COMPANY X

STRATEGIC HUMAN RESOURCE DEVELOPMENT PROJECT

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ABSTRACT

"Company X" is a leading manufacturer of advanced power electronics. The company develops, manufactures and markets products that convert raw electrical power into high-quality power required by electronic or electrical equipment. The ability to deliver innovative new products to market on a timely basis is therefore critical to company competitiveness, profitability and success.

The purpose of this analysis and report is to assist Company X in identifying and minimizing gaps within its human resource development infrastructure, and to propose recommendations for improvement. It examines internal issues related to project execution, specifically execution of new product development (NPD) projects across the organization.

Fundamental to this report is information derived from two sets of interviews with key personnel at Company X, together with an extensive review of internal and external literature. Topics related to project execution and NPD are explored and synthesized. These include training, organizational configuration, corporate culture and values, performance measurement, product development, program management, quality management, decision analysis, and resource planning.

As a result of this analysis, ten recommendations are put forward to address identified symptomatic and root causes of project execution issues at Company X. In the final analysis, achievement of the stated company objective of consistently delivering new products to market on time and within budget can only be achieved through an organization-wide shift in process and practice.

DEDICATION

Stephanie would like to thank her family and friends for their continued support of her endeavours, and Derek for his patience and encouragement.

Laura would like to dedicate this project to Eda and Graziano Favaro for their ongoing support and encouragement throughout the MBA program, and in all other aspects of life.

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1 INTRODUCTION

"Company X" is a leading manufacturer of advanced power electronics with a mission to deliver electricity to customers "anytime, anywhere" (Company X Corporate Overview, 2003, p.2). It is a privately owned company headquartered in Burnaby, British Columbia, with offices and manufacturing facilities in the United States, Spain, and Barbados. The company develops, manufactures and markets products that convert raw electrical power from any central utility, distributed or renewable generation, mobile or backup power source into high-quality power required by electronic or electrical equipment (Company X, http://www.companyx.com/corporate/company/index.asp, 2003). Established in 1983 with a staff of eight and revenues of $300,000, Company X has grown from humble beginnings to become a world leader in power electronics, earning annual revenues of $170 million CDN (*Canadian Electronics*, 2003, p.3).

Company X recently conducted a succession of mergers and acquisitions that have resulted in rapid growth and industry attention. Specifically, the company expanded its product and customer base through three key acquisitions: Statpower in October 1999; Trace Holdings, Trace Technologies and Trace Engineering in March 2000; and Heart Interface and Cruising Equipment Company in April 2000 (Company X Corporate Overview, 2003, p.4). Within the last four years, Company X has grown from less than 200 to about 600 employees, and has significantly expanded its operations and market reach geographically (Interview participant, August 26, 2003).

Company X has made substantial progress in integrating these acquired and distinct entities into one cohesive, market-oriented organization. However, the process has required revolutionary change, as well as continuous, ongoing efforts to align processes and procedures across the organization, and to create and cultivate the strategy and systems for profitable growth. Within the past year, Company X has emerged from this extensive transformation process and has established the infrastructure, systems and strategic focus necessary to execute its vision (Interview participants, August 26, 2003).

The purpose of this project will be to assist Company X in investigating and analyzing gaps within its human resource development infrastructure, and proposing recommendations for addressing identified gaps. This focussed development of a rigorous human resource

development ("HRD") infrastructure will add strategic value to Company X by enhancing the company's ability to achieve strategic objectives.

1.1 Project Outline

The objective of this project is to provide information, strategies and recommendations to assist the Human Resource department to better achieve the goals of the company in ways that support stated core values. This report will achieve this objective by first providing an overview of Company X's current situation. This analysis will review the company's current operations and strategy, and follow up with a discussion of current HR infrastructure and processes. Second, it will research and examine a number of issues that pose challenges at Company X. The final section will propose a set of potential solutions and a final recommendation for action.

2 PROBLEM SUMMARY

While Company X is now better positioned to achieve its strategic goals, new challenges have emerged that have the potential to negatively impact future profitability, reputation and stability. The most significant of these is Company X's history of inconsistent project execution. For example, Company X has developed a structured, eleven-phase new product development ("NPD") process designed to provide on-time product delivery to customers. On the one hand, the process is viewed as a core strength of the organization. It provides a structured approach that enables Company X to couple its understanding of the market with its technological expertise to deliver new products to customers. Through this process, Company X is able to leverage the synergies that were created by combining several relatively small companies into one larger, global organization. Consequently, it offers a competitive advantage because it is difficult for others to replicate (Interview participants, August 26, 2003).

However, many projects do not fully comply with the process and therefore fail to achieve stated quality and market objectives, timelines and budgets. Repercussions for the organization may include lost profits, lost opportunities, damaged reputation, employee frustrations, and delays on other related projects. In interviews with employees, the ability to manage projects and to execute product launches on time and within budget was consistently identified as a major area for improvement. In fact, this issue is so critical to Company X's success that it was highlighted in the January 2003 employee newsletter as being a key success factor in meeting 2003 revenue targets (*Connexions*, p.1).

Upon initial investigation, it appears that this challenge stems from a number of factors within Company X, including:

- Inconsistent training plans for employees
- Lack of project management mindset in project teams
- Inadequate prioritization of projects and/or decision analysis for opportunities, resulting in poor resource allocation decisions
- Gaps in project-specific skills development, specifically project leadership, management, and ownership
- Integration issues among acquired groups

- Motivational issues among employees
- Insufficient project-specific performance measurement criteria

2.1 Problem Statement

Based on this analysis, this project addresses the following:

> Company X faces issues with project execution, specifically execution of new product development projects. This results in unfavourable consequences for the company, both internally and externally.
>
> The problem stems from issues related to program and project planning, training infrastructure, employee ownership and teamwork, and project leadership.

This project will examine possible improvements to the human resource development infrastructure which impact on the above stated problem within the company. As a result of recommended improvements in this domain, the following benefits will be realized:

- improved customer satisfaction and brand reputation
- increased revenue opportunities through new product offerings
- improved flexibility and ability to adapt to change and respond to new market opportunities due to expanded employee skills and knowledge
- enhanced innovative capacity in new and existing employees
- improved employee satisfaction ratings
- reduced NPD costs and increased product margins as a result of more effective project leadership and improved communication among teams.

3 CURRENT SITUATION

3.1 The Company

3.1.1 Market Overview

Company X targets high-growth segments of the advanced power electronics market. The three segments include Distributed, Programmable and Mobile Power markets. The following diagram illustrates the distribution of revenues among these three markets:

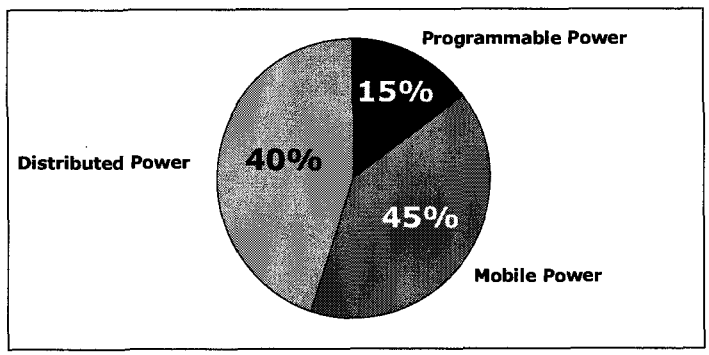

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Figure 1: Company X Business Portfolio

The company targets eleven sub-markets within these three areas. The breakdown into sub-market segments, and leadership characteristics associated with each major market area, are shown in the following table:

Market Segments	Sub-market Segments (Applications)
1. Distributed Power	1. Solar
	2. Wind
	3. Backup Power
	4. Emerging Technologies
2. Programmable Power	5. R&D, Manufacturing Test and Measurement
	6. OEM Equipment Power
	7. Datacom Backup Power
3. Mobile Power	8. Automotive
	9. Heavy Duty Truck, Work Vehicles
	10. Recreational Vehicles, Marine
	11. Consumer

Source: Company X, Copyright 2003, adapted by permission.

Table 1: Market and Sub-Market Segments

Essentially, Company X has secured a strong position in a number of growing markets. The company attributes its leadership position within these markets to its extensive experience in advanced power electronics and controls, and its market-focused, rapid product development and commercialization process (Company X Corporate Overview, 2003, p. 8).

3.1.2 Product Overview

Prior to 1998, the Company X product line consisted primarily of programmable power products used to develop and test electronic equipment. The aforementioned acquisitions enabled Company X to broaden its product offering and expand its supply of products to a wide range of complementary market segments worldwide. Recently, Company X has expanded its product offerings for renewable energy solutions such as solar and wind power, as well as backup power systems, portable power systems and programmable power for precision equipment. Additionally, the company introduced a number of key new products in 2003 for the consumer market and has experienced record-breaking sales as a result of alliances with retailers such as Canadian Tire, Costco, Radio Shack and QVC, a leading home shopping network (Interview participants, August 26, 2003).

3.1.3 Customer Overview

The Company X brand represents five values: market-based innovation, passion for solving customer problems, application flexibility, improving industry and technology standards, and shared success among customers, employees, partners and stakeholders (*Connexions*, April 2002, p. 1). Each of these values emphasizes the company's continuous focus on customer needs and defines the guidelines for business at Company X.

In addition to adding to its customer base in 2003, Company X has also maintained and developed relationships with key customers including Applied Materials, GE Wind, Ballard, Boat US, BP Solar, Cisco, Compaq, Fleetwood, Kyocera, Monaco, Schlumberger, Siemens, Xcellsis and channel partners such as Canadian Tire, Costco, Sam's Club, TestEquity, US Marine and West Marine.

Company X continues to expand its marketing capability and its quantity of third party distributors. For example, Company X has allocated more sales and marketing efforts in Europe, Asia, and the developing world. Offices have been established in Barcelona, Spain to grow sales in Europe and Africa, and in Miami, to support Latin American initiatives. Corporate websites have been launched in Spanish, French and Italian, and a German language website is in production.

3.1.4 Competitive Strategy

Michael Porter's (1979) strategic framework proposes that for organizations to be successful, they must choose between two mutually exclusive ways to compete – low cost or differentiation – because the activities required to achieve either position are distinct. Company X is pursuing a differentiation strategy through its focus on offering unique, value-added, innovative products. At the same time, the company strives to continuously improve processes and reduce product costs to preserve its leadership position in an industry that is becoming increasingly competitive. An important distinction is that Company X does not aim to decrease product costs to offer the lowest prices on the market. Instead, as products progress through the life cycle and the availability of substitutes increase, a low cost position provides Company X with the flexibility to reduce prices and still maintain reasonable profit margins (Interview participants, August 26, 2003).

Essentially, Company X is pursuing a strategy Hax and Wilde (1999) define as a "customer solutions" approach – coming to market with sought-after solutions to bring more value to customers. Rather than limiting scope to selected offerings in few markets, the company is focused on delivering a broad range of products that provide complete solutions to the end user. Through research and development in a variety of markets, the company offers a broad knowledge base that is attractive to potential customers who are looking for a "one-stop shop" for power electronics products (Interview participants, August 26, 2003).

While Company X faces competition in each of its market segments, no other organization is currently able to offer the same breadth of products to such a broad base of customers. Company X is differentiated from its competitors in this respect and seeks to develop both broad and deep market knowledge. To a certain extent, the company's unique approach is leading to the development of a power electronics "industry". While Company X is the current leader, attractive growth opportunities and industry attention are causing new competitors to enter the field. Company X aims to strengthen its position by pursuing the following three strategic objectives (Interview participant, August 26, 2003):

1. Building on technology and market knowledge to deliver sophisticated component solutions to customers in its market-focus areas

2. Delivering superior quality and service to customers

3. Achieving a low cost position in the manufacture of advanced power electronics products

While this competitive strategy is well-communicated throughout the organization, it also presents several challenges. In attempting to solve customers' needs in eleven sub-market segments, numerous new product ideas and market opportunities emerge on a frequent basis. However, resource constraints make it impossible to pursue all options. Company X faces difficulties in retiring legacy products, and in allocating resources and prioritizing among its extensive catalogue of existing versus new products. Since customers have come to depend on Company X to continue offering existing products, it is difficult for the company to discontinue and withdraw support for these products. While company growth is tied to products developed within the last three years, thirty percent of engineering work is needed to sustain the existing product line (Interview participant, August 26, 2003).

This presents a challenge from a human resources perspective because key personnel who are familiar with older products also possess the expertise needed to develop new products. Appropriate documentation and on-the-job training, as well as program planning, are needed to meet this challenge by expanding the base of product knowledge throughout the firm. Improved product prioritization is also essential to ensure that human resource efforts are directed to the most strategically significant and profitable endeavours.

3.1.5 Organizational Configuration

In terms of human resources, Company X's acquisitions enabled the company to increase its employee base from less than 200 to 600 employees and to expand geographically. As a result, the company has undergone several reorganizations to transition from a business unit structure to its current functional structure. In 2001, Company X integrated operations into market-focused units to leverage its market knowledge and application expertise to deliver on its promise of providing "solutions" to real customer problems. The functional structure has also had the effect of facilitating knowledge transfer across the organization and improving operational efficiency (Interview participants, August 26, 2003).

The following organizational chart illustrates the high-level breakdown of the company as of November 2003. The four key functional areas are Sales, Marketing, Engineering and Operations. These are supported by Finance & Legal, Quality Assurance, IT and HR functional groups as follows:

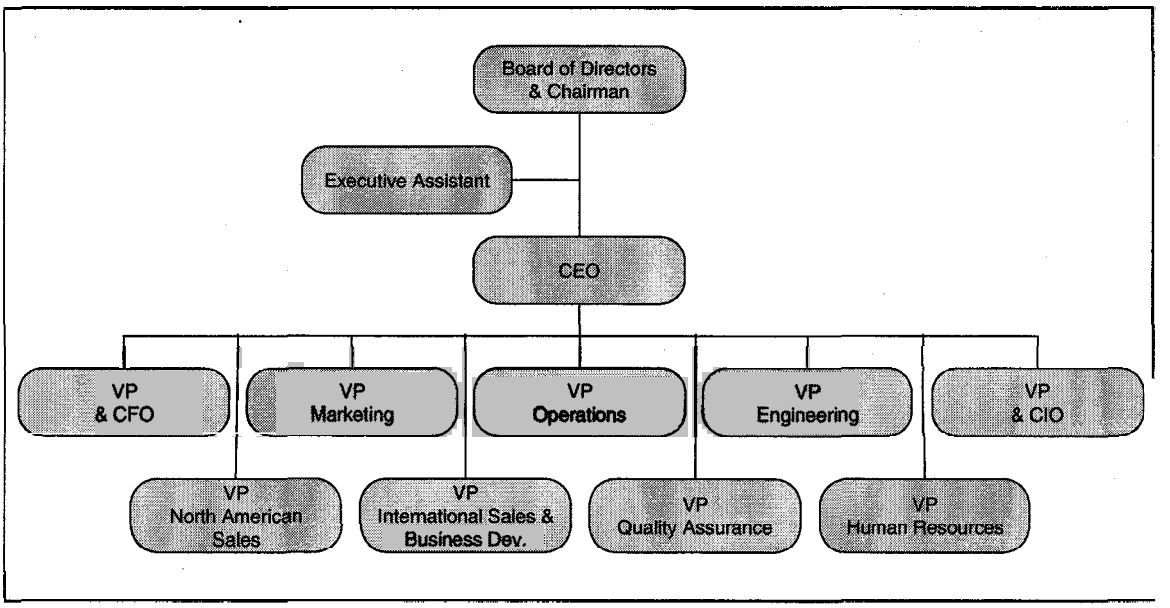

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Figure 2: Organizational Configuration: Corporate Management

In March 2001, an intensive strategic plan analysis and 5-year outlook for Company X was developed to position the company to be the leading player in its targeted market segments. One of the three critical success factors identified included the development of effective human resource ("HR") strategies for acquisition, retention, and development of top talent (Interview participant, August 26, 2003). In line with this objective, Company X has made several key hires and is focused on attracting, retaining, and providing growth opportunities for the "right" people with the skills, knowledge, experience and attitudes to help the company execute its vision. In fact, as recently as September 4, 2003, Company X appointed a new Chief Executive Officer with highly complimentary skills and experience to the company's executive and operational staff. It is expected that the new CEO will bring energy, renewed focus and an analytical approach to the management of the company (Company X, http://www.companyx.com/corporate/news/index.asp, 2003).

The company has physically located its major divisions to maximize knowledge-sharing activities and create new opportunities for innovation. For example, Research and Development functions are geographically situated in areas where technological synergies exist. By surrounding its research and development engineers with an active environment of innovation, new ideas will be stimulated and integrated more rapidly than in isolation.

3.1.6 Corporate Culture

In its "Corporate Overview" presentation, Company X highlights its experienced management team and entrepreneurial culture as key strengths of the organization (2003, p. 8). The consensus among senior executives is that Company X employees possess the talent, experience and expertise to execute the company's vision (Interview participants, August 26, 2003). However, the process of integrating the diverse cultures of the acquired organizations to create a consistent one that spans all organizational boundaries has been challenging. Company X has taken steps to build the culture by formally communicating a set of values throughout the organization.

The desired culture is based on five brand values. These include developing innovative products to meet market needs; creating solutions to customer problems; expanding the base of technological knowledge and expertise; maintaining a continuous dedication to excellence and leadership; and creating opportunities for all stakeholders to share in the company's success (*Connexions*, April 2002, p. 1).

Despite these formalized values, a harmonious culture has not yet fully blossomed. The company is still transitioning from a family-based business environment to one with a focus on profitability and fiscal growth. As such, a long-standing and necessary focus on the bottom line continues to exist and affects efforts to pay attention to more abstract but equally important issues such as building a positive ethos and cohesive culture within the organization. The traditional financial focus has likely been reinforced by the economic downturn of the past several years.

Nonetheless, company references to a healthy work environment and shared success demonstrate awareness that a balance is needed between a focus on the bottom line and recognition that achievement of corporate goals is dependent upon the skills, attitudes and goodwill of all individuals in the organization (Interview participants, August 26, 2003). Company X does recognize this gap and makes efforts to provide support for the transition from a financial to a people-centred focus. Actions such as providing meaningful recognition for innovative or exceptional employee or group contributions, would positively impact the company's efforts to build a healthy culture and a strong team-based learning environment.

Additionally, even though Company X has been operating for twenty years, recent acquisitions have altered the company fundamentally. Company X, as it exists today, is essentially a new corporate entity. Managing this massive growth and change requires effective communication throughout the organization coupled with the development of leadership within and among cross-functional teams so that skills, knowledge and cultural values can be transferred and acknowledged. This process continues to be a significant issue for the company. While it is expected that the newly appointed CEO and CFO will help define the leadership style within the firm, it is important for Company X to develop leadership talent at other levels of the organization.

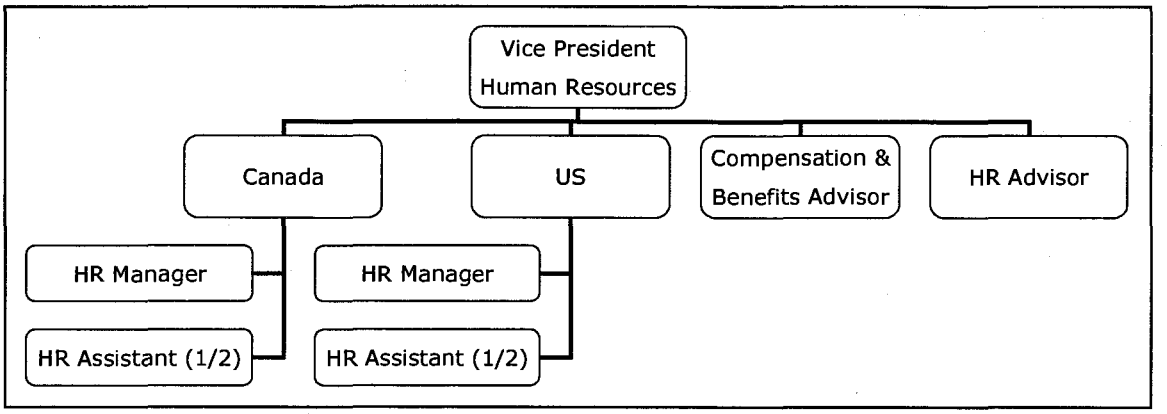
3.2 Human Resource Development

Quality human resources at Company X are integral to the delivery of customer solutions. Human resource development is defined by the U.S. Office of Personnel Management (2001) as "work that involves planning, administering or evaluating programs designed to develop employees and manage learning in the organization"). The Human Resources department works to ensure that the company acquires high quality talent, manages the succession of talent within the organization, monitors the performance of existing talent, and provides opportunities for talent to improve and grow. Successful execution of all of these activities is dependent on the configuration of the department, departmental resources and programs, supporting systems, and defined objectives and values.

The following discussion analyzes current programs, infrastructure and resources that comprise the Human Resource Development program at Company X. This analysis includes consideration of Operational Structure, Training Infrastructure, Physical Systems, Human Performance Measurement, Succession Planning, and Core Values. Since each of these HRD components impact the company's project execution and new product development capability, a discussion of each follows.

3.2.1 Operational Structure

The VP of Human Resources reports directly to the Company X CEO. The department is relatively small considering the size of the company and is comprised of the following personnel:



Source: Company X, Copyright 2003, adapted by permission.

Figure 3: Organizational Configuration: Human Resources

These employees are responsible for developing human resource initiatives, benefits administration, compensation administration, recruitment, training, performance appraisals, cultural development, orientation and strategic planning.

3.2.2 Training Infrastructure

Company X has recognized the need to further develop its training infrastructure and invest in employee training. Despite this, within the past couple of years, the company has severely restricted training expenditures due to economic conditions and cost containment. In 2002, the total budgeted amount for training was $518,000, however only $106,000, or 20%, was actually allocated to employee training (Company X Training Strategy 2003 Update, 2002, p. 12). Of this amount, 66% was directed toward tuition reimbursement and 33% toward a one-time workshop on lean engineering design provided by an external facilitator (p. 4). The budgeted year-to-date training allocation is .6% of total operating expenses however actual spending is only .2%.

Since Company X's bottom line focus and the need to control costs is expected to continue, HR must develop systems and metrics to link investments in training to business objectives and profits. For 2003, managers within each functional unit were responsible for setting a training budget. Managers reviewed the entire budget with Finance but were not required to submit their training plan or budget to HR. Consequently, in many cases, the training budget was unallocated or not discussed in detail (Interview participant, August 26, 2003).

Currently, the tuition reimbursement process is the most well-defined training process within Company X (Interview participant, August 26, 2003). A tuition reimbursement request form must be filled out by the employee's manager detailing the type of training, all costs including travel expenses associated with the program, and an explanation of how the training relates to the employee's current or potential future job duties. This form must be signed off by the executive team leader and the VP or Human Resources. If the training program cost is greater than $3,000, or if the training expenditure for any one individual employee exceeds $3,000 in one calendar year, the request must also be approved by the CEO (Company X Tuition Reimbursement Form). Any education that has been approved is reimbursed by the company upon successful completion and recorded in the employee's record within the Human Resources Information System ("HRIS").

Aside from this, there is no specific system in place to manage the ongoing education of employees as a whole. However, as part of its 2002 training strategy, Company X HR identified a need to implement systems, processes and products to support training. Specific initiatives include the development of:

- a system to track training expenditures and training hours per employee
- a training resource library on the company's corporate intranet site to display a training framework and store training documents. (Company X Training Strategy 2003 Update, 2002, p. 5)

The consistent use of these tools across the organization will help in building a learning culture, provide information on the network of competencies within the company, and assist HR in monitoring and measuring the effectiveness of training on work performance and overall results.

3.2.3 Physical Systems

3.2.3.1 Company X Enterprise Operating System

Company X has a number of physical systems designed for use by all departments. Its corporate intranet is one of these. It is accessible to all employees and managers and is a valuable communication hub that supports employee self-service and enhances knowledge sharing. Current benefits of the intranet include centralized records, continuity in communication and remote accessibility. It contains areas specific to HR that enable access to commonly-used forms

and documents supporting HR processes and procedures; publication of corporate HR policies; and interaction with limited HR-related personal information. Future uses planned for the HR section of the intranet site include employee access to, and ability to update, personal information and vacation scheduling, and increased interactivity (Interview participant, August 26, 2003).

3.2.3.2 Human Resource Information System ("HRIS")

Company X currently uses an HRIS system marketed by a Vancouver-based company called "HRA". The system contains functionality to manage resource scheduling, compensation, benefits, training, and performance results. It interfaces automatically with Payroll and is used to provide regular reporting for management and to calculate quarterly Sales Incentive payments. As well, the system uses built-in business rules to create automated events that assist in administering routine, event-driven functions, such as performance review notifications upon set dates.

Currently, the HRIS is only accessible to HR and payroll personnel. The need to maintain control over the data to ensure accuracy, reliability, and appropriate levels of confidentiality has prevented HR from extending access to the system to managers and employees throughout the organization (Interview participant, August 26, 2003).

3.2.4 Performance Measurement

The performance management process is well-established at Company X and well-documented under the HR section of the intranet site. Performance reviews are completed for approximately 90% of the organization's employees each year (Interview participant, August 26, 2003). While HR must drive and 'enforce' the process, it is the responsibility of managers to carry out the appraisals. However, HR provides support to managers by publishing the following documents on the company's corporate intranet site:

- A detailed outline of the performance management process
- Guidelines and suggestions to assist managers in conducting performance reviews

The process itself begins in January when senior management establishes corporate and team objectives for the year. Once these objectives are finalized, the following two forms are used to document and authorize the performance management process:

1. The *Objectives Setting Template* is used by executive team leaders to cascade objectives through to their teams and to document agreement between each employee and his/her manager on the employee's objectives for the year.

2. The *Performance Review Form* is used by managers and employees to review performance against objectives. This review must be conducted prior to January 31st of the following year and submitted to HR.

Company X has implemented a company-wide Corporate Bonus Plan to provide employees the opportunity to share in the company's success. Rather than setting individual targets, employees are rewarded based on the performance of the company as a whole. The Corporate Bonus Plan therefore provides a mechanism for communicating overall company objectives and for focusing employee efforts on shared goals. For example, the objective for 2003 is an Operating Cash Flow of $15 million. If the company fully achieves this objective, then each eligible employee will receive a bonus equal to his or her Target Bonus Percentage multiplied by the employee's salary (Company X Corporate Bonus Plan 2003). The performance management system, particularly the objectives setting process, provides each employee with a clear understanding of his or her role in achieving the target set by the bonus plan.

3.2.5 Succession Planning

Company X has recognized the need to identify key positions and individuals throughout the company and prepare development plans to ensure that the right people are in the right roles. Company X's first succession planning project is scheduled to be completed by the end of December 2003. HR is in the process of completing detailed profiles for each member of the Senior Management team as well as incumbents in key positions including director, manager and senior professional roles. The outcome of this process will be a consolidated succession plan and detailed action plans for implementation in 2004 (Interview participant, August 26, 2003).

3.2.6 Core Values

While the HR department does not necessarily identify a set of HR-specific core values, its activities are guided and driven by the core values of the corporation. The company strives for

excellence in product management, in predicting which markets to enter next, and in forming and developing strong customer relationships. The HR department endeavours to create high performance teams to support these three priorities (Interview participant, August 26, 2003).

3.3 Product Development

Chiesa, Coughlan and Voss (1996) define product development as "the process whereby new product concepts are taken through the stages of development, testing, and manufacturing to successful launch and support of the product" (129). They identify the following four activities as critical to implementing a successful product development process (135-136):

1. disciplined project management
2. effective teamwork and project organization
3. efficient transfer from design to manufacturing and distribution
4. high quality industrial design

Company X's ability to continuously improve upon execution of these activities is essential to achieving growth in profits and market share. In fact, product development is such a core activity that all of Company X's stated strategic objectives – building on technology and market knowledge to deliver sophisticated component solutions, delivering superior quality and service, and achieving a low-cost position in product manufacturing – are directly linked to product development.

3.3.1 Company X Product Development Process Overview

Recognizing this, Company X has formalized a process called Product Creation & Support ("PC&S") to guide the creation, delivery and support of new products across the entire organization. One of the main goals of the process is to reduce the time lapse between the initial product idea and delivery of the product to customers (Company X PC&S Framework, 2001, p. 7). Decreasing product cycle time enhances the company's ability to respond to market changes and customer needs, thereby increasing competitiveness and profitability. To communicate this message, Company X uses the catch-phrase "In Time – On Time". It emphasizes the importance of executing product development "On Time" to deliver products "In Time" to capitalize on market opportunities (p. 7).

The PC&S process consists of phase-gate control, cross-functionality and shared product ownership. For any new product activity or product program, a Business Champion and Technical Champion form a partnership to manage the product life-cycle from concept to market, and to maintain momentum and responsibility for initiating new products and/or product modifications after a product is launched. Ownership and execution of program deliverables rests with the Program Manager/Project Leader and depends upon an effective matrix, multi-functional Core Program Team (p. 6).

The process itself is comprised of four sequential phases – Definition, Development, Launch and Post Launch. These four phases are further broken down into the eleven activities shown in the diagram below:

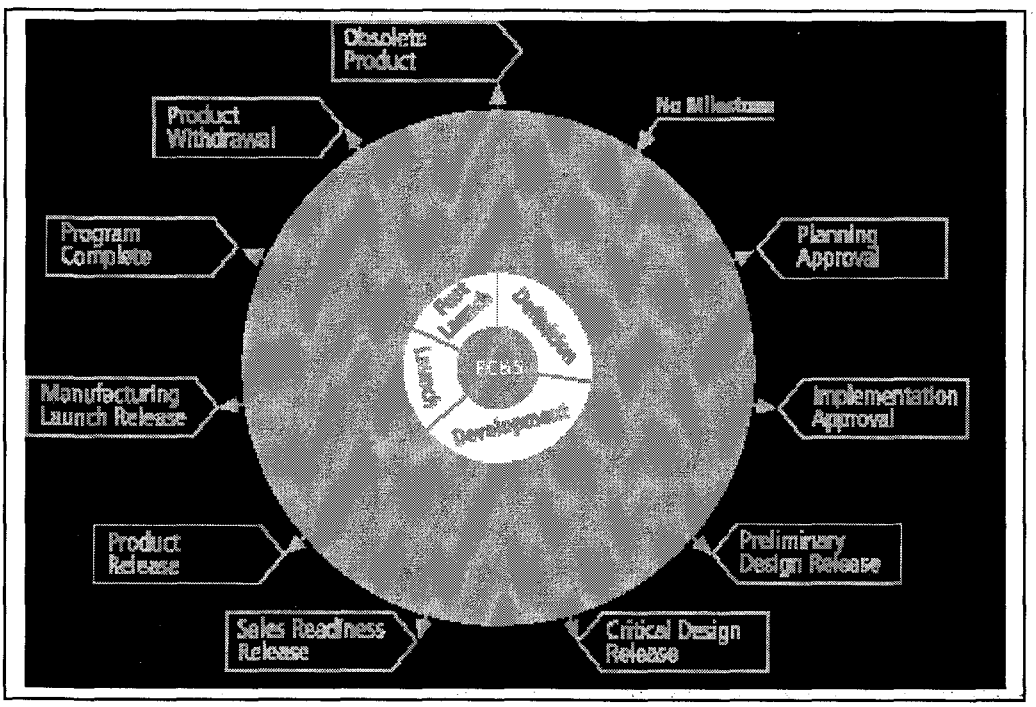


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Figure 4: Company X Product Creation and Support Process

The Program Team maintains responsibility for adhering to the PC&S process. However, a senior functional management review body called the Product Approval Committee ("PAC") oversees the process. The PAC provides each Program Team with business, market and technical guidance and assists with resource assignment priorities. As well, the PAC judges whether a process milestone at the end of a phase has been completed successfully before the product can move on to the next phase (p. 11).

3.3.2 PC&S Process in Practice

While the PC&S process on paper appears infallible, the reality is that some projects move seamlessly through the phase-gate cycle and achieve market success, while others are over budget and late to market, resulting in decreased profits and missed opportunities (Interview participants, August 26, 2003). In certain market segments, such as the consumer market, Company X's ability to execute the process successfully has resulted in improved margins and competitive advantage. However, in other markets, such as RV or marine, product scope tends to expand and subvert the process because the products are typically more complicated. Detailed analysis reveals that where projects have failed to achieve market and revenue objectives, steps in the process were skipped, or resources were either shifted to other projects or were insufficient to pursue all of the market opportunities. Examples include:

1. **Shore Power Converter** (Marine Market) – The target launch date for this product was initially set for May 2003. However, the product development team was so busy working on another project that the launch date was pushed back to the fourth quarter of 2003. While the project is now on track, Company X will have to forego $750,000 in revenue that was expected in the 2003 revenue plan.

2. **"Nova" RS2000 Sine Wave inverter/charger** (Mobile Market) – The target launch date for Nova was June 2003. Although the revised launch date was pushed back to October, the project is still not on track. Product features have expanded to such an extent that an anticipated delay of nine months has been created with a resulting $1,500,000 in lost revenues for Company X. In addition, it poses a significant threat to the company's leadership position in this market segment. (Company X Product Development Weekly Status Report, 2003, p.3)

On a broader scale, of the twelve products being developed within the Mobile market segment, six projects did not meet their target launch dates. Of those six projects, two have also not met revised launch dates. As well, not one of the twelve products being developed for the Distributed market in 2003 met its target launch date. In fact, as of July 31, 2003, actual revenue earned on new products represented only 38% of the revenue that was forecasted in the corporate business plan (Company X Major Programs Marketing Program Plan).

This data supports the widely recognized view among Company X management that while the PC&S process provides a useful foundation for product development, improvement of execution is needed. Of the four key product development success factors discussed earlier, analysis will focus primarily on strengthening Company X's project management practices,

teamwork and project organization. The research and analysis presented in the following section will explore these concepts in further detail.

4 PROBLEM ANALYSIS

4.1 Introduction

Porter's product life cycle model demonstrates that a company's strategy for a product changes from differentiation to low cost as the product matures and competitors enter the market, driving price down. Similarly, Company X must be able to follow a differentiation strategy for new products at the same time as a low-cost strategy for mature products. For example, in the wind power market, the product life cycle is very long and market demand changes gradually. However, in the consumer market, products mature quickly and the company must move from a differentiation strategy to a low cost strategy within the course of a year or two. Therefore, the infrastructure of the organization must be able to simultaneously support these distinctly different strategies, while allowing the company to effectively pursue various projects concurrently.

For Company X to achieve this, it must have a strong, flexible process for new product development, from the identification of new product ideas all the way through to the delivery of products to the consumer. Without a strong execution plan, the company will lose its competitive position as projects run over time and over budget, and the windows of opportunity close. A study of 193 high technology companies in North America suggests that "the leaders in product development show consistent superiority in project execution, portfolio planning, and management support mechanisms" (Deck, 1994, p. 50).

According to leading research on project delivery, there are a number of important inputs that contribute to successful project execution. These inputs include:

- training employees to acquire necessary skills
- measuring performance against internal and external benchmarks
- creating a quality management plan to guide outcomes
- configuring the organization to build cross-functional teams
- following a rigid product development process
- using decision analysis tools to assess opportunities and options

- prioritizing projects within a program model, and
- allocating financial and human resources to deliver on the set program.

To improve its project execution, Company X must address gaps within these areas of its project delivery system. The quality of these inputs determines the success of the end result and the ease with which project teams deliver on requirements.

4.2 Research Overview

Research including literature reviews, employee interviews and management consultation will be used to investigate the above-named inputs to project execution. Company X is searching for ways in which the company's human resource development infrastructure can be designed to address this problem. Key questions underpinning this research and analysis include:

1. How should Company X develop and train its employees and managers to achieve strategic business goals with limited financial resources?
2. How can Company X demonstrate positive ROI for HRD infrastructure improvements?
3. How should Company X prioritize strategic HRD infrastructure improvements?
4. How should Company X develop and train its executives and project leaders to improve expertise in the organization and management of new product development?

In two sets of interviews with Company X project employees, managers and executives, several symptomatic issues were commonly described by employees as the key problems contributing to Company X's project execution challenges. However, these "symptoms" seem to stem from deeper issues within the organization.

The following analysis is therefore divided into two sections: Symptomatic Issues and Root Issues. Symptomatic issues include Training, Organizational Configuration, Corporate Culture and Values, Performance Measurement, Product Development, Program Management and Quality Management. While improvements in these areas will improve the status quo, addressing the two major root issues of Decision Analysis and Resource Planning will enhance Company X's project practices in a more fundamental way, and address the symptomatic issues at the same time.

This analysis will summarize the key findings of the internal and external research and describe the challenges Company X faces with respect to both the symptomatic and root issues. The Recommendations section will then identify practices, processes and potential solutions to improve Company X's project execution capability and enhance its competitiveness.

4.3 Symptomatic Issues

4.3.1 Training

4.3.1.1 Overview

As discussed in Section 3.2.2, aside from its tuition reimbursement program, Company X does not have a well-organized and consistent approach to training. To address this, efforts were initiated by HR in 2003 to create a strategic plan for training, and develop a database to track training initiatives and expenditures. One of the key objectives of the training strategy was to improve the company's project execution capability. Specifically, training programs related to leadership development, project management, problem solving and cross-functional team facilitation were identified as critical inputs in the development of a project management mindset and a learning culture (Interview participant, August 26, 2003).

Preliminary discussions for this Applied Project centered on the development of a training framework and implementation plan to reinforce these internal activities. In interviews conducted for this project, Company X personnel expressed general support for investments in employee training and expansion of the training infrastructure. However, when managers were asked to identify knowledge or skill areas that would enhance the ability of their employees to execute projects, a different perspective emerged (Interview participants, October 17, 2003).

Managers attributed delays on projects to inadequate staffing, both in terms of the number of employees allocated to projects, and the breadth of skill sets and abilities of those employees. According to one interviewee, "too many silos of knowledge [exist throughout the organization] so experts have to be pulled off other projects" (Interview participant, October 17, 2003). Thus, while project management training, for example, would be beneficial in terms of enabling employees across the organization to "speak the same language," it would not alleviate issues related to lack of knowledge and skill transfer, and dedicated project resources. In this

environment, it is not surprising that managers generally felt that sending employees on training courses would only cause further delays to project timelines.

Additionally, training is often difficult to justify for managers in a growing organization where significant focus is placed on financial gain and expenditures are monitored tightly. The difficulty in demonstrating the impact of investments in training to revenues means that training expenditures are considered discretionary. However, research has consistently demonstrated the link between investments made in employee development, and a company's bottom line. According to a study of 500 publicly traded U.S firms conducted in 2000 by the American Society of Training and Development ("ASTD"), those firms that made the greatest investments in training and development earned 86% higher shareholder returns than those that did not, and 46% higher than the market average (Flynn, 2003, p. 13).

As well, a recent study of the twenty-five 'best' companies worldwide, across various industry sectors, demonstrated that a firm's ability to attract and retain high performers is directly tied to its investments in employees (Martel, 2003, p. 27). Specifically, by investing in training, compensation, benefits and facilities, the most successful organizations benefit from improved performance as well as enhanced loyalty and commitment. In essence, "high-performing, committed employees make for high-performing companies" (Martel, 2003, p. 27).

	U.S.[1] (2001 data)	Canada[2] (2000 data)	International[3] (2000 data)
Total training expenditures per employee	USD $761	CDN $859	USD $630
Total training expenditures as % of payroll	1.9%	1.8%	2.5%
Percent of employees that received training	78.5%	-	76.7%
Payments to outside companies as % of total training expenditures	20.9%	-	26.2%
Total training hours per employee	23.7	30	25.6

Table 2: Key Training Metrics

1 Thompson, Koon, Woodwell & Beauvais, 2002.

2 Harris-Lalonde, 2001.

3 American Society for Training & Development, 2002.

4.3.1.2 Best Practices

A study of leading global technology organizations such as Motorola, GE Aircraft Engines, and Borg Warner Automotive revealed a number of trends in global management development. The outcome of the research is a list of best practices that will serve as a framework to guide the discussion and research within this section (Sullivan, 1993).

4.3.1.2.1 Link training and development to strategy

In the previously mentioned study of twenty-five 'best' companies worldwide, it is not surprising that most seek to align HR strategy with company strategies and business goals. In all of these companies, senior HR executives participate in annual and strategic planning processes, providing input on the HR consequences of proposed actions, developing requirements for recruiting, compensation and training, and setting goals for retention (Martel, 2003, p. 29).

Organizations such as Federal Express, AT&T, Texas Instruments, Xerox, Hewlett Packard, and Boeing, go a step further to integrate training into the corporation. These companies and others participate in the ASTD Benchmarking Forum in an effort to identify best practices. To emphasize the importance of training as a business strategy, it is common for the most senior training position, or chief training officer, to have high visibility in these organizations, positioned at an average of three reporting levels from the chairperson or CEO (Kimmerling, 1993, p. 3).

At a more basic level, the company's mission and vision statements should guide human resource development efforts. While some company's mission statements are explicitly included in HR objectives and goals, others have HR-specific mission and vision statements which are consistent with overall company strategy. Of the nineteen original member companies of the Benchmarking Forum, training is explicitly mentioned in the corporate strategic plans of all but three companies (p. 3). In fact, since participation in the Forum attracts companies with strong financial and organizational commitments to employee training, it is common for the training organization itself to have its own mission statements and strategic plans.

In terms of content, mission statements of Forum members consistently included brief, broad descriptions of the relationship between training and corporate effectiveness, customer satisfaction, and quality (p. 4). According to Sullivan's research on leading multinational

corporations, "the company's mission must be articulated and the business strategy communicated in a way that rallies all employees to make the required changes" (1993, p. 3).

Since it is evident that employee development must be linked to strategy, the focus of any training initiative should be to enhance the company's competitiveness and facilitate its ability to achieve strategic objectives. Therefore, training and development must address both opportunities and challenges facing the organization. HR and management must first identify areas for improvement and then select the most appropriate training and development strategies to address those organizational issues.

4.3.1.2.2 Prove ROI in training

In a conference sponsored by the ASTD, training professionals were asked to identify and vote on the most significant trends affecting workplace learning and performance. Of the top ten most influential trends, the issue ranked number one was aptly titled "Money." According to industry insiders, the "increasing pressure from shareholders for short-term profits means that there is greater pressure on employees to produce results and on training to show a return on investment" (The 2002 ASTD State of the Industry Report quoted in Tomlinson, 2002, p. 18). In organizations where there is a lack of support for training and performance improvement programs, it is even more critical to measure the results of training and to demonstrate impact on the bottom line. In essence, ROI should be used to strengthen the learning process and to provide a means of evaluating and communicating the effects of training and performance improvement programs.

4.3.1.2.3 Leverage training technology

The delivery of training and the use of e-learning and other training technologies are making training more affordable, portable, customizable, and accessible. Traditionally, training has been delivered using a variety of methods, from scheduled classroom sessions to individual, self-directed learning packages. While these delivery methods provide the basic tools for distributing content, well-designed technology-based training such as multimedia and computer-based training, offers several advantages over classroom-based corporate education programs. By utilizing training technologies, organizations now have the ability to:

1. **Serve a geographically dispersed community of employees.** Large corporations have many employees, distributed regionally, nationally and internationally.

Utilizing technology to deliver training ensures that all employees have access to education programs across borders of time and space.

2. **Provide "lifelong" learning for employee retention.** While traditional techniques certainly deploy content, they rarely ensure that employees absorb and retain the knowledge. According to Sullivan, training technology can provide "greater mastery of the material in less time and with higher employee satisfaction" (1993, p. 2). As well, best practice organizations recognize that providing education and training builds greater loyalty and commitment among employees while at the same time, providing benefits to the organization in the form of improved performance and increased productivity, and minimizing the tangible and intangible costs associated with high turnover (Martel, 2003, p. 40).

3. **Offer 24/7 access to education.** If learning is scheduled during busy daytime hours, absorption, focus and retention are not maximized. 24/7 access allows employees to learn on their own schedules and enables global corporations to serve geographically dispersed employee groups simultaneously.

4. **Decrease training costs.** Disseminating information and instructors to all employees across time and space can be extremely costly due to travel time, scheduling, workday conflicts and materials development. However, training technologies are becoming more affordable, offering organizations the potential to lower costs. Typically, traditional classroom training is characterised by lower development costs and higher delivery costs whereas technology-delivered training tends to have higher development costs and lower delivery costs. That said however, companies like IBM claim to have been able to save $150 million by expanding the use of technology-based learning systems (Sullivan, 1993, p. 2).

5. **Ensure consistency in training.** As a result of the costs associated with centralized, instructor-led education in global organizations, training is often delivered by varied groups of instructors, "train the trainer" programs and line managers. Training technologies offer the ability to minimize such diversity in delivery, thereby ensuring more consistent standards and criteria for success.

6. **Create competitive advantage.** Corporations gain competitive advantage from skilled employees. Improving organizational learning through technology increases the company's quality of service, innovative and evaluative capacities, allowing it to become a stronger market player.

7. **Leverage corporate investments in technology.** Modern-day corporations continue to implement large-scale communication and collaboration technology infrastructures to improve organizational processes. Utilizing existing technology to deliver training provides opportunities for organizations to leverage these infrastructure investments in other ways. As well, enterprise-wide learning systems provide many easy ways to follow-up with participants upon completion of training programs, including surveys and online discussion boards.

8. **Serve all demographic groups.** Requirements are becoming stronger for employers to adapt to and integrate all demographic groups based on age, ability, ethnicity, gender, etc. Technology offers the ability to customize and adapt the content and delivery methods to enhance learning.

9. **Meet government regulations.** As government regulations change, corporations must also change their education programs to incorporate new requirements or new information. This can be costly in large organizations, and significant time lapses can occur before information is fully disseminated. Through technology, these costs can be minimized and the information disseminated on a timely basis.

While instructor-led classroom training continues to be the dominant form of training, the abovementioned benefits of e-learning technologies are contributing to its growth. An ASTD report summarizing findings from 270 U.S. organizations showed that the percentage of training delivered in the classroom declined from 79.4 percent in 2000 to 77.1 percent in 2001. In contrast, the percentage of training delivered via learning technologies rose noticeably to 10.5 in 2001, from between 8.5 and 9.1 percent over the last several years (Thompson, Koon, Woodwell & Beauvais, 2002).

This trend is also reflected in Canada and internationally. According to a Conference Board of Canada report conducted in 2001, 13 per cent of all training is delivered using learning technologies, up from 9 per cent in 1998 (Harris-Lalonde, 2001). Globally, "The 2002 ASTD International Comparisons Report" on patterns in employer-provided training states that there has been a steady increase in the overall percentage of training delivered via learning technologies, from 8.8 percent of all training time in 1997, to 9.7% in 2000 (ASTD, para. 5).

In terms of delivery method, text-only computer-based training and multimedia were the most common methods of presenting content to learners across the world. CD-ROM was the most common method used to distribute training to learners, followed by e-mail, the internet, intranets, and Local Area Networks (ASTD, para. 8).

4.3.1.2.4 Demonstrate long-term commitment

For training programs to be successful, participants must be able to transfer knowledge to the job. Unfortunately, however, research has shown that between 60 and 90 percent of what is learned in training programs, is not put into practice (Phillips & Phillips, 2002, p. 84). For example, a recent survey of training professionals conducted by researchers at York University revealed the following data on training transfer (Molinaro, 2003, p.13):

- Only 62 percent of employees immediately apply what they have learned in training courses. This figure has been shown to decline over time to the extent that one year after attending a course, only 34 percent of employees are able to apply what was learned.

- In terms of investments made in training, only 51 percent of investments resulted in positive changes in employee performance and only 47 percent led to improvements in organizational performance, suggesting that only half of all training programs are successful.

One of the main reasons for poor training transfer is that "there is still a strong tendency to view training as an isolated event rather than an ongoing process" (Molinaro, 2003, p. 13). Leading training and development researchers Jack Phillips and Patricia Phillips support this statement. In fact, they cite "regarding training as an event" as one of eleven reasons why training and development fails to meet expectations (2002, p. 83). They assert that organizations must recognize that changing employee behaviour requires continuous, ongoing effort, coupled with the proper motivation and support (p. 83). This requires a long-term outlook and commitment from senior executives.

The most effective way to demonstrate long-term commitment is for senior executives to not only allocate resources to the training function, but to also show support for specific programs by taking active roles (Phillips & Phillips, 2002, p. 85). Examples include having executives open or close training programs, attend courses and interact with employees, teach portions of courses such employee orientations, etc. In leading organizations such as GE, Intel and IBM, top executives recognize that demonstrating commitment to training initiatives is critical to ensuring the effectiveness of training investments, and to building a learning culture throughout the organization (p. 85).

In addition to commitment and involvement from senior-level executives, it is also critical for managers to reinforce and support training by providing opportunities for employees to immediately practice and implement new knowledge and skills in the workplace. In fact, in leading multinational organizations, managers are held accountable for the effectiveness of training initiatives through their own job descriptions, responsibilities, and reward systems (Sullivan, 1993, p.4). This ensures that training leads to behaviour changes and on-the-job improvements, and helps the organization maximize its return on training investments.

Of the more than 400 impact studies reviewed and conducted by Phillips and Phillips, the majority showed that the most powerful and simplest, way for managers to influence the learning process is to discuss the training with the employee before and after the program (2002, p. 84). By asking employees to think about how they can apply the learning before the actual training begins, and by following up with employees afterwards, managers can increase the transfer of learning to the workplace.

At the same time, Jack and Patricia Phillips suggest that participants themselves must also be held accountable for results, with or without an unsupportive manager (2002, p. 82). While the participants' role in a training program has traditionally been limited to attendance and learning, these researchers propose that participants should also be held responsible for applying the newly acquired skills, for driving performance and behaviour changes on the job, and for achieving business results and reporting those results to training and development staff (p. 82).

4.3.1.2.5 Assure lifelong learning

Demonstrating long-term commitment goes hand in hand with assuring lifelong learning. To succeed in today's fast-paced, rapidly changing business environment, leading global organizations recognize that they must provide and emphasize the importance of ongoing training and education. The knowledge, skills, attitudes and values required today are built upon on analytical and intellectual skills and capabilities, as opposed to the manual skills required in the Industrial Age. This change in the nature of work means that learning cannot be viewed as a one-time event but rather an ongoing, continuous process.

To illustrate, as a leader in corporate training and education programs, Motorola realized that the key to effective training was not simply a matter of providing courses for employees, but rather of motivating people to want to learn. The company overcame this issue by involving everyone in training, by creating a learning environment through initiatives such as the Motorola University, and by emphasizing "a continuing openness to new ideas" throughout the organization (Sullivan, 1993, p. 4).

Martel's study of twenty-five high performing companies reveals that education and training practices are based on the following five general principles. Examples are provided for each principle to demonstrate how best practice organizations are incorporating these values (2003, p. 38):

1. **Make learning continuous.** On Intel's web site, every employee is encouraged to "continue his or her professional development in skill areas of benefit to both the company and the individual" (p. 39).

2. **Make training informal.** Toyota has implemented a "Three-Fold Education System" comprised of on-the-job training, formal education and informal education. Of these three methods, a significant 90 percent of training is informal (p. 39). For example, job rotation is used "to teach new skills and to develop flexibility and a willingness to adapt quickly to technological change and to respond to challenges" (Sullivan, 1993, p.4).

3. **Share information.** Executives at Ericsson recognized that information sharing does not occur naturally between individuals, let alone across organizational boundaries. To overcome this, the company fosters a culture of knowledge sharing by rewarding people for sharing (p. 40).

4. **Meet changing needs with different job-related programs.** Best practice companies seek to continuously improve performance and enhance employee retention through orientation programs, management development, education in "soft" skills such as communications, and competencies training. To meet changing needs, HR is responsible for identifying competencies required by strategic plans, developing inventories of existing competencies, and creating training programs to fulfill identified gaps (p. 40).

5. **Promote general education.** Most of the best companies contribute generously to the general education of their employees by providing tuition reimbursement and time off, because experience has shown that enriching employees' education enhances loyalty and commitment to the company (p. 40).

All of these principles complement one another and work together to promote lifelong learning. Essentially, they form the building blocks in the development of a learning culture.

4.3.1.2.6 Develop intact teams

Organizations are becoming increasingly dependent on teamwork and shared responsibility. In fact, the widespread influence of teams and teamwork in organizations is influencing a transition from traditional hierarchical structures to very flat, self-directed, cross-functional configurations. Recognizing that the collective brainpower of a team exceeds the ability of any one individual, organizations are relying on teams to solve problems, make decisions, and achieve strategic and operational results.

Since individuals must depend on others to accomplish work, it follows that training and developing individuals separately is not as effective as training the team as a group. To facilitate

and enhance team development, and ensure that teams realize desired performance and results, "intact" teams – any group of people who work together on a regular basis - must progress through the training together. As Sullivan fittingly states, "To conduct a program on accelerating new product development without all functions present would be like cooking without all the ingredients at hand" (1993, p.4).

Among the most important benefits of training intact teams is that the theory and knowledge become part of the shared vocabulary, and the values and attitudes become part of the social environment and culture. As well, researchers studying team effectiveness claim that "addressing issues such as task interdependence, team member turnover, and task variety is most effective when intact teams are trained using task simulation, role playing, and guided task practice" (OPM, 1995, para. 6).

Training professionals take the concept one step further by recommending that supervisors actually conduct the training for their own teams. Comparisons of training sessions conducted by professional trainers versus those conducted by supervisors have demonstrated that while "trainers generally train better," "leaders are more capable of bringing about significant and lasting change" (Professional Development Associates, 2002, p. 5). The reason for this is that supervisors are better able to identify real training needs, deliver relevant and related content and follow up with their teams to reinforce learning and encourage on the job application.

A study of training and HR practices in Baldridge Award-winning companies revealed that having managers conduct training courses served two purposes: to demonstrate senior-level commitment to the quality message and to reinforce the importance of quality training to lower-level employees (Blackburn & Rosen, 1993, p.). However, in Japanese companies, sharing knowledge is so ingrained in the foundation of the organization that this practice is not limited to formal classroom training. Every individual is expected to be a trainer and to help others learn, to the extent that: "For managers to be successful, they must first be successful teachers" (Sullivan, 1993, p. 4).

4.3.1.2.7 Continually learn and implement best practices worldwide

The most innovative and successful organizations constantly scan the environment for new and improved management development practices and determine the relevancy of these practices to their unique situation. Organizations must recognize that all of the abovementioned

factors – from proving ROI to demonstrating long-term commitment to developing intact teams - contribute to the rate of learning within the firm. In essence, this creates a cycle whereby organizations must create and sustain a learning culture to benefit from the implementation of best practices.

4.3.1.3 Summary

Company X does not have a well-established training infrastructure because of the inherent challenges in demonstrating ROI and because sending employees on training programs is seen to cause further project delays. However, the research discussed in this section has clearly demonstrated that firms that invest in training and development perform better financially and are better able to attract and retain high performing employees. To ensure that training investments achieve the desired returns, it is critical for Company X to link training and development to the organization's strategy and implement a framework for measuring and communicating the results of training initiatives. Development of a training infrastructure will help Company X to improve its project execution capacity by promoting cross-functional teamwork, leadership, and a learning culture throughout the organization.

4.3.2 Organizational Configuration

4.3.2.1 Overview

The configuration or structure of an organization influences its ability to achieve strategic objectives. Likewise, the fit between structure and strategy has significant implications for the performance of the organization. For Company X to excel at its new product development projects, its structure, processes, operations and performance systems must support its ability to produce outputs that satisfy customers, generate profits, and ultimately, survive and succeed in a competitive environment.

To assess the fit between strategy and structure, it is necessary to begin with the identification and articulation of the organization's current goals, objectives and values, followed by a review of the extent to which the existing organizational configuration supports stated values and facilitates achievement of identified goals and objectives. At Company X, the strategy is well-defined and articulated throughout the organization. However, issues related to organizational configuration impede Company X's ability to deliver on its strategic objectives.

Currently, those employees at Company X who were interviewed for this project feel that product development activities are viewed as engineering activities rather than company-wide responsibilities. As well, despite efforts to improve knowledge transfer through recent structural changes, projects continue to suffer from a lack of cross-functional integration. As a result, the execution of project activities, which are dependant on input from various groups in the organization, is hindered by the misalignment of project execution processes with company-wide strategies.

Additionally, Company X managers felt limited in their ability to positively impact the likelihood of project success. According to one interviewee:

> The feeling is that you try to make changes but if the senior team doesn't buy into it, it won't stick. The senior team doesn't buy into anything that doesn't directly drive revenue. There's a real hesitation to put anything forward because there's no belief that anything will happen. (Interview participant, October 17, 2003)

This perception is problematic in all organizations, but is particularly detrimental in companies that depend on effective NPD processes for continued success. At Company X, company growth is tied to products developed in the last three years. Therefore, a rapid market-focused new product development process is integral to maintaining a market-leadership position in a variety of segments. To achieve this however, managers must be empowered to make decisions and lead efforts to shorten product cycles, meet project deadlines, and streamline processes.

The research provided in this section outlines a number of organizational characteristics that are required to enhance NPD success rates and accelerate time to market. These include:

- high-level commitment, involvement and leadership from senior management
- cross-functional team integration
- participative management style and project team structure

4.3.2.2 New Product Development and Organizational Characteristics

A number of organizational characteristics have been shown to enhance new product success and project execution capabilities. To illustrate, a study of NPD success in American and British firms demonstrated that factors related to marketing, organizational structure and culture,

and project execution were found to be critical to success whereas technology and product factors were not (Balbontin, Yazdani, Cooper & Souder, 1999, para 9). Similarly, a study of 193 high-technology companies in North America revealed that the leaders in new product development have configured their organizations to directly nurture and support NPD efforts. In these organizations, "senior executives are visibly committed to product development, cross-functional teams are promoted, and 'new product champions' are assigned and rewarded" (Deck, 1994, p. 51).

Robert Cooper's extensive research into NPD success factors provides further support for these findings. Cooper's Stage-Gate model offers a framework for NPD that stresses commitment from senior management and a cross-functional team approach (Cooper, 2001, p. 119).

4.3.2.2.1 Senior Management Commitment

One of the most visible ways for senior executives to demonstrate commitment to the NPD process is to allocate resources to projects in terms of funding, staffing, and employee release time from regular work (p. 119). While resource allocation is an essential activity, senior management leadership is also needed at a much broader strategic level. Factors such as advancing technology, product complexity and the need for greater company integration make it necessary for senior executives to become more deeply involved in all aspects of the product cycle, from determining the product/market strategy, to making investment decisions, to production (Slade, 1992, p. 36). Slade argues that executives are the only ones with the authority and stature to institute the changes required to improve new product success. Specifically, executive involvement is critical to the following high-level issues (p. 35-36):

1. Setting the strategies for new products, resource allocation, and major capital investment
2. Integrating the business through organizational realignments and cross-functional teams
3. Creating a positive learning environment
4. Establishing stable, institutionalized practices and structures
5. Assessing performance of the whole

Thus, while NPD may appear to fall under the domain of R&D and marketing, these issues are clearly beyond the scope of either of these functional areas. Deck's study of successful NPD practices shows (1994, p. 51):

- In 70 percent of high-performing companies, senior management demonstrates visible commitment to the firm's stated vision, market opportunities, and the role of NPD. This compares to only 33 percent of low-performing companies.

- In 75 percent of high-performing companies, senior management focuses as much attention on NPD as on other aspects of the business, versus only 42 percent for low performing companies.

Clearly, high-level commitment, involvement and leadership have a direct impact on new product success.

4.3.2.2.2 Cross-Functional Team Approach

Today's fast-paced business environment requires that organizations expedite decision making, shorten product cycle times, meet deadlines, eliminate redundancies and streamline processes. Rapidly expanding and growing companies like Company X are challenged to develop and evolve their infrastructures and internal mechanisms to remain competitive in the midst of constant change. To manage this organizations are becoming increasingly dependent on teamwork and shared responsibility. In fact, many organizations today consider cross-functional teams to be essential to achieving strategic and operational results. The benefits cited by organizations include:

- **Increased job satisfaction.** Employees who pull together as a team "have more pride – and more of a stake – in their individual performances."

- **A sense of closure.** "Everyone enjoys getting things done and moving on to something new. Cross-functional teams let you start projects fresh, without the baggage of unfinished business or loose ends to distract them."

- **Better cooperation among people and between departments.** Increasing the flow of communication between departments facilitates a better understanding of the value that each business function adds to a project. (SkillSoft Corporation, 2002)

In addition to these benefits, Cooper's research on NPD processes has demonstrated that cross-functionality enhances NPD success rates and accelerates time to market (Cooper, 2001, p. 119). Organizations can no longer afford to allow project work to progress in a linear fashion

from department to department. Instead, new relationships must be formed within the existing organizational structure that cut across traditional flows of authority. Effective NPD and project execution therefore require active participation and commitment, and shared responsibility, from various business functions across the organization, particularly marketing, R&D, engineering and operations (p. 119).

One of the inherent challenges in a cross-functional approach is the reliance on informal relationships for effective coordination, as opposed to the formalized hierarchy of authority depicted in organizational charts. While there is no one "right" way to organize for success, the structure of a firm may enhance or constrain the availability of resources, which ultimately impacts project success. For example, Figure 5 below shows that a project manager working within a strong matrix structure has much more authority to get things done than one in a functional organization because personnel are more likely to be assigned full-time to project work.

According to the Project Management Institute, organizational structures range from functional, to matrix, to projectized configurations (1996, p. 18). The following diagram details several project-related characteristics of the major structural configurations:

Project Characteristics \ Organization Type	*Functional*	*Matrix*			*Projectized*
		Weak Matrix	Balanced Matrix	Strong Matrix	
Project Manager's Authority	Little or None	Limited	Low to Moderate	Moderate to High	High to Almost Total
Percent of Performing Organization's Personnel Assigned Full-time to Project Work	Virtually None	0–25%	15–60%	50–95%	85–100%
Project Manager's Role	Part-time	Part-time	Full-time	Full-time	Full-time
Common Titles for Project Manager's Role	Project Coordinator/ Project Leader	Project Coordinator/ Project Leader	Project Manager/ Project Officer	Project Manager/ Program Manager	Project Manager/ Program Manager
Project Management Administrative Staff	Part-time	Part-time	Part-time	Full-time	Full-time

Figure 5: Organizational Structure Influences on Projects

In the previously mentioned study of NPD in American and British firms, the best results were achieved by those organizations that emphasized a participative style of management, coupled with a participative structure such as a venture team, matrix, product committee or task force. Participation was considered so critical that "some managers even considered close supervision and control, improved cost control systems, and better documentation of projects, not as helpful instruments, but as obstacles for the achievement of success" (Balbontin et al., 1999, para. 5).

Leading NPD companies also engage in a number of "distinguishing" project execution and management support practices to empower team members (Deck, 1994, p. 50-51). These include:

- Reviewing team composition during each stage of the NPD process to combine appropriate skills and resources
- Designating champions who have full or part-time responsibility for developing, promoting, and implementing ideas
- Creating a culture whereby NPD team leadership and team membership are considered accepted and necessary paths to success in the organization
- Rewarding and recognizing innovative behaviour

As well, Slade suggests that a firm's ability to effectively execute the NPD process depends upon the rate at which the entire organization learns (1992, p. 36). He cites the following team-organizational factors as being integral to the learning process and to the success of the product cycle (p. 36):

- Cross-functional teams require strong leadership, stability of membership, and high professionalism.
- Team members should be physically located in proximity to one another to enhance their ability to work together
- The management hierarchy should have few layers, and be characterised by a high degree of stability and continuity

4.3.2.3 Summary

The structural characteristics of an organization influence its ability to achieve strategic objectives and to effectively execute the NPD process. Research has consistently demonstrated the necessity of senior management commitment and of the cross-functional team approach in executing projects. Organizations can use the data presented here to assess gaps in current organization and team structures. However, the challenge for companies like Company X lies in implementing the necessary changes and demonstrating the long-term commitment that is required to perpetuate those changes.

4.3.3 Corporate Culture and Values

4.3.3.1 Overview

According to Harry and Schroeder, "values create the bedrock of any corporate culture and provide its philosophy for achieving success" (Borchert, 2003, p. 10). Organizational values and beliefs therefore provide a common direction for the day-to-day actions and behaviours of individuals. An organization has the ability to influence these actions and behaviours, and to build a culture that supports business success, through its system of rewards and measurements. Essentially, "business measurements drive values; values determine how people work; how people work determines profitability" (Borchert, 2003, p. 11).

While it is easy to define culture in an abstract sense, understanding culture and its impact on business outcomes, is extremely challenging. Culture is reflected all across the organization - in the performance and psychology of its employees, in its policies and procedures, in perceptions of authority relationships, in leadership styles, etc. - yet it is relatively intangible and difficult to measure and change.

Interviews with Company X personnel revealed a gap between the company's formal values and the existing culture. As mentioned previously, one of the most pervasive aspects of Company X's culture is its emphasis on the bottom line. While this focus is a necessary reality in today's business world, companies like Company X must also recognize that upfront planning and predevelopment homework helps to minimize cost and risk in latter stages of the NPD life cycle.

To continue as leader in advanced power electronics, Company X is faced with numerous new product ideas and market opportunities on a continuous basis. However, according to managers interviewed for this project, it is common practice to continue to "revise business cases to look good when in fact they aren't good. There's a lot of passion involved without numbers to back it up" (Interview participant, October 17, 2003). As a result, all project plans are revised until they receive approval, yet there are no mechanisms in place for managing, evaluating, prioritizing and allocating resources among projects across the corporation.

A consequence of this is that employees are shifted from one project to another depending on what is perceived to be the most urgent opportunity. The lack of dedicated resources means that project personnel cannot commit to timelines, to the point where postponements and delays on projects are becoming cultural norms. In this environment, it is difficult to build morale because employees lack a sense of control, completion and closure.

To build a culture that supports business success, Company X must therefore address this issue at the senior level of the organization through improved project prioritization and decision analysis. This, coupled with emphasis on the cultural characteristics discussed in this section, will foster the development of strong, healthy company culture. The following research reveals the importance of developing a learning culture, strong cross-functional teams, and a secure and stable work environment, to enhance NPD success.

4.3.3.2 Characteristics of Learning Cultures

The discussion in the preceding two sections on Training and Organizational Configuration has emphasized the importance of creating a learning culture that supports the organization's NPD and project execution capability. A learning environment has been shown to increase the organization's competitive ability by:

- Improving the effectiveness of training investments
- Encouraging training and professional development
- Promoting knowledge sharing across organizational boundaries
- Facilitating the organization's ability to implement best practices
- Expediting the product cycle

- Improving NPD success rates
- Enhancing project success through learning from successes and failures
- Supporting cross-functional team development through shared values and norms

Appelbaum and Gallagher sum it up appropriately by saying that organizational learning "is about the ability to harness and use knowledge for competitive advantage. It is also about the ability of an organization to learn from itself, its mistakes, its inefficiency and its employees" (2000, p. 5).

Roderic J. Gray's study of the links between organizational climate and project success provides further support for a learning culture. His research demonstrates that "a low-threat, secure and stable environment in which individual contribution is maximised within a distinctive team culture, offers the optimum environment for successful project outcomes" (2001, p. 108). Several factors were found to be negatively correlated with project success. These include (p. 108):

- The presence of threat, uncertainty and unfairness in the working environment
- Stress in individual project personnel
- Controversy, conflict or dispute at the senior management level about the attractiveness of a specific project or project definition
- Organizational change and environmental uncertainty
- Attitudes of mistrust for senior management
- Reluctance among project personnel to assert views or proposals

Management attention should therefore be focused on minimizing the presence of these factors and on building an organizational environment that supports successful project execution. An ideal culture is described by Gray as one in which:

> ...participants have maximum involvement in defining their own targets and goals, in which they feel free to question, challenge and contribute to the decisions of more senior people, in which their suggestions and ideas are actively sought and, once elicited, are valued and treated with respect, and in which intrinsic satisfactions are to be found. (2001, p. 108)

4.3.3.3 Summary

The research presented in this section reveals that NPD success is enhanced in environments characterised by stability, trust, learning, knowledge sharing, and teamwork. Unfortunately, the senior level management turnover, merger activity and organizational changes that have occurred at Company X in recent years may have impeded efforts to build this type of culture. However, the characteristics described above should serve as a guide to help Company X to cultivate the project management mindset, leadership and commitment that is necessary to take projects from concept to completion and to ultimately profit as a result.

4.3.4 Performance Measurement

4.3.4.1 Overview

Measurement of performance is an essential part of business strategy and key to achieving success. The axiom "what gets measured gets done" is particularly relevant in the context of organizations. Consequently, the organization's vision and strategic objectives should dictate what needs to be measured (Appelbaum & Gallagher, 2000, p. 8). In other words, performance measures must be directly linked to company goals and objectives.

As stated previously, Company X's objective is to deliver a broad range of products that provide complete solutions to end users in a variety of market segments. New product development is so critical to overall company success that it is highlighted on the front page of the January 2003 Special Edition of Company X's employee newsletter. According to the company Chairman:

> [In 2002] We focused on product development programs that will result in the introduction of key new products in 2003. These products will enable us to grow our market share in existing markets and to enter new markets. We all need to pull together to make sure these new products are developed within budget and get to market on time. (*Connexions*, p. 1)

Despite this emphasis on NPD activities, Company X does not perform project-based performance measurement or evaluation. The company's corporate scorecard emphasizes financial measures including a Monthly and Quarterly Revenue Analysis, Backlog Analysis, Accounts Receivable Analysis and Booking Analysis. However, the problem with these more traditional financial metrics is that they provide an indication of past performance, but offer little

information about the future (Kaplan & Norton, 1993, p. 134). As a result, these 'old' measures may not be relevant to new initiatives.

Company X has identified a number of Key Performance Indicators (KPIs) for its Product Creation and Support process. However, "the process falls down because it isn't being measured and project teams, and team members are not measured" (Interview participant, October 17, 2003). One of the fundamental purposes of Robert Cooper's (2001) stage-gate model (on which the PC&S process is based) is to break down the decision process into a series of steps and provide for timely evaluation, decisions, and bail-out points. While the PC&S process is extremely well-documented on Company X's intranet site, the gates are not used as go/no go evaluation points. According to one manager, "we have been poor in terms of following the process of the process." Another manager commented "Phase gates don't actually happen...PAC presentations now are more of a status report than go/kill decisions" (Interview participants, November 17, 2003).

Since an organization communicates what is important by its measurement and reward systems, it is critical for Company X to implement metrics to evaluate the ability of its PC&S process and teams to execute projects and deliver new products to market in a timely fashion. Performance measures would help Company X maintain a focus on strategy, drive behaviour, provide motivation from feedback, and bring commitment from participation (McCarthy, 2003, p. 17). In fact, the absence of project performance measures is detrimental because organizations tend to "perceive everything not on the list as unimportant" (Appelbaum & Gallagher, 2000, p. 8).

4.3.4.2 NPD Performance Metrics

Operations management authors Slack, Chambers and Johnston identify five key performance objectives: quality, speed, dependability, flexibility and cost (2001, p. 599). Specific performance measures are based on these objectives. According to McCarthy, a "good" measure is one that is simple, robust, meaningful, and SMART – Specific, Measurable, Achievable, Relevant and Time-based (2003, p. 25).

In evaluating the effectiveness of any process, it is important to acknowledge the reality that personnel at different levels of the organizational hierarchy use different measures to assess

performance. Since assessment begins with the detailed, granular, first order measures collected at the project level, organizations must begin by implementing relevant metrics and effective tracking at the project level. This is critical to improving evaluation and understanding at each successive level in the organizational hierarchy, and ultimately leads to enhanced decision making at the executive level.

While NPD consultant Gregory D. Githens highlights, time to market, cost of delay and vintage as three of the most popular NPD measures, several other measures are commonly used as well (2002, para. 7). A study of ten multinational manufacturing organizations across several industries revealed that the three most important measures currently being used to evaluate NPD performance are related to time and cost, followed by quality (Driva, Pawar & Menon, 2001, p. 372). The most commonly used measures were number of projects completed per year, number of field trials prior to production, actual versus target time for project completion, and number of new products released per year (p. 372). Table 3 shows the complete list of measures being used by these organizations:

Performance Dimensions	Performance Measures
Time	• Average time to market • On-time delivery • Adherence to schedule
Cost	• Total project cost versus budgeted cost • Profitability analysis – performance against objectives • Product cost • Actual versus predicted profit on products • Product development cost as percentage of turnover • Margin analysis
Quality / customer	• Number and nature of engineering change requests per project • Adherence to original product specifications • Number of field trials prior to production
General	• Percentage of sales from new products versus total sales • Number of new projects completed per annum • Number of successful development products versus total number of projects • Money generated by new products over first two years versus total sales value • Number of products taken up from product portfolio versus total number available

Data Source: Driva, Pawar & Menon, 2001, p. 373

Table 3: Most Important NPD Performance Measures

Similarly, research conducted by Hertenstein and Platt indicates that firms use a combination of financial and non-financial measures to assess NPD performance (2000, p.307). The key financial measures, in consecutive order, were revenue, product cost, and total development process cost. In terms of non-financial metrics, customer satisfaction and innovation measures were used most often, in addition to several other metrics (p. 316). Consecutively, these are (p. 316):

- Satisfaction – product
- Satisfaction – style
- Satisfaction – ease of use
- Number of patents
- Number of new products developed

- Team assessment of design effectiveness
- Achievement of specific strategic goals
- Time to market
- Number of products started
- Number of design modifications
- Number of products completed

4.3.4.3 Summary

While measures available to assess performance in NPD are numerous, Company X must select those that are best aligned with its strategic goals and objectives. This would help to ensure that personnel at all levels of the organization understand and share commitment to the same objectives.

4.3.5 Product Development

4.3.5.1 Overview

Company X has developed a very detailed framework for new product development projects. The framework is sound and is based on current product development theory. Additionally, the company has successfully educated its employees on the benefits and operational details of the framework. However, it is effective only if adhered to in its entirety, including all decisions points and project phases. At Company X, this does not always happen, due to a variety of factors including limited resources and time. Thus, the value of the framework is diminished to the point that it is a theory rather than a practice that will improve product delivery in the company.

Product-based firms are constantly under pressure to reduce cycle times and improve the success rates of new products (Cooper, 2001, p.113). One solution is to create a workable product development process. "Having a single, company-wide process not only improves productivity but also ensures that all efforts focus on critical factors such as customer responsiveness and clear value propositions" (Deck, 1994, p. 50). In other words, if an organization follows a structured process for product development, then the focus of the firm's

efforts can be geared towards business value generation rather than production itself. Cooper (2001) identifies three key drivers of product performance that are common to firms with excellent returns on product investments. These three drivers include:

- A high quality new product process
- A new product strategy
- Resource commitment for new product development.

The first driver, a high quality product process, provides definition and control for product development activities, and provides a framework for quality of execution. A product development process or framework defines a set of activities or phases of activities that are required for each product development initiative. By defining this process, the organization can ensure that key phases are not missed and decision points are scheduled which involve reviews of progress against established goals. The improvement of product development tasks and activities and review of the results generates direct benefits for execution. In a study of product-based firms, Cooper discovered that "by specifying the key deliverables at each gate or decision point and by conducting a thorough review at the gate... the quality of work (of observed firms) significantly improved" (Cooper, 2001).

Cooper (2001, p.115-123) identifies seven goals of a new product development process:

- Quality of execution
- Better prioritization
- Rapid parallel processing
- Cross-functional teams
- Strong market orientation with customer input
- Improved up-front research
- Competitive advantage.

The new product development process should be complete and thorough, mandating the completion of all major phases and objectives. Research has established that the early phases of

the product development process are most crucial to the success of product development. "(Product) leaders are much more likely (76% vs. 43% for key performers) to formulate early definitions of the product, and the value proposition of the new market" (Deck, 1994, p. 50). These phases include market analysis, ROI modelling, customer research, stakeholder input and release planning. This 'front-end loading' is crucial to product success. Also crucial is the integration of critical success factors into the product development process. These contribute to the development of best practices, which improve the effectiveness of new product development activities (Cooper, 2001, p.113).

The product development process is often owned by the product engineering department and updated as changes occur in the organization. Executive and project advisory committees, however, should encourage the acceptance of the process by the whole organization, as support roles and non-production groups are all likely to be involved in the process in different phases. For example, in the requirements generation phase, the marketing department may be responsible for generating business requirements and liaising with customers to solicit feedback and requests. Thus, the product development framework becomes an accepted means for understanding the project as a whole and the succession of activities from inception through to evaluation.

4.3.5.2 Summary

A product-based organization requires a product development framework to ensure successful completion of new product development projects. At Company X, the product development framework is well-developed but considered a "nice-to-have" and is rarely executed to completion. As a result, the company faces challenges with quality, timing, customer satisfaction, and employee morale. Research clearly demonstrates that adherence to a product development framework in full is necessary to the delivery of successful products. However, it is also understood that different projects require varying levels of structure, depending on the size and commitment to the project. Therefore, a product development framework can be designed for flexibility to accommodate different kind of projects, rather than requiring each project to follow the same extensive set of phases and review points. Incorporating this level of flexibility may help Company X improve its project execution.

4.3.6 Program Management

4.3.6.1 Overview

"Projects are the vehicle by which we turn business opportunities into valued business assets." (Lavingia, 2001). At Company X, new and existing products are assigned to programs in which the life cycle of the product is managed. The programs are implemented by Program Managers, but these professionals note and describe a disconnect between the design and implementation of programs. Authority for business decisions resides with other members of the company, and thus programs develop gaps which hinder successful completion. Additionally, employees throughout the organization do not complete deliverables in a consistent fashion, and have varying approaches to time management, organization of tasks, and documentation. The development of programs seems to lack consistency and efficiency in delivery and ownership of deliverables.

In recent years, the program management function has gained popularity in product-based organizations. This function is often compared to the project management function, but there is a distinct, if subtle, difference between the two. While project management refers to the control and management of all stages of a particular project, program management extends the traditional definition of the project management role to the delivery of *solutions* – the major difference being the addition of administrative services, process management and solution architecture (Microsoft Corporation, 2002).

The benefits of this approach include shared responsibilities for deliverables, clarity of ownership and accountability, empowerment of team members, focus on business value, shared definition of project vision, and improved communication (Microsoft Corporation, 2002). Most importantly, this approach attempts to broaden the objectives of the project team by increasing the importance of the business value provided by the product. The better the team understands the business value proposition, the better the resulting product will be at creating this value. Therefore, the project is treated as a program – a component in an overall strategy to deliver on business goals.

Stuckenbruck (1981) defines a project as "a one-shot, time-limited, goal-directed, major undertaking, requiring the commitment of varied skills and resources". The important distinction between project activities and sustaining activities is that project activities are temporary in

nature, with a defined start and end date. This means that projects require creative solutions for each new activity, and a unique management approach for temporary teams.

Probst (2002) defines 13 common reasons why projects fail:

1. Unclear scope or direction
2. Unclear requirements
3. Lack of resources
4. Undefined project end date
5. Lack of clear deliverables
6. Not having timeframes for tasks
7. Not knowing who is on the project
8. Poor communication
9. Lack of planning
10. Not knowing where to go to access project information
11. Changing requirements or scope
12. Cost and schedule overruns
13. Lack of buy-in and accountability.

Program management skills are required to address these situations and ensure that they do not occur with any regularity. The following discussion describes program management as a mindset rather than as merely a set of activities. It presents the components of this mindset as skills that enable teams to develop products in an efficient and successful way. While product development processes provide frameworks for planning activities, the program management mindset provides team members with the skills to carry out these activities within the constraints that are set by the program's attributes. Program management equips teams with the skills to deliver on time, within budget, while meeting and exceeding quality specifications.

4.3.6.2 Ownership

The Program Manager (PM) is responsible for driving the progress of a program, from initial planning and scheduling, through to design and architecture, and, finally to the delivery and subsequent maintenance of the resulting product. In addition to this, the Program Manager is a negotiator, a communicator, a leader, an architect, and a problem-solver. Some have likened the Program Manager to a CEO of a temporary organization. The PM must be able to manage people, timelines, conflicts, technology and stress.

Typically, a Program Manager comes from a discipline related to the product being developed. For instance, many engineers become Program Managers for engineering-related products. Likewise, artists are often Program Managers for creative products. This is not a requirement though it does add value to the role. The most important attribute of a Program Manager is a well-developed program management mindset – the ability to think in terms of the overall program for all activities.

The Program Manager is involved with all activities related to the program, from inception through to evaluation. As the individual responsible for the execution of the project plan, the PM should be involved in planning activities to ensure that resource allocation, scheduling and product concept are all sound. The PM sees the program through to delivery of the product, and often remains involved through sustaining activities as well.

4.3.6.3 Summary

Company X's product programs lack consistency in deliverables and ownership of project activities. Employees use various approaches to completion of project tasks, and these approaches may cause inconsistencies and inefficiencies when employees are placed together in a project team. Development of program management skills throughout the organization can help Company X create highly effective project teams and, as a result, deliver new product development projects in less time with fewer resources. When ownership for programs resides with the Program Manager, there is a greater likelihood of success in project execution. Program management should be considered an organization-wide skill, rather than isolated to the engineering department, or engineering professionals.

4.3.7 Quality Management

4.3.7.1 Overview

When an organization faces challenges with customer satisfaction, employee satisfaction, project deliverables or revenue results, it is an indication that the organization needs to address its approach to quality management. Quality can be measured and defined in many different ways, based on many different stakeholder groups. Thus, different areas within the organization may have different expectations for the delivery of quality. The introduction of a corporate-wide quality management program can help create consistency in delivery upon expectations, and can act as a frame of reference for evaluating performance and designing performance-based rewards and goals.

Company X has recently identified the need to develop a quality management position within the organization to coordinate the quality management infrastructure that affects all production activities, in addition to customer-facing services. While the organization had made efforts in the past to address quality in production, the resulting policies and processes were not owned by any specific group or individual, and therefore lacked consistency in implementation. Without a well-defined quality management infrastructure in place, inconsistencies and inefficiencies will occur in execution activities, and will impact product quality, timing of delivery, customer satisfaction and employee pride.

According to Claver, et al (2003), a quality management program for a product-based organization can generate the following results:

- Increased revenue
- Improved competitive position
- Excellent financial results
- Increased yield
- Improved general performance
- Measurable and improved customer satisfaction
- Improved employee satisfaction.

The working document for a quality program is the quality plan. This plan is a corporate document that defines practices, processes and standards that are required by all members of the organization in their work-related activities. Of course, certain activities will require more specific guidelines for quality management, and some guidelines will not be applicable for all areas of business. However, the plan provides a common understanding and approach for the entire organization, which contributes to consistency in execution and deliverables.

4.3.7.2 Organizational Fit

Crow (2001) advises that a quality program ensures that requirements for quality match the capabilities of the organization. While it is commendable to aim high, goals and objectives are likely to be more effective and accepted if they are achievable. To make goals more achievable, successful quality plans consist of several phases of rollout, with review and adjustment stages built in between (Crow, 2001). Incremental rollout with minor adjustments to the status quo is more easily implemented by employees. Compliance improves because change is presented in more palatable quantities, allowing employees time to recognize and assimilate results of previous changes before embarking on new activities.

Every organization has a slightly different configuration, depending upon its chosen strategic activities and competencies. According to Claver et al (2003), a quality program can create further differentiation for competitive firms, and strengthen strategic initiatives. Thus, a firm should consider its orientation when designing a quality program, and place emphasis on the areas where quality is important to strategic development, whether these are internal or external (Claver, et al, 2003). To achieve this, the organization must first define a shared understanding of quality at the corporate level as well as at departmental levels.

Quality management does not suit any one particular configuration better than others. However, some configurations may include activities that are easier to measure and quantify. In such organizations, benchmarking and performance measurement become a more common part of the corporate culture. Production-based firms, for example, tend to include more tangible activities which can be measured and benchmarked in unit-based metrics. However, a service-based firm may find it more challenging to measure performance and progress in non-financial metrics. Thus, it may be more difficult to build quantifiable quality metrics within service-

oriented firms. It becomes important for such firms to define quality according to their specific activities, and develop benchmarks that are meaningful to their organization.

4.3.7.2.1 Standards

Sometimes quality is defined by an industry or regulatory body. In this case, a set of quality standards are set forth by external parties, which are used by firms within the industry as commonly accepted benchmarks. In the case of regulation, these are minimum levels of acceptable quality, and the organization has no choice but to meet these requirements to compete in the industry. Firms that adhere to either industry or regulatory standards must commit resources to monitoring amendments and developments to standards, to remain abreast of advancements in quality benchmarks. As Leonard (1997) indicates, innovative firms in particular can create competitive advantage from becoming involved with standards development. Such involvement is a means of importing knowledge from external sources and positioning the firm as a leader in quality.

4.3.7.3 Summary

A quality management infrastructure can help organizations improve deliverables throughout a project's life cycle and in sustaining activities. At Company X, quality management is becoming increasingly important as the company's brand is strengthened and becomes more visible. While policies and processes have been designed to help guide the quality of products and services, ownership and implementation have not been strong. A quality management plan will help ensure that the company's brand remains visible and respected, and customer solutions are successful in meeting market needs.

4.4 Root Issues

As described above, project execution issues at Company X appear to be related to a number of issues, as have been described in the previous discussion. However, it is evident that these issues are symptomatic of two major problems that are at the foundation of Company X's project execution challenges. These root causes include over-centralization in decision analysis and isolated resource allocation decisions. These issues are discussed below and are followed by recommended courses of action for consideration by the organization.

4.4.1 Decision Analysis

4.4.1.1 Overview

During interviews with the authors, Company X employees identified numerous conflicts in business priorities that affected decision-making activities. Thus, many projects have been suspended rather than killed while new priorities are being addressed. Additionally, the appropriate individuals are not always involved in making decisions, or are not well informed from a production perspective. The result is that many employees feel that they are not really part of the planning process and do not have an impact on the company's success. They also feel frustration that projects with a poor business case are approved for production at the expense of existing projects. With a program of continually suspended projects and no formal decision analysis framework, the company risks losing potential returns on investments already made. Additionally, the company faces increased exposure to risk and resource allocation problems which are major drivers of project failure.

Competitive organizations, such as Company X, are constantly presented with opportunities for investment. These may be new investments that aim to bring profit, investments that are required to protect the company's current position, or 'obligatory investments' that the company must make to meet regulatory requirements of the industry or the business itself (Chen, 1998). At Company X, new product ventures as well as line extensions for existing products all require the commitment of resources from the company, and therefore can be considered investment opportunities. Regardless of the motivation for considering an investment decision, the company must consider all opportunities placed before it, and decide whether to embark on a particular investment path, or bypass the opportunity.

Because an investment decision involves committing resources (financial, human or material) for a period of time from a given supply, care must be taken to ensure that the opportunity is not only beneficial on its own, but that it does not adversely affect other areas of the business. The utilization of a structured decision analysis framework can help managers maintain a clear picture of new opportunities in the context of the organization's existing investments. This process helps managers consider various alternatives and arrive at sound decisions based on quantified risks and uncertainties (Lavignia, 2001).

For the product-based organization, decision-making for new opportunities is a regular occurrence. Thus, product-based organizations can benefit significantly from a structured decision analysis process. In fact, in his research, Deck (1994) notes a correlation between high performance (based upon financial results) and formal decision analysis processes among product-based organizations. He states that high performing companies have established formal processes for managing opportunities throughout a company-wide portfolio of product development efforts. These companies have established criteria and goals that lead their decision-making activities across the organization, rather than just within business units.

The benefits of using a clearly-defined and structured decision analysis framework within a product-based organization include:

- Reduction in time to market for new products
- Reduction in bottlenecks in the product development process (many bottlenecks exist due to delays in decision-making)
- Clarity of company-wide priorities, leading to streamlined work activities
- Increased confidence in management and staff
- Reduction in risk throughout the project life cycle

When analyzing new opportunities, managers are looking for situations that generate benefits for the company, either in the long or short term. The resulting benefits (either quantitative or qualitative) should exceed the total expenditures for the entire project (Chen, 1998). This is, of course, a simplistic model and a number of additional considerations are required to accurately judge the benefits of an opportunity. Thus, a combination of techniques and methods should be utilized in a system that makes most sense for the organization. The following discussion introduces some common methods and frameworks for decision analysis in a product-based organization.

4.4.1.2 Managing Risk

The major motivation for a well-planned and thought-out investment decision is the reduction of risk for the company and for the stakeholders involved in undertaking the new opportunity. While it is understood that every new project is accompanied by some risk, it is

possible for managers to reduce project risk throughout the project life cycle, and have contingency plans for unforeseeable risks, should these occur.

4.4.1.3 Summary

One of the root causes of Company X's project execution is the fact that Company X does not utilize a common, structured decision analysis framework. As a result, there are numerous suspended projects, frustrated employees, over-allocated resources and financial constraints that have emerged as major issues within the organization and limit the company's ability to deliver successful projects. With so many endeavours underway at any given time, it is especially important that Company X evaluate new investment decisions appropriately to maximize returns and minimize risk. Company X needs to investigate strengthening its project-specific decision analysis framework as well as its company-wide decision analysis processes.

4.4.2 Resource Planning

4.4.2.1 Overview

Project execution issues at Company X appear to revolve around resource constraints. Resources are built into a project plan at the outset, but this support is eroded as new projects are initiated. Project interviewees identified major issues with scheduling and coordination among project groups during the development of the project plan. Management decisions must be made when the project plan is initiated. Once the project plan is in place, short- and long-term planning can take place, and resulting decisions may affect areas of business other than just the associated project. However, especially in Company X's case, multiple projects can create strains on the company's resource pool, and careful coordination across projects is required to realize success in project delivery. Based on feedback from interviewees, project resourcing is completed in isolation from all other projects, and as a result resources are over-allocated and scheduled for too many projects.

The integral components of a project plan are resources including people, equipment, money or technology. It is understandable, then, how successful resource management is integral to project success. According to Chen (1998), resource utilization is the most important area of decision-making for any organization. When resource constraints are not considered in the creation of the project plan, or are inadequately assessed, the project schedule may not be

achievable, and the effects can include project slippage, lost revenue opportunities, and cost overruns.

With sound resource planning practices in place, a project-oriented organization can ensure that bottlenecks are reduced, the right skill sets are assigned to the right tasks, quality requirements are met and/or exceeded, and the business can reap maximum rewards from the resulting products.

4.4.2.2 Types of Resources

Akpan (1997) defines three types of resource planning situations:

- time/cost tradeoff
- unconstrained resource optimization
- constrained resource optimization.

Each of these situations requires a slightly different approach to planning for required resources, whether these are human or capital resources, equipment or materials. Furthermore, each type of resource possesses unique characteristics that must be considered when planning for resource utilization in a project. In most cases, these resources are limited, and it is quite unique for an organization to be in the position to afford to consistently equip all project teams with dedicated resources for every task in every project. Therefore, project resources are often shared among projects, and planning for resource usage, whether resources are constrained or unconstrained, is critical to project success.

It is also important to consider resource capacity. On the one hand, the company must provide at least a minimum level of resources to sustain project work, and the combination of resources selected may not always meet identified needs. On the other, it is inevitable that there are also idle resources at any given time. While most organizations endeavour to reach 100% utilization of available resources, this may not be realistic. In fact, it may be more beneficial to keep 20 to 25% of resources idle to accommodate unforeseen situations or emergencies (Paula, 1997). The organization can also develop a plan to best utilize idle resources within its project portfolio through intelligent scheduling and forecasting (Akpan, 1997). The allocation of

resources between sustaining activities and new projects can help ensure that idle resources are fully utilized.

Due to a project's heavy dependence on resource availability, and the potential economic impact of incorrectly allocated resources, it is essential that a project-oriented organization expand its resource planning activities both across the organization and externally. Should conflicts occur between project resources, lack of a particular resource may become a bottleneck and hinder progress. The methods described below can help an organization assess resource requirements across projects, and ensure that resource bottlenecks do not negatively affect the business.

4.4.2.2.1 Challenges

Resource planning activities can be made more difficult by a number of circumstances. As Paula (1997) describes, when there is an information gap between decision-makers and project managers, resources can become over-allocated and create conflicts between projects. Additionally, less visible programs may be delayed or inadequately resourced in favour of programs with greater scale and visibility. When programs are negatively impacted in this way, project teams often encounter morale issues and loss of pride as their projects become disrupted or delayed. Additionally, morale problems can occur when team members are only involved in single tasks within many projects and do not have the opportunity to experience the completion of a project from start to finish.

Other challenges that resource planning managers face include conflicting priorities for resources, mutually exclusive resources, limitations of availability, limitations on substitute resources, and limitations on the ability to partially allocate resources (Badiru, 1992).

4.4.2.2.2 Single versus Multiple Projects

While it is conceivable that a smaller start-up organization may focus all of its efforts on one initiative, most project-oriented organizations will undertake a number of projects that overlap in start and completion times. Managing resources across multiple projects requires an additional dimension in planning. In a single project scenario, one set of resources is dedicated to one project, and therefore scheduling can occur in a linear fashion. In a multiple project scenario, conflicts are bound to occur, and trade-offs must be made, requiring managers to perform

valuation exercises that will govern trade-off decisions. In his research, Carbno (1999) concludes that in organizations where resources are scarce, larger projects should be resourced at higher levels than smaller projects given the impacts of delay and cost.

The portfolio management approach (as discussed in the previous section) considers all initiatives underway and planned when making resource planning decisions. Resource planning for a single project cannot occur in isolation of other initiatives that the organization has undertaken or plans to undertake.

4.4.2.3 Summary

New product development projects at Company X present numerous resource planning challenges due to isolated resource planning and continued shifts in prioritization of projects. Since resources are the foundation of project execution, it is imperative that these be allocated with efficiency and according to a plan. With its multiple project environment, Company X must pay careful attention to resource scheduling and long-term planning to ensure that current and future projects are adequately resourced to deliver success. There are numerous techniques that Company X may consider in determining allocation of resources. Most importantly, Company X must ensure that it considers its entire portfolio of projects when making resource allocation decisions.

4.5 Analysis Summary

Analysis of the NPD process and project execution at Company X has uncovered a number of issues that impact the company's ability to successfully deliver new products to market, and ultimately, the company's competitiveness and profitability. Interviews with Company X personnel revealed the following key problems:

- **New project proposals are rarely rejected.** This restricts Company X's ability to focus its limited resources on a select number of key projects.
- **Projects never get killed.** As a result, resources that could be better utilized on other more favourable projects are not available.
- **Portfolio management is not in place.** Decisions to pursue projects are made in isolation by senior management without considering other projects on the go or resource availability.

Basically, these issues can be boiled down to two common issues facing organizations today: "too many projects and not enough resources" (Interview participant, October 17, 2003). The internal consequence of these issues is a weak company culture and low employee morale. Essentially, a failure to prioritize among projects creates a cycle whereby projects are frequently put on hold because resources are needed to pursue other projects; employees lack a sense of pride and accomplishment, and effective cross-functional teams fail to develop, because employees are put to work on pieces of the project but never the whole thing from start to finish. As a result, there is no personal attachment or commitment to deadlines because employees fail to believe that project deadlines are real.

While these problems are related to human resources, they cannot be resolved through improvements to the human resource development infrastructure. Company X's issues related to NPD and project execution stem from issues that are much deeper than HRD and training. The inability to execute projects on time and on budget is related to two root problems which both relate to decision making at the senior level. These include:

1. over-centralization of decision analysis
2. isolated resource allocation decisions.

Company X can pursue a number of options to deal with these issues. If the company chooses to do nothing, unfavourable consequences will accrue, both internally and externally. A failure to decentralize decision making and improve prioritization of projects will decrease the ability of employees to maintain the flexibility required to react quickly to new market opportunities. The failure to deliver products to market when customers require them will decrease customer satisfaction and brand reputation, which will impact overall competitiveness and profitability. While the following comment is somewhat dramatic, it emphasizes the severity of the issue: "The best we can do right now is not fail" (Interview participant, October 17, 2003).

However, if Company X chooses to enhance its project execution and NPD capability, the company can implement changes to various processes, policies and practices. Company X can either improve the status quo by initiating improvements to the symptomatic issues, or transition the company to a new level of maturity in project delivery by addressing the root causes of the problem. The following section outlines recommended courses of action.

5 RECOMMENDATIONS

5.1 Solutions for Symptomatic Issues

5.1.1 Develop a Framework to Measure ROI in Training

The primary objective of an ROI calculation is to demonstrate to senior management the impact of training initiatives on business outcomes. This serves to maintain access to training funds and to enhance the status of the Human Resources function. In organizations like Company X, where there is a lack of support for training and performance improvement programs, it is even more critical to measure the results of training and to demonstrate impact on the bottom line. Company X should implement an ROI framework to strengthen the learning process and to provide a means of evaluating and communicating the effects of training and performance improvement programs.

To measure ROI, or Return on Training Investment (ROTI), Donald Kirkpatrick's four-level framework can be used to evaluate and measure results of training, and to refine the training process (Lewis, 2003, p. 1-2). While the fourth level of this model measures the impact of training on business outcomes, Patrick Phillips proposes that it is necessary to go a step further and convert business improvements to monetary values to compare the benefits of the training with the costs of the program (1996, p. 46). Therefore, the information provided in the following table synthesizes Kirkpatrick's four levels of evaluation, as well as Phillips fifth level:

Level		Purpose	Questions	Method/Tools
1	Reaction and planned action	Measure initial reactions to the training	What are participants' initial reactions to the training program? Did participants feel that the material would help them in their jobs?	Questionnaires interviews focus groups opinion surveys
2	Learning	Measure change in knowledge, skills and abilities	What skills, knowledge and attitudes have changed as a result of the learning?	pre-testing post-testing
3	Applied learning on the job	Measure the on the job behaviour change	Are participants using the new skills and knowledge on the job?	Observation follow-up assignments surveys/questionnaires interviews focus groups action plans performance contracts
4	Business results	Measure the impact of training on business results	Did application of the skills and knowledge on the job impact business results as planned?	surveys/questionnaires action planning follow-up training sessions performance tracking
5	Return on investment	Calculate ROI	Did the monetary value of the results exceed the cost of the training program?	ROI process model (described below)

Data Source: Phillips, 1996, p. 43, and Lewis, 2003, p. 1-2.

Table 4: Five Levels of Evaluation

Ideally, Company X's initial training needs assessment should be linked to evaluation based on this framework. For example, HR and management must first perform a needs assessment to identify business needs, job performance needs, skills and knowledge deficiencies, and training preferences. Then, specific training program objectives, or critical success factors, must be identified at each level and evaluated upon completion of the program to assess the effectiveness of the training. Example objectives or metrics proposed by Phillips and Phillips include (2002, p. 80):

- **Level 1 – Reaction**. Receive a job relevance rating from participants of at least 4 out of 5
- **Level 2 – Learning**. Achieve a job simulation test score average of 80

- **Level 3 – Application.** Ensure that at least 60% of participants use all customer interaction skills with every customer

- **Level 4 – Business Impact.** Increase the external customer satisfaction index by 25% in 2 months

- **Level 5 – ROI.** Achieve a 3:1 benefit to cost ratio one year after the training program implementation

The model is cumulative, such that the evaluation data collected at each level builds upon the prior step. Therefore, the value of training investment can only be understood by performing a complete evaluation using all levels of the model. However, it is unreasonable to expect organizations to evaluate every training program at all levels, given time and resource constraints. It is recommended that Company X establish targets outlining the percentage of HR programs that will be measured at each level. Since the cost and time required to conduct evaluations increases incrementally, a general rule of thumb is to evaluate all training for reactions, but only 40 to 70 percent for learning, 30 to 50 percent for behaviour, 10 percent for business results, and 5 percent for ROI (Phillips, 1996, p.44).

To perform the ROI calculation, Phillips outlines three steps (1996, p. 12). The first requirement is to isolate the effects of the training from other factors that may have occurred during the same time period. Company X can draw upon the following techniques to accomplish this objective and to collect the required data (p. 12):

- Control groups

- Trend line analysis (time series)

- Forecasting methods

- Participant, supervisor, or management estimates of training impact

- Customer input

- Expert estimates of training impact

- Subordinate impact on training impact

- Calculations/estimations of the impact of other factors

The second step in the ROI process is to convert the data to monetary values. Again, a number of techniques may be used to quantify the improvements. These include (Phillips, 1996, p. 12):

- Historical costs
- Supervisor, management or participant estimation
- Expert opinion
- External studies

Once the data is collected and valued monetarily, the third and final step is to calculate the costs of the training program by performing the following ROI calculation (p. 12): ROI (%) = (Benefits – Costs x 100)/Costs

Evaluating training programs at each of the five levels will enable Company X to ensure that training programs are aligned with measurable business results. It would also facilitate communication of feedback on training program effectiveness to all stakeholders, including HR staff, program designers, training facilitators, and of course, senior management. This feedback can be used not only to make improvements to the design, development and delivery of the program, but also to demonstrate to HR staff that the ROI process actually works and adds value to the HR function. Essentially, with increased pressure for accountability in today's business world, Company X HRD managers must demonstrate accountability for its spending, and "the results-based training process must be examined if training and development is to be successful and respected in an organization" (Phillips & Phillips, 2002, p.85).

5.1.2 Develop the Project Management Mindset in All Team Members

5.1.2.1 The Program Management Mindset

The program management mindset is a fundamental way of thinking about activities and deliverables that helps project team members manage their deliverables and ensure quality in delivery. This mindset is valuable to employees through all levels of the product development team, from managers to architects, to manufacturers, to quality assurance and customer service representatives. It helps individuals frame deliverables and break work down into smaller portions to improve manageability and scheduling. The development of this mindset for all

Company X employees would strengthen the consistency of deliverables and cross-functional teamwork.

The program management mindset is derived from five major skill areas: milestone management, planning and estimation, team development, communication and resource management. Through experience and training, employees can develop these skill areas and improve their capabilities in managing time, resources and people. Company X employees specifically will benefit from developing the following skill areas related to new product development.

5.1.2.1.1 Milestone Management

Program management involves the coordination and delivery of specified requirements within predetermined timelines. The major deliverables within a project are considered milestones where key decisions are made depending on the outcomes of the deliverables, or where shifts in project focus occur. Milestones can be based on technology deliverables, completion of project stages, key dates or times, or the completion of project-related decisions.

By assigning project activities to milestones, program managers are able to section work off into manageable packages for project teams to complete. Each work package can be more accurately scheduled and monitored when it is assigned to a milestone goal. Program managers use a variety of methods to monitor milestone progress, which allow them to report progress to project stakeholders.

Additionally, milestones provide program managers with points of reference with which to manage project scope. Should changes occur in scope (due to internal or external change initiatives) the program manager can communicate the impact of the change by considering the impact on key milestones. Essentially, milestones provide project teams with goals to work towards, a common set of references for project stakeholders, and a means of breaking down project work into manageable sections.

5.1.2.1.2 Planning and Estimating

The planning and estimation activities of any project are the most important of the project's life cycle. Decisions made during this time impact the project for the remainder of its life. Conversely, errors made during this phase can grow exponentially as the project progresses

and cause major issues with final delivery. Adequate time should be scheduled for these activities to ensure the project plan is well understood, assessed and accepted by groups that have responsibility. Planning and estimation are key skills that program managers must develop and hone. These skills involve the ability to accurately schedule project activities, estimate costs for resources, forecast issues that may impact project delivery, and document project components in a clear and meaningful way that is comprehensible to all project stakeholders. This last skill is of critical importance as the success of a project depends largely on its ability to meet or exceed stakeholder expectations. For this to occur, the program manager must be sure that critical success factors have been established and documented to the agreement of all stakeholder groups, and that critical success factors drive the design of subsequent phases in the project.

Developing a project schedule requires the coordination of project team members who create detailed task schedules for their respective work packages. By breaking down deliverables into smaller and smaller work packages, team members are able to provide the program manager with increasingly accurate estimations of task durations. The program manager can then build an overall project schedule that provides time and cost estimates to all project stakeholders.

A number of methods are used for project planning, including the critical path technique, Program Evaluation and Review Technique (PERT), and Precedence Diagramming Method (PDM). These techniques are widely accepted and provide the program manager with tools to create more accurate project plans and assess the impacts of constraints.

5.1.2.1.3 Team Development

The project team is the foundation of project execution. A poorly designed team may not function efficiently and can add additional layers of complexity that are not easily reduced once the project is underway (Gannon, 1994). High performance teams are necessary for producing high quality products and processes, and are the basis for an effective, efficient and evolutionary project organization. The program manager must put together high performance teams from the inception of a project, and help those teams develop as individuals and as cohesive units.

Highly effective teams share a number of key characteristics. Leonard (1997) asserts that high performance teams are defined by diversity in working, learning and personal communication styles. The productive clash of styles can promote creative problem solving, and discourage routines that lead to habitual work patterns (Leonard, 1997). Additionally, the

distribution of accountability and ownership across project team roles fosters pride in workmanship and commitment to quality. As team members develop experience in specific roles, they can be rotated through other roles to develop diverse skill sets and appreciation for the whole team effort (Gannon, 1994). This distributed knowledge also reduces risk that resides in dependence on specialized experts, who can become bottlenecks and can produce tremendous negative impacts should they become unavailable.

Modern business literature favours small, multidisciplinary teams that are highly agile and scalable (Gannon, 1994 & Leonard, 1997). Such teams can easily adapt to a variety of conditions, which allow them to thrive in an environment of change. This approach is especially effective in technology firms where change is a constant, and is necessary for growth. Additionally, small and agile teams are more conducive to innovative tasks where the path may not yet be clearly defined. In organizations such as Company X, where innovation is as necessary as sustaining activities, these types of teams can help the organization achieve strategic objectives such as first to market.

5.1.2.1.4 Communication

Above all else, the program manager must be an excellent communicator. The program manager is responsible for communication with all project stakeholders, team members, suppliers, and customers. Considering that the program manager's most common task is the distribution, documentation and management of information, exceptional communication practices and skills are imperative. Most importantly, communications with stakeholders should be customized to stakeholder needs (Stuckenbruck, 1981). For instance, project stakeholders such as executives likely require only milestone or progress updates which report summary data. In contrast, project team members may require daily or weekly reports including extensive detail of project issues and activities.

To transfer information effectively cross project teams and stakeholder groups, program managers rely on communication tools for distribution and retrieval of information. For example, Microsoft® Project Central is a software tool for program managers that includes centralized project management tools and functions to help disseminate information automatically, based on a set of rules as defined by the program manager (Microsoft Corporation, 2003). To report on project activities and issues, the program manager must also establish a system that provides the

program manager and team with the ability to measure and monitor project metrics in an efficient and standardized manner.

In addition to orchestrating a constant flow of information between various interested parties, the program manager must also be proficient at creating clear and organized documentation of project requirements and correspondence. Documentation must be developed according to user needs, and must capture all necessary information to support the activities that it is supports. Concise correspondence and attention to detail are appreciated by a time-constrained project team.

5.1.2.1.5 Managing Resources

Project resources consist of material, capital and human resources. Each type of resource has unique characteristics and constraints that require careful scheduling and sourcing. Program managers are responsible for procuring resources that cannot be provided internally, and working with suppliers to negotiate fair compensation for time and materials. The nature of these arrangements can impact project execution in significant ways, by restricting flexibility, availability and cost.

When scheduling resources, these considerations can be accounted for by budgeting additional time and cost for possible project slippage, and negotiating agreements in which suppliers agree to terms for delivery that ensure a level of accountability and reduce uncertainties. Resource planning and utilization is discussed in detail in remaining sections (see Resource Planning) and can be derived with significant accuracy using various techniques.

5.1.3 Build Cross-Functional Teams

Since a cross-functional project team is one small part of a much larger organization, the larger structure is likely to influence the organization of the project team. Actual team structure however, depends on a variety of factors including the size of the team, skill levels of personnel, project complexity and time available for project execution. Therefore, it is necessary to use different team structures for different types of projects. According to project management consultant Jon Bergstrom:

> For smaller teams with skilled team members, a leaderless approach might be used. Innovation and idea-generating teams often are leaderless but have a facilitator to keep teams "on process" and moving forward. The purpose of the facilitator is to allow all team members to fully participate without someone on the team having to both facilitate and keep the team moving forward on the process. For an operating organization with many interdependencies between groups, a "matrix" organization is often used. (2000, para. 2)

Effective cross-functional teams are vital to the success of NPD and project initiatives. Since team leadership, membership and structure change from project to project, it is critical for the organization to foster team development to ensure project success. The Project Management Institute recommends a number of tools and techniques for team development (1996, p. 100). These include:

1. Team-building activities
2. General management skills
3. Reward and recognition systems
4. Collocation of team members
5. Training

5.1.4 Align Organizational Structure with Strategy

Authors Burton and Obel, advocates of the dominant "structure follows strategy" proposition, recommend a two-stage process for determining the optimal configuration for any organization (1998, p. 254). The model is based on first describing and classifying the strategy into one of the 'modified' Miles and Snow (1979) five categories, and then recommending an optimal organizational structure for the given strategy (Burton & Obel, 1998, p.254). The five categories include Prospectors, Analyzers with innovation, Analyzers without innovation, Defenders, and Reactors (p. 252).

Of these five types, Company X's strategy can best be characterised as Prospector, where product innovation is high, product and market breadth are wide, capital requirements are high to exploit product development or market opportunities, and price levels are high. Prospectors are defined by Miles and Snow as:

> Organizations that almost continually search for market opportunities and regularly experiment with potential responses to emerging environmental trends. Thus, these organizations often are the creators of change and uncertainty to which their competitors must respond. However, because of their strong concern for product and market innovation, these organizations usually are not completely efficient but they are effective. (1978, p. 29)

For the prospector strategy to be successful, several organizational design characteristics are recommended. These include (Burton & Obel, 1998, p. 259-260):

1. **Low formalization**. For prospectors to respond quickly to new product and market opportunities and to process complex information, the organization cannot be constrained by rigid rules.

2. **High or low complexity.** Complexity refers to the degree of job specialization, number of layers in the organizational hierarchy, and extent of facilities and personnel. In prospector organizations, a high requirement for innovation requires that the organization be comprised of either generalists or specialists, as opposed to a combination of the two. For example, if the organization's product portfolio is considerable, as is the case at Company X, it may make more sense for employees to specialize in specific skill and knowledge areas. However, a high degree of specialization requires extensive coordination mechanisms to communicate and process information, increasing overall complexity. In general, the organization must adopt a structure that creates a balance between the amount of coordination required and the ability of the organization to process that information.

3. **Low centralization.** To innovate and react quickly, it is essential for decision making power to be decentralized throughout the firm.

4. **Simple, matrix or ad hoc configuration, not a bureaucracy.** In prospector organizations, environmental complexity is high and the rate of change is rapid. According to Henry Mintzberg, machine and professional bureaucracies rely on the standardization of procedures and outputs, or skills and norms, to coordinate activities throughout the firm (1981). Simple, matrix and ad hoc configurations are therefore more appropriate for prospector organizations to facilitate the ability to react quickly and to innovate.

According to Burton and Obel, as organizations evolve, they may progress through stages where situational misfits may occur between structure and strategy (1998, p. 310). For example, in prospector organizations, a potential misfit would occur if top management were risk averse (p. 310). Since success in these organizations depends on innovation, and innovation depends on the ability to take risks and generate new ideas, the strategy will be ineffective if management requires a high level of control.

At Company X, the consistent delivery of new products to market is critical to overall business success. The company needs to recognize that centralized decision-making and high formalization of behaviour will constrain its innovation capability, which will ultimately impact competitiveness and profitability. Company X needs to ensure that its structure facilitates rather than impedes its ability to achieve strategic objectives.

5.1.5 Create a Sustainable Culture of Learning

The research provided in the analysis section of this document clearly shows that organizations that wish to excel at NPD must cultivate a learning culture. Company culture is also a key factor in attaining quality objectives. In a study of total quality and human resources management in Baldridge Award-winning companies, Pauline Brody, chairwoman of Xerox's Quality Forum, explains that achievement of TQM objectives requires a fundamental change in organizational culture (Blackburn & Rosen, 1993, p. 50). The changes she describes are the same as those needed to improve NPD and project execution. Essentially, organizations that seek to build a culture that enhances project success must make the following transition:

- "from an environment of distrust and fear of reprisal to one of openness and trust where creativity can flourish;
- from working as individuals ***to working as teams***;
- from protection of organizational turfs ***to the breakdown of departmental barriers***;
- from an autocratic management style of direction and control ***to a softer style of team leader and coach***;
- from power concentrated at the top ***to power shared with employees***;
- from a focus on results to a focus on continuous improvement of the processes that deliver the results; and finally...
- from making decisions based on gut-feel ***to an analytic, fact-based approach to management***" (Blackburn & Rosen, 1993, p.50).

Building a culture that incorporates these practices is essential for organizations like Company X, whose success depends on its ability to deliver innovative new products to customers when they require them.

5.1.5.1 Best Practices

Japanese organizations best exemplify this type of culture. The practices described above occur naturally in Japanese industry because they are also characteristics of national culture. In fact, the Japanese enjoy a natural competitive advantage in managing complex high-technology products because "what comes naturally to them" – teamwork, communication, collaborative decision making – "requires investment, discipline, education and practice for us" (Breen, 1995, p. 108).

Teamwork and learning are so critical to Japanese culture that advancement in the organization is tied to the development of subordinates. In fact, managers cannot be promoted if they have not trained and developed a replacement (Sullivan, 1993, p. 4). To excel in NPD and project execution, Company X needs to embrace these same principles and create a culture that provides advancement opportunities based on communication, teamwork, problem-solving and group facilitation skills.

Research has shown that leading North American companies are recognizing the importance of cultivating these practices. Deck's study of 193 high-tech companies revealed that the most successful NPD companies emphasize team leadership and team membership as accepted paths to success in their organizations (Deck, 1994, p. 51).

Additionally, Martel's study showed that the twenty-five best companies worldwide engage in specific practices to foster a learning culture (2003, p. 27). These organizations emphasize continuous learning, informal training, knowledge sharing and continuous improvement (p. 38). As well, at a broader level, high-performance companies recognize that a shift is occurring in the values of workers and the nature of work. Consequently, these companies are adopting new management practices, personnel policies, and systems of reward and measurement to enhance employee retention and build strong, healthy cultures over the long-term. Company X can draw from a number of general principles that guide human resource development practices in these organizations (p. 29-33). These include:

- Conveying the importance of the firm's work
- Engaging employees through communication, supervisory relationships, empowerment, and performance management

- Recognizing employees
- Valuing employees as "whole people" by providing flexibility in work hours and workplaces, as well as services, facilities, and celebrations

These principles, and the practices described earlier, represent a list of ideal characteristics for organizations seeking to build a culture that supports project success. While there is no one "right" way to implement the desired cultural characteristics, communication is widely recognized as a critical factor in the successful implementation of any change initiative. As well, it is clear that Company X senior executives must "insist and ensure that these changes are built into the fabric of the organization, management process and company culture" (Slade, 1992, p. 37).

Perhaps most importantly, Company X must recognize that any cultural change requires considerable time and work, and is a process that is never complete; "culture has to be created and then continually recreated" (Martel, 2003, p. 41). In leading global organizations, one of the simplest, and most effective, ways of achieving this is through the continuous retelling of stories of past achievements (p. 41).

5.1.6 Implement Project-Specific Performance Metrics

To communicate the importance of NPD programs to overall company strategy, Company X must implement project-specific performance metrics and evaluate those metrics at all levels of the organizational hierarchy and across all departments. Company X must recognize that to remain competitive, responsibility for the effectiveness of NPD activities must be shared across the entire organization. Several frameworks and project- and NPD-specific performance measures are suggested in this section.

5.1.6.1.1 Balanced Scorecard

The Balanced Scorecard is a comprehensive framework developed by Kaplan and Norton (1993, p. 135). It is a performance measurement system that translates strategic objectives into a coherent set of measures. Company X can choose measures representing four different perspectives to complement and enhance traditional financial indicators. These include:

- **Financial perspective** - To succeed financially, how should we appear to our shareholders?

- **Customer perspective** - To achieve our vision, how should we appear to our customers?

- **Business process perspective** - To satisfy our shareholders and customers, which processes must we excel at?

- **Learning and innovation perspective** - To achieve our vision, how will we sustain our ability to change and improve?

The balanced scorecard would offer Company X a more balanced and complete picture of performance, and provide a mechanism for communicating business goals and strategies throughout the entire organization.

5.1.6.1.2 Benchmarking

Benchmarking is the act of measuring and comparing the work processes of one organization to those who have demonstrated exceptional or innovative operational performance. For example, Toyota is benchmarked for its manufacturing processes, Intel for design, Motorola for training, and Honda for rapid product development (McCarthy, 2003, p. 7). Benchmarking can therefore be a fast flexible tool for Company X to learn from other best-in-class companies and adapt their success strategies to the performance challenge at hand. The objective of the comparison is to help identify opportunities for improvement by attempting to answer the following questions (Kempner, 1993, p. 22):

- How well are we doing compared to others?

- How good do we want to be?

- Who is doing it the best?

- How do they do it?

- How can we adapt what they do to our organization?

- How can we be better than the best?

Table 5 ties the concepts of balanced scorecard and benchmarking together. Best Practices, LLC, a leading source of Benchmarking and Best Practice information, conducted a study of fourteen world-class organizations in the electronics and manufacturing industries (2000). The companies profiled were renowned for their implementation of the balanced

scorecard. Since the purpose of the scorecard is to capture and report relevant aspects of a firm's operations, the breadth and depth of scorecard measures is unique to each organization. However, the following chart provides a summary of typical measures used by best practice organizations within electronics and manufacturing industries:

Perspective	Performance Metrics
Customer Focus	• Market Share Gains • On-Time Delivery • Installation Time Reduction
Commitment to Quality	• Cost of Quality • ISO-9000 • Supplier Quality
Flexible Factories	• Inventory Turns • Manufacturing Cycle Times • Test Times
Fast Product Cycle Time	• Fast Time to Market • Fast Software Product Introductions • Design Time Reduction
Organization and Teamwork	• Employee Turnover • Sales per Employee • Accident Rates

Source: Best Practices, LLC, 2000.

Table 5: Balanced Scorecard Perspectives and Performance Measures

Like Company X, the ability to expedite the product development process and deliver products and services to customers "In Time" and "On Time" is critical to successful execution of strategy in these organizations. This is evidenced by several of the performance measures including On-Time Delivery, Installation Time Reduction, Manufacturing Cycle Times, Test Times, Fast Time to Market, Fast Software Product Introductions, and Design Time Reduction. Clearly, time to market is a critical success factor in NPD firms. The implementation of metrics to evaluate this dimension is essential in communicating what is important throughout the entire organization.

5.1.6.2 NPD Project Metrics

While Company X can choose from a multitude of measures to evaluate NPD programs and portfolios, Githens recommends that organizations begin by identifying metrics to track NPD project status (2002, p. 2). He outlines three essential practices for determining project status. These include:

1. **Baseline schedule**. Ensure that the project team develops an appropriately detailed baseline schedule of work, schedule, resources, expenses, scope, risk, etc. This project plan serves as a resource to enable the team to self-manage its work.

2. **Performance measurement system**. Develop a performance measurement system and a communications plan at the outset that details the metrics that will be reported and the frequency and method of reporting. Project status should be reported "as of" regular, pre-defined reporting dates, and should measure the quantity of work accomplished, resources expended, and variances.

3. **Measure against baseline**. Performance should be compared against the baseline, and variances should be determined as values, not percentages. This allows for a more complete understanding of the project's status.

Githens also defines five rules to facilitate better understanding of project status metrics. These are (2002, p. 3):

1. "Don't accept guesses or drive your NPD process with metrics that are guesses."

2. "If you must accept a guess, documented and validate a set of assumptions to support the guess."

3. "Status first and forecast second."

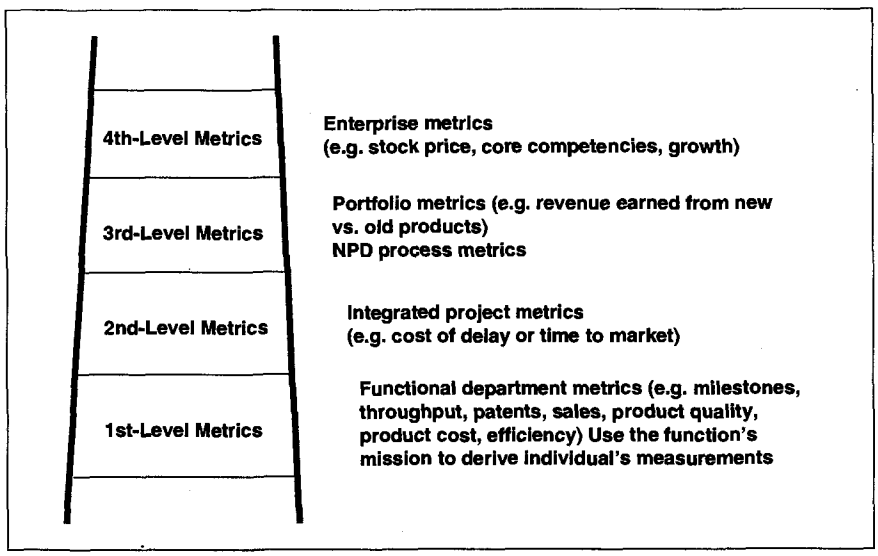
4. "Don't assume that a number is valid just because a computer generated it."

5. "The purpose of measurement is insight for improvement."

This last rule emphasizes that the purpose of providing metrics is to foster improved discussion and decision making, not to cause 'analysis paralysis' or encourage micromanagement. The real value of metrics lies in enabling project teams to self-manage their work and to communicate project status to executives (p. 6).

To improve a firm's ability to communicate and align understanding among stakeholders, Githens also recommends the use of a tool called the "ladder" (2003). He contends that the

reason some companies are more successful than others in product development is due to a better understanding of NPD metrics at all levels of the organization. The ladder is based on the theory that communication problems occur because individuals "use language at different levels of detail" at different levels of the organizational hierarchy (2003, p. 2). The ladder shown in Figure 6 illustrates four levels of metrics associated with NPD.



Source: Githens, 2003, p. 3.

Figure 6: The Ladder of Abstraction for NPD Measures

The ladder shows that first order metrics are granular and may only be relevant to an individual, program, or department. However, the metrics become progressively more abstract and broad as they progress up the ladder to the executive level. The reason this tool is effective is that it allows managers to elevate the organization's attention to the next higher level on the ladder.

The implementation of the frameworks and metrics described in this section, and the tracking and evaluation of those metrics at all levels of the organization, are critical for Company X. Since new product development is key to overall company success, the measurement and evaluation of performance would help to drive support for product development activities and to promote continuous improvement of NPD and project execution processes company-wide.

5.1.7 Develop a More Flexible NPD Framework

While Company X has developed a strong framework for new product development, it has experienced challenges in completing every stage in the framework for most projects. To remain competitive and agile, it is recommended that the organization develop more flexibility in its new product development so that the major required phases of a project are mandatory with each project, but the additional phases are optional depending on the criticality of the project and the risk associated with it. Most importantly, each project should include the five major phases [4]: Envisioning, Planning, Developing, Implementing, and Maintaining (Microsoft Corporation, 2003). At minimum, checks and reviews for each stage should occur to ensure that the critical requirements are not excluded. These phases are described in further detail below.

In the Stage-Gate System as described by Cooper (2001), these phases are joined together through "gates", or review points in which the deliverables are evaluated against a set of predetermined criteria – usually quantifiable metrics such as actual spending and market analysis. The results of the evaluation determine whether to continue on with the project or kill it. This framework reduces risk within the project by escalating financial and resource commitment as the project progresses and new information becomes available.

5.1.7.1.1 Envisioning

During the envisioning phase, project stakeholders work with the program manager to develop business requirements for the product and frame off the project in terms of vision and scope. Microsoft Corporation (2003) defines vision and scope as follows:

> Vision is an unbounded view of what a solution may be. Scope identifies the part(s) of the vision can be accomplished within the project constraints. (Microsoft Corporation, 2003)

The objectives of the envisioning phase include unifying the project team behind one shared vision for the project, defining objectives and constraints, identifying risks, designing communication architecture, and commencing the planning process at a high level. The resulting document, often called the Vision and Scope Document, serves as a project charter for the key

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[4] The product development stages as outlined in this document are largely based on the Microsoft Solutions Framework (MSF) Process Model from Microsoft Corporation. Though they are not unique in design, the labels are similar to the MSF model. The MSF model is based on a combination of the Waterfall method and the Spiral method for solutions design.

stakeholder groups. Typically, high-level estimates of project timelines and costs will be included in this document, and will allow the project advisory committee to make initial decisions on project progression.

During the envisioning phase, key project stakeholders are involved in providing input and requirements from the business perspective. Project team members may be consulted to provide input on schedules, costs and risks. Additionally, during this phase the program manager can construct the project team and identify leaders to drive the project activities. The project team may include customer representatives to provide input into major decisions to prove business value.

Upon completion of the envisioning phase, the stakeholder groups are convened to review the envisioning document. Included in the envisioning document are identified objectives and critical success factors which should correspond with business needs, and drive the design of the detailed project deliverables. Depending on the culture of the organization, the stakeholder groups may be required to sign off on the envisioning document to demonstrate commitment to the established vision and scope. In doing so, the stakeholders cement the direction of the project and provide a reference for future project-related decisions.

5.1.7.1.2 Planning

The planning phase of a product development project involves creating detailed schedules, resource utilization plans, activity assignments and deliverable definitions. Additionally, the project team completes the functional design of the product to the point of being ready to build. The importance of this phase of the project cannot be emphasized enough due to its impact on the success of the subsequent activities. "The most important element of project preparation is a completely developed project execution plan reviewed and (the key) understood and committed to at all levels by all responsible owner business and project management parties" (Dahlen, 2001). The purpose of a project execution plan is to provide a focal point for commitment of all involved parties, document their roles and responsibilities, and identify and prioritize critical execution issues with potential constraints and ensure that specific mitigation actions are taken (Dahlen, 2001). Included in the project execution plan may be GANTT charts for project scheduling, project team plan and role definitions, quality management plan and schedule, summary of deliverables, and milestones with go/kill decision criteria.

The program manager will determine the exhaustive list of detailed tasks for delivery to meet the objectives and critical success factors outlined in the envisioning document. This task list provides the basis for the project schedule. The development of project schedules can involve both top-down scheduling (provided by stakeholders and managers) and/or bottom-up scheduling (provided by project team members for specific activities and tasks). Many program managers will combine both of these approaches to arrive at the final schedule.

Many organizations recognize the importance of getting the project details right from the start. Not only does accurate planning at the outset reduce the risks and chances for error, but may be essential to reducing time to market. Uppal (2002) states that firms are "beginning to recognize that they must have new and fundamentally different project execution plans that reduce project cycle time to satisfy current future demands of the business units... Carefully planning and effectively executing commissioning and startup activities can reduce the project's overall cycle time". Many product development projects fail due to poor planning and forecasting, which is completed during the planning phase. Therefore, program managers are wise to budget adequate time for project planning and scheduling to ensure that all required information is collected and adequate resources are allocated. The accuracy of planning activities also depends on the completeness of the envisioning activities.

Once again, the review and signoff by project stakeholders is necessary upon completion of the project execution plan to assure a common understanding of deliverable dates and deadlines for decisions throughout the project lifecycle. Critical decisions are major potential bottlenecks and the project schedule must communicate clearly when stakeholders must be available to avoid holding up the project progression. Additionally, project team members must review the final work breakdown schedule to understand key deliverables and deliverable dates.

5.1.7.1.3 Developing

The developing phase involves the physical architecture of the product as per the functional specifications created during the planning phase. Theoretically, the project development team should be able to start building upon commencement of the developing phase and require little revision to functional specifications. The developing phase involves technical execution of specifications and testing of completed deliverables. Upon completion of the developing phase, the scope of the project as outlined in the envisioning document should be complete. As is common in many product development projects, scope may change as the project

milestones are reached and new information becomes available. However, if these scope changes are documented, assessed and accepted by project stakeholders, then the business case for changes will have been made and should positively impact the final deliverables (Microsoft Corporation, 2003).

Throughout the developing phase, testing occurs upon completion of key deliverables. This testing is outlined in the testing plan that is developed during the planning phase. Testing may include user representatives, internal quality assurance teams and stakeholder groups. Not only should a product be tested for technical stability, but should also be assessed by customer groups. Often a firm will release a test version of a product (or "beta") for customer review. This may not be a requirement, but can provide valuable insights to design engineers.

Upon completion of scope requirements, the testing team must sign off on completion of scope, as well as completion of design requirements. Sign off may also be required by stakeholder groups and executive prior to public release.

5.1.7.1.4 Implementing

Product implementation involves the dissemination or installation of a product in the customer environment, stabilizing the installed product, and transitioning the product to the maintenance team for support (Microsoft Corporation, 2003). Essentially, products are transitioned from a temporary testing environment to a production-ready environment. The transition activities should have been documented during the planning stage and coordinated by the product manager.

The implementing phase involves many customer-focused activities that are driven by the customer support function. Imperative during this stage are market introduction plans, product support plans, communication plans for external parties, and clear identification of transition roles for project team members. Customer support team members, for example, may be partnered with technical team members for the duration of the implementing phase to answer technical questions and provide feedback to the technical development team on issues reported from the customer groups. This partnering may be phased out as the initial product becomes stabilized and accepted within the customer environment.

Product success is often associated with implementation success rather than technical superiority. In other words, the most technically advanced product is only as successful as its implementation. Therefore, much emphasis needs to be placed on building a proactive implementation plan. For example, a software company familiar to the authors had built a software product for release in the education market. Although the product was technically superior to its competitors, and many of the technical customers understood its merits, the product would consistently fail to be implemented as customers did little with the product after purchase. Finally, the organization packaged an implementation plan design with the purchase of the software, and required customers to create an implementation plan suited to their individual requirements. Following this, product usage increased significantly and customers began using the product in new and innovative ways. Rather than installing the product and "seeing who would use it", customers were now designing a plan for success and providing their employees with a framework within which to use the product. Similar plans can be developed for most products and can impact acceptance ratios significantly.

5.1.7.1.5 Maintaining

When a product has achieved the stabilization criteria as designed in the planning phase, it can be moved into a maintenance mode. Maintenance includes support for current versions, and minor upgrades to existing products. Some products with extensive life cycles may include many upgrades while others are more dynamic and are obsolete within a short period of time. Upgrades to these types of products often do not warrant investment. A maintenance plan should be developed during the planning phase and will guide activities for the lifetime of the product.

5.1.7.2 Phase-Gate Systems

In defining a high quality product development process, Cooper (2001) identifies "go/kill decision points where projects are actually killed" as an attribute that is critical to success in product delivery. Essentially, the phase-gate approach, or Stage-Gate™ System as coined by Cooper (2001), involves the design of an operational and conceptual product development process around project phases connected by "gates" or decision points where the product is evaluated based on a set of predetermined criteria for quality control and continued investment. These decision points are structured in such a way that resource commitment is escalated as new information becomes available. The Stage-Gate System™, or a similar phased approach, has been adopted by many leading firms and continues to be used in new and innovative formats.

The main benefit of a phase-gate approach is the reduction in risk and uncertainties for new product investments. As a new product moves from idea to inception, risk becomes gradually decreased with new information. While it is impossible to avoid risk in a new product development opportunity, it is possible to manage risk when outcomes are uncertain. The phase-gate approach distributes risk over process phases, with key decision points between each. Cooper (2001, p.124) defines risk as "a combination of how much is at stake and the uncertainties of the outcome". The gates in a phase-gate approach break the amounts at stake into smaller manageable portions, which reduces the amount at stake for each incremental investment decision. As the project progresses, uncertainties are reduced and the amount at stake can be increased. In a phase-gate approach, "risk has been reduced by converting an all-or-nothing decision into a two-stage decision: two steps and two decision point" (Cooper, 2001, p.125). With more options available and more information, risk is reduced.

With a more flexible new product development framework, projects delivered at Company X can be completed in shorter timelines, with greater alignment to initial requirements and with minimal managed risk.

5.1.8 Create a Company-Wide Quality Management Plan

While Company X has recognized the importance of quality management as an organization-wide function, there has not as of yet been a company-wide quality management plan delivered which governs product and service delivery at all levels of the organization. The documentation of quality standards and processes for the organization ensures that there is consistency in the delivery of products and services, and that employees take pride in the work that they do. It is recommended that Company X create a company-wide quality management plan with input from all employees including production-level employees and management employees.

5.1.8.1 Structure

A quality management plan should document corporate expectations for delivery of project goals and daily operational activities. Through documented standards, practices and processes, the quality management plan should include the following (Claver, 2003):

- **Customer involvement.** The plan should define a communication mechanism for receiving and disseminating feedback and requests from customers, as well as the incorporation of activities involving customers at all stages of the product development life cycle.

- **Management commitment and leadership.** If management is perceived by all employees to support and practice quality standards, the quality management plan becomes a corporate-wide doctrine, rather than a guidebook for making good products.

- **Quality planning schedule.** Each group within the organization has different definitions of quality, and thus different expectations for delivery of quality. A well-defined method and schedule for setting quality objectives, with action plans for delivery, ensures that the organization can deliver on quality as a cohesive entity. Additionally, employees from all levels should be involved in the development of quality objectives.

- **Continuous evaluation for improvement.** Along with quality planning cycles, organizational groups should develop frameworks for measuring and evaluating their performance according to the established objectives. Scorecards, key performance indicators, and satisfaction surveys can all be implemented across the organization to evaluate quality delivery. Reward programs such as quality awards can incent employees to strive for quality performance goals (the European Quality Awards receive much industry attention and actually set standards for delivery across industries).

- **Organizational learning.** To ensure continuous improvement within groups, the quality management plan should document learning objectives for groups and individuals. The creation of a learning environment helps to encourage training and professional development, and discourages silos of knowledge from forming, which can hinder the delivery of quality products. Crow (2001) describes a "proactive feedback and corrective action" mandate which directs feedback from previous projects through to current projects For proactive measures to be put in place to counter similar errors or challenges.

- **Communication systems to foster cooperation.** Internal communication systems should enable employees to work collaboratively with each other, regardless of hierarchy or location. It has been documented that cross-functional teams with mixed communication styles help deliver creative solutions (Leonard, 1998).

- **Process management.** While each organizational group must own and build their own internal processes, the documentation and oversight of process development should be included as part of the quality plan. Centralized management of work processes can ensure consistent performance levels and knowledge sharing across the organization.

- **Organizational awareness.** The "soft" side of quality management involves the creation of a positive and motivating workplace for employees. Employee

> satisfaction is the foundation for organizational improvement – satisfied employees feel increased ownership, motivation, pride and commitment, which drive them to produce higher quality work. In fact, the drive for quality comes from the individual. "Creating a (quality) culture requires channelling individual self-interest toward quality goals. Effective teamwork with mutual trust among the members of the team is one of the key factors in the success stories" (Parker, 2003).

The development of a company-wide quality management program will help Company X meet and exceed customer expectations, reduce errors and increase employee pride. These improvements will increase the perceived value of a Company X product and contribute to brand equity. Additionally, they will streamline and govern project execution activities and thus improve upon the product development process.

5.2 Solutions for Root Issues

5.2.1 Decentralize Decision Making

Currently, product development decisions at Company X are centralized within the executive level, with input from various sources. This situation causes delays in decision-making, which translates to delays in project execution, and the resulting decisions do not necessarily reflect the important input from production-level employees who are ultimately impacted by the decisions themselves. Therefore, it is recommended that Company X distribute decision-making activities appropriately based on risk and expertise, to reduce delays and improve employee ownership over project activities and deliverables. It is also recommended that the company empower its managerial and production-level employees with decision analysis tools that can be used according to the type of decision and circumstances involved.

5.2.1.1 Methods

Most opportunities produce results that are not solely financial in nature. This is why it is important to integrate both qualitative and quantitative factors into any decision. The main challenge that managers face in valuing future opportunities is that many benefits or downsides are difficult to quantify and, therefore, compare. Therefore, selecting a decision analysis framework for the organization to use across all business areas can be next to impossible. Selecting a combination of methods to suit the structure of the business will be most likely to produce successful results. The decision-making process is a fluid one, and the existence of a framework should not restrict the organization's decision makers from experimenting with other

frameworks. For instance, a purely economic model may work well for a new marketing opportunity, while the next marketing opportunity may be better suited to a conjoint analysis.

Additionally, employees may have different requirements for decision-making than management, and therefore may derive greater success from different methods and frameworks. The important consideration is whether the criteria for decisions are consistent throughout the organization, across business units and vertically through the corporate structure. Decisions are made every day, in small projects and large, and by all levels of employees. A consistent set of criteria helps ensure that their results are aligned.

Within the product development process, decision-making occurs regularly. Some decisions are less impactful than others, but all are required to keep the process going and ensure that time and cost budgets are met. By empowering all members of the project team to make decisions when they are required, managers help ensure that the project moves smoothly. Team members can be trained to use decision analysis techniques and can be provided with accepted decision criteria from the executive level to build confidence in decision-making.

The following methods are commonly used throughout the organization for decision-making activities. Each is appropriate to different employee groups, at different times and for different decision types. Each endeavours to help the organization reduce uncertainties and quantify risk in investment decisions.

5.2.1.1.1 Decision Trees

Decision trees are graphical decision analysis tools that help managers plot the range of possible decisions and their related outcomes related to a major investment opportunity. The first stage in any decision analysis situation is to identify the issues surrounding the decision. For example, the risks for the situation, the factors affecting risk, key management decisions that must take place, the range of possible decisions and the range of possible outcomes.

When the full set of possible decisions and their related outcomes are established, these are plotted in a graphical diagram called a decision tree. These choices are displayed over time and clearly demonstrate the opportunities and losses associated with each path. This approach allows rapid decision-making and organized, methodical analysis of opportunities.

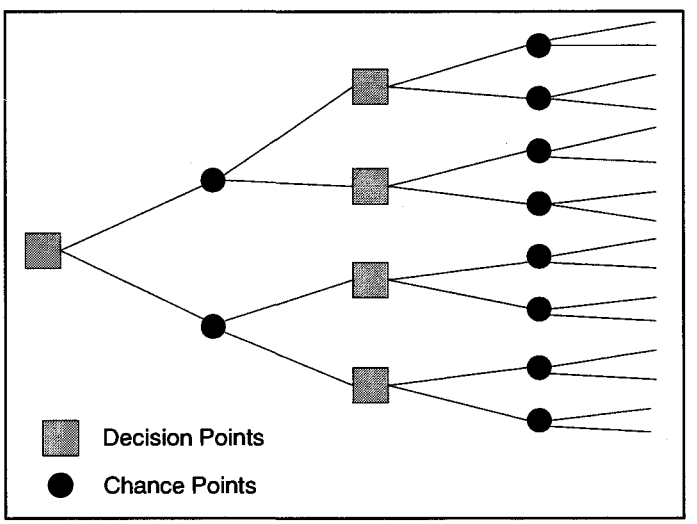
A decision trees consist of two components:

- Structure (choices; possible outcomes), and
- Data (risks; value of each possible outcomes)

These components are represented by two graphical elements:

- *Decision points*, indicating areas where a decision must happen
- *Chance points*, indicating areas where one situation or another could possibly result

After plotting these components, the probability and expected values of the outcomes should be calculated and placed on the diagram (see below).



Source: de Neufville, 2002 quoted in Maine, 2003, p. 22.

Figure 7: Decision Tree

The results of the decision tree do not indicate one best solution, but rather provide a framework with which to alter inputs and measure changes in results, and establish alternate strategies for opportunities. This approach is dynamic and flexible, and well suited to a fast-paced organization. Decision trees offer balance between best and worst case scenarios.

5.2.1.1.2 Sensitivity Analysis

Sensitivity analysis (SA) is a quantitative decision analysis technique that demonstrates how a change in inputs to a business model affects the outputs of the model. Used primarily in a

financial capacity utilizing economic models and financial worksheets, the SA technique can be extended to less traditional uses with project attribute models. For example, when measuring economic factors of a given project opportunity, changing the time to market can demonstrate how financial returns will be impacted, calculated by simple or complex formulas input into the SA tool.

Sensitivity analysis can be executed using simple spreadsheet software such as Microsoft® Excel, which is versatile and powerful enough to incorporate complex formulae and variables for quick calculation of results. What is not immediately inherent in the pure mathematical calculations, however, is the assumptions that are made regarding quantitative and qualitative inputs. It is important to consider these when interpreting results of an SA exercise.

5.2.1.2 Implementation

Decisions are made every day in every area of Company X's business. It may not be necessary or practical to engage in a full decision analysis practice for every decision that needs to be made. The aforementioned models become most useful when decisions are complex, strategic or time-sensitive. However, the use of a decision analysis model teaches decision-makers the basic techniques and skills that form a decision-analysis mindset and help managers think analytically in all areas of their daily work. Decision analysis tools can be used by most Company X employees for most activities and are relatively cost-effective to implement. Costs for implementation can (but may not necessarily) include specialized training and software tools.

5.2.2 Use a Portfolio Management Technique for Resource Allocation

Company X should strongly consider the use of a portfolio management approach for project resource allocation. While this type of approach is also useful for financial resource allocation, it is highly effective in organizations that undertake multiple projects at any given time. Without considering all major initiatives and the resources required when planning for new projects, the company will continue to face major challenges with project delivery due to over-allocated resources and shifting priorities.

The portfolio management approach to making new product development decisions involves collecting information about new opportunities and evaluating these in the context of other projects that are either underway or planned. Portfolio management is very important in

organizations that endeavour to undertake a multitude of projects of varying characteristics, such as Company X does. In addition, Company X competes in a variety of markets at different stages in their life cycles, adding further complexity to the strategic decisions to undertake new product development projects.

The portfolio approach (similar to a financial investment portfolio) allows the organization to map out projects against corporate strategic objectives and distribute risk among projects with varying levels of uncertainties. As with a financial portfolio, managers choose opportunities with varying degrees of risk to maximize returns within their chosen risk profile, in the short and long terms.

Projects within an NPD portfolio are assessed based on a number of factors, including:

- Strategic fit
- Time to market
- Resources required (financial, capital and human)
- Return on investment and time until returns are recognized
- Economic costs
- Intangible benefits such as enhanced reputation, brand awareness, etc.

The portfolio method is a model for organizing and assessing projects within the context of other initiatives. Coupled with more rigorous quantitative analysis techniques, this model is highly valuable to the product-based organization and imperative to organizations with multiple, diverse, concurrent projects. The portfolio management model provides links between projects and the overall strategic direction of the organization. The projects within a portfolio are reviewed not individually, but rather as one set of interrelated activities (Siderio, 2003) that can be monitored and controlled individually to achieve a set of objectives. In contrast, single project assessments are more likely to demonstrate the fulfillment of several objectives but certainly not all.

Project portfolio management (PPM) software is available to enable organizations to view all projects within the portfolio, across several distinct metrics and aligned with several

strategic objectives. Additionally, PPM software can help orchestrate and coordinate project activities, and provide business intelligence to decision-makers about multi-project attributes. Web-based PPM software provides access to this information by key decision-makers throughout the organization.

5.2.2.1 Resource Planning Methods

A number of methods exist that can be used to help schedule and plan for resource requirements. When considering the methods to use, Akpan (1997) suggests that the manager must consider both the nature of the constraints on the project (whether these are cost-based or time-based). As well, the manager should consider how the organization defines cost. This orientation can affect the methods used for resource allocation – either costs cause resource constraints, or constraints cause costs. By becoming very clear on which resources may delay timely completion of the project, managers will be better equipped to plan accordingly.

5.2.2.2 Ownership of Resource Allocation

By the time that a project is approved by a project approval committee, extensive analysis should have already taken place to justify the value of the project. This analysis should include a high-level assessment of required resources, put forward by those who will be responsible for project execution. At this time, it must become clear whether resources will be supplied from internal sources or will be complemented by external sources. In either case, the project or program manager who will oversee the detailed planning and implementation phases will be required to schedule all required resources according to availability and project requirements; coordinate with other project team leaders to ensure that shared resources are accessible; ensure that all constraints are analyzed, documented, and; have a contingency plan to manage possible roadblocks to success.

6 CONCLUSION

Company X's ability to continue to deliver innovative, value-added, quality products and solutions to customers depends upon sustained improvement of product development and project management processes. Company X recognized the inherent challenges in executing new product development projects and initiated this study to identify opportunities that will strengthen and enhance existing processes through training and human resource development. This concern has led to an extensive review of external literature, and a thorough examination of Company X's current situation through its intranet, external web site, written materials and interviews with key personnel. As a result, ten recommendations have been put forward to address symptomatic and root causes of NPD and project execution issues at Company X.

To mature as a new product development company, and to address its project execution issues, it is recommended that Company X attempt the following:

- Decentralize Decision Making
- Use a Portfolio Management Technique for Resource Allocation

As well, it is recommended that Company X implement a number of other initiatives focused on solutions to symptomatic issues. These include the need to:

- Develop a Framework to Measure ROI in Training
- Develop the Project Management Mindset in All Team Members
- Build Cross-Functional Teams
- Align Organizational Structure with Strategy
- Create a Sustainable Culture of Learning
- Implement Project-Specific Performance Metrics
- Develop a More Flexible NPD Framework
- Create a Company-Wide Quality Management Plan

While this study was initiated by the HR department, the complexity of the recommendations generated speak to the need for a company-wide commitment if change is to

occur. The challenge lies in communicating to all groups and individuals within the company so that they become active participants in implementing these massive shifts in process and practice. The long-term commitment that is required to initiate and sustain these changes must begin at the top and permeate the entire organization.

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APPENDIX A*

SIMON FRASER UNIVERSITY

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BURNABY, BRITISH COLUMBIA
CANADA V5A 1S6
Telephone: 604-291-3447
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November 21, 2003

Ms. Laura Favaro
Graduate Student
Faculty of Business Administration (MBA)
Simon Fraser University

Dear Ms. Favaro:

Re: Xantrex Technologies Inc. strategic human resource development project

The above-titled ethics application has been granted approval by the Simon Fraser Research Ethics Board, at its meeting on November 17, 2003 in accordance with Policy R 20.01, "Ethics Review of Research Involving Human Subjects".

Sincerely,

Dr. Hal Weinberg, Director
Office of Research Ethics

* For inclusion in thesis/dissertation/extended essays/research project report, as submitted to the university library in fulfillment of final requirements for graduation. Note: correct page number required.