Abstract

This paper analyzes the importance of the decision making process in an organization and discusses its importance to the business of the organization and the ways in which an ineffective process could impact the organization’s profitability. The decision making process is considered within the context of an IT organization that requires strategic alignment. Since the key success factor in alignment is effective decision making, it is important that decision making is successful. Thus, I consider IT Portfolio Management as an effective tool in the decision making process.

In many organizations, the decision making process is sub optimal. In an IT organization, decision making errors are often due to lack of an effective IT portfolio. My hypothesis is that the lack an effective portfolio in an IT environment is due to the poor design of the Portfolio Management. Hence, the key objective of this research is to identify some best practices that an organization can adapt in designing its IT portfolios.

The key purpose portfolio management is to improve, speed-up, and optimize decision making in an organization. Errors in decision making will result in poor quality, ineffective strategies, and failure of leadership. A sample matrix organization agreed to participate in this research.

1. As a first step, I met the leaders of that organization and explained the purpose of this research. In subsequent meetings, I interviewed leaders using the questions in the research. The interview collected and reviewed the relevant data and findings pertaining to the issues raised in this paper.

2. As a second step, I listed and examined the main findings directly related to the questions asked in this paper.

3. In the final step I conducted a detailed analysis of the results and findings made by the various researchers. The data collected was further analyzed and a set of ten (10) best practices were identified for the IT portfolio design. Research shows that a unified approach is necessary in both the application and project portfolio design, careful analysis should be conducted and communication to stakeholders and change management process should be considered. Equally, risk and issue management processes should be followed. Decision matrices should be tools used to prioritize requirements and projects. Also, continuous improvement should be an ongoing approach with documentation a vital step in the design process.
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1. Introduction

Information Technology (IT) is a key factor in every organization’s business model, therefore IT needs strategic alignment with the core business value proposition. “Alignment remains an important issue for CIOs in part because failure to align information technology (IT) to business is believed to result in the failure of many IS initiatives” (Turban, Leidner, Mclean, & Wetherbe, 2007). As part of an organization’s strategy planning team, the Chief Information Officer (CIO) needs to continuously improve the alignment of information technology with evolving business requirements.

This business alignment is established using IT Architecture. “IT Architecture is a high-level map or plan of the information assets in an organization. It is a guide for current operations and a blueprint for future directions.” (Turban, Leidner, Mclean, & Wetherbe, 2007). Information technology strategy can be planned based on the IT architecture and business strategy. IT architecture holds the potential to align intangible concepts and ideas about the enterprise so that the enterprise’s tangible requirements can be aligned and harmonised.

Alignment can be achieved with strategic IT planning, IT architecture, careful and continuous integration to business strategy, and with ‘structured and well managed’ operations. The IT leader’s challenge is to lead and bridge business, development and operations successfully by translating strategic business initiatives into innovative solutions that can boost organization productivity, reduce costs, reduce time-to-market and spur growth capacity.

The alignment is a process to be carried out at various levels of the IT including leadership level, middle management level, and operational level. The important and key success factor (KSF) of the alignment is the effective decision making. Decisions are made at the leadership level, middle management level, and operational level. IT environments without a standardized decision making and planning processes increase the risk of poor on ineffective performance. Decision making can therefore be better managed using a portfolio. Portfolio Management will help to prioritize and create decision plans. In a management decision process, the portfolio will act as a media or middleware between strategic planning, IT projects, and service delivery. This means carefully designed portfolio management with portfolios for projects and operations is an essential factor of an IT department.

Organizations may have project management and service delivery frameworks supported with software engineering processes such as configuration management, but in many situations both project delivery and service delivery are not completely managed using appropriate portfolios. This can be the root cause for common problems such as inappropriate prioritization of requirements and projects, improper identification of requirements, no, or low, information on critical IT and business assets leading to higher costs in future projects, a lack of or low control of product and service lifecycles, and poor service quality. These are results of poor alignment of Information Technology to business objectives.
IT Portfolios are a powerful tool in an IT management process, especially the investments on IT. According to Jeffery and Leliveld (2004), IT Portfolio Management (ITPM), “has evolved into a combination of practices and techniques used to measure and increase the return on individual and aggregate technology investments — existing and planned — and to reduce risk. An investment portfolio comprises all direct and indirect IT projects and assets, including infrastructure, outsourcing contracts and software licenses.”

According to a white paper on the public sector by Oracle Corporation, the project environments have many errors. The Enterprise Project Portfolio Management has not matured nor achieved its required goals. “Many organizations have made the mistake of equating project management with EPPM and, as has been discussed, they are not the same thing. It is common to observe certain characteristics of organizations that have achieved only a low level of maturity in EPPM by focusing solely on project management “(Oracle 2010). For an IT portfolio to be effective in its decision making process, mature Enterprise Portfolio Management must include project portfolio for decisions related to projects and application portfolios for decisions related to operational support.

**Hypothesis**

In an IT organization, decision making errors are due to lack of effective IT portfolio. **My hypothesis is that the lack of an effective IT portfolio is due to the poor design of the Portfolio Management.** Hence, the key objective of this research is to identify some best practices that an organization can adapt in designing and managing its IT portfolios.
2. Research purpose and research questions

2.1. Purpose:

The purpose of the research is to understand the decision making process in a sample IT environment, analyze and identify issues, and to find out how portfolio management can help information technology organizations in their decision making process. Then this research will identify some best practices that an organization can adapt in designing its IT portfolios.

While considering the complex nature of IT operations, the significant challenges of IT leadership, and an environment requiring dynamic changes and growth, carefully planned portfolio can certainly help the management and growth of IT. In the market advanced studies, and different standards organizations such as PMI and ITIL are available. This research will attempt to understand a sample organization’s details of the portfolio management process, decision making process, and its related problems. It will include interviews with managers and the CIO, technical staff, and consultants, and conclude with an analysis of the available data to suggest some “best practices” which an organization can adapt to design its IT portfolio.

2.1. Research Questions:

In relation to the study there are 9 high level questions:

1. How valuable is portfolio management for an organization?
2. How do organizations benefit from portfolio management?
3. How much organization’s strategic planning is related to the portfolio management?
4. How is portfolio management implemented in an organization (for projects and operations)?
5. An IT Portfolio Management is similar to a financial portfolio as it prioritizes requirements and manages IT resources including budget, machines, facilities, tools, and human resources. Considering this, what are the problems of the organization in prioritizing? What issues were faced in the past?
6. For an organization, what are the issues in the present portfolio?
7. With the understanding that portfolio management will fix many problems in prioritizing and managing, how does the organization see the benefits of portfolio management? How could the portfolio management framework be developed or modified to achieve a maximum benefit?
8. What are the process areas that could be benefited with portfolio management? i.e. projects only or projects and operations?
9. What are some best practices to solve these quality issues using portfolios? What are the considerations needed in designing those portfolios?
3. Literature review

3.1. IT, Strategy, and Portfolio – Background

From a strategic point of view, IT is an important factor in any business. The basic question that could be asked at this point is “in general how much IT could influence and contribute to its strategy”?

In a recent interview the director of the Accenture, Bas Telgenkamp said, “Our research indicates that CIOs of High Performance IT organizations are involved directly with the business output and that they tune their activities to the current and future business demands of the entire organization. They have successfully phased out their legacy systems and are embracing new technologies. The push for the right balance between cost optimization and budget availability, knowledge and resources is an important condition for growth.” (Bas Telgenkamp, 2010).

When CIOs develop strategies that are advantageous to the business there has to be a portfolio in place to accomplish the set goals. According to Ron Kifer, Vice President of Program Management at DHL Americas, “portfolio management can help you gain control of your IT projects and deliver meaningful value to the business. Portfolio management takes a holistic view of a company’s overall IT strategy”. “The IT portfolio is managed like a financial portfolio; riskier strategic investments (high-growth stocks) are balanced with more conservative investments (cash funds), and the mix is constantly monitored to assess which projects are on track, which need help and which should be shut down.” (Kifer, 2003)

Decision making is very important in IT strategies. There could be multiple strategy choices in a strategy decision making process. At this stage, careful prioritization is required to make a decision based on one of the choices. When a strategy is implemented, program and project management, and operations management will be the processes used for implementation. The portfolio management process is an essential part in program, project management, and operations management. The portfolio management is needed for improved decision making and resource management. In many organizations the portfolio management process has not produced satisfactory results and has not provided effective support to decision making and resource management, which could be the root cause of failed IT strategies. In addition poor design of the portfolio might be the reason for its lack of effectiveness. Hence, research is needed to identify best practices to design IT portfolios.

3.1.1. How Does IT Develop Strategy?

“Aligning IT with the organization has two facets. One facet is aligning the IS function’s strategy, structure, technology, and processes with those of the business units so that IS and business units are working toward the same goals. This facet is referred to as IS alignment” (Chan, 2002). Another type of alignment, referred to as IS strategic alignment, involves aligning IS strategy with organizational strategy. (Turban, Leidner, Mclean, & Wetherbe, 2007). An
organization will have different business units such as human resource, finance, marketing, research, engineering, processing, and procurement. ‘IS Alignment’ can be seen as a detail level of the alignment process where these business units and IT functions are aligned. An Information Technology (IT) department may have levels such as CIO, Directors, Senior managers, managers, technical and operational employees. These levels can also be viewed functionally, in terms of business analysis, project management, database management, infrastructure design, application development, testing, support, and documentation. At every level and in every function of the IT department, the structure, technology, and processes are aligned with the business units. This enables smooth and coordinated overall functioning of the units, and synchronized working towards the same business goals. On the other hand, ‘IS Strategic Alignment’ is the overall ‘IS Strategy’ aligning with the organization level business strategy. At this level of alignment (the highest level), the IS Strategy (or IT Strategy) is a part of the organization’s business strategy.

The IS alignment is the key success factor for the IS strategic alignment. IS alignment is a continuous process and its strategy must be planned for a long term. The IS alignment is all about how best it functions in its service delivery. Issues such as service interruptions, service non-availability, poor quality of service, low scalability of service, de-supported and back-dated technologies, and poor customer service can be dangerous to the IS alignment. IT should understand business requirements and provide full technical support with infrastructure, technology, and people. When this is reached a satisfactory level for end-users, managers, and business leaders, the IS alignment can be seen as complete. The IS strategic alignment is an innovative strategy for the business strategy.

3.1.2. Success Stories in Strategy
Several companies provide examples of success in IT strategic alignment. Wal-Mart’s low cost strategy supply chain driven by the effective management of logistics, made possible by its IT strategic alignment, (Banker, 2010) is a well known story. IT Infrastructure investments at Mercedes-Benz (Hoch, 2006) is another example. In 2001 when Benz USA identified their technicians training requirement increasing, they decided to be innovative and invested in distance learning technologies. In 2001, 4,500 technicians were trained using 41 trainers, at per trainer cost of $75,000. By 2004, the number of trainers could train 6,500 technicians.

Cisco’s case is also interesting. When Peter Solvik, CIO, planned a strategy to implement ERP at Cisco, his project required a significant budget provisioning based on the total budget. The results of this strategic alignment were great successes. “Solvik recounted the experience: We’ve learned an incredible amount in 48 months of live e-commerce. We have racked up Internet shipments of product from 0% in July of 1996, to 2% of our revenue in August of 1996, to $800 million in calendar 1997, and to $1.5 billion each quarter in 1998-a current run rate of 65% of our total revenue. As of January, 2001, Internet-commerce-based revenue represents 92% of our total revenue base, a run rate of over $25 billion annually. Cisco operates one of the biggest electronic sites in the world.” (Nolal, 2005).
3.1.3. **Portfolio**

More than 80% of IT activities are operations (You need to put a source for this information).

Efficiency of IT operations can be achieved with standardization and normalization of operations. To standardize and to normalize operations such as projects and IT service delivery, we can use portfolio frameworks based on standards. For example, project management can be more effective if we use the PMI PMBOK based project management framework that is specifically adapted for an organization. Similarly, ITIL based IT Service management framework could be used for service delivery operation. Both projects and service delivery will need portfolio based management to be consistent, efficient, and economic.

The IT Portfolio Management concept is analogous to financial portfolio management, but there are significant differences. Financial portfolio assets typically have consistent measurement information, and this is at the base of the concept’s usefulness in application to IT. However, achieving such universality of measurement would take considerable effort in the IT industry. IT investments are not liquid, like stocks and bonds, and are measured using both financial and non-financial yardsticks (for example, a balanced scorecard approach); a purely financial view is not sufficient. Finally, assets in an IT portfolio have a functional relationship to the organization, such as an inventory management system for logistics or a human resources system for tracking employees’ time. This is analogous to a vertically integrated company which may own an oil field, a refinery, and retail gas stations. .

3.1.3.3. **Portfolio in projects and program**

“Project is a temporary endeavor undertaken to create a unique product, service, or result.” (PMI, 2008)

“A program is a group of related projects managed in a coordinated way to obtain benefits and control not available from managing them individually. Programs include an element of ongoing work and may include elements or related work outside the scope of discrete projects in the program.” (PMI, 2008)

“Portfolio is a collection of projects or programs and other work that are grouped together to facilitate effective management of that work to meet strategic business objectives. The projects or programs of the portfolio may not necessarily be interdependent or directly related.” (PMI, 2008)

3.1.3.4. **Portfolio in IT operations**

Projects have a definite beginning and end, whereas operations are continuous processes. Project management lifecycle begin with initiation and end at closing. In a functional management where operational activities are involved there is generally not a defined and visible lifecycle. If an operational framework is standards based (example ISO, ITIL, etc.) and/or managed using service level agreements, then it can be periodically audited, and its lifecycle can be identified and managed.

3.1.3.5. **Portfolio Management**
The portfolio management describes the management of an organization’s portfolio of business change and operations initiatives. It is a coordinated collection of strategic processes and decisions that together produce the most effective balance of organizational change and business as usual.

Effective portfolio management leads to processes and behaviors that enable successful delivery across an organization’s entire change management.

3.2. *Business and IT Environment*¹

To begin this research, it is important to have an understanding of the business and IT environment, and the way in which they generally interact. The BTOPP (Business, Technology, Organization, Process, and People) framework from Michael Scott Morton’s *The Corporation of the 1990s* is a good example for this context. The following illustrates the high-level of the framework.

**The BTOPP (Business, Technology, Organization, Process, and People) System**

![BTOPP Diagram](image)

*Source: Adapted from Michael Scott Morton, 1988*

¹ (Scott Morton, 1991)
When we review the elements of the BTOPP, the following details could be seen:

**B - Business:** Information technologies need to align with a market need or opportunity. They should meet an internal need for information and thus strengthen the value chain that leads ultimately to the customer. Any planned application of IT must be tightly linked to—business strategy.

**T — Technology:** Hardware and Software together is functional in a technical environment. That could network with planned level of security and functionality. The system must be configured and networked with other business systems to ensure that the right information can get to the right people at the right time.

**O — Organization:** Organizations must be structured and restructured to get the most from their IT bases. This means much more than downsizing. The location of work teams, offices and customer service facilities are all affected. The adjustment to new technologies can take months, even years.

**P — Process:** Business processes must be engineered to focus on end-to-end service delivery, recognizing and integrating the new capabilities of IT. After the first time, these processes must continue to be reengineered often to reflect changing conditions. A wide variety of management practices and work procedures must be adjusted and changed to mesh with the major engineered business processes, such as product design and order processing.

**P — People:** Employees, customers and business partners must learn how to use the information system. They must not only be comfortable with the software, they must also have the know-how, motivation and authority to use the capability, such as information they receive to get their jobs done. And that means not only getting their jobs done, but more importantly, improving how they do their jobs. They must know what their jobs are and how technology has changed them.

### 3.3. The Decision Making Process

IT Governance describes the process by which decisions are made by its leaders. Decision making is an important activity of the IT from its strategic level to the operational level. The decisions could include strategic plans, operational plans, budget, and technology directions. The decisions are for the business of the organization and aligned to the business strategy. It is important that the IT decisions are carefully made with sufficient analyses, using optimized processes, and by capable people to get the maximum benefit from the decision.

The decision making process in every organization is different and may be based on its leadership strategy. This research focused on one single organization in a matrix IT environment and made a detailed review on its decision making process and portfolio.
management. This analysis is based on the data obtained from the review and further references.

3.4. Challenges in decision making process

Normally, change resistance can be seen as a risk in the decision making process, and preparing for the decision implementation and making an agreeable decision always present a challenge. Sometimes decisions made may need to balance needs and interests of different groups. The timing of the decision could also be a challenge.

3.4.1. Behavioral challenges can affect decision making

An individual’s behavior or behavior of a group has an impact on decision making. When analyzing, reasoning, and summarizing data, ‘thinking’ and ‘feeling’ are two actions normally performed. The importance is in both when and where a decision is made. For quick decisions, ‘feeling’ can be more effective but otherwise ‘thinking’ is generally better. Similarly, extrovert and introvert personality types cannot be used to determine whether an individual is a good decision maker. Extroverts are highly energetic but introverts may generate more ideas. Judging and perceiving personality types are also important. Judging types are more likely to give orders, while perceiving types are better decision makers, as they are more likely to consult and interact with others when making a decision. (Wikipedia, INFJ (2011, June 8))

3.4.2. Personality can influence decisions:

There could different types of people at different levels involved in a decision making process. Some of those people may be directly involved in the decision making process and some may be indirectly involved. In a decision implementation, an individual at any level, who has political strength, can influence the detail content of the decision. At a high level, a leader can influence teaming and process for the decision making.

3.5. Importance of decision making

3.5.1. IT runs its business based on decisions

For any activity that must occur in an IT environment, there has to be a decision on which Leaders can base a plan. Operational activities are managed using a pre-determined plan and procedure. Projects are to be planned and executed on a case by case basis. Any changes in activities needs decisions and new plans have to be in place. In general, decision making is an important activity is important from the senior level to the junior level of an IT organization.

IT environments without a standardized decision making processes and planning processes are likely to have lower performance levels. Such IT environments may be trying to adapt a waterfall model for decisions and management. But those could be ineffective as the modern decision
making and planning tools are capable of helping us with best selections and plans. These best selections and plans are achieved with carefully managed matrixes, permutations and combinations, and structured processes.

3.5.2. Impact of success and failure in decisions  
Failure of a decision cannot be considered in an absolute sense, the success or failure must rather be measured in degrees. Depending on the degree of success the advantage will be higher or lower. In the same way, depending on the degree of failure the disadvantage also will be higher. In most situations, the measures could be made with qualitative values; however, the assigned degree of success or failure may not be a definite percentage.

3.6. Information Paradox  
As per the definition in (FUJITSU CONSULTING with John Thorp, 2007), the Information Paradox is “the phenomenon that while the unit cost of IT is decreasing, organizations continue to spend increasingly large sums of money on IT in the belief that information, and the investment in IT to provide that information, is a “good thing,” despite the all too frequent reality that we cannot demonstrate a connection between investments in IT and business results.” This explains that, in some cases, Information Technology management has not been fully realized in the market. A good portfolio may not be in place to maximize the advantages from decreases in unit cost. There has to be a connection between investment, market, and return on investment. In this section, we will see what the underlying reasons are for this Information Paradox.

In an Information System, leaders and/or decision makers confront the Information Paradox every day. It takes a variety of practical forms. Expensive new information systems are delivered, but they don’t work properly; or people have not learned how to use them effectively; or, most often, the technology is working smoothly on the surface but, for some reason, it does not produce the expected business results. Other projects have gone well close to the implementation but were abandoned due to C-level decisions. Another example occurs when operational support is doing its best to satisfy the needs of customer, but damage the configuration with mismatch of documentation and software versions. There is a growing body of evidence that new and improved technology has not consistently produced business results over a period of several decades. The reality of Information Technology is that it has not lived up to the promise on five levels:

1. **Productivity performance of the economy:**  
Experts have advanced a number of explanations for this phenomenon which are summarized by Pam Woodall in *The Economist,* 2 “Survey of the World Economy: The Hitchhiker’s Guide to Cybernomics,” and a *Scientific American* article by Wayt Gibbs

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2 (Woodall, September 28, 1996)
called, “Taking Computers to Task.” The four most commonly mentioned explanations are:

a. Measurement Error
   In general, IT investments are intangible and productivity is notoriously difficult to measure in the service sector, where IT has been extensively applied. Hence, the jury of econometric experts is still out on the measurement issue.

b. Small Installed Base
   IT hardware costs are too low. Software and hardware together will not account to a noticeable portion of a firm’s capital stock. The hardware alone may cost only two to five percent of the project budget. However, there could be a misunderstanding that IT has made a significant investment. Some figure’s suggest there could be a maximum of 12 or 13 percent of capital invest required (for a US firm).

c. Poor Quality Software and Information Systems
   New and modified technologies and software interfaces may be complex. This will be difficult for people to learn and hard for the project management to implement. This could delay, or even cancel, applications of IT to increase business productivity. This has been a growing problem and introduced long-term impact on economic productivity.

d. Learning Lags
   Without restructuring a conventional organization, the newer generations of IT including PC, tablets, and internet Wi-Fi will not be productive. True electronic commerce is a remodeling of the conventional retail bank branches and storefronts. This leads to what the economists call a learning lag.

2. Business results of companies and other organizations
   In a matrix environment, the IT investment is often intangible. The NPV and ROI need not be independently calculated as IT investments blend with many other factors to produce business results. As Scott Morton (Scott Morton, 1991) points out, except in the simplest cases of automating manual functions. IT is also being applied to more varied business functions in more varied ways. It is hard to allocate costs and revenues when the IT infrastructure supports an entire business.

Workplace performance of individual knowledge workers and work groups
   Individual IT users are not satisfied with their technologies. Initially, they had difficulty becoming proficient quickly and then, as soon as they think they had mastered an
important business application, a new version arrives. There are a significant number of dissatisfied users when new technologies are introduced. It is clear after several decades that technological change imposes significant new learning challenges on knowledge workers every day. This also is a big part of the Information Paradox.

3. **Reliability of IT project delivery**
Project management and software engineering standards have been slow to develop and even slower to be adopted. Project management performance has been inconsistent. All too often organizations have sunk millions of dollars into “runaway” projects that deliver less functionality than promised, significantly later and for considerably greater expenditure than planned. In the worst cases, some projects end up being cancelled.

4. **Reliability of IT operational support**
Consistent and service level based operational support is a necessity in every organization. It has to be built on strong configuration management to be consistent and standardized. However, poor quality server, business productivity losses, poor service response, and increasing problems from work around and inappropriate configuration management are increasing problems in any organizations. IT departments initiate new projects to fix these problems, but eventually this will not be sufficient to eliminate these root causes.

### 3.7. Summary of Literature Review

Information Technology (IT) is important in any business. For an IT department and its strategy to be successful, there should be an effective decision making process in place. The portfolio management process can be used to make the decision making process effective. In many organizations these portfolio management processes have not produced satisfactory results. This problem could be due to lack of an effective portfolio which in turn could be the root cause of failed IT strategies. IT and business needs must be linked. There is a link between business, technology, organization, process, and people. This can be better understood from the BTOPP framework of Michael Scott Morton (section 3.2). This further explains the importance of success in IT decisions.

The decision making process in every organization is different and may be based on its leadership strategy. Different types of challenges can impact this decision making process. An individual’s behavior or behavior of a group has an impact on decision making. There could be different types of people involved in a decision making process. Even though the unit cost of IT is decreasing, the IT spending may be increasing and there may not be good evidence on the investments return. This phenomenon is known as Information Paradox, and it occurs due to poor decisions made in an IT department. All of these challenges show the complexities in a

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3 (FUJITSU CONSULTING with John Thorp, 2007)
decision making process as well as the need for careful decision making to lead an organization towards business success. The next part of this research paper will provide evidence that how a well designed and managed IT portfolio can be a solution to these decision problems.
4. Research design and data collection

4.1. Problem Definition

4.2.1. Main Problem
The main problem of this research can be summarized as follows:

Some IT departments do not have effective Portfolio Management that would help to reduce costs, reduce time-to-market and spur growth capacity.

The hypothesis is that the lack of an effective IT Portfolio in an IT environment is due to the poor design of the Portfolio Management. The objective of this research is to identify some best practices that an organization can adapt in designing its IT Portfolios.

As per the hypothesis and objective, the overall requirement of this research is to analyze different portfolios in IT projects and operations, to understand their applications, and to identify some best practices that an IT organization can adapt in designing its portfolio.

This main problem can be decomposed into the following four sub problems for the better management of this research.

4.2.1.1. Sub Problem – 1 : Decision Making Challenges at the CIO Level.
This sub problem is about the decision making at CIO level. In an organization, it is important to know how the CIO makes decisions. The analysis will focus on the role of CIO in the organization’s strategic planning perspective.

The basic idea here is that an understanding is required about the role of CIO in an organization and how he/she makes his/her decisions. This sub problem will be studied, analyzed, and researched with understanding on CIO’s activities in an organization. The CIO’s decision making is very important for the IT and has significant impact on the business of the organization. This question is to understand the need, importance, and applicability of portfolio management in CIO’s decision making process.

4.2.1.1.1. Research for Sub Problem - 1
This sub problem will be studied, analyzed, and researched with the help of a CIO. The CIO will be contacted and interviewed to understand the process. The following standard questions will be addressed during the interview.

1. What are the types of decisions made by the CIO?
2. What are the challenges for the CIO leadership?
3. How does he/she analyze problems?
4. What is the normal timeframe for making decisions?
5. How the decisions are made and communicated?
6. What are the challenges in this decision making process?
7. What are the impacts or effects of CIO decisions?

4.2.1.2. Sub Problem – 2 : Overall Decision Making Challenges in an IT
This sub problem is about different decision making levels in an IT. The IT may have multiple management levels. All of these levels may have to make decisions in areas such as prioritizing, planning, and budgeting. These are very important for the organization’s business.

When different management levels and people are involved in decision making, a standardization will be required to manage these decision making processes. Otherwise, problems such as conflicting decisions, decisions moving into different directions lowering IT effectiveness, poor decisions, etc. could occur.

4.2.1.2.1. Research for Sub Problem - 2
This sub problem involves study, analyses, and research in the following items and questions:

1. What are the different management levels involved in decision making?
2. Who are the key people involved in decision making?
3. What are the types of issues and matters involved in each person’s decision making?
4. In general, how do they make their decisions? How do they communicate their decisions?
5. What are the problems found in these decisions?
6. Does the organization use portfolio management to standardize these decisions?
7. How best the organization could improve the decision making with portfolios?

A questionnaire can be prepared for this sub problem. One IT department can be contacted and requested for its help in this research. More data can be collected from published journals, statistical reports, IT audit reports, and other publications.

4.2.1.3. Sub Problem – 3 : Process Management Challenges
This sub problem will look into problems in an IT that could be solved with portfolio management.

An organization may have IT projects and normal operations. In projects there may be situations that different projects are simultaneously managed. In such situations resource availability may be low, budget may not be sufficient, and requirements may be very high. The decision making could be done for each area. But these areas may not be combined and based on this combination decisions may not be taken. Such a combined decision making process will need matrixes with measurable qualities or quantities.

In this type of customer centric situation operational management, the decision making may not be balanced to the IT spending and budget. As an example, there could be many requests for reports may not be for any specific need and may be based on trials. These types of reports may be generated once and may never be re-used. This could be a growing trend and will create two problems. There will be hundreds of unused reports in the application that require increased maintenance cost and these extra activities will create new resource requirements. In other words there could be some factors such as an ever growing number of reports and...
programs increasing maintenance cost, uncontrolled small requirements increasing operations cost, quick workarounds for problems increasing cost, improper system lifecycle management pointing to high cost in future projects, etc. There should be a management process to control these inventories, avoid increasing operational costs, and improve application lifecycle management.

4.2.1.3.1. Research for Sub Problem - 3
This sub problem involves study, analyses, and research in the following items and questions:

1. Does the organization have a combined approach for making decisions for resources, budget, and requirements?
2. Does the organization maintain control on operational requirements?
3. Does the organization manage inventory of reports and programs within an application?
4. Does the organization manage application lifecycle? How do they normalize quick workarounds on fixes done on applications and systems?
5. Do they have problems from increasing operational cost? How do they control operational cost without affecting quality and people’s motivation?
6. Do they use the portfolio management to solve any of these issues?
7. Do they think a portfolio can be a solution to these issues?

4.2.1.4. Sub Problem – 4: How to Improve Effectiveness of Decision Making?
This sub problem is about improving the organization’s decision making and eliminating or reducing its issues. The effectiveness of portfolio management in this context will be the research here. Organization may have an existing portfolio management process. That may need some improvements to manage these problems.

This sub problem will be addressed based on the findings of the sub problems 2 and 3.

4.2.1.4.1. Research for Sub Problem - 4
This sub problem involves study, analyses, and research in the following items and questions:

1. Do they have an existing portfolio management process? If so, what are the decisions managed using portfolios?
2. How valuable is the portfolio management the organization?
3. How the organization is benefited from portfolio management?
4. How much organization’s strategic plan related to the portfolio management?
5. How the portfolio management implemented in an organization? (For projects and operations)
6. What are the problems of the organization in prioritizing? What issues were faced in the past? (This will be answered based on the research findings of sub problem 2 and 3).
7. What are issues in the present portfolio?
8. How did they develop the existing portfolio? How could the portfolio management framework be developed or improved to obtain the maximum benefit?
9. How can we solve these quality issues using portfolios? What are the considerations needed in designing those portfolios?

4.2. Data Collection

A thorough review of the purpose and background of a portfolio was conducted. That was used as a baseline for moving forward to further research.

The key purpose of the portfolio management is to improve, speed-up, and optimize decision making in an organization. In any organization, in any area including strategy planning, prioritizing is very important. When it comes to a high-level decision making, the underlying data, external and internal factors, and people impacted by the decisions need to be considered in general.

In accordance to the above understanding, this research needed review of a reasonable number of IT department that are matrix organizations. The selection of those organization needed considerations such as various geographic locations and different business types. Such a detailed research was out of the scope of this research. One sample matrix organization was approached and they agreed to help this research.

1. As a first step, I met the leaders of the organization, explained the purpose of this research. Then in subsequent meetings interviewed leaders using the questions in the research. The interview collected and reviewed the relevant data and findings pertaining to the issues raised in this paper.

2. As a second step, I listed and examined the main findings directly related to the questions asked in this paper.

3. In the final step, I conducted a detailed analysis of the results and findings various researchers made. Based on the analysis results were found.

Based on the above mentioned three-step process, the paper has offered certain recommendations about the various issues surrounding the research questions, the answers to which the paper has investigated. The recommendations are followed by a conclusion, which forms the final opinion on the various issues and questions raised in this paper.
5. Results

For this research I focused on one organization as a sample case to conduct research to identify best practices in the design of the portfolio management. After preparing a research questionnaire, I conducted interviews with the organization. Data was collected during the interview process, and this data was further analyzed to identify required results. In this process, I also, reviewed publications, online journals and books to find out details and ideas for this research.

5.1. Reviews with sample organization

5.1.1. Background

The sample organization is a matrix IT department. Its headquarters are in Edmonton. It has geographically distributed IT support offices in Vancouver, Calgary, Saskatoon, Regina, Winnipeg, and Ottawa. This government department is a medium size matrix IT environment. The CIO leads the IT department and reports to an executive level. PMO and functional management is reporting to the CIO. The PMO has been developing an improved PM framework with project portfolio and strategy model. The functional management supports the needs of business units. Functional supports are satisfactory to end-users.

I conducted an interview with this sample organization and the CIO helped me in collecting the information. The following data had been collected during the interview process.

5.1.2. Data

The data was collected using interviews. The questions used in the interviews were based on sub-problems. The following questions were answered by the management.

1. What are the types of decisions are made by the CIO?
   The CIO is responsible for making decisions in regards to operational budgets, staffing, operational priorities, and contracts. She has to balance the total budget between individual operational projects and strategic projects, based on the total allowable budget and business requirements. Two key considerations for budget decision making are an ‘approach to formal processes and methodologies’ and ‘industry standards’.

2. What are the challenges for the CIO leadership?
   The following are challenges for the CIO leadership:
   - The CIO needs to balance the business from every angle. This is a necessary tactic for this level of strategic leadership. Portfolio management can be one of the tools used to manage this challenge.
• Management of resources is an ongoing challenge for the CIO. Portfolio management is an effective tool to manage this challenge.
• Projects and operations agility is another challenge. As a part of managing this challenge the PMO is being modified.
• Challenges of time to speak at executive table (boss is the primary speaker). The approach of using a third-party to communicate to the executives may not be convincing

3. How does he/she analyze problems?
   Lessons learned from past experience will be the key information for a strategic approach to new problems. Process tools that are applied in decision making include ‘root cause analyses’ and ‘problem observation’. To avoid a problem being repeated the department must “be connected and be aware” of all issues.

4. What is the normal timeframe for making decisions?
   The timeframe for decision making depends on the situation. Urgent matters are decided upon immediately. Depending on the decision type strategic planning and recommendations decision could take weeks to months.

5. How the decisions are made and communicated?
   Some decisions as made by consensus-oriented decision-making processes. Some are made with majority opinion and some are individual decisions. These processes depend on each case of the decision needs. The process may seek advice and input from people, review the cases, and then communicate the details.
   The decision could be communicated in different ways. The communication could be verbal, one-on-one, presented to a small group, presented to a full group, or by email.

6. What are the challenges in this decision making process?
   Change resistance is one of the challenges to the decision making process. Another challenge is that the pace of execution often slows one the execution is started. After decision is made, flaws in the decision could reverse the action and create yet another problem.
   The remedy to these problems includes managing with transparency, evaluating and fixing smaller problems that occur while dealing with change, and to be honest and responsible to the organization. Portfolio management can be an effective process to facilitate these remedies.
7. **What are the impacts or effects of CIO decisions?**
   Based on the history of decisions made and implemented, if the analysis and research are correct, then positive results could be expected. However management expectation is that everything may not be smooth. Given this expectation, management invites feedback from employees both before and after implementation of decisions. They then respond accordingly to ensure the research and analysis are correct.

8. **What are the different management levels involved in decision making?**
   - Executives, Deputy Minister and Additional Deputy Minister are top managers
   - The CIO is the key person at the IT strategic decision level
   - PMO is the level below CIO (operational and project activity decisions – mostly in consultation with CIO due to the size of the organization)
   - ITS Steering committees: IMT Council, Governance - the next level in IMT council (they provide project recommendations and strategic directions).

9. **Who are the key people involved in decision making?**
   - Executives, ADM(s), Deputy Minister
   - CIO
   - Managers
   - ITS Committees, steering committees

10. **What are the types of issues and matters involved in each person's decision making?**
    Depending on each person’s level, the type of issues and matters involved will vary. The strategic investment decisions are made at the executive levels. The CIO is responsible for the overall budgetary control, budget planning, and negotiation. This process is a bottom-up process, in which managers bring their portion of the project and operations budget to the CIO.

11. **In general, how do they make their decisions? How do they communicate their decisions?**
    The decision making is an iterative process in many cases, except wherever some quick decisions are required. The tools used are described in the earlier questions. Portfolio management is used in decision process that standardizes the decision making. The

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This organization has management levels such as executives, CIO, Deputy Minister, Additional Deputy Minister, Directors, Senior. managers, managers, technical and operational employees.
decisions are communicated through CIO with recommendations and supporting evidence.

12. What are the problems found in these decisions?
The problems in decisions may vary depending on the situation and people involved. This could include issues such as timing and inaccessibility to senior officials.

13. Does the organization use portfolio management to standardize these decisions?
Yes, this organization has been using portfolio management to standardize the decision making process. They have been improving the portfolio matrixes and also trying to keep them simple and easy to use.

The Present Portfolio Management:
This IT department has been using portfolio management in its strategic projects and operational projects. This project portfolio is managed to make decisions on priority and planning. This management is made easy using matrixes that quantitatively estimate and prioritize requirements and projects. This process has been turning into a success with its application in decision making and planning in strategic directions and projects.

The portfolio has a matrix with measures for a three phase process.
- Rating (Value Vs Rank)
- Ranking (Totaling-up numbers – putting in priority sequence)
- Recommendations to executives

The qualitative values could be converted into quantitative values to identify priorities.

➢ At the executive level the priority could be consensus or could subjectively change.

See an example in

5.2. Portfolio Matrix

14. How could the organization best improve its decision making with portfolios?
- Experience and maturity; the portfolio will be continuously monitored for its effectiveness and adaptability. This monitoring process will implement required changes as part of the continuous improvement. Thus, through years of experience portfolio management will turn into a highly efficient tool in the decision making process.
- Careful communication; careful communication is a required activity in the decision process, irrespective of which tool may be used. The communication process will take care of the portfolio management process.

15. Does the organization have a combined approach for making decisions for resources, budget, and requirements?
Yes, this organization has a combined approach for decisions for resources, budget, and requirements.

16. Does the organization maintain control on operational requirements?
Yes, this organization maintains control on operational requirements.

17. Does the organization manage inventory of reports and programs within an application?
The organization experienced higher than expected costs on the Finance project. The old finance system had no documentation and hence the project needed extra cost for reverse engineering and developing documentations. Then, they migrated from the old finance system to a new finance application and implemented some project disciplines. The project disciplines were intended to reduce operational cost and future project cost.

18. Does the organization manage the application lifecycle? How do they normalize quick work around fixes done on applications and systems?
There is a change management process in place to manage system change management. Changes are managed with approval, analysis, and implemented based on configuration management. Bug fixes are done as per issue management routine. The application lifecycle could be managed with the configuration management.

19. Do they have problems from increasing operational cost? How do they control operational cost without affecting quality and people’s motivation?
There are some challenges in estimating, controlling, and managing operational cost.

20. Do they use portfolio management to solve any of these issues?
Many of these issues have not yet been solved using portfolio management. They have been improving the project portfolio and believe that the application portfolio will be helpful in these situations.
21. Do they think portfolio can be a solution to these issues?
They understand that the application portfolio will help them manage ‘aging applications, codes, and reports’.

5.2. Portfolio Matrix

This is a sample portfolio matrix based on the above organization’s portfolio matrix. The organization’s matrix was similar to this sample one. This is taken from (Wideman, 2007).

The portfolio management makes a key assumption that there is more work, more projects, requested than the organization can execute in the prevailing year because of its limited resources. So, during the selection process, some of the initially proposed work was scaled back or cut altogether. The Prioritization step is important to make the decisions that will ultimately help determine which work is authorized.

5.2.1. Ranking:

Ranking of portfolio components may be assigned according to some hierarchy such as:

- **Mandatory.** You need to rank this work. It will all be authorized, although you may have some discretion in how much funding you provide and when the work starts.
- **Business critical.** This category of work must also be performed; however, there is much more discretion in terms of scheduling, funding level and balancing.
- **High priority.** These projects are ranked in terms of value, urgency and alignment to your goals, objectives and strategy.
- **Medium priority.** As for high priority but at a lower level.
- **Low priority.** Everything else goes here. It is likely that anything in this category will not be funded.

Ranking is fraught with difficulties, not because it is fundamentally difficult, but because of the competing interests. There are a number of ways to resolve project-ranking issues, especially when there are multiple projects on a similar level to consider and it is difficult to keep all in mind at once. Probably the simplest approach to choosing from among many portfolio components is to establish an agreed hierarchy and mark every component accordingly.

The comparison of any two projects relies on the participants' personal knowledge, objectivity and sound judgment. The result is strictly qualitative, but with the right people involved, this is probably as good as any.

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5 (Wideman, 2007)
5.2.2. The approach is as follows:
1. This is a simple matrix.
2. There can be any number items in no particular order. In this specific example only five items are provided. They are numbered as 1, 2, 3, 4, and 5 with legend “Items #”.
3. Now each item needed to be given a score to find its rank. In this scoring process we will consider only one (1) parameter. All parameters are equally important. Assume that the parameter in the matrix below is “benefiting business”. Then we will find out this parameter’s priority among these five items.
4. The priority is calculated with a high value of 4. That means, whatever items are available, there will only be a maximum score of 4.
5. In this case, the item with highest priority will be given a score of 4 (here item #5 has four ////).
   The next priority item will have score 3 (Item 2 with three ///), the next priority item will have the score 2 (Item 3 with two //), the next item will have score 1 (item 1 with one /).
6. Note: The above steps (3 to 5) will be repeated for all parameters. In this case we are considering only one parameter (benefiting the business). Once all parameter scores are calculated, then we will calculate each item’s average score.
7. Based on the average score that an item has, the highest scored item it will become rank number 1, then next will be ranked 2, and so on. After rank 4, there could be multiple rank 5 (s), and these rank 5’s will be insignificant, as rank 1 is the main project for the decision process. If that is not considered, there are three other projects (or requirements) as alternates (Ranks 2-4).

<table>
<thead>
<tr>
<th>Parameter: Benefiting the Business</th>
</tr>
</thead>
<tbody>
<tr>
<td>Items #</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>Item Score</td>
</tr>
<tr>
<td>/</td>
</tr>
<tr>
<td>Item Rank (determined after all parameter scores are calculated)</td>
</tr>
<tr>
<td>4</td>
</tr>
</tbody>
</table>

5.2.3. Multiple Criteria Weighted Ranking
You must take into account multiple rating criteria for project ranking; you can develop a spreadsheet along the lines. Even then, you may need to invoke the Simple Comparative Matrix described above, to resolve competition between closely ranked projects within a given criterion.
This is further explained in the analysis section, 6.3.4. Portfolio Decision Matrixes
6. Analysis

6.1. The Decision Making Process

As we saw in Section 3.2, according to Michael Scott Morton’s BTOPP framework, business, technology, organization, process, and people are integrated. Hence decision making in an IT environment is crucial to the success of the business.

In Section 3.4, we discussed the Information Paradox in an IT environment. Problems can be seen in the productivity, business results, work place performance, project delivery, and operational support of the business. Decision errors always trigger these problems. When a decision for an operational support issue or project delivery is made, errors in the decision will lead to the information paradox, in which information may be new and expensive, but processed inefficiently and therefore underutilized.

6.1.1. The Sample Organization

In the case of the sample organization (refer to section 5.1), it is clear that the organization understands the importance of effective decisions and how the portfolio can help its decision making. “The CIO is responsible for making decisions in operational budget, staffing, operational priorities, and contracts. She has to balance between operational projects and strategic projects based on the total allowable budget and the business requirements. Two key factors for budget decisions are ‘approach to formal processes and methodologies’ and ‘industry standards’”. Here, we understand that the CIO’s decisions are critical to the success of the IT and the business of the organization. So, it is important that these decisions to be well organized and managed through a process. As we discussed in section 6.3, behavioral challenges and personality preferences are to be carefully managed. From the later parts of the interview questions (2, 3, 5, 6, 7, 8, and 13), we can infer that the organization has a high level of control on these issues.

6.1.2. Challenges related to information paradox

As described in Section 6.6, productivity performance of the economy, business results of companies and other organizations, reliability of IT project delivery, and reliability of IT operational support are the areas that present problems within the information paradox. When we closely monitor each of these (as described in section 6.6), we can understand that the errors happening could be related to the decisions made. “The productivity performance of the economy” (refer page 13) is mainly due to four (4) errors; measurement error, small installed base, poor quality software and information systems, learning lags. The case of measurement error is typical in many organizations and needs careful attention. Application portfolio can be a solution to this problem. Small installed base is another issue based on misunderstanding, and so on. In general, we can understand there are decision errors that lead to these factors of information paradox. The sample organization (refer section 5.1) is aware of these situations and has been moving to avoid these with an IT portfolio.
6.2. How can businesses improve the probability of success in decision making?

Based on the data in 5.1.2, the portfolio management is a tool to improve the probability of success in decision making. In a matrix IT environment, decisions are related to resources and the business of the organization, therefore the portfolio needs to be related with business strategy, business units, business operations, and budgeting.

6.2.1. Is Portfolio Management a Panacea?
The portfolio management is not a panacea for all problems that may happen in a decision making process. The factors that can improve probability of success include the portfolio, management structure, process framework, people, culture, technological and financial leverage, and leadership. However, a portfolio is a key tool in the decision process and important for the decision making process.

As we see the case of the sample organization:
For question number 21, “Do they think the portfolio can be a solution to these issues?” the answer is “They understand that the application portfolio will help them manage applications, codes, and reports”.
However when we look at question number 6 for the sample organization, “What are the challenges in this decision making process?” the answer is “Change resistance is one of the challenges to the decision making process. Another challenge is that the pace of execution often slows the execution is started. After a decision is made, flaw in decision (reverse the action) yet another problem “.

These clearly mean that the Portfolio Management is an effective tool, but it is not a panacea.

6.2.2. How can the portfolio be used in decision making?
As per the data received in section 5.1, and other references, decision making can be divided into three major groups:

1. Programs or project decisions
2. Operational decisions
3. Emergencies

1. Program or project decisions
The CIO and senior management will have an annual, half year, quarter, or month plan for technological advancement and/or improvement. These plans may be based on business requirements and/or for competitive advantage aligned to the business strategy. Prioritization and selection for these will be very important. The decisions should be effective and valuable and need to be communicated to executive management and
various other levels of the organization. These plans also may be decided based on consulting with business units such as finance, operations, marketing, and human resources. The PMO, program management, and project management also will have to make decisions on requirement priorities, project priorities, and resources.

The sample organization already planned to move to an improved portfolio based decision planning in its program and project decisions making. For question number 13, “Does the organization use the portfolio management to standardize these decisions?” the answer is, “Yes, this organization has been using a portfolio management to standardize the decision making process. They have been improving the portfolio matrixes and also trying to keep the matrixes simple and easy to use.”

2. Operational decisions

IT operations will need annual planning sessions. This has to be done based on an understanding of the level of service required for each business unit such as finance, operations, marketing, and human resources. These business units may have business operations requirements that may vary from unit to unit. Finance may need their application service availability for 95% on a full year basis. However, for human resource, the importance will be for scalability of operations; the system must allow up to a million simultaneous external users. Operations may be more worried about data security and reporting needs. A Service Level Agreement (SLA) will be a management tool to maintain a control on the expectations of the users and to maintain the quality of service provided by IT.

Reports are a requirement for most business units. Depending on the business unit’s operational requirements, there may be needs for reports that are for one time use or can generated periodically. Since the business units’ data is stored in the database, the request will come to the IT. As the IT is able to support with accurate and timely reports, number of requests for new reports will grow over time. As a solution, IT may be able to develop a data warehouse and data mart. But these may not be permanent solutions. There will more requirements for data intelligence and reporting solutions. These could create ever-growing inventory of report-programs

In addition to the above problem, there will be more problems related to the application maintenance and customer support. As there could be more and more work-around(s) done on existing code, there will be additional lines of code (can be identified separately) that goes into the application. Also, there could be additional program codes that are created as per request by business units. These also add extra lines of codes to the application.

This means that an ever growing inventory of applications could be a significant problem and added cost for every matrix IT environment. This needs to be managed to control
operational cost. This sort of a problem will be a hit on projects with added cost for identifying some unknown areas and managing them. A management and control on the inventory of applications, server and system software, hardware, and databases are required.

When we analyze the questions and answers (asked to the sample organization), the above situations are evident. There are many levels that need to make decisions for the entire planning of the operations and the management of inventory. An application portfolio will be an essential tool for this management process. This will help in this operational planning, maintaining applications, making decisions, and controlling cost.

3. Emergencies
Emergencies are breakdown situations such as an application which stopped functioning, a database that crashed, a network failure, and a hardware failure. The decision making in these situations cannot be done using an application portfolio or even a project portfolio. Instead, there has to be an evaluation of these situations and preventive steps has to be taken to avoid them happening in future.

The application portfolio may use incident and problem management model to manage these emergencies. An incident is an emergency, and that will be immediately managed when that occurs, possibly with an hour time. That incident should be further reviewed and turned into a problem. That problem management will become a priority in application portfolio based on budget, resource, and other business level priorities. Based on the established priority, the problem management will identify technical and business requirements and then turn them into a project. The project portfolio management will further prioritize and move that project forward.

6.3. Portfolios
In the above section we found that the portfolio management is a good tool to improve the probability of success in decision making. The project and program will need a project portfolio and operations will need an application portfolio. This paper will not provide a full framework of these portfolios or their complete interconnections. That level of understanding will need multiple years of research and analysis. In this section we will have a short description of these portfolios.

6.3.1. Project portfolio
The project portfolio managers new strategic IT initiatives, generally classified as initiatives designed to move the business forward. Managing these initiatives is typically known as Project Portfolio Management. The portfolio will classify initiatives into classes of priorities using pre-
defined matrixes or measures. The portfolio will have a detailed approach to manage with programs, large projects, and simultaneous projects. This level of the portfolio management will help level resource between all projects, requirements within programs and large projects, and full control on the budget.

The sample organization already understood this need and started implementing an effective project portfolio.

6.3.2. Application portfolio
An application portfolio concerns IT maintenance and sustaining operations, including hardware, software applications, and staff, also known as “keeping the lights on”; managing sustaining operations is often also referred to as Application Portfolio Management. This application portfolio will maintain an inventory of hardware, software applications, and staff as a resource inventory. That will help to identify and control the cost for sustaining operations. Any growth in the cost of maintenance can be identified and controlled.

The sample organization understands this as a need and will move to this portfolio management in future.

6.3.3. A Unified Approach to IT Governance
IT governance practices aim at ensuring that expectations for IT are met, its performance is measured, its resources are managed, and its risks are mitigated. A unified approach to IT governance can be accomplished using both project portfolio and application portfolio. This combined portfolio shall be known as IT Portfolio. It is unfortunate that in many companies using project and application portfolios together is not a common approach. Neither project nor operations management is supported with a portfolio. Without complete portfolio support and without both a project portfolio and an application portfolio, IT Governance will never be optimized. Optimized IT Governance can only guarantee full ROI to the organization.

The sample organization understands the importance of a unified approach to IT governance. It will have an unified IT Portfolio once the application portfolio management components are also developed.

6.3.4. Portfolio Decision Matrixes
In the unified IT portfolio approach, the decisions making is crucial to success and needs careful prioritization. Matrixes are very important in this process level and they could be used to help the prioritization.

As seen in the answer to question 13, the sample organization (refer section 5.1) has been using a matrix in its project decisions. The matrix they planned included measures for three phase process.

- Rating (Value Vs Rank)
- Ranking (Totaling-up numbers – putting in priority sequence)
- **Recommendations to executives**

  The qualitative values could be converted into quantitative values to identify priorities.

  ➢ At the executive level the priority could be agreeing or could be subjective change.

Further to this answer, a matrix is explained in this paper, in section 5.2. In a decision there could be any type of issue involved. The majority of decisions will be directly related to the business of the organizations. So when we work on these matrixes, the initial and important consideration should be on the business and/or strategic priorities that should be considered. The primary default ranking is as per this ranking. This is explained in section 5.2.1. Sections 5.2.2 and 5.2.3 explain the rating and ranking model. **The following sample case did not use the data collected from the sample organization.** This matrix used the basic concepts of the sample organization’s matrix. It also has used different types of scores. For ‘Criticality’ the score is calculated based on a scale of 1 to 9, where 9 is the highest priority. For ‘Project Success’ and ‘Benefits’, the scores are calculated based on probability (%). This example is provided to illustrate another possibility of ‘scoring and ranking’ with the sample organization’s ‘matrix model’.

<table>
<thead>
<tr>
<th>Proj #</th>
<th>Criticality</th>
<th>Project Success</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td># 1 to 9</td>
<td>Prob</td>
<td>Cost</td>
</tr>
<tr>
<td>A</td>
<td>7</td>
<td>2</td>
<td>80%</td>
</tr>
<tr>
<td>B</td>
<td>4</td>
<td>3</td>
<td>65%</td>
</tr>
<tr>
<td>C</td>
<td>2</td>
<td>4</td>
<td>70%</td>
</tr>
<tr>
<td>D</td>
<td>9</td>
<td>1</td>
<td>45%</td>
</tr>
<tr>
<td>E</td>
<td>1</td>
<td>5</td>
<td>90%</td>
</tr>
</tbody>
</table>

**Note:** Projects A and C score equally, and since they are low on the list may have to be resolved subjectively.

In the above example, the rank is an integer assigned based on a numerical value we assign to different parameters, such as Criticality, Project Success and Benefits. Based on the average of the rank of the parameters, we identify an average score for each project. The priority of each project is then determined based on this score.

The sample organization uses an approach of three phases as follows:

- **Rating (Value Vs Rank)**
  
  This is explained in the above matrix. Project A in the matrix above is an example. The rank for ‘Benefits’ is calculated by multiplying an understood probability (%) and the value of the project. The probability is 50% and value is 20M. Then PV is calculated in a scale of 1~5, the rank is assigned as 5, based on the scores of the other projects.

- **Ranking (Totaling-up numbers – putting in priority sequence)**

  In the matrix for every project, columns criticality, project success, and benefits have ranks. The average of these rates is used to calculate the priority.

- **Recommendations to executives**
The quantitative values could be converted into qualitative values to identify priorities.

- At the executive level the priority could be agreeing or could involve subjective change.

### 6.4. Portfolio Development Process

This paper does not intend to provide full details about the development of both project portfolio and application portfolio. So, this section will present ideas about the development process.

#### 6.4.1. Issues that could impact the development process:

The research interviews have looked into one sample organization’s decision making process, issues, and challenges. That organization was in a process of improving its portfolio and PMO. The following issues reflect some of the issues told by the sample organization and also some issues that we could see in general.

1. The development of a portfolio needs to be for both project portfolio and application portfolio. The project portfolio alone will not be sufficient to optimize IT governance. An application portfolio is also essential and needs to be considered seriously.
2. The matrix used needs to be completely connected to business requirements and the needs of the business units involved. Loosely connecting the benefits of fulfilling a business requirement to a numeric value may be confusing. There has to be more clear rationale to assigning numeric values.
3. A macro-environmental analysis using PESTEL (Political, Economical, Social, Technological, Environmental, Legal) model would have been an advantage in the implementation. (Oxford University, 2007)
4. The decision makers include steering committees, executives, and managers. The development process may include their inputs and buy-in.

#### 6.4.2. Portfolio Development

A portfolio can include structured groupings of projects, requirements, strategic plans, and operational plans by management to achieve defined business results, while meeting clear risk/reward standards. The portfolio management has been applied to financial investments for decades, helping decision makers choose among increasingly numerous and complex options in a volatile environment. The analogy to the financial markets is powerful. The IT and business environments are now fluctuating, much like the stock and bond markets and the current value of individual IT investments can change with those fluctuations. There are problems forecasting future values and benefits streams. The portfolio concept allows investors to select among complex options and adjust investment selections over time to meet defined risk/reward criteria. The time has come to apply this concept systematically to manage blended (BTOPP) investment programs. This means looking at the investments you make in IT, the portfolio based decision management will help meet the organization’s diverse and potentially conflicting demands. It also means taking a panoramic view of needs and opportunities and not looking at any isolated levels. (FUJITSU CONSULTING with John Thorp, 2007)
A high-performance portfolio must be built on the foundation of solid project and operation frameworks that produce reliable benefits streams over time. As each project incorporates a big picture of benefits realization, the portfolio be anchored in an even bigger picture. The portfolio’s composition reflects a balanced set of high-value opportunities that, together, promise the best overall return, in dollars and other benefits. Portfolios are not static; their composition needs to be adjusted to take into account changes in the environment and better knowledge of investment opportunities. Portfolio management means active involvement, not just picking the expected winners and letting the portfolio take its course. The term “portfolio” indicates the need to have a balance of opportunities to deliver the most value over time, and allowing for the vagaries of the future. With a stock and bond portfolio, financial planners look for a balance of investments to thrive in most environments; they never stop monitoring the performance of that portfolio. The same active involvement is required for a portfolio of blended business investment programs. (FUJITSU CONSULTING with John Thorp, 2007).

6.4.3. How to Select and Manage an IT Portfolio?
How do we develop and manage a portfolio in an organization? Unfortunately, given the complexities of business reality, there is no easy answer to this question. The challenge is too many choices chasing too few resources. Some organizations seem to be luxurious in spending for the design and development of a portfolio, but end up with limitations on the portfolio in project level only. Failures can happen in different areas including analysis, design, communication, implementation planning, and implementation. The following are some important key factors that could help in the selection and management of the portfolios:

1. Environmental Analysis:
Understand business functions, organization, culture, programs, projects, PMO, operations, customer service, and business requirements. The tools shall include macro-environmental analysis or PESTEL (Political, Economical, Social, Technological, Environmental, and Legal) and SWOT (Strength, Weakness, Opportunity, and Threat).

The sample organization used many of these analyses including SWOT.

2. Prepare Value Cases for Business Opportunities:
In this analysis the preparations will be more focusing on the business opportunities that can be focused in the portfolio. This sort of an analysis will lead to the following questions;

- Are we doing the right things? What is proposed, for what business outcome and how do the projects / process contribute?
- Are we doing them the right way? How will the work be done, and what is being done to ensure that it will fit with other current or future capabilities?
- Are we getting them done well? What is the plan for doing the work, and what resources and funds are needed?
- Are we getting the benefits? How will the benefits be delivered? What is the value of the program (financial worth, alignment and value risk)?
The sample organization did a similar analysis in their design process.

3. **Manage Risks and issues to Increase Value:**
   A Risk is an uncertain event that could impact your chosen path should it be realized. Risks are events that are not currently affecting you – they haven't happened yet. Once a risk is realized, it has the potential to become an issue. It is important to point out that not all risks become issues. In any system, it is important to manage risk to increase the value. Hence, the portfolio management process also will need a risk management to increase its value over time.

   Based on my interviews I did not find a risk and issue management process at the sample organization. It is important to implement this in their process, if this is not already implemented.

4. **Integrate, Manage and Leverage Process Interdependencies:**
   Integration, management, and leverage of process in projects and operations are very important. A project activity may have relation to one in operations. They all need to be networked in a relational model.

   The sample organization has some good initiatives in this type of practice.

5. **Design based on organization, culture, and people:**
   The portfolio is something that needed to be managed by all people in an organization; otherwise, the effectiveness of the portfolio is questionable. In many organizations the portfolio is controlled and managed by the PMO and many functional management sides are not aware of that philosophy. Either they are not trained to use it or they just ignore that process. The root causes of this issue could be the lack of people involvement from the inception of the portfolio, lack of communication, poor people buy-in to the change management. The design of the portfolio must be based on the organization, its culture, and with participation of the people.

   The new design and implementation at the sample organization is based on the organization, culture, and people. They have done a good level of analysis and the design have also taken a good level of care to make sure these aspects were taken into consideration.

6. **Audit, continuously improve - Adjust Portfolio Composition:**
   The implemented portfolio will need continuous improvement. The portfolio management process needs to be audited for its effectiveness. The audit details the reviewed and necessary changes need to be made over time. The continuous improvement should keep adjusting the portfolio composition towards higher perfection to meet the organization’s business goals. This process will allow the portfolio to mature with the
organization over time. Otherwise, the portfolio could be discarded or removed from the company’s management process.

The sample organization may need to implement an audit process for its PMO and portfolio management processes.

6.5. Best Practices for Portfolio Development

As per the analysis in the above section it could be further identified with a set of best practices that can be adapted for the design of the IT Portfolio. The following are the best practices for the portfolio development:

1. **Design IT Portfolio (application portfolio and project portfolio) as a unified approach to IT Governance**

   As we see in the case of sample organization, portfolio management is a very good tool for the decision making process. In the case of the sample organization, decision making is not just a process in project management; decisions are required in operations too. The sample organization understands that it will need a combined approach to the portfolio management, a portfolio for projects and operations.

   The majority of decision making will be based on prioritization of requirements and allocation of resources to meet business requirements. Priorities could be decided within a project, within a program, and within a PMO, for one operational area, for more than one operational area, and between operations and projects. So this point to a need that the project portfolio and the application portfolio have to be tightly integrated, works together, and must be managed together. The portfolio management plans of both project portfolio and application portfolio must be made together and coherent.

2. **Analyses:**

   The sample organization used different analyses to understand its capabilities, acceptance to change, and other background details. The analyses used interactive sessions that were facilitated by PMO – portfolio designers. These sessions, open-ended interviews, SWOT analysis, and other historical data analysis were helpful for them in their design process. The analyses had phases to understand cultural and historical background, effectiveness with change management, different strengths and weakness, various challenges, and business expectations.

   The Portfolio must be designed with full understanding of the organization’s capabilities, culture, people, history, and other background details. This is necessary for the planning of the design process, designing, and planning the implementation.
In an organization, people are the key elements that act in a process. There could be a way people will be acting and responding to ideas and situations. That can be understood through the organizational culture and history.

The portfolio will be a new tool that has be used to manage the decision making process, however the decision making process has been happening in some way for many years. The existing decision making process may has some advantages and disadvantages. A thorough analysis must understand full details of the existing process and its capabilities and problems. Also there could be some resistance in changing this process. A close and in-depth understanding of this change resistance is very important at this stage.

3. **Design of Application Portfolio**

Currently, the sample organization does not have an application portfolio. They understand and agree that the application portfolio is very important for their organization. While analyzing answers to questions 17 to 21, it is clear that application portfolio is a necessity for this organization. It understands that application portfolio will be a necessary tool for its IT asset and operational resource management. It has plans to design and implement an application portfolio in future.

An application portfolio is one that can include the portfolio management of operational priorities, operational requirements, IT assets (applications, etc), and operational resources. This needs to be tightly integrated to project portfolio so that the resource and requirements between projects and operations also can be managed.

The design process should consider existing decision process, environmental factors, organizational culture and history, and change resistance. All people that are related to this area needs to be involved in the design process, their inputs shall be collected, and design should consider such customizations on decision processes and matrixes, and a commonly agreeable portfolio should be designed.

4. **Design of Project Portfolio**

The sample organization has an existing project portfolio and they performed a good re-design to improve that project portfolio. The organization understands that importance of project portfolio. The design took care of the existing decision process, environmental factors, people, cultural factors, and change resistance. This was a practical step for the design process. The design included various factors of the existing requirement, too.
A project portfolio is one that can include portfolio management of project priorities, business requirements, program requirements, and project resources. This needs to be tightly integrated to application portfolio so that the resource and requirements between projects and operations also can be managed.

The design process should consider existing the decision process, environmental factors, organizational culture and history, and change resistance. All people that are related to this area need to be involved in the design process, their inputs shall be collected, and design should consider such customizations on decision processes and matrixes, and a commonly agreed upon portfolio should be designed.

5. **Communication and stakeholder management:**

The sample organization’s project portfolio implementation was done with an excellent communication process. This considered all required stakeholders, provided various types of presentations, and periodic / regular communication.

The design and implementation of the portfolio must be carefully done with sufficient communication. The communication process can start with a well defined list of stakeholders and communication plan. The communication plan may include proposal presentations, information sessions, interactive meetings, status updates, interactive developments plans, and communication matrixes.

Present proposals to all levels of the organization, consult stakeholders and receive their feedback, involve people in the analysis and design process, and continue communication with improvements.

6. **Organizational Change Management:**

The sample organization considers the change management and understands the need appropriate change management strategies. It considers change management as an important factor and understands change resistance may be a problem in this process.

The design and implementation of the portfolio involves organizational change management. However, in many situations, designers of the portfolios may not understand this and hence, change management may not be a focus in this process. The successful implementation can be achieved with better change management. The change management can start with an understanding of the change resistance. Based on the change resistance and environment, the communication, interactions, and speed of change can be planned.
7. **Importance of decision matrixes in portfolios:**

The sample organization used very good and simplified matrixes in the design of the portfolio. It considers simplicity in the matrix as very important, as a complex matrix will be avoided by users. My suggestion is a different one - I consider usability of matrix, not the simplicity of the matrix. A matrix similar to that of the sample organization’s type is illustrated in section 5.2.

The major application of portfolio management can be in the decision making process. There must be some kind of measurable ways to take decisions as a rational for the portfolio management. Matrixes with qualitative and/or quantitative measures are good tools to standardize the decision process. However, to keep the use simple, easy to use simple matrixes are used and can be seen as ineffective in many cases. Ineffective matrixes can lead to disagreements in the decisions. In the case of matrixes, let an expert develop and derive the outcomes. The team can use both simple and complex matrixes depending on situations. People will learn complex matrixes over time; however, the complex matrix could be more efficient.

8. **Manage Risks and Issues.**

As per my interviews and findings, the sample organization did not use risk and issue management process in their portfolio design. I strongly suggest that this is a requirement and should not to be seen as an option.

Risks have to be identified, analyzed, and managed. A risk identified shall be analyzed with its probability of occurrence and impact. Management shall be avoidance, mitigation, or acceptance. Maximum advantage has to be taken from positive risks. Issues are current events and needed immediate attention once they are identified.

Examples of possible risks and issues will include items such as “lack of cooperation”, “insufficient data”, “senior management may not fully understand the matrix and prioritization process”, and “some probable conflicts”.

Early identification of issues and risks are important in the IT portfolio management. Refer 6.4.3, item 3.

9. **Manage by following the framework and with continuous improvement:**

The sample organization did not plan a continuous process for their portfolio management process (this could be applied to its PMO). The design and implementation were not completed. So a further plan for the continuous
improvement and management of the framework could be a future plan only. This could be achieved using a carefully designed process audit.

The portfolio management should ensure the designed portfolio framework is properly followed. There could be some issues that may exist in the framework. A project manager or an operations manager trying to fix these issues in their areas alone will not help the health of the decision making process. Allow the risk and issue management to fix the issues.

The portfolio management shall focus on continuous improvement. Periodic process audit should monitor the effectiveness of the portfolio management, and understand the issues in the decision making process. Based the audit findings and issue management recommendations, regular design changes have to be made.

This is intended to continuously improve and achieve excellent quality in the process. Process quality of 6th sigma shall be the strategy in this continuous process.

The Capability Maturity Model (CMM) is a service mark registered with the U.S. Patent and Trademark Office by Carnegie Mellon University (CMU) and refers to a development model that was created after study of data collected from organizations that contracted with the U.S. Department of Defense, who funded the research. This became the foundation from which CMU created the Software Engineering Institute (SEI). Like any model, it is an abstraction of an existing system. ([http://en.wikipedia.org/wiki/Capability_Maturity_Model](http://en.wikipedia.org/wiki/Capability_Maturity_Model)). It has five levels. They are:

Level 1 - Initial (Chaotic): At this level the processes are undocumented and in a state of dynamic change, tending to be driven in an ad hoc, uncontrolled and reactive manner by users or events.

Level 2 – Repeatable: At this level that some processes are repeatable, possibly with consistent results; process discipline is unlikely to be rigorous, but where it exists it may help to ensure that existing processes are maintained during times of stress.

Level 3 – Defined: At this level that there are sets of defined and documented standard processes established and subject to some degree of improvement over time.

Level 4 – Managed: At this level using process metrics, management can effectively control the AS-IS process (e.g., for software development).
Level 5 – Optimizing: At this level the focus is on continually improving process performance through both incremental and innovative technological changes / improvements.

The continuous improvement process should be aiming to achieve the level 5 of the CMMI.

10. Document:
Online and hardcopy, up-to-date documentation on portfolio framework should be maintained.

The sample organization has already developed a good number of documents and advised me that it will further improve the documentations.

6.6. Limitations
This research data had some limitations. This research needed repeated visits to the same organization for collecting and reviewing data. Due to the limited timeframe of five months, only one organization is selected for this study. This limitation of one organization may have some effect on the analysis and recommendations.
7. Recommendations

A portfolio is an essential management component in IT governance, as the IT Governance is according to which decisions that are made by its leaders; the portfolio is a successful management tool to guide this decision management process. Both projects and operations need the portfolio management. Projects need to be managed using project portfolio and operations need to be managed using application portfolio. IT organizations that depend only on project portfolio management may be in error with its decision process, as it could be seeing only project and not seeing the operational requirements. So, it is highly recommended that both project management and operations management should use portfolios in the decision management.

The design and management of the portfolio has been an ongoing issue for many IT departments as the design, implementation, and management could be ineffective. Without enough people buy-in, interest, and completeness, the portfolio management cannot be successful. Section “6.5 Best Practices for Portfolio Development” can be considered as recommendations for this research paper.
8. Conclusion

Information Technology (IT) is an important strategic component and needs to be aligned to the organization’s business strategy. There are different arguments about the alignment of business and IT strategies; however, both business and IT should not go in parallel as that would seriously affect the business success.

IT investments are intangible investments and in many organizations the decisions for IT investments and IT operations have many errors. The errors create low ROI and that indirectly impact organization’s business benefits. In most cases of decision making, very low considerations are given to proper prioritizations and evaluations, and decisions are done with few assumptions and/or specific interests. These are major errors and factors that waste a significant portion of the IT budget. If this could be eliminated, the value that an IT brings to an organization will be very high.

Many IT departments use project portfolio management and are not finding it very effective. There should be a combined approach for the IT governance, the IT Portfolio – both project portfolio and application portfolio.

This research has gone into some detail and identified the need of such a combined portfolio. The research did not try to define a portfolio framework; rather it identified some best practices that can be followed in the design of an IT portfolio. The IT portfolio is specific to each organization depending on the organization’s needs. These best practices also will need continuous review and modification depending on different new situations and changes.
9. References in APA format


