able to input information into the supplier evaluation tool. A Level 3 user or higher can update the whole evaluation or just a portion of the evaluation depending on what part of the supplier was visited. The system then store proposed updates with the name and date of proposal for evaluation. These submissions are then stored in a table for the review of a Level 2 user. When the Level 2 user enters the system, he/she can review all proposed updates to the reference for a given supplier. It is then the responsibility of this user to determine the most appropriate evaluation from various inputs and update the reference record to reflect this.

7.5 Chapter Summary

This chapter introduces the reasoning for the implementation of an information technology solution for the supplier evaluation system. The IT system will provide many benefits, most notably data integrity and usability. In addition, many of the lessons learned around the project management and design of the IT project is also discussed. In summary, the planning and design phases are critical to the success of the project. IT is a powerful tool that many companies have utilized to improve business processes and this is also true with the P&W supplier evaluation system. At the conclusion of this research project, the Beta version of the IT system was being finalized. The organization would then populate it with relevant data, test the system, and incorporate changes and improvements from user feedback.
CHAPTER 8 - CONCLUSION

Literature states that a successful supplier tool requires both management support and a defined, robust evaluation process. The research of this thesis explored both of these aspects. The support from management and influential people within the organization is the first and most important requirement for change in an organization like Pratt & Whitney. In addition, design of the supplier evaluation requires an extensive research and planning phase as well as input from the user and customer. And finally, information technology can be utilized to improve and enhance the process.

Before design of the system, organizational approval of the change is essential. First, the organization must be assessed. It is often tempting to use stereotypes or norms as a starting place, but even each group within an organization is slightly different. It was determined that Pratt & Whitney was experience and hierarchical based. With support from management and respected individuals, a project is given credibility. The “sell” of the concept must occur first and the whole organization needs to see the support of the change.

A supplier evaluation process will help P&W perform and meet its goals as the old process was ad-hoc. The greatest value will be documented, consistent information on all international suppliers of interest. The process will also enable the company to compare the technical capabilities of the supplier against the requirements for each project. This is valuable information as the technical competency is one of the most important criteria for supplier selection. The information technology system is an enabler to implement this change.

The change within P&W strategic sourcing is just beginning. As with the aerospace industry, there is still much opportunity to be captured in the global market in terms of footprint and cost savings. P&W and UTC recognize this potential and are instilling the processes and

systems to allow them to strategically approach their business and remain competitive in a dynamic global market.

8.1 Recommendations

Pratt & Whitney realizes that it needs to change to stay competitive in the aerospace market and expand its supply base internationally. There is no shortage of suppliers who want to enter the market and are willing to partner with the company. The question is how P&W makes sourcing decisions. The implementation of the supplier evaluation process will be an improvement. However, it is the acceptance of the change that will determine the success. The support from the key, influential, respected individuals must be obtained for true change to occur and for the process to be fully adopted into the organization.

With development well on its way, the system is almost complete. In order to gain full support, the benefits of this system should be advocated and demonstrated to these key individuals. Once the credibility of the system is confirmed and the benefits of the new process are clear, the organization will quickly adopt it into standard practice to help meet its goal for 2012.

8.2 Next Steps

The system needs to be beta tested and the user feedback should be incorporated. There are plenty of opportunities to add further functionality to the system. The most notable is to add basic savings calculations (labor, material, transportation, etc) into the system to provide estimates that can be part of the sourcing decision. In addition, the classification of parts that can and cannot be exported to certain countries is also a concern as P&W is also a military contractor. Therefore, incorporation of this information up-front can also add benefit to the decision process so that it is determined early on in the process rather than further in supplier negotiations.
Outside of further development of the P&W tool, the division should work to collaborate with its UTC sister divisions. Each division has historically acted as an individual company. However, the knowledge and scale of UTC as a corporation will be invaluable. There are simply not enough resources to talk to every supplier and to know every required fact. If the divisions work together through the corporate collaboration project, P&W would be able to do more with less. It is a competitive advantage that has yet to be leveraged and could be one of its greatest assets to compete and achieve its goals.

8.3 Update

The research for this thesis ended in August 2009, but approximately eight months has elapsed since then. As an update, P&W successfully finished the development of the IT database and had users provide input for the Beta version. The system is still undergoing testing at this time. The database is being populated with relevant data from current and new suppliers. This will provide documentation for its suppliers as well as the ability to test the system and refine its output.
Appendix A: Explanation of Categories in Supplier Evaluation

Experience – This section primarily focuses on the experience level of the supplier and its employees. The experience gained through supplying large, international companies helps a supplier become attuned to the needs of the global business environment. Understanding a supplier’s experience with international customers and the required expectations for quality and delivery before a supplier relationship is created may ease the need for supplier development.

Environment, Health and Safety – This section focuses on the supplier’s efforts to minimize their effect on the environment as well as the health and safety of their employees. This section is important as purchasers do not want to expose themselves to a potential public relations issue or liability by working with a supplier who causes undue harm to the environment or their employees.

Logistics and Delivery – This section captures information on the supplier’s ability to meet delivery goals for their customers, internally as well as for their sub-tier supply base.

Quality – This section focuses mainly on the approach the supplier takes towards maintaining and improving their product and production process quality levels.

Operations – This section looks at the general layout of the production process and material flow.

Communication – This section helps identify the level of openness the supplier has with the company as well as the state of their communication technology.

Financial Records – This section analyses the financial records of the supplier in order to identify any potential trouble or issues with bankruptcy, etc.

## Appendix B: Screenshot from Excel-based Supplier Evaluation

### Experience Review

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Company</strong></td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>Response</td>
<td>Comments</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Does the Supplier have any experience with the aerospace industry or Pratt &amp; Whitney?</td>
<td>No experience with the aerospace industry</td>
<td>Experience with the aerospace industry but not with Pratt &amp; Whitney or UTC</td>
<td>Experience with Pratt &amp; Whitney and/or UTC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Does the Supplier currently sell and ship to Fortune 500 companies? (if so, please provide examples)</td>
<td>No</td>
<td>Suppliers serve only domestic customers</td>
<td>Yes, Supplier serves international customers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>How long has the Supplier been involved with the aerospace industry?</td>
<td>0 years</td>
<td>5 years</td>
<td>&gt;10 years</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Who are your top 3 customers? (Informational)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Personnel

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Organization Structure</strong></td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>Response</td>
<td>Comments</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Does the Supplier have a defined purchasing organization?</td>
<td>No</td>
<td>Yes, a few dedicated people</td>
<td>Yes, an organization has been developed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Does the Supplier have a defined quality organization?</td>
<td>No</td>
<td>Yes, a few dedicated people</td>
<td>Yes, an organization has been developed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Does the Supplier have an assigned P&amp;O account representative?</td>
<td>No</td>
<td></td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix C: Screenshots from Excel-Based Part Matching Tools

Specialized Manufacturing Tool

NOTE: Screenshots taken from Corum

Figure 5: A small scale example of the specification and capability matrix. If a given specification requires a certain process, a '1' is placed in the corresponding matching cell.

Figure 6: An example of the Supplier Process Capability input.

Figure 7: The results from an example Supplier-Part Match.

## Basic Manufacturing Tool

<table>
<thead>
<tr>
<th>Supplier Name</th>
<th>Competency 1</th>
<th>Competency 2</th>
<th>Competency 3</th>
<th>Competency 4</th>
<th>Competency 5</th>
<th>Competency 6</th>
<th>Competency 7</th>
<th>Competency 8</th>
<th>Competency 9</th>
<th>Competency 10</th>
<th>Competency 11</th>
<th>Competency 12</th>
<th>Competency 13</th>
<th>Competency 14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supplier A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supplier B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supplier C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Competency Scores

- **Supplier A**
  - Competency 1: 91%

- **Supplier B**
  - Competency 1: 0%

- **Supplier C**
  - Competency 1: 0%
Appendix D: Screenshots Excel-based Reports

Supplier Scorecard

Supplier Name: Supplier XYZ

The Overall Supplier Evaluation Score is: 65%

<table>
<thead>
<tr>
<th>Experience</th>
<th>Financial</th>
<th>Quality</th>
<th>E, N &amp; S</th>
</tr>
</thead>
<tbody>
<tr>
<td>91%</td>
<td>20%</td>
<td>80%</td>
<td>69%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Logistics &amp; Delivery</th>
<th>Operations</th>
<th>Communications</th>
</tr>
</thead>
<tbody>
<tr>
<td>88%</td>
<td>60%</td>
<td>56%</td>
</tr>
</tbody>
</table>
Appendix E: Screenshots Access-based System

Supplier Evaluation

Testing Company

Supplier Code: 12562  Date of Evaluation: 

Reset All Answers  Save Supplier Review  Technical Primary Level

Experience  EHS  Logistic  Quality  Operations  Communication/Systems  Financial A  Financial B

Company Experience

1) Does the Supplier have any experience with the aerospace industry or Pratt & Whitney?
   ○ No experience with the aerospace industry.
   ○ Experience with the aerospace industry but not with Pratt & Whitney or UTC.
   ○ Experience with Pratt & Whitney and/or UTC.

2) Does the supplier currently sell and ship to Fortune 500 companies? (If so, please provide examples)
   ○ No.
   ○ Yes, but Supplier serves only domestic customers.
   ○ Yes, Supplier serves international customers.

3) How long has the Supplier been in business?
   ○ 0 years to 5 years
   ○ 5 years to 10 years
   ○ >10 years

Technical Competence

Testing Company

Supplier Code: 12562  Date of Evaluation: 

Reset Answers  Save Tech Competence

Tech 1  Tech 2  Tech 3

Tech 1 Type

Option 1   Option 2   Option 3
Option 4   Option 5   Option 6

Material

Option 1   Option 2   Option 3
Option 4   Option 5   Option 6

Wall thickness

Option 1   Option 2   Option 3
Option 4   Option 5   Option 6

Finish

Option 1   Option 2

Comments
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