INSTITUTO SUPERIOR TÉCNICO
Universidade Técnica de Lisboa

GESTÃO DO PORTFOLIO DE INVESTIMENTOS EM SISTEMAS DE INFORMAÇÃO

Miguel da Nave Pina Mendes

Dissertação para Obtenção de Grau de Mestre em

Licenciatura em Engenharia Informática e de Computadores

Júri

Presidente:	Professor Pedro Sousa
Orientador:	Professor Miguel Mira da Silva
Vogais:	Professor José Delgado

Novembro 2007

Acknowledgments

Faço questão de expressar a minha gratidão a todas as pessoas que, de uma forma ou de outra, me ajudaram ao longo do último ano neste projecto.

Em primeiro lugar gostaria de agradecer ao Professor Miguel Mira da Silva, não só pela oportunidade que me foi dada mas também pelo interesse sempre demonstrado, pela sua orientação e visão pragmática e optimista dos problemas.

Ao Rui Rodrigues, pelo acompanhamento ao longo de todo o projecto e pelas trocas de ideias que por certo contribuiram para o aumento de qualidade deste trabalho.

À minha família, especialmente os meus pais e irmã, pelo seu apoio e paciência ao longo deste último ano.

A todos os meus amigos, e porque não só de trabalho vive um indivíduo, obrigado pelos bons momentos de descontracção. Um agradecimento especial ao colega e amigo Fernando Graça, pela ajuda prestada na fase final deste trabalho.

Abstract

Today's market constraints force organizations to manage their portfolio of IT investments in the best possible way, in order to optimize the delivery of technology solutions. Meanwhile, the adoption of full outsourcing strategies has become a common practice, which obviates the necessity of ensuring new management and control measures. This work describes how an IT Portfolio Management framework relates to these situations, presenting the specific case study of an organization.

Throughout the paper an analysis of the state-of-the art of ITPM will be made, the problem that this thesis tries to solve will be described, and the different design and implementation stages of the framework detailed. The work ends with the evaluation and impact assessment of the project.

As actuais condições de mercado obrigam cada vez mais as organizações a gerir o seu portfolio de investimentos em Sistemas de Informação da melhor forma possível, de modo a optimizar os seus serviços e produtos tecnológicos. Entretanto, a adopção de estratégias de outsourcing total tem vindo a massificar-se, o que releva a necessidade de serem garantidas novas medidas de gestão e controlo aplicadas à gestão dos Sistemas de Informação. Este trabalho descreve de que modo uma framework de Gestão de Portfolio de Sistemas de Informação está relacionada com estas problemáticas, apresentando um caso de estudo específico numa organização.

Ao longo do documento é feita uma análise do estado da arte da gestão de portfolio de TI, é descrito o problema que a tese visa resolver e são detalhadas as fases de desenho e implementação da framework proposta. O trabalho termina com a avaliação de resultados e análise de impacto do projecto.

Keywords

IT Governance, IT Portfolio Management, Outsourcing, Framework, Process Modeling.

Table of Contents

List of Figures

List of Tables

List of Acronyms

BPMN	Business Process Modeling Notation
CIO	Chief Information Officer
CobiT	Control Objectives for Information Technology
ERP	Enterprise Resource Planning
IT	Information Technology
ITIL	Information Technology Infrastructure Library
ITPM	Information Technology Portfolio Management
ITSM	Information Technology Service Management
MOF	Microsoft Operations Framework
NPV	Net Present Value
RFI	Request for Information
ROI	Return on Investment
SLA	Service Level Agreement
TCO	Total Cost of Ownership

1 Introduction

This work documents the work developed regarding the masters in Information Systems. A thorough description of the different implementation stages will be described, from the analysis of the state of the art to the results, evaluation and conclusion.

In this section, a brief overview of the first sections will be given, starting with the context, followed by the problem needed to be solved and the proposed solution.

1.1 ITPM Context

There is more to IT than just applications and infrastructure. Information Technology has become the backbone of modern organizations, which can no longer succeed without it. However, IT has historically been a bottleneck, a source of expenses and a supplier of misaligned, off-budget projects. In fact, an estimated 68% of IT projects are neither on time, nor on budget, not even delivering the original agreed business goals [1]. Nevertheless, the fundamental IT's fundamental support has led to an increasing importance among enterprises, resulting in a continuous evolution of the IT function. Maximum value must be delivered, while cost must be tightly controlled [2].

Therefore, buzzwords like IT Service Management or IT Governance have become increasingly familiar, as they encourage the adoption of a wide range of best practices to manage IT. ITSM is an approach that combines a series of processes and best practices in order to enable organizations to deliver technology services of proven quality. Likewise, IT Governance is a set of processes and organizational structures that aim at narrowing the bridge between the organization's strategy objectives and the IT function. One of these processes is IT Portfolio Management, a recent but important matter of concern, and a unanimously appointed way of improving an organization's portfolio of projects. ITPM is a discipline that aims at ensuring business and IT alignment, establishing methods to prioritize between projects according to the available resources.

When combined, the two set of best practices (ITSM and IT Governance) will surely transform the delivery of technology services for the better.

Outsourcing, a way of improving an organization's efficiency and concentrate on its core competences, is also an adopted practice among several companies. However, as well as creating value, incurring in an outsourcing strategy also entails risks. The organization must not become completely dependent on its business or IT partner, must not lose track of its IT projects lifecycle, and must ensure that control measures are put in place to allow for the management of a sometimes blurry and difficult relationship. Altogether, the combination of ITPM and outsourcing can be extremely beneficial.

Sections 2 and 3 will present a state of the art of ITPM. Starting from a broader area, a description of IT Service Management and IT Governance will be presented, stressing the differences and synergies between the two. IT Outsourcing will then be addressed, with particular emphasis on the relation with the previous subjects. Finally, a comprehensive overview of ITPM is presented, including a description, historical analysis, problems faced, possible benefits and some of the best practices carried out by organizations.

1.2 Problem

"You can't manage what you can't measure".

Managers must access concrete information to act upon. That's why, nowadays, practically all modern organizations rely upon business intelligence tools in order to make decisions.

However, strangely enough, this situation doesn't often apply when it comes to deciding which projects to execute, specially the ones related to information systems. When the IT function lacks the capacity to develop all project requests, which will likely happen, there must be a way to choose among them. In fact, about 76% of companies have too many projects for the resources available, which means that projects are under-resourced [3]. Unfortunately, it seems that few organizations have a well establish method for evaluating projects, with projects chosen in a nearly-random way being the most common situation.

What's worse, if a company outsources its IT function it becomes more difficult to both control the available resources and to know when to kill projects if they're becoming bottlenecks to the IT portfolio.

The problem presented in section 4 of this work is related to this situation. Although generic, it also applies to the case study presented in section 6, for which a specific solution was developed and presented.

1.3 Solution

An effective way of managing a full outsourcing relationship and help delivering valuable IT services is to establish an ITPM process.

By embracing such a solution, an organization ensures that the responsibility and decision-making capabilities are on its side. Therefore, it can choose among different project requests, using different metrics and key decision factors.

A solution of this kind will also almost certainly strengthen the bonds with the IT supplier, enabling a better control of what is being done. Also, ITPM will likely contribute to the choice of a near-optimal project portfolio, meeting the most important business demands and ensuring the execution capacity for both client and supplier.

There are some concerns, however, that must be kept in mind before adopting such a solution. There are also key success factors essential to ITPM's success that must be taken in consideration.

All these variables will be addressed in detail in section 5 of this work.

1.4 Thesis Structure

This work is organized in the following way:

Section 2 presents brief descriptions of IT Governance, IT Service Management (and the synergies between the two) and IT Outsourcing.

Section 3 introduces the *state-of-the-art* of IT portfolio management, with particular emphasis on the best practices already identified, the major benefits and the major pitfalls, as well as a brief overview of the existent market tools.

Section 4 describes the generic problem that this work addresses,

In **Section 5** a solution for the stated problem is proposed. It is a generic framework, adaptable to different realities, that contains the key steps that must be taken in order to ensure its correct implementation.

Section 6 describes the particular case study of this work. It entails a description of the organization's information systems department and its particular aspects, as well as the solution proposed to solve the encountered problem.

An evaluation is then presented in **Section 7**, containing the achieved results and their respective explanation.

Section 8 consists in the conclusion of this work, giving an overview on the work presented and explaining the future related work that could be done.

2 Managing IT

IT Portfolio Management is a relatively new subject of research and concern from management staff. Therefore, it is yet to reach maturity and there is still much work to be done for organizations to achieve consistent positive results with its implementation. However, effective ITPM is essential for organizations that strive to excel in the way their portfolio of IT investments is managed [4].

Although some best practices have been identified and some large scale organizations have already achieved satisfactory results in implementing an IT Portfolio process [5], it is difficult to find generic frameworks that can be adapted to real situations.

Meanwhile, today's market constraints force organizations to deliver more and more efficient IT solutions. The traditional bottleneck that information systems departments represent is no longer affordable, as enterprises cannot sustain the lack of good results while incurring in great expenditures.

ITPM is a discipline related especially to IT Governance but also to IT Service Management. IT must be run like a business, thus tools from other areas must be applied. ITPM derives from financial portfolio management [6], which exists for a while now and has proven results.

In this section, an overview of a larger area of study will first be presented, with descriptions of IT Service Management and IT Governance.

2.1 IT Evolutionary Stages

IT organizations are submitted to three different stages (see Figure 2-1) while evolving [7]. The first stage is *IT infrastructure management,* in which IT acts simply as a technology provider, focusing on managing the enterprise's infrastructure and arranging for technology solutions [8]. Unfortunately, this is the stage where most organizations stand at the present.

In the next stage, *IT Service Management*, the IT function acts as a service provider by actively identifying and delivering services needed to its customers, while managing Service Level Agreements (SLA's) to ensure quality targets are being met. Service desks are usually implemented and play a crucial role in bridging the gap between business and IT, serving as a single point of contact to all the organization's business users.

The final stage of the IT function's evolution is *IT Governance,* where IT organizations become strategic partners, closing the gap between IT and business goals and ensuring strategic alignment and business agility.

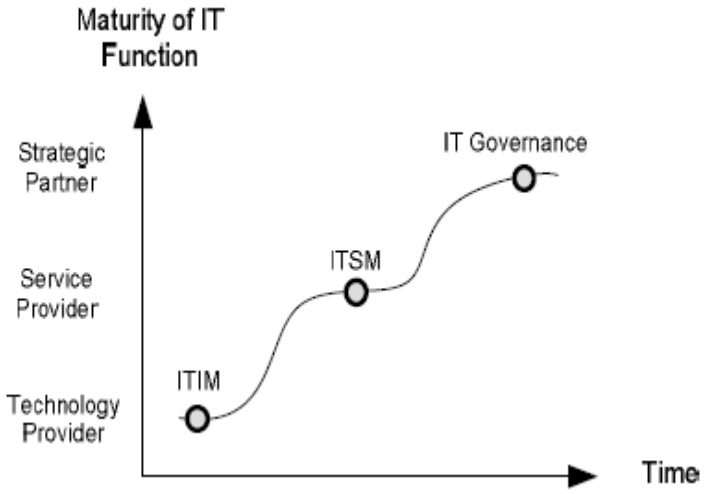


Figure 2-1: IT's different evolutionary stages (Source: [8])

It is indisputable that business success depends largely on how well the IT infrastructure is managed. However, technology operations do not exist for IT reasons alone, but to deliver, develop and maintain services which support business operations. This means that organizations on the two later stages of their IT function will surely reap the rewards by managing their information systems on a service-oriented way and establish an IT Governance framework capable of ensuring alignment between corporate and IT objectives.

In order to understand what IT Service Management and IT Governance truly represent, a brief description of each will be presented in the following sections.

2.1.1 **IT Service Management**

Among several definitions for IT Service Management the following was adopted in this work, since it covers its key aspects in a simple way:

Definition: IT Service Management is a set of processes that cooperate to ensure the quality of IT services, according to the levels of service agreed by the customer. It manages large-scale IT domains such as systems management, network management, systems development, based on many process domains like change management, asset management and problem management [9].

Simply put, IT Service Management involves a shift from managing IT as stacks of individual components (hardware, software, people, data, and accommodation) to focusing on the delivery of end-to-end services using best practices. This discipline is not concerned with a particular vendor's product or the technical details of the systems to be managed. Instead, it focuses on providing a framework to structure IT-related activities and the interactions of IT technical personnel with business customers and users.

IT Service Management has two fundamental objectives [9][10]. First of all, it ensures that IT services are cost-effective, value-adding and of high quality. Additionally, it aims at reducing the long-term cost of service provision.

A number of IT Service Management best practices have been developed. These include HP ITSM Reference model, IBM IT Process Model [11] and Microsoft MOF [12]. However, all of them evolved from ITIL, the standard infrastructure library that is independent of any supplier [10].

ITIL (Information Technology Infrastructure Library) was established back in 1989, being managed by the UK's Office of Government Commerce and supported by the IT Service Management Forum (itSMF). ITIL consists of a set of best practices for lowering the costs and improving the quality of IT services delivered [13]. It offers comprehensive and generic processes, tasks and responsibilities that can be adapted to any organization, bearing in mind each one's idiosyncrasies.

As presented in Figure 2-2, ITIL is built on five major areas: Service Support, Service Delivery, Infrastructure Management, Application Management and Business Perspective. The two most popular areas, service support and service delivery, are organized as follows:

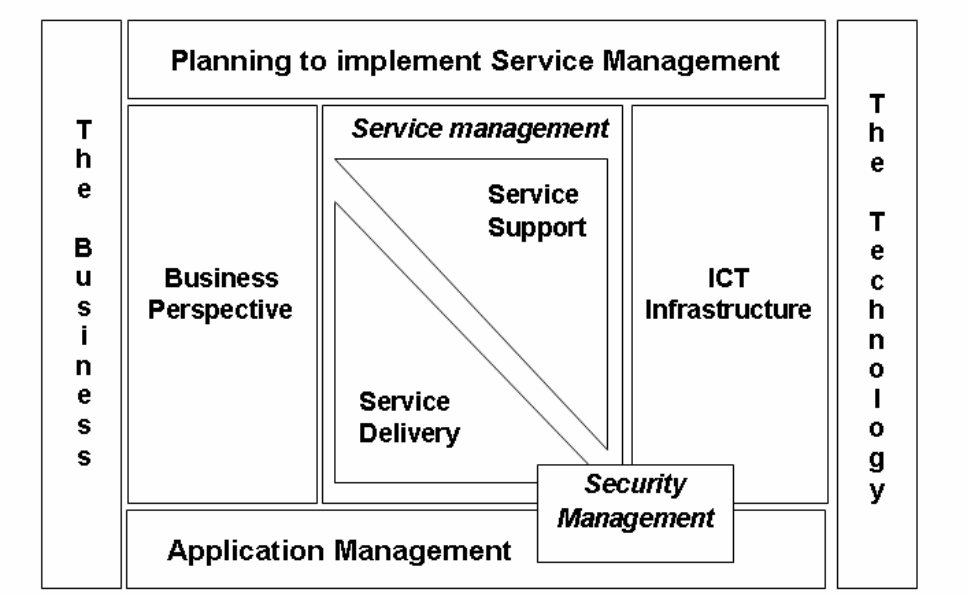


Figure 2-2: The high-level structure of ITIL (Source:**[9]**)

Service support contains the operational processes, namely Release Management, Configuration Management, Incident Management, Problem Management and Change Management. These processes aim at managing the IT function on a day-to-day basis by solving incidents, facilitating the introduction of changes and controlling the versioning of items.

On the other hand, Service Delivery contains the tactical processes: Service Level Management, Capacity Management, Availability Management, IT Continuity Management and Financial Management.

Their main objective is to ensure that IT services are provided as agreed between the service provider and the customer, according to the specified SLAs.

All these processes are closely related and aim at covering the major activities of IT service organizations [14].

Obviously, it is essential to bear in mind that the implementation of an infrastructure management framework alone is not enough, as poorly defined processes, roles and metrics can greatly undermine IT and even business effectiveness. ITIL covers these fundamental aspects, as it promotes the continuous control of established targets for the services it offers.

However, there is room for improvement. Organizations might think of ITIL as a necessary and sufficient framework for the success of their IT departments which is not true, as important processes have been left out of ITIL, their benefits passing unnoticed. One of these processes is IT Portfolio Management.

Despite being considered part of IT Governance, ITPM has close ties with some of the ITIL processes. For instance, it could gather information from Configuration and Capacity Management in order to better estimate the available resources and could provide cost targets for IT Financial Management to work on. Therefore, ITPM should probably be part of ITIL in order to optimize the synergies with other processes and promote a better integration with service delivery and service support as a whole.

2.1.2 **IT Governance**

For IT Governance, the adopted definition comes from the IT Governance Institute [15]:

Definition: IT Governance is the responsibility of the Board of Directors and executive management. It is an integral part of the enterprise governance and consists of the leadership and organizational structures and processes that ensure that the organization's IT sustains and extends the organization's strategy and objectives.

Basically, IT Governance is about having the right people making the right decisions through a defined framework in order to maximize IT value. The greatest tangible benefit for organizations that have consistent IT Governance procedures is the above average returns they get from their investments [7].

Effective IT Governance depends on a few main decisive aspects. For instance, general IT principles should be traced and an IT architecture should be defined to establish clear general rules and avoid ambiguity and redundancy in satisfying business needs [8]. Another key aspect is the unambiguous selection and prioritization of which IT investments to make. This is provided by ITPM, which will be thoroughly analyzed in later sections of the present document.

The best-known IT Governance framework is CobiT [15]. Developed by the IT Governance Institute, CobiT is an open standard independent of technological platforms that offers control over information

technology. As depicted in Figure 2-3, it consists of an executive summary that highlights the main benefits and a business oriented framework that covers IT activities and derives general guidelines and control objectives.

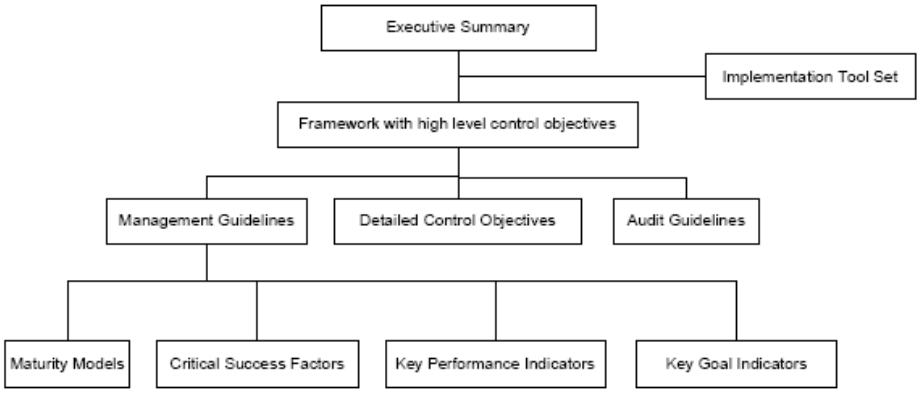


Figure 2-3: The CobiT framework (Source: **[8]**)

CobiT compiles a set of adopted control objectives for business and IT managers to use, addressing IT Governance and the key performance indicators associated with process improvement [16].

CobiT and ITIL can complement each other, in the way that CobiT can supplement the IT operational process strengths of ITIL with its critical success factors and key performance indicators.

However, CobiT is probably an overambitious framework. In fact, a study conducted [17] shows that only 10% of the IT community uses at least a part of CobiT. It has 34 high-level control areas and 318 detailed control objectives, which makes it almost impossible for organizations to realistically aspire to implement the framework, especially small ones.

Although some smaller subsets of CobiT already exist, these were mainly created to achieve compliance requirements (example: Sarbanes-Oxley). Therefore, subsets dedicated to implementing CobiT in small or medium sized organizations with moderate effort should be created. This would enable more successful implementations of the framework, since that the complete framework is too costly and time-consuming to implement.

2.1.3 **IT Service Management vs IT Governance**

To conclude this section, the difference between IT Service Management and IT Governance will be detailed, as this is usually a matter subject to confusion. An illustrative model is presented in Figure 2-4.

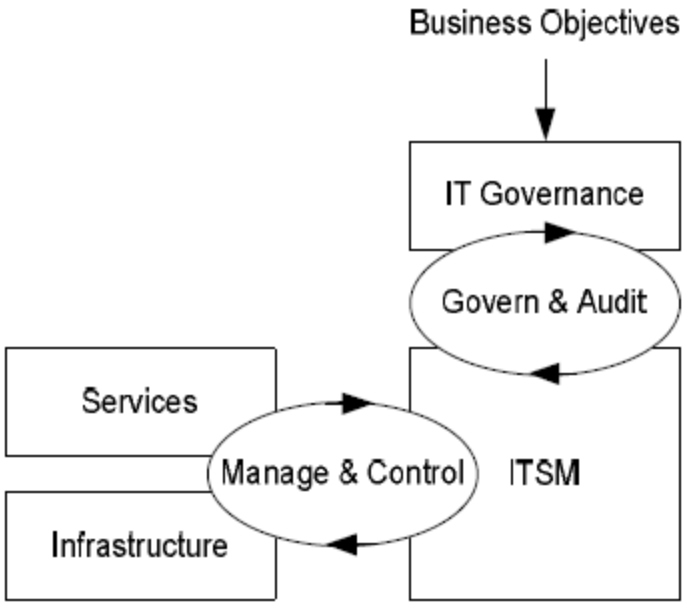


Figure 2-4: Conceptual model of the relative positioning of IT Governance and ITSM (Source: **[8]**).

The conceptual model presented in Figure 2-4 shows the relative positioning of each discipline. IT Governance, as stated before, must ensure alignment with the overall business strategy. Through business objectives, IT Governance must derive goals, objectives and performance metrics for IT. On the other hand, IT Service Management aims at managing the IT infrastructure's resources effectively and providing IT services according to the objectives received from governance.

The two are not mutually exclusive and could (should) be combined in order to provide a powerful IT governance and control in IT service management [18]. Using a known expression, the overall objective is to “run IT like a business”, comparing obtained with expected results, controlling performance indicators and promoting regular audits to the IT process overall.

2.2 IT Outsourcing

With the increasing competition and market volatility caused by the rapid evolution of information technologies, enterprises must adapt themselves to a changing and aggressive environment [19]. An enterprise can no longer afford having an IT department as a liability when IT isn't a core competence, otherwise major spending will take place whilst not delivering results [19].

However, in order to succeed, it is important to maintain updated technologies, improve business efficiency and effectiveness, promote integration between partners and clients, and reduce the time to market of products. IT Outsourcing, which started as a strategy for cost reduction is now seen as a powerful tool for improved business performance [20][21]

Through outsourcing, organizations can focus on their core capabilities and actually save money while acquiring IT solutions and services from specialized companies [22]. IT is an expensive part of the organization to establish and maintain, adding to the fact that the expertise of in-house IT departments often lags behind today's technology [22]. Moreover, companies frequently confront a wide disparity between the capabilities and skills necessary to realize the potential of these technologies and the reality of their own technology capabilities and skills. The good news is, a vendor will have more experienced and specialized employees in a sufficient number to operate at a scale a single enterprise cannot [23].

IT Outsourcing reduces the company's risk exposure to changing market and competitive constraints. These constraints might be of different nature, like changing buyer preferences or changing technology. Outsourcing puts the burden on outside suppliers that will have to keep up with the latest trends; otherwise, the outsourcer company might change suppliers with minimal effort and impact to the business.

2.2.1 **IT Outsourcing and IT Governance**

Outsourcing does not only create value, it also entails risks [22]. If a task depends on the completion of other, its associated risk will be higher. Therefore, if a business function depends on an outsourced service, there is the need for coordination and mutual adjustment.

In order to manage the outsourcing partnership and to mitigate the inherent risks, a governance model has to be developed by client organizations. This model must ensure the supplier's delivery of the expected business value and ensure the organization is investing in the right projects and capital is not being wasted [24]. This is particularly true in full outsourcing models, where a designated IT supplier dominates the IT infrastructure and accounts for the majority of services, projects and application changes.

IT Governance, through its best practice ITPM, plays a crucial role in this subject by addressing the balance of power in the outsourcing relationship [22][23].

Firstly, it provides clients with knowledge about the complexity of its investments and their likely impact on the overall portfolio.

Secondly, it can provide tools to estimate the amount of effort required, in terms of resources assigned to each initiative, as well as updating the resultant productive capacity.

Lastly, it enables the gathering of information about the overhead and value of its investments.

ITPM also enables the client's IT managers to apply monitoring and control procedures on the supplier, transforming the relationship in a transparent one.

3 IT Portfolio Management

Organizations must meet the challenge of distinguishing between good and bad IT investments in a myriad of investment requests, resultant of all the hype around information technology [25].

In addition, the increasing importance of IT to the business has resulted in greater spending in this department than in any other [4]. This stresses the need to be very cautious with IT investments, assuming they will bring indisputable value and are aligned with the overall business strategy and corporate objectives.

Simply put, IT can either be a strategic partner that adds value, drives organizational growth and transforms the business or a source of waste and incompetence. The decision of how to manage IT is obviously up to companies. This is easier said than done, since a good understanding of the IT infrastructure is required to establish effective metrics to aid the management task.

Some organizational changes have already been developed. For instance, measurement for return on IT investments has changed from yearly to quarterly, which has reduced significantly the margin for error of large projects. However, most business executives have little regard for IT and minimal visibility into their IT investments, which generally range from 1,5% to almost 7% of revenues [1], making it clear that an approach is needed to ensure that these investments meet or exceed expectations.

And this is where IT Portfolio Management comes into play. In spite of not being a new concept, with studies going all the way back to the early 80's [26], it was not until recently that ITPM became a subject of much interest among organizations and the scientific community. This can be explained by a number of factors like tighter budgets or the large failure rate of projects – according to the Standish Group, 68% of projects aren't on time or on budget [5].

3.1.1 Definition

A portfolio of IT investments consists mostly of projects. The nature of a project itself is variable, in the way that not only software projects are considered. Infrastructure and (consulting) service projects are also eligible to be part of the investment portfolio of an organization. Figure 3-1 shows an enterprise's IT Portfolio broken down in three distinct sub-portfolios, each one for a different type of project. It also shows that IT and business strategy must be aligned, dictating the needs that will result in future projects, supported by software, hardware, and human resources.

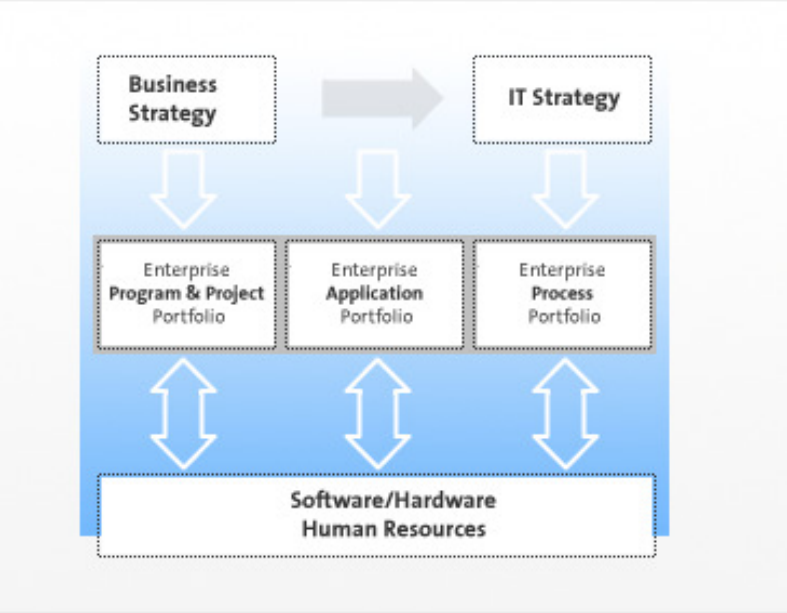


Figure 3-1: Holistic view of an enterprise's IT Portfolio Management (Source:**[27]**)

With the portfolio scope defined, it is worth establishing a few definitions. For the management of the IT portfolio to succeed, two fundamental requirements must be met: doing the right projects and doing projects right [28].

One the one hand, doing projects right is a concern addressed by the discipline of Project Management. The proposed definition from the Project Management Institute is the following:

Definition: Project Management is a methodical approach to planning and guiding project processes from start to finish.

Project processes are guided through different stages (initiation, planning, executing, controlling and closing), being a methodology widely used in the control of complex developments.

One the other hand, doing the right projects is ensured by IT Portfolio Management, whose definition comes from the IT Governance Institute:

Definition: IT Portfolio Management is a discipline that ensures alignment between IT and business objectives. It is about human and capital resource allocation and prioritization between various projects.

Furthermore, ITPM tries to ensure that all project requests are scored against a defined criterion, providing the management staff with business intelligence to make the right decisions.

A successful IT Portfolio process is not easy to implement. There must be full commitment from management and processes within the organization must be changed [4]. However, when properly implemented, it yields great benefits that cannot be ignored, starting with a thorough understanding of IT

projects. The following sections will give detail on some of the best practices, problems and benefits that categorize ITPM.

3.1.2 **Best Practices**

Although this is an area yet to achieve maturity, there already have been identified some key best practices for creating and managing a successful IT Portfolio process. In this section, the most important are described.

The first step to a successful portfolio management implementation is the gathering of a detailed inventory of all the IT projects in execution [29]. This may very well be the first holistic view of the entire IT Portfolio and will surely help to identify redundant projects, the current (mis)alignment with strategic goals, and gain an understanding of the total resource requirements [30].

Another important aspect is establishing an IT Portfolio process where all the project proposals are linked to a business case and submitted to an assigned competence centre for a first evaluation. The business case must have enough information to understand its strategic fit and make high-level estimates of cost, risk, and business value. This first evaluation process can be extremely important in the early detection of overlapping and poor project proposals, reducing the organization's project portfolio charge [16].

One of the key issues of ITPM is, of course, the prioritization of projects. The prioritization should be a result of the categorization, scoring and the predicted available resources. On the one hand, a categorization of projects should occur with a maximum number of projects assigned to each category according to the strategic goals of the organization. On the other hand, projects in each category should be submitted to a series of scoring variables, in order to assess their potential value. A total scoring should be assigned to each project considering its expected value and risk and estimations about its total cost and financial benefit for the enterprise [1].

Finally, the last best practice identified is the regular reviewing and managing of the IT Portfolio [29]. This is essential to assess how projects are doing and checking if there are enough resources and budget to execute projects on hold in the pipeline. Furthermore, actively reviewing the portfolio enables the making of *go/ kill* decisions regarding each project separately [28] [31].

Of course, some of these best practices are hard to implement and most of them aren't even commonly adopted. ITPM clearly lacks a well-defined and generic process, like the processes described in ITIL, for its implementation to be successful on a broader scale. Moreover, organizations seem to consider ITPM an isolated process, thus failing to take advantage from the sharing of information with other processes. It is advantageous to first establish an IT governance model and then position an ITPM framework according to its strategic objectives.

3.1.3 **Existing problems**

Despite being well aware of ITPM and believing in its benefits, most organizations fail at obtaining real value out of it [5]. Therefore, a lot of work is yet to be done in organizations to achieve a level of maturity capable of successfully establish a management process of their IT Portfolio. The following problems are amongst the most weighted criteria for failure.

One of the hardest problems to overcome is the difficulty to eliminate *pet projects* [32]. While ITPM aims at establishing a fair evaluation of projects to select the most interesting investments, there are usually projects sponsored by top managers that automatically obtain high priority. The problem is serious and hard to overcome. The value of these projects is unknown, and sometimes they aren't even aligned with the strategic goals of the organization. What's worse, projects that yield a good compromise between value and risk and benefit and cost are left behind, for there is no room for them in the organization's portfolio. Therefore, the ITPM process becomes flawed and, in order to invert the situation, even before the implementation of a fair process, mentalities must be changed.

It is hard to achieve a right number of projects, as there are usually too many projects in organization's portfolios. As a result, the time to market or projects start to suffer, and projects end up in a queue waiting for people and resources to become available [4] [28].

Quality of information on projects is also deficient. When the project team lacks the time to do a decent market study or a solid technical assessment, often management is forced to make continued investment decisions in the absence of solid information. This means that projects are approved that should be killed.

Most project selection tools consider the projects against some hurdle or minimum acceptable value [33][4]. The trouble here is that lots of projects pass the hurdles. What these methods really fail to do is provide for a forced ranking of projects against each other. This means that if the standard is low, there will be a too larger backlog of projects to execute. On the contrary, if the minimum acceptable value is too high, the organization's resources will not be conveniently exploited.

Another hurdle to a successful implementation is the difficulty of killing projects. Often projects aren't on time or off budget and still their execution continues. The problem is, resources that could be used in other projects are being wasted, leading to major gridlocks in the pipeline of projects [28].

ITPM is by nature a bureaucratic processes, as it entails the assessment, evaluation and decision of executing projects [3][15]. This is necessary to avoid bad decisions by arranging regular governance comities. Therefore, executives must be assured that ITPM brings great value and all the bureaucracy surrounding it is strictly necessary.

Another concern to keep in mind is that not all projects should be evaluated against the same criteria. Projects have different goals, can be categorized in different manners and, due to their nature, some are riskier than others and some provide greater value. Therefore, a percentage of the portfolio should be assigned to different categories and projects in each of those would be prioritized accordingly. When this is not done, portfolios usually become unbalanced, with a too greater number of small projects. This

means that projects which may bring real value to the enterprise are left out because of their complexity and risk associated [28].

The most serious problems aren't the ones related to flaws in the process. These can be easily overcome, depending on the commitment and know-how of the team assigned with the process reengineering task. The greatest problems concern mentalities of individuals and the maturity of the IT organization overall. The organization that served as case study for this survey showed precisely this situation, as the games of power and the fear of change are very hard to reverse.

3.1.4 **Benefits of IT Portfolio Management**

When successfully implemented, IT Portfolio Management yields great benefits to organizations. The benefits that deserve attention are enumerated next.

- **Improved resource allocation**. Through IT Portfolio Management, a better insight is gained on what and when human and technology resources will be needed, which is especially important when we are talking about specialized or scarce resources [33]. This is also valid when an organization incurs in a full outsourcing environment, due to the need of assigning a team to supervise the supplier's project execution.
- **Cost savings.** The most tangible benefit of IT Portfolio Management is the potential cost savings that the process can offer. Research [1] shows that organizations can experience cost savings of up to 40% comparing to the past, certainly a huge breath of fresh air for IT executives.
- **Elimination of project redundancy.** Another extremely valuable benefit of IT Project Management is the possible elimination of project redundancy. The greater visibility and existence of a unique competence center helps eliminating redundant solutions, which has obvious implications in the IT architecture and the competitive advantage overall. Figure 3-2 illustrates a typical IT architecture, where the lack of control over IT Projects results in the existence of multiple redundant initiatives.

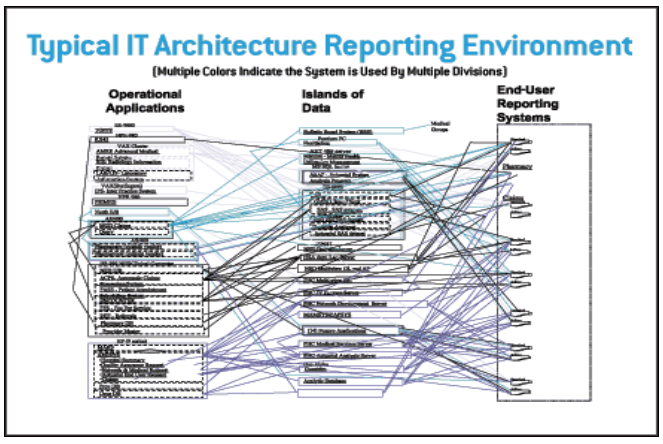


Figure 3-2: A typical IT Architecture (Source: **[34]**)

- **Prioritization and comparison of projects.** If, on the one hand, some small organizations may have a relatively small pipeline of projects, the same isn't necessarily true in the majority of the enterprises. The large amount of project requests from organization units make it almost impossible to make the right decisions about which projects to execute without an established Portfolio Management framework. By defining the different vectors of analysis, metrics and scoring criteria and making sure that all projects are submitted to this evaluation, the distinction between good and bad projects becomes evident. Therefore, only worthy projects are implemented
- **CIO empowerment.** IT Portfolio Management gives the CIO the ability to prove the value of projects that may have a low ROI, while lowering the priority of projects that may show high ROI but are misaligned with the strategic objectives [4][26].
- **Life cycle visibility.** IT Portfolio Management also drives organizations to take a balanced approach to evaluating individual projects and to optimize the mix of projects it undertakes. It establishes that risk must become a more rigorously considered part of IT decision making. Moreover, it challenges organizations to monitor the value of an IT investment not only when the investment is approved but through its entire life cycle. In this way, the IT Portfolio will likely optimize IT value while balancing risk and return, due to a more holistic approach.

3.2 In-house vs Outsourced IT Portfolio Management

When organizations execute their own projects, IT governance becomes simplified. It is easier to be aware of the organization's technological and human resources, manage their allocation and therefore be able to select which projects to execute.

When an organization works in a full outsourcing context, IT Governance gets complicated, since that the organization isn't in full control of the situation.

Firstly, it is difficult to estimate the productive capacity of the outsourcer, the number and complexity of projects that can be executed during a determined time frame.

Secondly, and having the certainty that it is essential to track the entire life cycle of projects, it is hard to assess how projects are doing and in what stage of development they are. The information has to come from the outsourcer, which implies that a transparent relationship must be established.

Finally, it is more difficult to define metrics and compare the expected worth to the real results because of the lack of visibility throughout the whole process.

Strangely or not, it seems that the scientific community isn't paying much attention to these problems, making literature and research work difficult to find.

3.3 Metrics

This section addresses the particular subject of metrics, since it is an important concept in the IT Management area, as well as being part of the solution presented later in this document.

Ambiguity is one of the worst enemies of good decision making, which means that managers should always have concrete information to act upon. The usage of metrics is crucial in this way, by guaranteeing that reliable data from the desired areas or business units is at the disposal of the managerial staff. Disciplines like Performance Management and tools like Balanced Scorecard are employed to address these issues, and that is why they have become so important.

Useful business metrics, in general, have two main properties [41]:

- **To support larger objectives**. It is done by helping maintain the focus on the big picture, ensuring alignment with the defined KPIs and strategic goals;
- **To assist good decision-making**. This is accomplished by providing quantitative, non-ambiguous criteria.

As well as with the business in general, metrics also apply to Information Systems. Business is intimately related to numbers, and IT must be part of the equation. In fact, the metrics used to measure the value of IT resources and investments are changing, as CIOs go beyond the classic ROI and TCO formulas to prioritize their investments [43]. More attention is being devoted to this subject, with the help of some of the frameworks stated in earlier chapters, like ITIL or CobiT.

Drilling down to Portfolio Management, and like IT in general, the performance of an IT Portfolio Management process strongly depends on the metrics defined. There are two fundamental types of metrics [25].

On the one hand, process performance metrics are related to measuring the process itself and aim to assess its overall efficiency throughout the whole lifecycle. These can measure the project backlog, the number of projects in execution and the bottlenecks of the process. Section 7.2 addresses this subject in more detail.

On the other hand, metrics must be defined to help prioritizing projects, based on the expected value of each. Although these are only estimates and thus the process may not be absolutely accurate, a well defined set of metrics should provide a pretty close approximation of what the projects really are worth. This is the single most important step in an IT portfolio management process, thus metrics must be chosen with purpose. Most authors consider risk, financial, and value metrics as a necessary part of the project prioritization task [25]. Examples of these are:

- **Financial metrics** [4] [25] [28]**:**
    - NPV, which is a must-have metric in investment decisions, evaluates the present value of a series of future net cash flows that will result from an investment, minus the amount of the original investment.
    - ROI, the expected return on the investment, also a must-have metric for every project proposal.

    - Internal Rate of Return, an indicator of the efficiency of the investment.
    - Payback Period, which is the time span until the sum of cash inflows and cash outflows totalizes 0.
- **Value metrics** [25] [43]:
    - Strategic value like external client measures, strategic fit, market and customer value or degree of innovation. Although value is a rather ambiguous concept, and these metrics cannot be as accurate as the financial ones, it is important to assess the strategic benefits or improvements that the project will bring.
    - Tactical value like system availability and responsiveness, project delivery timing, performance metrics, longevity and productivity metrics. The same as for strategic metrics applies, as these metrics allow for the project to be evaluated among different parameters of tactical importance.
- **Risk metrics** [25] [41]:
    - Business risks, which don't specifically have to with technology, ranging from external risks (competitors, suppliers, vendors) to the risk of misalignment with strategic goals or failure to achieve compliance requirements or customer satisfaction.
    - Technological complexity, which can be broken down into the complexity of the IT architecture, the complexity of applications and/or processes, the feasibility of the project in technological terms or the performance requirements and complexity.
    - Project risks and interdependency with other projects.
    - Resource risks. These have to do mainly with people, the most important being staff availability, know-how and experience.

Moreover, financial metrics should be broken down into benefit to the business and cost metrics. Cost metrics have to do mainly with the expenses that the project will bring to the organization. Some of the most common are hardware, software, licensing, and human-related costs [10].

The truth is that one size does not fit all. Whereas the different nature of each organization makes it nearly impossible to establish an optimal generic solution, what organizations must guarantee is to take a balanced approach in choosing which metrics to apply, taking into consideration the available human resources and the dimension of the portfolio. That is, there must be a commitment between agility and a rigorous and detailed analysis of the portfolio [25].

3.4 ITPM Tools

The objective of this section is to present a brief overview of the ITPM market and the main existing characteristics of the most complete tools.

The amount of ITPM tools in the market has proliferated in recent years [35]. This growth is related to the awareness of IT managers to the potential value of having reliable decision-making products helping in the selection of projects. In fact, most of the leading vendors of ITPM solutions have started to integrate Portfolio Management solutions, while established ITPM vendors are revamping their products to survive in the competitive environment.

Nevertheless, the market is yet to reach its full potential and its growth is expected in upcoming years. According to a study conducted, the worldwide market of ITPM is likely to grow 14.9% from 2004 to 2009 with total revenue of $808M, well above the overall software market revenue growth [36].

The particular nature of this area makes it extremely difficult to gain access to different vendor tools in order to experiment and analyze them, since all the software solutions are quite expensive. Therefore, it will only be made a high-level analysis of the major ITPM tools, their market positioning, weaknesses and strengths – all based on research material gathered.

The following are some of the most important features identified, which IT Portfolio Management tools should support.

- **Basic Project Calendar.** The possibility to create a basic project calendar and identify (by skill sets) the resources that will be needed.
- **Categorize Resources.** Have the ability to categorize each human resource according to function in order to maximize the productive capacity and make better estimations of when projects can be completed.
- **Prioritization.** Contain a powerful prioritization tool, in order to distinguish the best projects among the whole portfolio. Projects should be prioritized through different dimensions like value, risk, benefit and cost.
- **What-if scenarios.** The creation of what-if scenarios to enable the simulation of different project executions during a predefined time frame. This aspect is extremely relevant in order to optimize the execution phase of the selected projects.
- **Visibility.** Visibility is critical for all IT processes, from strategic planning to work execution management. Therefore, IT organizations must be able to see business objectives and monitor the demand pipeline.
- **Budget creation to forecast and track costs.** IT Portfolio Management tools are critical in reporting project and maintenance effort costs, creating project-level budget for investment analysis and resource forecasting and chargeback reporting.

3.4.1 **ITPM Market**

The IT Portfolio Management market is now a competitive one, with multiple vendors trying to attain a relevant position. However, it is also a hybrid market, since those vendors have different backgrounds. There are ERP vendors, which aim at integrating different solutions in a single software package (one of those being ITPM), consistent ITPM packages that offer the best generic solutions aimed at mature organizations, and solution vendors that target more specific project needs.

A Forrester research depicted in Figure 3-3 showed the market situation:

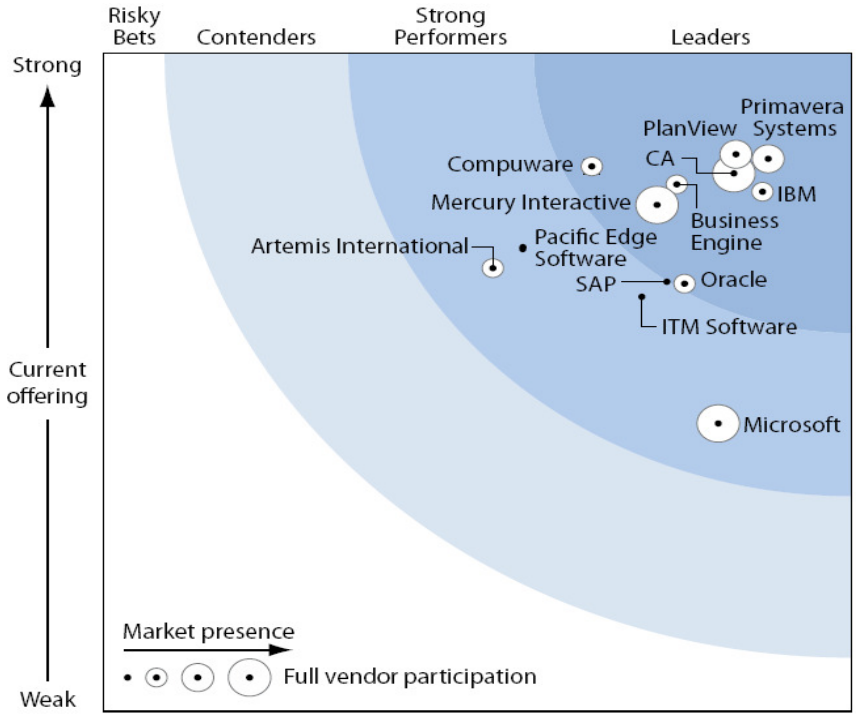


Figure 3-3: IT Portfolio Management vendors (Source: **[35]**)

With respect to Figure 3-3, a brief description of the most important vendors is now provided, with a special emphasis on Mercury Interactive, the chosen tool to support future work.

- **Primavera Systems.** Primavera offers a broad choice of functionality, as well as the ability to configure planning and tracking depth for different organization maturity levels. Its continued strength in resource management and strategic approach makes IT Portfolio Management a holistic part of IT management.
- **Compuware.** Compuware's Changepoint solution offers strong functionality across all areas of IT Portfolio Management. Its integrated IT management solution gathers important information from across multiple areas such as operations and development teams, enabling organizations to get a broader view of all of their work and resource requirements. It also emphasis on collecting business-specific metrics, making it a good choice for value-driven organizations.

- **Microsoft.** Microsoft is an extremely project-centric vendor, due to its product Microsoft Project. Relying too much on the development of custom interfaces, it is however a sleeping giant. With the acquisition of UMT, Microsoft may well revamp its position in the Portfolio Management market.

3.4.2 **HP Mercury Interactive**

Mercury Interactive experienced a growth rate of 83.6% in 2004 in its IT governance segment. It's share of the ITPM market in 2004 was 10,1%, ranging revenues of about $40.7M. Recently acquired by HP in mid-2006, Mercury software is expected to contribute to HP's revenues with over $100M alone [36].

The tool's ITPM module is integrated with a Demand Management module. This module works as the single point of contact with the business, and through which all the business needs are submitted. The needs are then divided according to their nature and the ones that represent strategic demands are forwarded to the Portfolio Management module.

Once in the process of portfolio management, a business need passes through different stages. It starts as a proposal, where a high level business case is written and attached, and a first evaluation is made. The approved proposals are transformed onto projects, where a much more detailed business case is made.

The tool allows for the ranking and rating of projects according to business value and risk, the estimation of cost and business benefit and the assessment of needed resources. There is also the possibility of running multiple what-if scenarios in order to optimize the portfolio and rank the projects accordingly. These scenarios present themselves as multi-dimensional bubble charts like the one in Figure 3-4, with configurable axes that facilitate the understanding of the portfolio mix.

Figure 3-4: Mercury's portfolio analysis

Having defined the IT project portfolio, the solution provides integration with the Dashboard and Project Management modules, to allow for the monitoring and control throughout the entire life cycle.

Once the project is implemented, the item that once was a proposal and then became a project is now an asset. Assets are then managed during their entire life cycle through Mercury's Asset Portfolio Management process.

4 Problem

Over the past decade, outsourcing some of the value chain activities traditionally performed in-house has become increasingly popular. Outsourcing strategies involve a conscious decision to abandon or forgo attempts to perform activities internally and instead pass them along to outside specialists or business partners.

And so, as with other activities, IT Outsourcing has become a commonly adopted practice. Organizations desperately try to improve their technology departments' efficiency and see this as an opportunity to achieve better value for money.

However, the adoption of such a strategy is not straightforward. Some of the major problems of IT outsourcing are the ones that follow [20][37]:

- **Cost and complexity –** the cost and complexity of managing the outsourcing relationship aren't dismissible. Whereas most companies under-invest in the ongoing governance and management of the service provider relationship, they underestimate the time, money and people it takes to effectively manage operations performed outside the organization.
- **Associated risk –** there is always the risk of having outsiders do our own job, even more if the activities are crucial to the business. Relationship problems can occur, which can lead to the necessity of changing suppliers and incur in greater spending, and the organization may become too dependent upon others to run its business.
- **Glossing over quality systems** – it is crucial to ensure any vendor selected has in place quality systems that will meet the organization's requirements. Less control means that the activities may be performed without the expected and desirable quality.

Full outsourcing, however, goes one step beyond. Instead of occasionally outsource an IT project and develop others in-house, an organization that embraces a full outsourcing strategy systematically delivers IT project requests to a selected supplier to whom it maintains a SLA, with most of the technological and human resources being on the supplier side. This aspect constitutes an additional challenge, forcing an organization to optimize its portfolio of IT investments and try to make the best of the chosen outsourcing strategy. It also enhances the associated risk, because of possible strong dependencies on the selected supplier.

At the same time, most organizations are yet to reach a maturity level on their IT operations that allows them to deliver consistently good results. And the blame is often put in the way projects are managed. However, most of the times the real problem comes from behind and has to do with the (lack of) selection and prioritization of projects. Market constraints force organizations to modernize and to reduce the time-to-market of their products in a way that most IT departments cannot keep up with. The

IT portfolio must be optimized to produce the best possible results with the available resource and time restrictions.

Therefore, one question begs to be asked:

How can an organization select and manage its IT project portfolio when it is engaged in a full IT outsourcing environment and thus all projects being executed by an outside IT supplier?

That is, if managing the IT portfolio of an organization is hard for itself and the larger the organization the harder it becomes, then doing it while not getting ahold of most of the resources presents an additional difficulty.

This question is practically unaddressed in the scientific community, but is likely to come up on most of managers' minds. For instance, it is hard to predict if there will be available resources to meet all the business units' needs, and if not, what and how many projects will the organization be able to execute.

Additionally, more distance means less control. Maintaining a balanced portfolio of projects doesn't end in selecting which projects to execute as managers must learn from past projects to better estimate in the future. However, it is harder to track how a project is performing, and if it is performing according to expected, when it is executed outside the organization. Also, if projects are given a "go" decision without any real impact and benefit analysis, and without concrete evaluations, it becomes more difficult to access their results in the future. That is, the real results of a project should be compared with the expected outcome in the "go decision" stage, in order to give concrete information for managers to act upon in the future.

4.1 Case Study's Specific Problem

The case study of this work is a large Portuguese organization, which works in a full IT outsourcing environment with a chosen business partner.

Because of the great number of technological needs, and because resources are finite, the organization started having problems with its IT function. In fact, with hundreds of IT project requests, the backlog of projects started growing to unacceptable levels. Moreover, without knowing the true resource availability and available productive capacity of its supplier, it was nearly impossible to optimize the execution of projects.

Furthermore, a comprehensive number of projects exceeded the expected budget and/or duration. Although penalties defined in the SLA apply, the fact is that the organization is severely penalized due to the poor efficiency caused and the delay with which most of the projects enter the later production phases.

The major cause appointed for this situation was the lack of a balanced and executable IT portfolio. An effort was made to establish an IT portfolio management process, but it was clearly not delivering the expected results.

Therefore, the question posed above became valid for the stated organization. On the one hand, the organization would not abandon its full IT outsourcing strategy. The impact to the business would be too great, as a whole organizational restructuring would be needed and the costs would be extremely high. But, on the other hand, the IT function was clearly struggling to satisfy business demands in an efficient manner.

The following sections describe the solution presented to this organization in order to solve the problem of selecting and managing its IT portfolio, as well as analyzing the results and drawing upon conclusions,

5 Proposal

The proposed solution to the stated problem is the implementation of an IT Portfolio Management framework, containing the process and associated constraints. The implementation is neither simple nor straightforward. Therefore, a series of successive steps must be taken in order to ensure its correctness. The focus of this generic proposal is not only to establish an ITPM process but also to guarantee its successful implementation in a real case scenario.

To do so, the recommended steps to achieve a satisfactory result are depicted in the figure below:

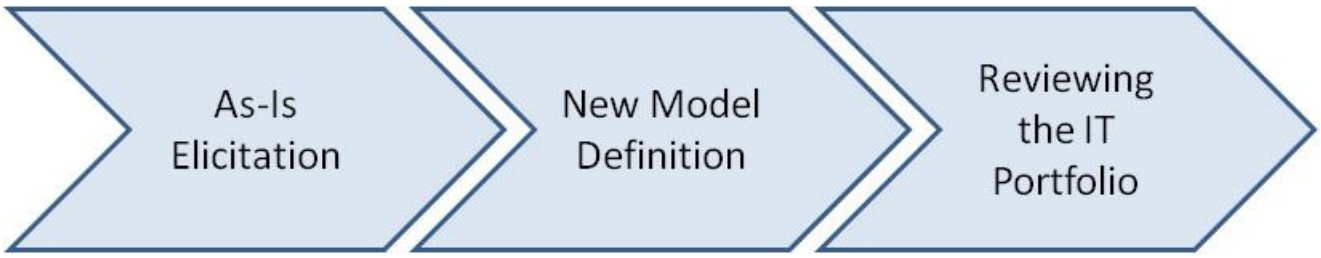


Figure 5-1: Steps to ITPM definition

5.1 Understand the As-Is Situation

If applicable, the first thing to do is to analyze the existent process. The analysis must be made at several levels, namely its interfaces with other processes, main activities, key intervenients and used documents and templates. This will likely result in the understanding of the process' qualities and its major pitfalls. These conclusions are very important, as they avoid the making of past mistakes and allow for the maintenance of what is justifiable.

In addition, a picture of the IT projects in execution, as well as the size of the portfolio backlog, must be taken. The gathering of this information will be fundamental, as it will provide a holistic view of the entire IT Portfolio. This kind of knowledge gives insight about the size of the existent IT portfolio, the different kinds of projects and the resource allocation. If bottlenecks are to be identified, then measures can be taken to eliminate them and set the stage for a fresh new framework to be implemented.

Besides, the as-is elicitation not only sets the starting point but also gives a first impression of the overall efficiency of the organization when it comes to selecting and prioritizing projects.

5.2 New Model Definition

The following step is the definition of the new model. From the previous analysis, some conclusions have by now been drawn. The main aspects of the process shall be:

5.2.1 **Identifying Key Participants**

The first assessment that must be made is related to the key participants in the process. Although involved in a full outsourcing strategy, an organization must still maintain a team of IT employees to manage the relationship with the supplier(s). These employees will ideally have different competences and different backgrounds.

Therefore, ITPM requires the constitution of a specialized competence center. This team must have senior analysts, budget experts, service managers who maintain direct contact with the IT supplier and governance managers that ensure the alignment with the corporate objectives and enterprise.

All project requests will be sent to this team, which will evaluate and prioritize the business cases using their expertise.

In addition, each business unit must nominate a liaison to make the bridge between business and IT. This entity has the responsibility of helping the project sponsor to write the business case, likely using his accumulated experience. Furthermore, if applicable, the liaison will have access to the ITPM tool, in order to automatically forward the project request to the competence centre for further evaluation.

5.2.2 **Identifying Interfaces**

ITPM isn't obviously isolated from the other processes. Therefore, when designing the process, it is necessary to pay attention to the common interfaces.

It is important to bear in mind that ITPM should be part of a comprehensive IT Governance framework. If that is the case, then it must respect the general IT principles traced. Additionally, it must provide new control objectives and comply with defined key process indicators (some are described in the Evaluation section of this work) to populate a possible IT scorecard.

The most important interface, and that will always exist, is the one with the Project Management process. ITPM is the first step in a project management framework, as it establishes the projects that will in fact be executed. Therefore, the last activity of the process shall be the communication of the "go decision" to the sponsors of the initiative and a designated Project Manager, if applicable, to start gathering the necessary resources.

Finally, there can sometimes be the case that project requests are made but don't quite meet time and cost requirements. That is, a line must be drawn to separate projects from little application changes. The criterion to make this distinction is commonly based on cost and effort required, since not every request justifies the effort to create a project. Therefore, a first assessment on the business case must be made, with the small requests being routed to change management processes.

5.2.3 **Major Steps**

Having made the previous decisions, the next step is to actually model de process, by defining the activities and designing the main flow, taking in consideration the interfaces and key participants identified previously.

These are generic activities, which should apply to all ITPM implementations. Each implementation, due to its expected particular nature, will then probably have other specific tasks (section 6 details the specific process implemented in the case study). The proposed activities are, therefore, the ones that follow.

Writing the Business Case

The first step of the process is the writing of the business case associated with the business need. This shall preferably be done by the project sponsor (in order to *sponsorize* the project from the beginning) with the help of the previously identified liaison, a nominated interlocutor that possesses sufficient information and know-how about the process. The business case must contain the following information:

Information	***Description***
Description of the business need	Contains a brief overview of the business need, in order to facilitate its future understanding and establish the scope for the project to come.
Objectives	The main strategic objectives for the business need. It enables a high-level perception of the project's importance to the business, as well as facilitating the discovery of requests with similar objectives that can possibly be grouped together.
Project Sponsor	The name, contact, and business unit of the project sponsor.
Associated business needs	In spite of being optional, this is an important piece of information to share. If people from the business identify similar business needs, generally from the same business unit, they should share this information and reduce the future overhead caused by the analysis of possible groupings.
Number of users	The expected number of future users or employees that will directly benefit from the IT investment.
Desirable dates for the project	The expected start and finish dates for the project. This information enables the execution of "what-if" scenarios, regarding the different time intervals of future projects and available human and technological resources.

Table 5-1: Business case information

In addition, and most importantly, there must be defined scoring variables. That is, each project request must have an associated group of metrics that will have a determined scoring method, according to the type of project.

In this work, the following three groups of metrics for the business units to write are proposed:

- **Value metrics** – Value is a relatively ambiguous concept. What might be valuable to one stakeholder might not be to another. In this way, IT Portfolio management is essential to articulate the core values of the organization so that decisions can be made that are aligned with these values. Therefore, in order to optimize the IT portfolio, there must exist an agreement and alignment between IT and business regarding the definition of value, as the misunderstood of this variable will likely cause ITPM to fail. The best way to ensure this is to define common standard metrics, applicable to all IT investments.

- **Risk metrics** – Risk is also a relatively dubious concept, and most people can't accurately tell what it is. However, it is very important to make risk assessments, as risks can negatively impact IT (and other) investments through changes in scope and unplanned funding requirements. What's worse, they can impact other related projects, therefore delaying or compromising the potential generated value, affecting performance, and causing a loss of competitive advantage. Risk must be evaluated for individual investments and assessed across the entire portfolio. To do so, a consensus as to the allowable boundaries and thresholds must be reached, as well as what risks should be evaluated prior to project executions. In the proposed solution, a set of risks were identified, which will be presented later.

- **Benefit metrics** – Related to value, the third decisive factor is the expected benefit. However, benefit is in this way a financial measure. Benefit metrics like ROI or NPV are quantifiable and must be addressed before projects execute, in order to estimate the future income of the investment. These metrics will set the blueprint for future comparisons between the real and expected returns.

Section 6 presents the set of metrics corresponding to each of the three dimensions that were proposed in the case study.

Pre Project Portfolio

All business cases should be grouped together. However, the way they are sent to the IT Department's competence center is variable. This activity should ideally be automatic, which would require for the business case to be electronical and embedded in an ITPM application. If not possible, then the document should be written in an electronical format and sent by email. Anyone belonging to the competence centre can then collect the incoming requests and group them in a common portfolio.

When considering a full outsourcing strategy, however, the IT department must act as a single point of contact in both ways. And, in order to create a transparent and efficient structure, there must also exist only on entrance channel for all the IT requests. This means that not only should project requests fall into this pre-portfolio, but also small application changes and other IT initiatives, with their respective template.

Consequently, the different types of requests should be separated in this step. Project requests will follow the IT portfolio management process flow, while other requests will go allow their designated paths, like a Change Management process.

Selection and Classification of Project Requests

Having the pre-portfolio well established, a first, high-level analysis of the different project requests shall be made afterwards.

Firstly, and because without accurate information it isn't possible to succeed in the management of the IT portfolio, a completion assessment must be made. In case of missing or dubious information, the business case should bounce-back for additional detail.

Additionally, each project should have an associated classification, as different projects cannot be equally evaluated. The nature of a large application change is obviously different from a new corporate ERP. Furthermore, a risky project but with a potentially high income in the long run cannot be evaluated solely on the revenues it generates over the following two years. And because the desirable number of each type of projects varies with the corporate objectives, the following division was adopted (adapted from [25]):

- **Projects that Run the Business** - projects that aim at keeping the business operational by updating or adding certain desired functionalities to existent applications;
- **Projects that Grow the Business** – projects that fall in this category are likely to support business initiatives that include the creation of new products and services, although maintaining the same scope of operations.
- **Projects that Transform the Business –** these are innovative projects, the ones that generally entail greater risks but also possible greater revenues. Their purpose is to support business strategies that include breaking into new markets or expanding beyond the current scope in the same markets.

This classification will allow for projects to be compared against similar ones, ensuring the fairness of the process.

Implementation Strategy

Because resources are finite, the IT portfolio must be as optimized as possible. The optimization will depend upon a good implementation strategy of the different business needs. Therefore, to avoid project redundancy and eliminate the existence of similar projects in execution, measures must be taken to group project requests in appropriate clusters.

The proposed grouping method goes as follows:

- **1 to 1 relation** – it applies whenever a single project request corresponds to a single project. These are the simplest cases, where no additional work is needed.
- '**N' to 1 relation** – if similar project requests occur that correspond to one major business need, then a project will be created to merge the lot. It requires the making of a new business case that will reflect the new situation, especially regarding cost, effort and benefit estimations.
- **1 to 'N' relation** – if a business need is for itself too complex and can easily be decomposed into different pieces with different objectives, than the divide and conquer strategy should apply. Therefore, the original business need will originate more than one project, with their scope well defined and according to their logical division.
- **Program** – a corporative initiative composed of several different projects. It bears extreme importance to the business and so must take high priority. An example of a program is a strategic initiative to ensure compliance with new regulations.

This method was applied in the proposed solution described in section 6,

Business Case Completion

With the implementation strategy defined and the business case at the disposal, the information systems department, through its governance centre, must complete the project request's valorization. Value, benefit and risk metrics were previously estimated, so it is now time to figure out the expected costs of the project:

- **Cost metrics** – One of the most restraining factors when evaluating IT investments are financial constraints. Miscalculating the potential costs of IT investments may present devastating consequences, as budgets are finite. Therefore, some valuable IT projects may never be executed because part of the monetary resources is allocated to off-budget projects. Additionally, as stated previously, redundant investments, poor prioritization and unwillingness to retire existing investments or kill IT projects create a huge drain on costs, also impeding the execution of the ones that could add value and competitive advantage. A set of common cost metrics is exemplified in section 6, although there can be situations where other costs apply. Because the context is a full outsourcing strategy, costs with the IT supplier can be estimated based on past experience. If questions persist, however, than the elaboration and sending of a RFI to the supplier is advisable.

In addition to cost, this step entails the estimation of the expected project duration and the expected effort required, in man-hours. The expected effort required has mainly to do with the available human resources belonging to the IT supplier, since that the effort on the organization's side is comparatively lower and consists mainly on applying regular controls and making regular assessments.

Having completed the estimations on budget and effort, it is time to assess if the business need corresponds to a future project. Because sometimes people from the business may submit a project request that doesn't quite meet the project requirements and thus passes the first analysis, it is a good practice to establish a threshold value for each of the two variables, to distinguish between a project request and an application change. Therefore, if applicable, the request must be forwarded to the change management process in this step.

This activity should be performed by members of the governance centre who have the necessary know-how, and ideally based on past experience of projects with similar characteristics.

Prioritization

Having the whole lot of project requests and associated business cases, it is time to prioritize them. In order to do so, two conditions must apply: the existence of sufficient information and the establishment of a scoring method. With the access to information guaranteed with the previous steps, a prioritization method must then be put in practice.

The prioritization of a project must depend on the following decisive factors:

- **Available resources** – the information gathered about the project will likely give insight about its dimension. Therefore, the expected effort required should by now be estimated, in terms of total duration in man-hours. The use of this information will optimize the IT portfolio, by squeezing small projects in available time slots and coordinating the execution of bigger ones. To do so, the information systems department must have access to the supplier's work force and the current and future allocation of each resource, especially key resources. This task is facilitated with the help of an ITPM tool, with the embedded parameterization and respective project allocation of each employee. Other possibilities may also be used, like regularly updated project time sheets.
- **Type of project** – the previous classification of each project will now come into play. There has to be a balance between the different types of projects in an organization's portfolio: the ones that run the business, the ones that grow the business and the ones that transform the business. A common mix is respectively 60%, 30% and 10%. However, one thing to watch for is a mismatch between allocation percentages and the organization's objectives. If an organization plans to grow its revenues 100% over the next few years and has determined that 80% of its resources should be allocated to run the business, then there is probably a mismatch. If the quota for a determined type of project is reached, all of them must be freezed until further opportunities.
- **Scoring** – the previously filled value, risk, and benefit metrics all have an associated value and weight. The combined values will sum up to a final score, indicator of the project's overall strength. Instead of being compared against a threshold value, projects must be compared among each other. This is because; one the one hand, if the threshold is too low all projects

will be sufficiently good. On the other hand, if the threshold is too high, fewer projects than wanted will be given a “go” decision. The calculation method depends upon the number and nature of metrics, and the different types of projects. The next section states the chosen scoring method for the particular case study.

- **Cost** – the costs of a project must also come into play when making a prioritization. The estimations made by the governance centre are used in this step, which will help to identify projects that are too costly and others that fit in the expected budget.

Execution Decision

The previous prioritization will be communicated to the different stakeholders. Each project, once given a “go” decision, will enter the project portfolio to later be executed.

Projects will remain in the portfolio until their start date arises and the required resources are made available. A few weeks before the assigned Project Manager should ideally be gathering the team and establishing the communication plan, according to the expected effort.

5.2.4 **Defining the Process Flow**

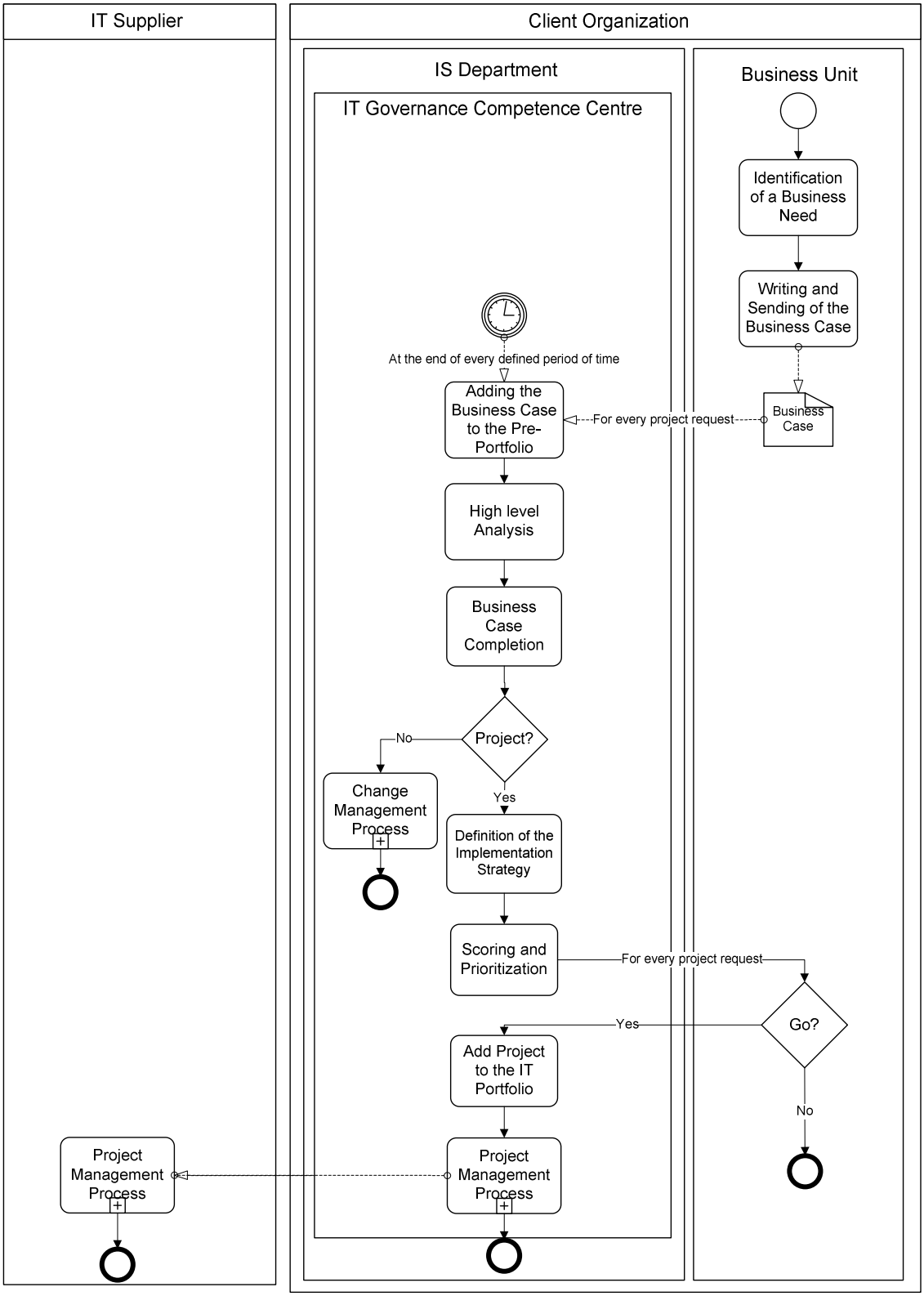


Figure 5-2: Conceptual ITPM process in BPMN notation

Having defined the key participants, the interfaces and the process' activities, the process flow can now be designed. It is depicted in Figure 5-2.

The process presented in this section is generic, and should serve as a road-map rather than a strict solution. However, the following chapter will present a specific process adapted to a real case study.

The used modeling notation in figure above is the BPMN [38].

5.3 Reviewing the IT Portfolio

In order to ensure the overall efficiency of the process, there must take place regular reviews of both the project portfolio and the projects in execution, during their lifecycle. The two situations are addressed in this section.

5.3.1 Reviewing the Project Portfolio

The greatest effort to establish an IT project portfolio happens when the strategic plan for the upcoming year(s) is defined. Corporate objectives are set, and according strategic measures are taken.

IT objectives, of course, derive from corporate objectives. Therefore, the different business units submit most of their IT project requests in this phase, in order to fulfill their strategic targets. The IT governance competence centre will then evaluate and select the different requests and compose the portfolio for the upcoming budget cycle.

However, business needs will naturally come up during the whole year. New needs may arise, and initiatives that were once left behind may acquire a greater priority due to external constraints. On the other hand, it isn't viable to permanently review the IT portfolio as new project requests are made.

The solution for this problem is to freeze it between revisions. There must take place regular meetings to access the existent portfolio and, at the light of new accumulated project requests, do a new prioritization. The advised time span between revisions is three months, at the end of each trimester.

5.3.2 Reviewing Active Projects

A stage-gate approach is an iterative process, where activities are represented at each stage and decisions at each gate. It provides the process with discipline, structured oversight and monitoring of IT investments at critical stages during their lifecycle. [31]

The key elements of this approach are the gates, as they offer important control points for IT investments, improving their quality and success rate and eliminating low value-added or bottleneck investments [39].

Being a relatively difficult decision to make, and a common pitfall in IT portfolio management implementations, the decision to kill a project must be seen as a cost-saving, trouble-avoidance measure. However, it must not be made in a random way, and specific time constraints must be defined. The high-

level stage-gate approach proposed is depicted in the figure below. This model was created in order to facilitate *go/kill* decisions at the end of every step.

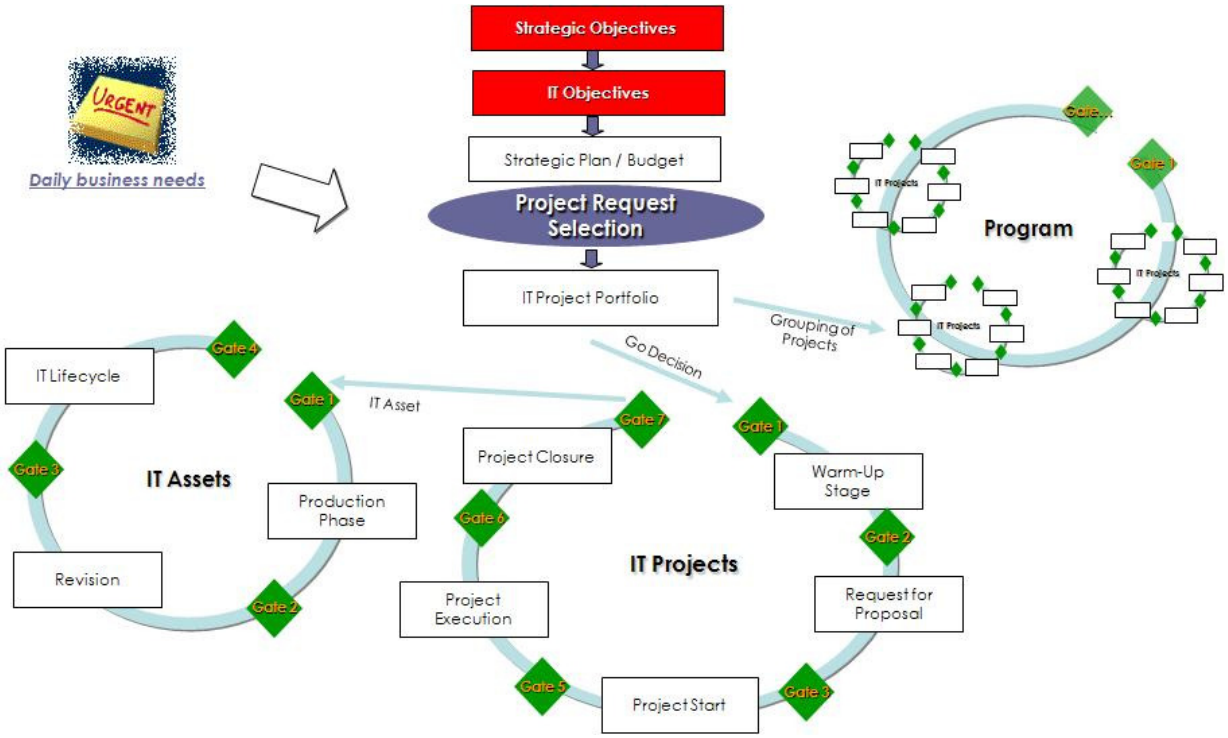


Figure 5-3: Stage-gate approach to the process

5.3.3 **Assessing Completed Projects**

Once projects are completed, conclusions must be drawn to estimate the overall efficiency of the process.

Therefore, the achieved results must be compared with the estimated values, information that is present in the business case. This activity will also make project sponsors accountable for their projects, in cases where they were too “optimistic” when evaluating the future investment.

6 Case Study

This section describes the fundamental characteristics of the framework proposed in a real case study. Because some of the measures taken were described in section 5, they're not as detailed in the following pages.

Specific implementations, however, are documented and thoroughly explained.

6.1 Organization

The organization where the case study relied upon is one of the largest in Portugal. It employs thousands of workers and contains a few organizational units and several departments. Its operations aren't only limited to Portugal, but scattered around the world as well.

The information technology needs are, as one can imagine, immense. Besides the daily business needs, IT services and products must be delivered in order to support the various strategic initiatives for the upcoming years. Moreover, corporate programs of high priority are occasionally launched, mainly to meet regulatory demands, which must have the required technological support.

As far as information systems are concerned, the organization works in a full outsourcing environment. That is, all of its IT projects are by default developed by a selected contractor, which also usually keeps the maintenance contracts of previous executed projects. The outsourcer has a dimension and an amount of resources that the organization would struggle to achieve.

However, in order to maintain a certain degree of control, a small IT department was created to manage the relationship between the two sides. This department, belonging to the organization's Holding, employs about 80 people with varied competences whose main objective is to act as a liaison between the IT function and the business.

Among its tasks, the most important are to keep track of how projects are doing, solve relationship problems and ensure SLA's targets are being accomplished, maintain a big picture of the whole organization's information systems situation and manage the IT budget. The budget for IT investments, of course, is extremely large.

Nevertheless, even though a lot can be spent, the need for having an unambiguous process to select which projects to go through with was felt. With millions being annually spent, dozens of projects in execution and others awaiting a "go" decision, it was decided to establish a means for selecting and prioritizing IT project requests.

For further understanding, the conceptual model of the IS department's organizational structure is depicted in the figure below:

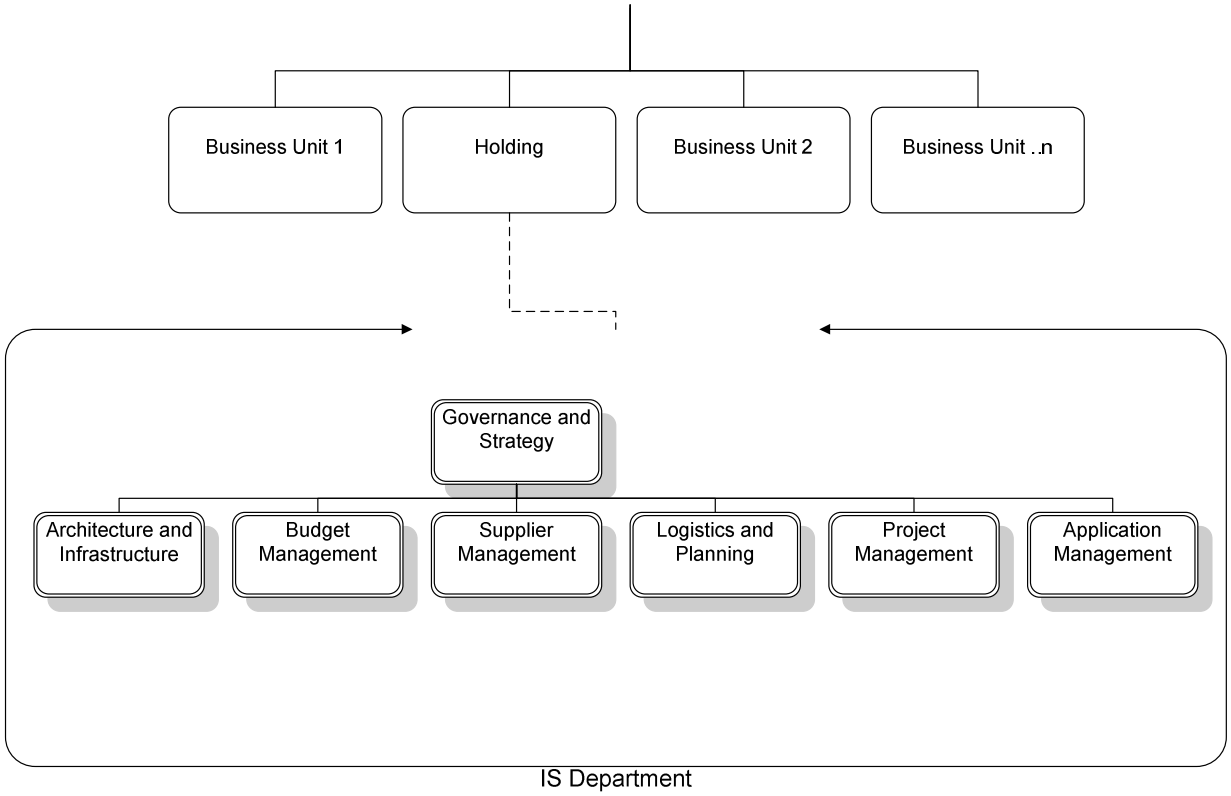


Figure 6-1: IS Department's structure

This model shows the different areas of the department, with a strong focus on the outsourcing relationship. The "Governance and Strategy" area is related to the corporate governance and drives IT objectives, the "Logistics and Planning" is responsible, among others, for the IT portfolio, and the other areas each have different competences in the managing of the IT function and the outsourcing relationship.

6.2 Previous Model

Although some effort was put to achieve a satisfactory IT portfolio management, the organization was coming short on achieving good results. Therefore, the first task to implement a new solution, as stated in the previous section, was to analyze the as-is situation.

The figure below represents the conceptual process modeled in BPMN, without incurring into unnecessary detail. The original process was modeled using the QPR Process Model application, in the organization's specific (and simple) notation.

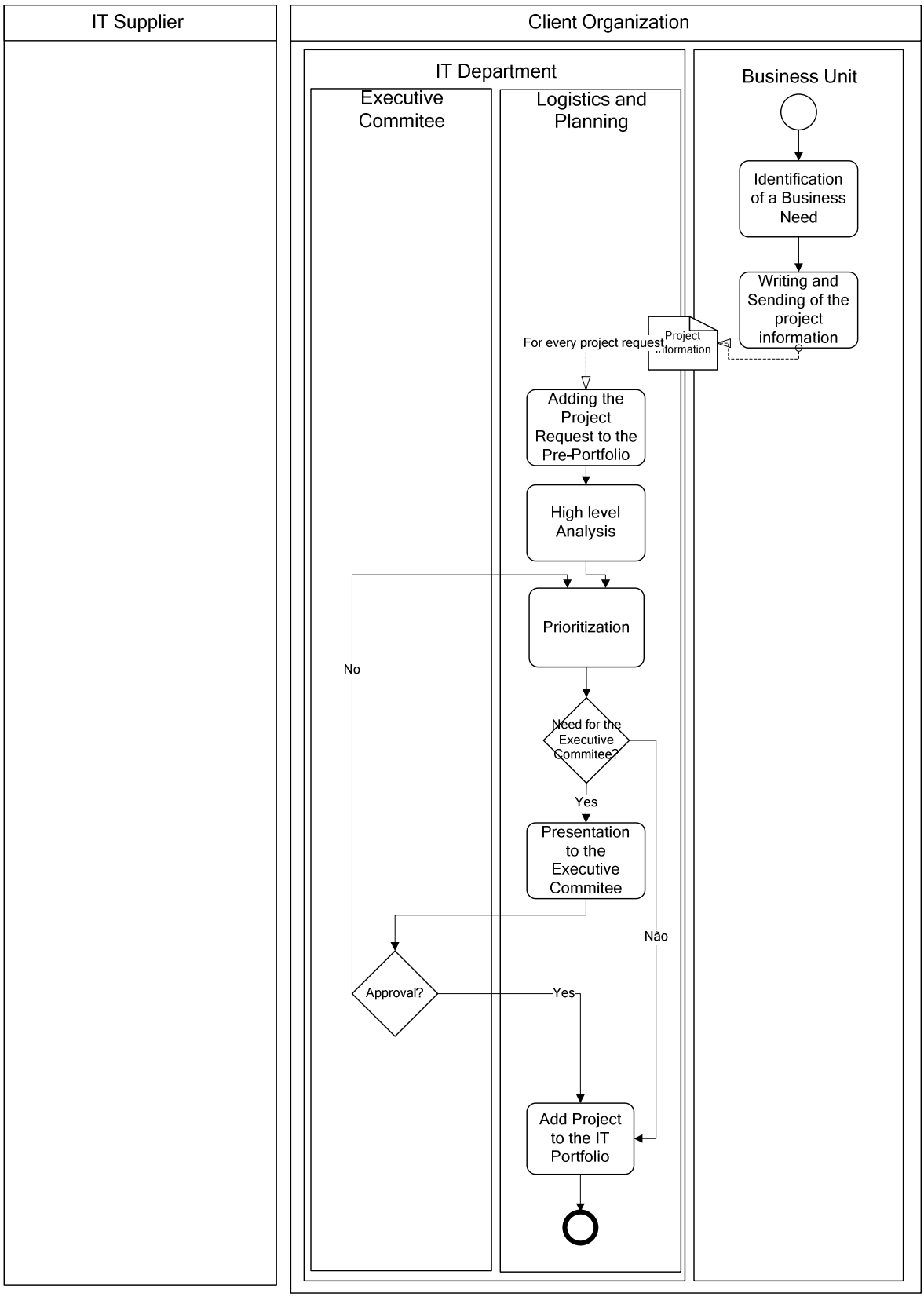


Figure 6-2: Organization's previous model

The analysis of the model provided for some conclusions, with the major problems identified, as well as value-added characteristics, being described in the table 6-1 below.

These conclusions were then taken into account when proposing a new solution, described in subsection 6.3.

Type	***Characteristic***	***Explanation***
Positive	Competence centre	The creation of a competence centre (Logistics and Planning) is always a good step to ensure a formal selection and approval method of IT investments.
Positive	Financial analysis	Initiative of tracking the investments' financial results.
Negative	Lack of information	Projects were submitted with little concrete information, causing inefficiencies in the process.
Negative	Ad-hoc prioritization	Lack of a formal prioritization method, aggravated by the lack of concrete information. The prioritization was made based on *feeling*.
Negative	Redundant projects	Lack of a consistent analysis on similar projects, and possible groupings.

Table 6-1: As-is situation analysis

6.3 Proposed Solution

The proposed solution was obviously based on the generic framework presented in the previous chapter.

Therefore, in this section, only the specific implementation characteristics will be detailed, related to the particular nature of the case study.

6.3.1 **Key Participants**

Although a Governance competence centre already existed, it clearly lacked enough know-how to make accurate decisions. In fact, the governance centre was only constituted by two people.

Therefore, it was proposed to form a transversal governance centre, with employees from each of the functional areas. This factor is quite important, as it enables the estimation of more precise costs and duration of projects. Although all project requests would be forwarded to the same department, the regular meetings to manage the IT portfolio would involve every member and benefit from his experience. The proposal included: 2 members from the previous Governance area, 1 project manager, 1 member of the infrastructure area, 1 senior analyst, 1 member of the budget management area and 1 member of the supplier management area.

6.3.2 **Interfaces with Other Processes**

The first interface identified was related to the change management process. The previous model of the department involved two distinct incoming flows: one for projects, which would later integrate the IT portfolio, and one for application changes. It was suggested the creation of a single incoming flow, that is, a single point of contact, with all the requests being grouped together in a pre-portfolio. This characteristic makes the life of the business staff easier and enables the creation of automatisms between the two different processes, ITPM and Change Management.

Additionally, the organization had created a Project Management framework constituted by major processes, from the Kick-off to the Phase-out. It was proposed the integration of the ITPM process in this framework and the creation of automatic interfaces with the Kick-off phase.

6.3.3 **Business Case**

In addition to the standard fields described in the previous chapter, a set of metrics to enable the scoring of each project request was defined.

Although the first set was larger, it was decided in cooperation with different employees to make life a little easier for people who submitted the business cases. The introduction of a more complex form would probably lead to a bigger shock and consequent resistance to adhere to the process.

This work was done based on the assessment made in the subsection 3.3, particularized to the present project.

Value Metrics

The table below gives a description of each of the possible value metrics for each project. Although generic, some main not apply to every project. For example, a project with the objective of run the business will hardly support the organization in breaking into new markets. Therefore, the scoring method described ahead in the thesis reflects this concern.

The variable 'Compliance' doesn't have an associated score, being a text field with the objective of supplying information about the project.

Name	***Description***
Compliance	Contribution to ensure the organization's compliance to legislation acts.
User satisfaction	Estimated percentage of user satisfaction growth, by facilitating their job.
Customer satisfaction	Estimated percentage of customer satisfaction growth, by directly improving customer service.
Customer growth	Estimated percentage of customer growth.
Market share	Estimate percentage of the business unit's market share growth.
Upselling	Estimate the percentage of product sales market growth.
Market volatility	Capacity of improving the current business agility to new market constraints.
Customer retention	Improved capacity of retaining the existent customers.
Break into new markets	Support for breaking into new markets or segments.
Sustainable competitive advantage	Capacity of helping the organization to achieve a sustainable competitive advantage over rivals.
Brand improvement	Likelihood of improving the commercial brand of the organization.
Market launch	Capacity of reducing the time-to-market of products or services.
Corporate social responsibility	Capacity of improving the organization's corporate social responsibility visibility.
Business units involved	Number of business units involved in the initiative.
Productivity	Estimated percentage of the growth in productivity of the respective business unit(s).
Longevity	Estimated longevity of the underlying technology.

Table 6-2: Value metrics

Risk Metrics

As stated previously, a risk assessment is fundamental to help preventing future drawbacks to the project and take provision measures. The set of risks identified is common to all projects, the scoring method being later described.

Name	***Description***
Dependency with other projects	Risk of strong inter-dependence with other projects.
Security	Different security risks. E.g. access control, denial of service.
IT Architecture	Complexity of the IT architecture necessary to support the initiative.
Development	Risk associated to the necessity of using too specific or non-standard technologies or programming languages.

External risks	Risk of changes in the external environment (e.g. new regulations, new market constraints).
Technology lifecycle	Risk of the IT solution becoming obsolete.

Table 6-3: Risk metrics

Benefit Metrics

When identifying the necessity of a business need, people must have a minimum sensibility of what financial benefits will the project bring to the organization.

Therefore, a series of benefit metrics must be indicated, which will sum up to the final score of the project. Needless to say, the more financially attractive the project, the higher priority it will have.

Name	***Description***
Revenue growth	Estimated percentage of revenue growth for the business unit(s).
ROI	The return on investment for a given period of time.
Payback period	The amount of time until the benefits exceed the costs of the investment.
Cost reduction	Estimated percentage of cost reduction for the business unit(s).
NPV	The expected sum of annual net benefits, discounted by an estimated interest.

Table 6-4: Benefit metrics

Cost Metrics

Cost metrics are the responsibility of the IT Governance centre. Based on past experience, and the know-how of its members, different costs for the IT project must me estimated. These costs will not enter the scoring of a project, but will also influence the prioritization. Similar projects with different costs will obviously get different priorities.

Name	***Description***
Software maintenance cost	Annual cost of maintaining the relevant software applications.
Hardware infrastructure	Annual TCO of the hardware to support the software in production.
Services	Men-hours cost of the expected maintenance services.
Software licensing	The expected cost of the required licenses of the desired software.

Table 6-5: Cost metrics

6.3.4 **Scoring and Prioritization Method**

As stated and detailed previously, in section 5, the prioritization method depends upon a few decisive factors: the final scoring, the costs of the project, the type of project, and the expected duration and available resources for the project.

Cost Assessment

The elicitation of the major costs of the project was promoted, with the creation of specific fields to be added to the business case by the governance centre team. The total estimated cost, bearing in mind the type of project and its objectives, provides an important prioritization input.

Custos de Exploração Anuais	
Manutenção da solução informática	*Custos anuais associados à manutenção de soluções informáticas necessárias à iniciativa.*
0 €	
Infraestruturas de CPD	*Custo anual e total de propriedade (TCO) das máquinas disponibilizadas para suportar a solução informática em produção (exemplo: base kTpm-c ou MIPS).*
0 €	
Serviços de manutenção	*Custo anual e total de horas.homem para manter a solução informática.*
0 €	
Licenças	*Enumerar e apresentar valores para outros custos anuais de licenças de software.*
0 €	
Outros	*Enumerar e apresentar valores para outros custos anuais de manutenção.*
0 €	

Figure 6-3: Business case's cost fields.

Scoring Method

The final scoring of a project is the sum of each different evaluation dimension.

$$Scoring = \left(\frac{\sum_{i=1}^{3} X_i}{3}\right) + \sum_{n} W_n + \sum_{m} \theta_m + \left(\sum_{j} (Y_j) + (\sum_{k} P(Z_k) * I(Z_k)\right)$$

$$\theta_m = \begin{cases} 0, & \theta_m < 3 \\ \theta_m, & \theta_m \geq 3 \end{cases}$$

$$\begin{cases} X_i = MultiValueMetrics \\ W_n = BinaryValueMetrics \\ \theta_m = AdditionalMultiValueMetrics \\ Y_j = BenefitMetrics \\ Z_k = RiskMetrics \end{cases}$$

First of all, the equation involves the value dimension. *Value,* unlike *benefit*, is a rather ambiguous concept. Moreover, not all the value variables identified are applicable to each project. Therefore, it was decided to implement a scoring method that doesn't oblige to fill up all the benefit metrics.

There are two types of metrics: binary, whose possible values are just '0' and '1'; multi-value metrics, whose possible values range from '1' to '4', most of them being scored in terms of percentage.

In this way, the following method was chosen: the scoring of at least three binary metrics and three multi-valued metrics is mandatory, with the 'Business Units involved' being necessarily one of those. The resultant scoring will be the simple arithmetic mean of each group of metrics.

In addition, the more information the project sponsor will give the higher scoring his project will achieve. Therefore, for each binary metric beyond the mandatory three, its value will be summed up to the total scoring. Likewise, for each multi-value metric beyond the three, if its value is positive ('3' or '4'), it will be summed up to the total scoring.

Figure 6-4 below shows the different metrics, already described in subsection 6.3.3. The light yellow color indicates multi-value metrics, the light blue indicating binary metrics. The language used is Portuguese, as the image was taken from the electronical proposed business case.

Valor			
Estratégico			
Conformidade com normas	*Normas com as quais o grupo tem que estar em conformidade e às quais a solução informática tem que dar resposta. Exemplo: Auditorias SOX, Normas da ERSE.*	Enumerar as normas textualmente.	
Satisfação dos colaboradores	*Estimativa percentual da melhoria de satisfação de colaboradores. A solução informática vem facilitar/agilizar o trabalho diário dos colaboradores da*	**1**- até 25%; **2**- 25,1% a 50%; **3**- 50,1% a 75%; **4**- até 100%	
Satisfação do cliente	*Estimativa percentual da melhoria de satisfação do cliente. A solução informática irá melhorar directamente o relacionamento com a base de*	**1**- até 25%; **2**- 25,1% a 50%; **3**- 50,1% a 75%; **4**- até 100%	
Aumento do número de clientes	*Percentagem estimada de aumento do número de clientes. A solução informática irá expor positivamente o negócio no mercado, com resultados directos no aumento da base de Clientes.*	**1**- até 25%; **2**- 25,1% a 50%; **3**- 50,1% a 75%; **4**- até 100%	
Market Share	*Estimativa percentual do aumento da quota de mercado no qual se insere a Unidade de Negócio (exemplo: produção eléctrica).*	**1**- 0 a 5%; **2**- 5,1 a 10%; **3**- 10,1% a 15%; **4**- Mais de 15%	
Upselling/Cross-selling	*Potencial de utilização do mesmo meio (ex: canais de distribuição, base de clientes) para diversificar a oferta ao Cliente e evoluir dentro do mesmo produto/serviço (ex: optar por um produto de maior valor acrescentado) ou levar o Cliente a adquirir produtos/serviços complementares.*	**0**- Não; **1**- Sim	
Volatilidade de mercado	*Agilidade na resposta a eventuais alterações de mercado onde a Unidade de Negócio está inserida (exemplo: novos canais de distribuição).*	**0**- Não; **1**- Sim	
Retenção de clientes	*A solução informática irá contibuir para melhorar a capacidade de retenção da base de clientes actual.*	**0**- Não; **1**- Sim	
Novos mercados	*A solução informática irá suportar/integrar a expansão do negócio para novos sectores de mercado(ex. Gás) ou novas áreas de negócio (ex. Operações Logísticas).*	**0**- Não; **1**- Sim	
Vantagem competitiva sustentada	*Capacitar a empresa para ganhar uma vantagem competitiva de mercado relativamente aos seus competidores, com um elevado grau de sustentabilidade e de diferenciação, através da solução informática ou do produto final que esta suportará.*	**0**- Não; **1**- Sim	
Lançamento no mercado	*A solução informática irá agilizar/reduzir o tempo de lançamento de produtos/ serviços para o mercado.*	**0**- Não; **1**- Sim	
Gestão de Marca	*A solução informática é importante para o valor da marca/imagem comercial.*	**0**- Não; **1**- Sim	
Imagem de responsabilidade cívica	*Influencia a reputação e a imagem da Unidade de Negócio sob o ponto de vista ético (exemplo: apresentação pública de indicadores de impactos ambientais).*	**0**- Não; **1**- Sim	
Tactico			
Nº Unidades de Negócio Envolvidas	*Enumerar os conjuntos de outras Unidades de Negócio do Grupo que vão beneficiar com a solução informática desenvolvida*	**1**- 0 a 2 UN EDP; **2**- 2 a 4 UN EDP, **3**- 4 a 6 UN EDP, **4**- 6 UN EDP ou mais	
Produtividade	*Estimar em percentagem o acréscimo global da eficiência operacional da Unidade de Negócio.*	**1**- até 25%; **2**- 25,1% a 50%; **3**- 50,1% a 75%; **4**- até 100%	
Longevidade	*Estimar o tempo de vida útil da solução informática. Duração prevista em anos, do tempo previsto que a solução informática ficará a dar suporte válido ao negócio. Aplicável quer a melhorias sobre soluções já existentes ou novas.*	**1**- 3 anos; **2**- 6 anos; **3**- 9 anos; **4**- mais de 12 anos	

Figure 6-4: Different binary and multi-valued metrics

The next variable represented is benefit. Because the financial costs and benefits of a project must necessarily be assessed at the beginning, and tracked throughout its lifecycle, all the benefit metrics described in figure 6-4 below are mandatory.

Also, because the estimation of precise financial values isn't often straightforward or even realistic, different intervals were defined in terms of percentage (except the Payback Period, in terms of time intervals), each one with an associated value ranging from 1 to 4. Therefore, the total benefit scoring is the sum of its different metrics: *revenue growth, ROI, payback period* and *cost reduction.* In addition, the estimated NPV must be taken into account, when assessing the overall benefit of the project.

Beneficio			
Financeiro			
Crescimento de Lucros	*Percentagem estimada de crescimento do lucro global da Unidade de Negócio.*	**1**- até 3%; **2**- 3,1% a 6%; **3**- 6,1% a 9%; **4**- Superior a 9%	
Return On Investment (ROI)	*Retorno esperado do investimento da solução informática. A soma de cash-inflows sobre a soma de cash-outflows durante o tempo de vida da solução*	**1**- 1 a 6%; **2**- 6,1% a 10%; **3**- 10,1% a 15%; **4**- Superior a	
Payback Period	*Estimativa do tempo necessário para pagar o investimento inicial realizado.*	**1**- até 12 meses; **2**- 13 a 36 meses; **3**- 37 a 72 meses; **4**-	
Redução de Custos	*Percentagem estimada da redução de custos global da Unidade de Negócio.*	**1**- até 3%; **2**- 3,1% a 6%; **3**- 6,1% a 9%; **4**- Superior a 9%	
Valor Anual do Beneficio esperado	*Estimativa anual do benefício financeiro que a Unidade de Negócio espera obter através da solução informática desenvolvida. Projeção financeira estimada com base em redução de custos, novos produtos, e outras*	**0 €**	
Investimento anual	*Estimativa para o Ano '0' em curso e projeções futuras, dos montantes previstos cativar pela Unidade de Negócio, para cobrir as necessidades de investimento na solução informática*	**0 €**	

ANO 0		ANO 1	ANO 2	ANO 3
Serviços	0 €	0 €	0 €	0 €
Software	0 €	0 €	0 €	0 €
Formação	0 €	0 €	0 €	0 €
Outros valores	0 €	0 €	0 €	0 €
	TOTAIS	**0 €**	**0 €**	**0 €**

Figure 6-5: Benefit metrics in terms of scoring

Finally, the third dimension of the scoring equation is the project's associated risk. It's imperative that every project has an associated risk assessment. To come up with the final risk scoring, the value of each individual variable is the function of its probability of occurrence multiplied by the expected impact to the project, as depicted in table below. Although some literature recommends the creation of 3x3 or 5x5 matrixes, it was opted to create a 4x4 to avoid the temptation of choosing the middle option.

P(i) / I(i)	***Low***	***Mid-Low***	***Mid-High***	***High***
Low				
Mid-Low				
Mid-High				
High				

Table 6-6: Risk assessment matrix

Just as a reminder, the people responsible for each project request will be held accountable for the associated business case, in cases where the estimated outcome was too optimistic.

Risco			
Dependência com outros projectos	*Risco que poderá advir da dependência com outros projectos.*	**1**- Elevado; **2**- Considerável; **3**- Pequeno; **4**- Inexistente	
Segurança	*Risco de existir falha nos controlos de acessos, ou outros.*	**1**- Elevado; **2**- Considerável; **3**- Pequeno; **4**- Inexistente	
Arquitectura de sistemas	*Risco derivado da complexidade da arquitectura envolvida (exemplo: inovação, número de elementos/camadas envolvidas).*	**1**- Elevado; **2**- Considerável; **3**- Pequeno; **4**- Inexistente	
Desenvolvimento	*Risco associado à utilização de tecnologias (exemplo: linguagens de programação) pouco standards de mercado ou muito específicas.*	**1**- Elevado; **2**- Considerável; **3**- Pequeno; **4**- Inexistente	
Manutenção da tecnologia	*Risco de a tecnologia utilizada se tornar obsoleta.*	**1**- Elevado; **2**- Considerável; **3**- Pequeno; **4**- Inexistente	

Figure 6-6: Risk metrics and their associated scoring

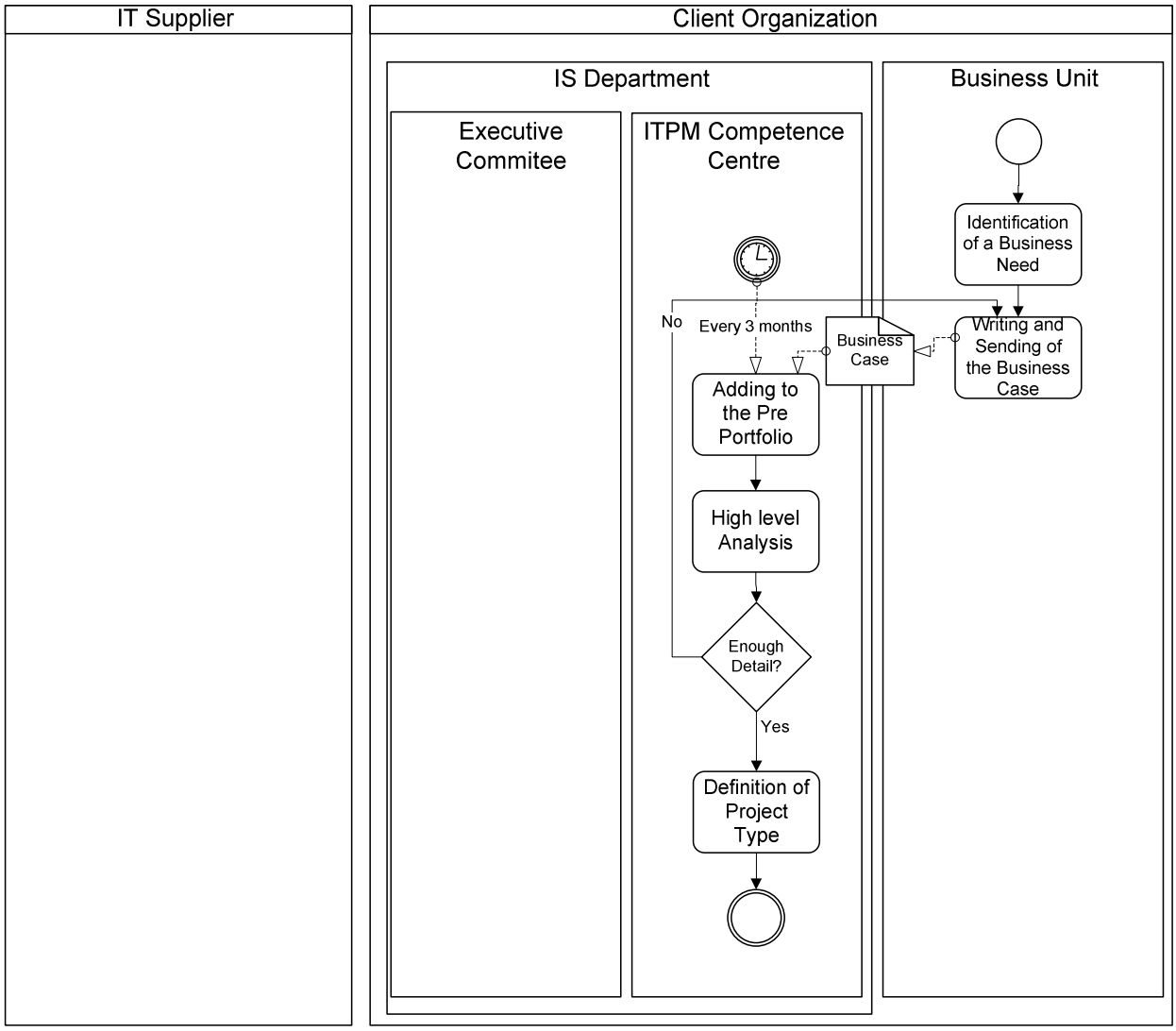
Prioritization

With the scoring defined, the prioritization can be completed. The prioritization method proposed also takes in consideration the expected duration of the project (based on know-how and past experience), the available portfolio quota left for the type of project, the available and expected productive capacity of the IT supplier and the expected costs of each project.

$$Prioritization = f(Scoring, Cost, Effort, Project\ Type, Available\ Resources)$$

6.3.5 **Process Flow**

Taking into account all the previous steps, and the proposal presented in section 5, the process flow for managing the IT portfolio in the organization was suggested. The process is obviously an approximation of the generic process that was proposed, being however adapted to the real scenario.



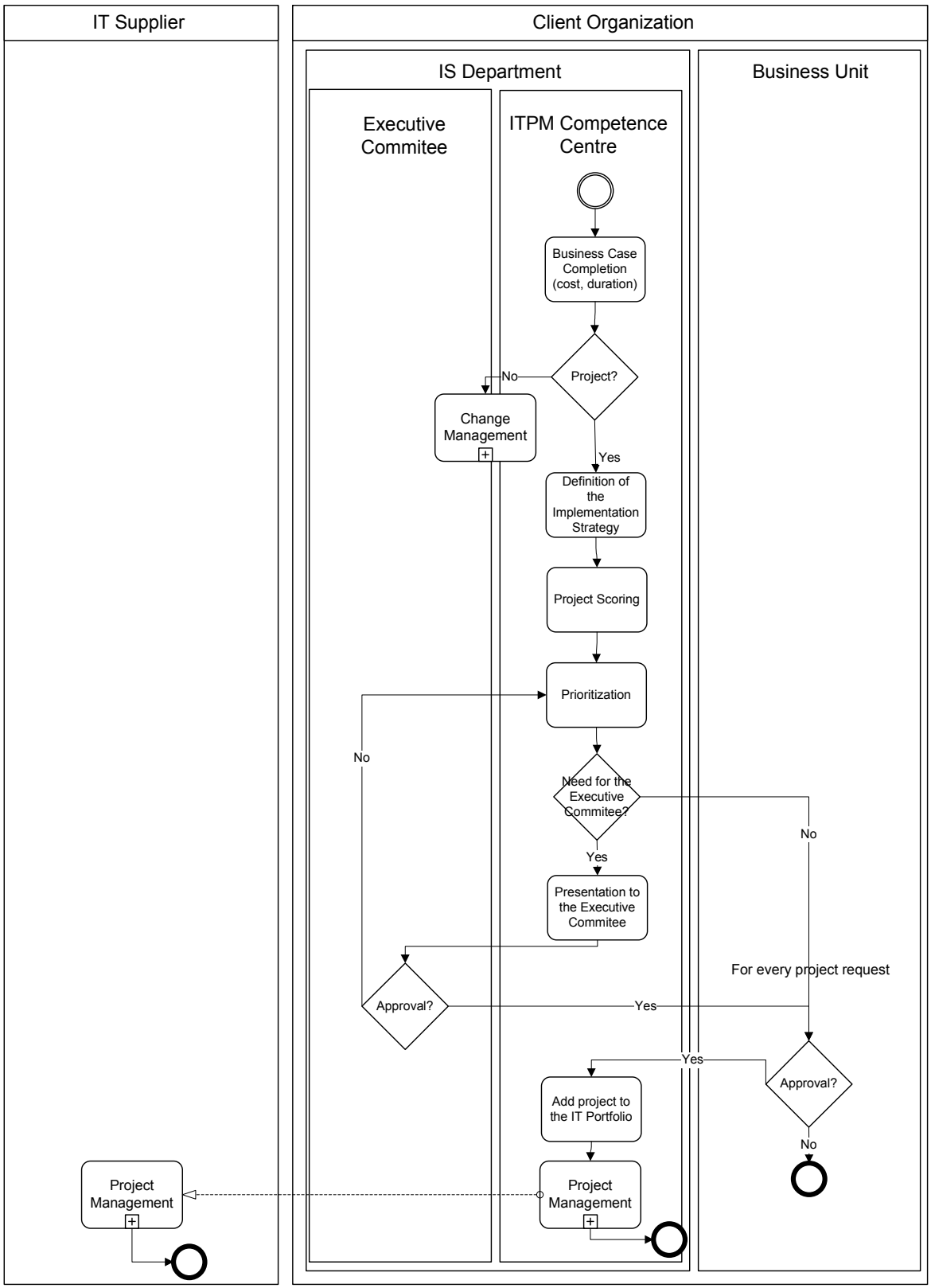


Figure 6-7: Proposed ITPM process model for the organization

7 Evaluation

Without the right sponsorship, organizational initiatives are doomed from the start. Sometimes this is a lesson that must be learned the hard way.

Projects that involve organizational change must be treated with care in order to succeed. Consequently, process reengineering projects require the approval of all the intervenients and support from the management staff for its modifications to be successfully implemented.

Although the organizational impact of the proposed solution wasn't extremely high, there were some key implementation aspects that needed do be addressed. Unfortunately, mainly because of external factors, some constraints undermined the expected implementation.

The following two sub-sections evaluate the work done and explain the reasons why some things went right and others went wrong. Sub-section 7.1 explains the external factors that contributed to the relative lack of success of the particular implementation in the stated organization. Sub-section 7.2 presents an evaluation of the work developed.

7.1 Undermining Factors

The major external factors that affected the project are, as stated previously, described in sub-sections 7.1.1 to 7.1.3.

7.1.1 The Lack of Technological Support

The benefits of automating an ITPM process are immense. Existing market applications provide valuable capabilities such as providing for a customizable set of metrics with the respective automatic classification, what-if scenarios, and information about available and occupied resources.

All these capabilities and the common integration with other modules, being ITPM part of large IT governance centres, make these kind of packages very expensive. This is a hurdle that organizations need to overcome, and can do so by developing proprietary solutions with open-source code.

However, the organization described in the previous chapter possesses a powerful tool, Mercury's IT Governance Centre. Among many other modules, this software bundle encapsulates a customizable IT portfolio management application. Therefore, as stated previously, the whole solution was designed with the objective of being supported by the stated application.

Once the work was completed, with the process flow well established, the scope of the activities defined and the necessary documents elaborated, it was time to implement the necessary customizations to the tool.

An assessment made on the tool, bearing in mind the required functionalities, identified the following inexistent capabilities that needed to be implemented:

Designation	***Description***
Business Case	Customization/ creation of the electronical form, in order to formalize and ensure an automatic flow. Capability of creating budgets and benefit estimations for further evaluation, as well as value and risk metrics for later scoring.
Notification Portlets	Creation of notification portlets, to warn the competence centre team of incoming project requests.
Resource Tracking	Creation of an interface to access the different IT supplier's resources, and their respective allocation.
What-if Scenarios	The tool allows for the creation of *what-if* scenarios. However, the system must also save these scenarios for future consult, whenever the revisions to the portfolio occur.
Change Management Interface	Creation of an automatic interface to redirect application change requests to their respective process.

Table 7-1: Required customizations to Mercury ITG

These functionalities would likely provide the sufficient support to create automatisms to the process, optimizing it as a whole. However, due to other priorities, the task was consecutively postponed until the organizational restructuring (see section 7.1.3).

On the one hand, the lack of visibility and sponsorship of the project made it a secondary priority, as other initiatives took place. On the other hand, without the technological support the process becomes less visible, as process modelling and execution should ideally be served in pairs.

7.1.2 **The Quest for Power**

In the information age, accessing information is crucial to perform most jobs. Getting privileged access to important information and being able to make decisions based on that, however, grants a person with tremendous power.

Being part of an IT portfolio management committee provides for such power. The access to information about all project requests of an organization and the ability to decide which ones to execute is a function that bears great responsibility. This is why the IT portfolio management solution proposed

contains an unambiguous method of prioritizing requests, to make the committee's job a little easier and make the process completely transparent.

It is also one of the main reasons why there was resistance to change when trying to implement the proposed solution in the previously stated organization. Because people from business units who submitted project request only associated general information to it, it was difficult to fairly distinguish among projects. However, this was a convenient solution for some. The decision, although requiring posterior approval by management staff, was made by a single employee, using a decisional Microsoft Excel spreadsheet. The spreadsheet, to which no one had access to, allegedly contained several formulas that were part of an algorithm this employee came up with.

The proposed solution obviously undermined this employee's power, who was the main intervenient of the process and one of its most important stakeholders. For several weeks there were meetings to try to overcome this hurdle and explain the benefits this kind of solution could bring to the organization.

With the help of "highly-ranked" sponsorship it was possible to come up with a solution. The new method would prevail, but the final score based on the different metrics would be calculated in the employee's spreadsheet, which required the customization of the ITPM tool to incorporate an interface with MS Excel. The results would then be migrated back to the main software, enabling the support of the following steps of the process. The calculation formula, of course, would be the newly proposed, only executed outside the tool to provide this employee with a dummy sense of power.

Despite not being the optimal solution, we believe it had to be done in order to solve this unexpected organizational problem.

7.1.3 **Organizational Change**

The single most important external factor of this project was the change in top management, as the former CIO was replaced by a new one.

By the time the former CIO left his position, the project was nearly finished and awaiting approval to be put in practice. The new process would be adopted, the necessary technological changes and customizations would take place and people would be introduced to the new templates, specially the business case. The only question was "when".

However, in mid April, the former CIO was replaced by a new one. This is a relatively common situation in organizations, as are the different personalities and different ideas that each top manager demonstrates. Organizations have to change in order to evolve, and changing for the better should always be considered a good thing. In this particular situation, however, it is our opinion that the organizational change ordered was not beneficial.

This information systems department was extremely oriented to a full outsourcing environment, with specific functional areas. Moreover, it was organized to act as a liaison between the business units and the IT partner, managing the relationship.

There was a “Governance and Strategy” area that ensured alignment with corporate governance and business strategy. This department issued the governance directives to the other functional areas, making decisions and approvals whenever necessary.

Focusing on ITPM, there was a functional area denominated “Logistics and Planning”, which acted as a single point of contact with the business. Therefore, all project requests fell into the same portfolio, where the decisions of which projects to execute would be made. Once given the “go decision”, projects were to be given a project manager, from the Project Management area, which would take the necessary measures to assure its start. This, as stated in the section 3 of this work, is unanimously considered a best practice.

However, with new management came an organization restructuring. The current organizational structure is depicted in the figure below.

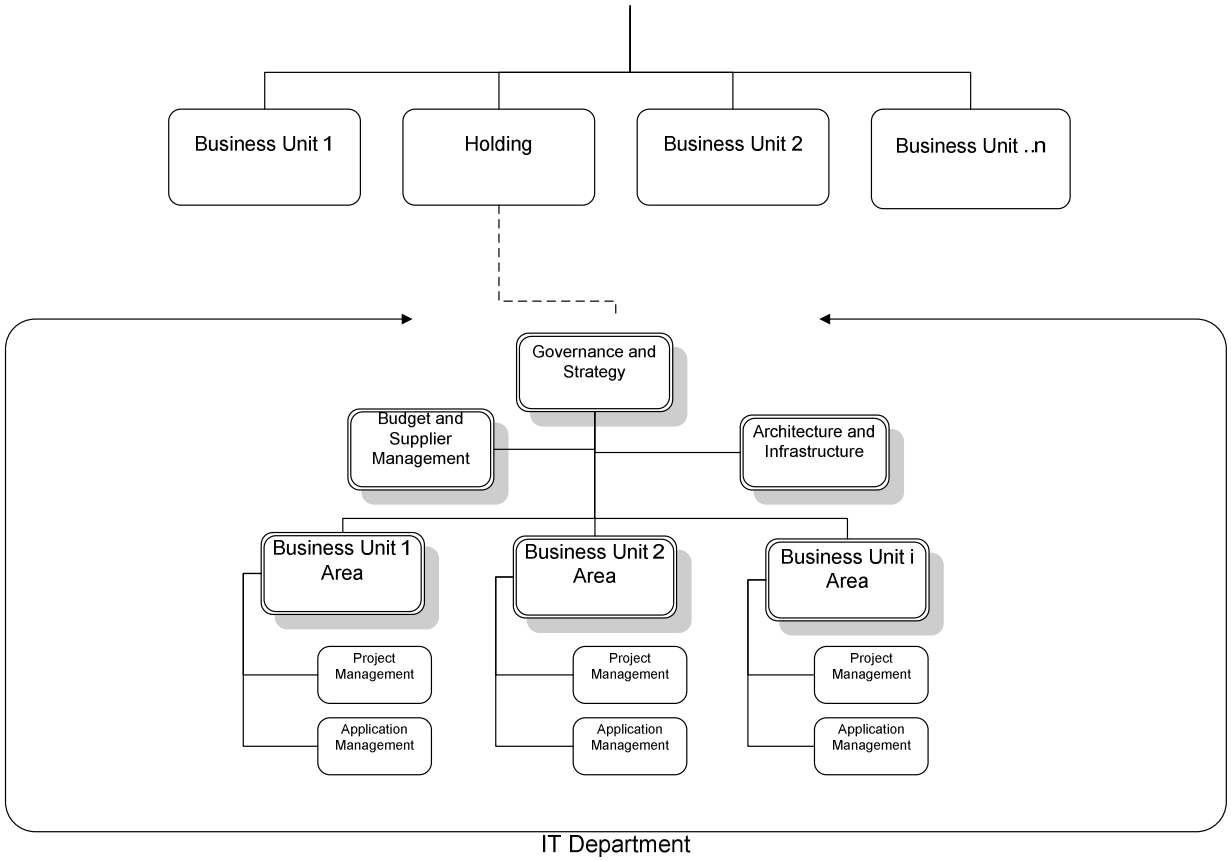


Figure 7-1: IT Department’s new structure

In our opinion this is precisely what should not be done. The diagram shows a vertical integration where there were created areas to serve each group of business units independently. Therefore, several Project Management and Application Management, among others, coexist in the department. However, the biggest problem is the fact that there isn’t a centralized competence centre to manage the IT portfolio.

Instead, each business unit has a determined budget to spend, and the portfolio prioritization is only done concerning each different sub-portfolio. The problems that this organization will encounter for not having an overall portfolio prioritization are obvious.

With the prioritization being made at a lower level, and a defined share of the overall portfolio allocated to each business unit, the problem is only partially solved. In fact, it can lead to situations where value-adding projects cannot take place and mediocre projects will execute because they are the best among the worst.

Without an overview of the overall portfolio it is hard to estimate what the available resources will be. Furthermore, it becomes almost impossible to optimize time and resources to meet the selected projects and their temporal restraints.

And so, due to this situation, the proposed process could no longer apply. Therefore, only the business case templates and some customizations to the IT portfolio management tool are expected to hit the production phase in the near future.

7.2 Process Evaluation and Results

Although this work was developed without a daily and direct supervision from people in the organization, and using an academic and non-biased approach, there were close ties with the major stakeholders of the project. In this way, there were periodic reviews of the work being done.

Table 7-2 summarizes the major modifications that had to be made during the development phase, and the final proposal is then evaluated in the next sub section.

Once the proposed solution was completed, it was sent for approval of the IT governance committee and the key intervenients of the process. This included the process flow itself, as well as the templates, prioritization method, and desired customizations to the ITG Portfolio Management tool.

The relevant changes, incorporated in the final version presented earlier in this work, were the following:

Change Requested	***Justification***
Grouping projects into a Program	Being a large organization with the occasional need of launching corporate programs, it was asked to create such a grouping method.
Splitting the business case template	Different metrics are the responsibility of different areas.

Table 7-2: Changes to the final proposal

The first change was the introduction of an additional means of grouping project requests, the group of similar projects in a Program. This functionality was needed because being a large organization, it sometimes needs to execute corporate programs, common to several business units. As they often have

to take maximum priority to satisfy an emerging business need or accomplish a crucial strategic objective, their execution might as well be divided in smaller, controllable projects. For prioritization means, however, the different projects conceptually form a program, with the combined set of metrics, unless it is a situation of the highest emergency.

The first proposal considered a single business case template that would be filled out by both the business and the IT department. However, it was decided that there should be the two mentioned templates. The rationale behind this decision was that information about the expected costs of the project should be the responsibility of only the IT department, and should be the result of the different business needs grouped in the project.

7.2.1 **Evaluation**

As previously stated, the context for the work developed changed drastically, and the proposal made is in stand-by until further notice.

Therefore, it is impossible to evaluate the complete framework, for there are no concrete results. However, the current ITPM process can be compared to the one proposed using an evaluation matrix. To do so, the ITPM Maturity Model proposed in [39] will be used, depicted in the following table:

ITPM Element	***Stage 0***	***Stage 1***	***Stage 2***	***Stage 3***
1. Centralization	No centralized database of projects.	All projects kept in one database; IT spending tracked centrally and rolled into one database.	In addition to the centralized database, a centralized project office is responsible for collecting, analyzing and distributing project information in a common format: Projects are monitored occasionally.	In addition to the centralized database, the centralized project office almost always monitors and controls projects.
2. Financial metrics	Financial metrics are not used for appraisal.	Some financial analysis is undertaken with special attention to Payback Period and ROI.	NPV and/or IRR are sometimes utilized for evaluation and prioritization of projects.	Financial analysis is always done. NPV and/or IRR are almost always used.
3. IT-investment decision-making techniques (e.g. Balanced Scorecard, KSF)	Such techniques are not used for appraisal.	Such techniques are used once in a while.	Such techniques are occasionally used to evaluate projects.	A combination of such techniques is used to get a holistic picture of projects and to evaluate projects almost always.

ITPM Element	*Stage 0*	*Stage 1*	*Stage 2*	*Stage 3*
4. Risk analysis	Risk and uncertainty are not considered during evaluation.	Occasionally risks are evaluated. In most cases the attention is in financing / cash flow risks.	Financing / cash flows risks are considered but most of the focus is in the complexity of the project and technology risk.	An extensive risk analysis is almost always performed. Attention is devoted to project complexity, technological risk, team experience and cash flow risks.
5. Interdependencies	Overlaps and duplication of project results are not considered.	Some consideration of overlaps and duplication of project results.	Cross-project dependencies and implementation bottlenecks are frequently considered.	Interdependencies are almost always managed. In addition, significant attention is given to cross-project dependencies.
6. Constraints	Constraints are not considered.	Little constraint analysis. Only the control of the budget/financial capacity is considered.	Frequently evaluate budget/financial capacity and competition for scarce resources. Staff capabilities are occasionally evaluated.	Budget/financial capacity constraints are always evaluated. Staff capabilities & competition for scarce resources are frequently managed.
7.Top management involvement	Top management is never involved in project selection.	Occasionally have top management involved in project selection.	Frequent involvement of top management in the project selection process.	Systematic review of projects at specific stages. Top management involved in the project selection process and business leaders are accountable for project results.
8. Optimization	No process in place to optimize the portfolio.	Very few processes to optimize the portfolio are in place. Some efforts are spent in generating regular project portfolio reporting.	Frequently have regular project portfolio reporting and annually, or more frequently, the overall project portfolio is prioritized.	Processes to optimize the portfolio are applied. Project outcomes are always compared with the original targets and project benefits are centrally tracked.
9. Specialized software	Manual: software is not used.	Non-specialized software used to manage the project portfolio.	Occasionally use specialized software to manage the project portfolio.	Use of portfolio software almost always- real time updates on the portfolio, performance and health.

Table 7-3: ITPM Maturity Model (Source: [40])

The results achieved are described in the table below. The table shows the stage that the organization is in, in each of the nine elements. In addition, it shows the possible stages that could achieve with the proposed solution.

A justification is also given to support the chosen stages in each square of the matrix.

ITPM Elements	***Current Situation / Justification***	***Proposed Solution / Justification***
1. Centralization	**Stage 1** – Projects are centralized in different locations, relating to each business group area.	**Stage 3** – A centralized competence centre to keep track of every project and prioritize project requests in the portfolio
2. Financial metrics	**Stage 3** – Financial analysis, namely NPV, ROI and Payback Period always used.	**Stage 3** – Financial analysis, namely NPV, ROI and Payback Period always used.
3. IT investment decision-making techniques (e.g. Balanced Scorecard, KSF)	**Stage 2** – Alignment with corporate and IT objectives ensured.	**Stage 2** – Alignment with corporate and IT objectives ensured.
4. Risk analysis	**Stage 2** – Risk assessment in every project request, with posterior scoring of risk metrics.	**Stage 2** – Risk assessment in every project request, with posterior scoring of risk metrics.
5. Interdependencies	**Stage 1** – Overlapping and duplication of projects are only considered in each sub-portfolio.	**Stage 3** – Formal method to group similar projects or that bear relevant interdependencies.
6. Constraints	**Stage 1** – The focus is on the control of available remaining budget.	**Stage 3** – projects prioritization based on benefit and cost constraints and resource availability among others.
7. Top management involvement	**Stage 2 –** project sponsors accountable for serious miscalculations; annual top management revisions of each portfolio and in conflict situations.	**Stage 2 –** project sponsors accountable for serious miscalculations; annual top management revisions of the portfolio and in conflict situations.
8. Optimization	**Stage 1** – Besides the annual revisions of each of the portfolios, other revisions occur in an ad-hoc manner.	**Stage 3** – Comparison of achieved with estimated results in the business case; portfolio optimization every four months.

9. Specialized software	**Stage 1 –** Use of spreadsheets and other non-specialized technologies.	**Stage 1 –** Use of spreadsheets and other non-specialized technologies, in case the identified customizations to the specialized tool were not implemented.

Table 7-4: As-is vs To-be evaluation

7.2.2 **Control Measures**

In order to access the future efficiency and ensure the quality of the process, several control measures were defined. Although these will not be put in practice, for now, they remain as a suggestion to the future. The control measures are listed in table 7-5 below. The description of each is given, as well as the organizational unit to which it corresponds.

Control Measure	***Organizational Unit***
Total number of project request / Per time unit / Per business unit	Business Unit
Total number of pending requests / Per time unit / Per business unit	Business Unit
Total number of rejected requests / Per time unit / Per business unit	Business Unit
Total number of projects in the portfolio / Per time unit / Per business unit	Business Unit
Total number of requests that originated one project / Per time unit / Per business unit	Business Unit
Total number of requests that originated more than one project / Per time unit / Per business unit	Business Unit
Total number of projects linked to a program / Per time unit / Per business unit	Business Unit
Total number of projects / Per state / Per time unit / Per business unit (Backlog)	IS Department
Medium deviation between the real and estimated duration of projects	IS Department
Medium deviation between the real and estimated cost of projects.	IS Department

Table 7-5: Control measures for the ITPM process

8 Conclusion

The way the IT portfolio of an organization is managed dictates how well the organization will perform both technologically and financially. Today's market constraints require most organizations to excel in the delivering of IT solutions, and the ones who struggle to keep up with the technological pace will almost certainly fall short on achieving competitive advantage.

Time is of the essence, and the time-to-market of services or products is absolutely crucial to the success of a technological initiative. Therefore, there is little room for error, and failed or off-budget, off-time projects must be avoided.

Meanwhile, many organizations are starting to embrace full IT outsourcing strategies, expecting to become more agile and efficient in delivering their IT solutions.

The real challenge is to achieve a satisfactory combination of both practices. That is, managing the IT Portfolio in a full outsourcing context, where it has harder to know what and when resources are available. This was the problem that tried to be solved in this work.

A solution for the stated problem was presented, in the form of an IT Portfolio Management framework. This solution is generic and intends to provide orientation lines to follow, in order to achieve a successful IT portfolio.

The case study provided a way to implement a specific solution. It is a large organization that is struggling with the ability to satisfy all incoming IT project requests and to find a way to establish a fair prioritization method. This problem is, once again, aggravated by the fact that the organization works with close ties with an IT supplier, in a full outsourcing context.

However, the theoretical solution alone isn't enough to achieve satisfactory results regarding IT Portfolio Management. In fact, despite their proven abilities, many organization-related initiatives fail for various reasons. Therefore, the implementation of the solution has to be properly and carefully executed. There has to take place an effective communication plan, with the scope and objectives of the process well defined. Additionally, attention must be put on the employees' fears and distrusts, especially the most important ones to the success of the initiative and the ones that can undermine it.

Finally, the work doesn't end with implementation of the solution. For each project the actual and expected outcomes must be compared, which will enable managers to assess the overall situation and improve the process' efficiency over time.

8.1 Main Contributions

This section presents an analysis of the main contributions of the project, subdivided in three different dimensions.

8.1.1 **ITPM Process**

Sometimes there is the need to let go of the great, and stick to the good. This is often true regarding organizations, where changes are seen with special fear and distrust.

The work started with the assessment of the current situation, taking a blueprint of the as-is process and associated documentation. Because there is no need to reinvent what is already being correctly done throughout the world, the next step was to study the state-of-the-art of IT portfolio management, allowing for the identification of best practices and common pitfalls, among others.

After these first two steps were completed, and starting from the conclusions gathered, the design of the process started. Through different iteration stages the process flow was designed, with the identification of the activities, participants and major interfaces. It was an ongoing work, which also consisted in the definition of the business case and identification of the necessary changes to implement in the ITPM workflow tool, Mercury's IT Governance Centre.

8.1.2 **Organizational Impact**

The impact on the organization wasn't (at least until now) as high and positive as expected, as some key factors undermined a completely successful implementation of the proposed solution.

The potential of the solution was, in our opinion, pretty high. An efficient method of selecting and prioritizing all the organization's IT investments could greatly optimize the IT portfolio and provide for huge savings, avoiding the execution of invaluable projects.

The framework itself was ready to enter a production phase. Through several meetings during the design phase, new functionalities or changes were successively introduced, shaping the framework to the particular needs of the organization. However, some unexpected external factors came up.

The change in top management proved to be fatal, as the newly appointed CIO proposed a new organizational structure that didn't contemplate the management of the IT portfolio. We strongly believe that this a step back in trying to converge the organization's IT governance to known best practices. In fact, we believe that in the near future people will look back and realise the mistake made, with the IT budget being spent in a *had-oc* manner and without the expected return.

8.1.3 **Measuring ROI**

A successful IT Portfolio Management can indisputably lead to improved results. In fact, its potential ROI is huge, in the way that millions can be saved by avoiding the execution of invaluable or excessively costly, time and resource consuming projects.

However, whereas it is almost sure that the project portfolio will be valuable altogether, it isn't easy to measure the impact of "what it is" versus "what would have been" situations.

Therefore, the easiest and most accurate way of measuring the ROI of ITPM is to do the opposite, compare the expected outcome of chosen projects to the actual results. This emphasises the importance of a rigorous business case and obviates the fact that ITPM doesn't end in selecting which projects to execute. The assessments made will give a pretty accurate idea of what the overall process' efficiency is, and allowing for future improvements. Optimality is hard to achieve, put ITPM takes organizations one step closer.

8.2 Future Work

The focus of this work was to propose a framework for solving the particular problem of managing an organization's IT portfolio, especially in a full outsourcing context. However, there is some related work that could be done, that fell out of the defined scope.

In addition to ITPM, there are other IT Management processes that are crucial for running the IT function.. Some of these processes are part of ITIL, the known set of best practices, to whom ITPM has close ties. For instance, it could gather information from Configuration and Capacity Management in order to better estimate the available resources and could provide cost targets for IT Financial Management to work on. Future work could focus on analyzing the possible interfaces and propose a means of integration of these processes, in order to maximize the value of each one to the business.

The solution was proposed without any technological restrictions. That is, it can either be implemented with or without the support of an ITPM application. However, a good technological support will provide for automation benefits, as well as offering analytical and predicting tools.

The development of a complete ITPM application isn't by all means straightforward, as it will have to contain different capabilities and powerful decision-support tools like 'what-if' scenarios. Moreover, these applications are often integrated in large IT governance packages, containing multiple modules. These are the main reasons why the ITPM market is flooded with expensive products and lacking cheap, value for the money solutions.

However, taking into consideration all the best practices, decisive features and pitfalls identified, and with the generic process flow established, an ITPM application could be developed in the future. It would ideally offer interfaces with other applications, like a CMDB, in order to fully support the generic process.

References

1. **Jeffrey, Mark and Leliveld, Ingmar.** Best Practices in IT Portfolio Management . *MIT Sloan Management Review.* Spring, 2004.

2. **Goldstein, Philip J. and Jeffrey, Mark.** IT Portfolio Management for Colleges and Universities: Balancing Risk/Return for Strategic Results. *ECAR.* February, 2996.

3. **Cooper, Bob and Edgett, Scott.** Ten Ways to Make Better Portfolio and Project Selection Decisions. *PDMA Visions Magazine.* June, 2006.

4. **Datz, Todd.** Portfolio Management: How to Do It Right. *CIO Magazine.* May, 2003.

5. **Jeffrey, Mark and Leliveld, Ingmar.** IT Portfolio Management Challenges and Best Practices. *Kellogg School of Management and Diamond Cluster.* Spring, 2003, pp. 1532-1539.

6. **Landsberg, M and Meilijson, I.** Demand for Risky Financial Assets: A Portfolio Analysis. *Journal of Economic Theory.* 1990.

7. **HP.** Transforming IT Organizations into Service Providers. [ed.] IEEE. 2003.

8. **Sallé, Mathias.** IT Service Management and IT Governance; Review, Comparative Analysis and their Impact on Utility Computing. *HP Techreports.* 2004, pp. 95-104.

9. **itSMF.** IT Service Management, an Introduction. 2004.

10. **Bon, Jan van, Pieper, Mike and Veen, Annelies van der.** *Foundations of IT Service Management based on ITIL.* s.l. : Van Haren Publishing, 2006.

11. **Berry, John.** IT Optimisation Solutions: Transforming the enterprise. *IBM Global Services InternetWeek Online.* 2002.

12. **Microsoft.** MOF Executive Overview. *Microsoft TechNet.* August, 2004.

13. **Young, C.M.** An Introduction to IT Service Management. *Gartner Research Note.* 2004.

14. **Rosenthal, S and Salle, M.** Formulating and Implementing an HP IT Program Strategy using CobiT and HP ITSM. *HICSS: Proceedings of the 38th Annual Hawaii International Conference on System Sciences.* 2005.

15. **ITGI.** Control Objectives for Information and Related Technology . 3rd Edition, 1998.

16. **Weill, Peter and Woodham, Richard.** Don't Just Govern: Implementing Effective IT Governance. *MIT Sloan Management Review.* April, 2002.

17. **Ysteuparaert, Dirk.** IT Governance Survey 2006. *PwC Publications.* 2006.

18. **Ballou, Melinda and Elliot, Stephen.** Establishing IT Governance and IT Portfolio Management for Business Adaptability. *IDC.* December, 2005, #34670.

19. **George, Jennifer and Jones, Gareth.** Contemporary Management. *McGraw-Hill.* 3rd Edition, 2003.

20. **Barthelemy, Jerome.** The Hidden Costs of IT Outsourcing. *MIT Sloan Management Review.* Spring, 2001, 42.

21. **DiRemoaldo, Anthony and Gurbaxani, Vijay.** Strategic Intent for IT Outsourcing. *Sloan Management Review.* 1998, #140.

22. **Chaudhury, A., et al.** A Relationship Perspective on IT Outsourcing. *ACM.* December, 2003, Vol. 46.

23. **Hongxun, Jiang, Honglu, Du and Xiang, Ye.** Research on IT Outsourcing based on IT Systems Management. *ICEC'06: Proceedings of the 8th International Conference in Electronic Commerce.* 2006.

24. **Gewald, Heiko and Helbig, Kay.** A Governance Model for Managing Outsourcing Partnerships; A View from Practice. *HICSS: Proceedings of the 39th Annual Hawaii International Conference on System Sciences.* 2006.

25. **Handler, Robert and Maizlish, Bryan.** *IT Portfolio Management Step-by-Step.* s.l. : Wiley, 2005.

26. **Bonham, Stephen S.** *IT Project Portfolio Management.* s.l. : Artech House Inc., 2005.

27. Enterprise IT Portfolio Management. [Online] Sexonia Systems. http://www.saxsys.de/consulting/ITPortfolioManagement.asp.

28. **Cooper, Robert G., Edgett, Scott J. and Kleinschmidt, Elko J.** New Problems, New Solutions: Making Portfolio Management More Effective. *Stage-Gate.* 2000.

29. **Aral, Sinan and Weill, Peter.** Generating Premium Returns on Your IT Investments. *MIT Sloan Management Review.* Winter, 2006.

30. **Wood, Michael R.** PPM: Concepts, Tools and Approaches. *Gantthead.* November, 2006.

31. **Cooper, Robert, Edgett, Scott and Kleinschmidt, Elko.** Optimizing the Stage-Gate Process: What Best practice Companies Do. *Industrial Research Institute.* September, 2002, Vol. 45, 5.

32. **Jeffrey, Mark and Monteiro, Sheldon.** Missing Millions: Unlocking Strategic IT Value. *Kellogg Publications.* 2006.

33. **Machavarapu, Sai.** Steps to Prioritization. *CIO Editorial.* July, 2006.

34. **Marco, David.** The Importance of Data Integration. *TDAN.com.* July, 2004.

35. **Visitacion, Margo.** The Forrester Wave: Project Portfolio Management, Q1 2006. *Forrester.* March, 2006, pp. 95-104.

36. **Ballou, Melinda, et al.** Worlwide IT Project and Portfolio Management 2005-2009 Forecast and 2004 Vendor Sales. *IDC.* December, 2005, #34221.

37. **Dibbern, Jens, et al.** Outsourcing: A Survey and Analysis of the Literature. *ACM SIGMIS Database.* 2004.

38. **White, Stephen A.** Introduction to BPMN. *IBM Corporation.* May, 2004.

39. **Loong-Tatt, Benjamin, Oh, Lih-Bin and Teo, Hock-Hai.** IT Portfolio Management: A Framework for Making Strategic IT Investment Decisions. *ECIS'07: The 15th Europeean Conference on Information Systems.* 2007.

40. **Cooper, Robert G.** Stage-gate systems: A new tool for managing new products. *Business Horizons.* May-June, 1990, Vol. 33, 3.

41. **Kendrick, Tom.** Defining and Implementing Metrics for Project Risk Reduction. 2005

42. **Hayes, Ian S.** Managing the Project Portfolio. *Clarity Consulting White Paper,* 2004.

43. **Chabrow, Eric.** Businesses Apply New Metrics in Measuring IT's Value. *InformationWeek*, 2006.

44. **Business Engine.** Embracing the Complete Value of Project Portfolio Management. *Business Engine White Paper*, 2004.

A. IT Management Frameworks

Conceptual, high level views of the previously referred service management frameworks.

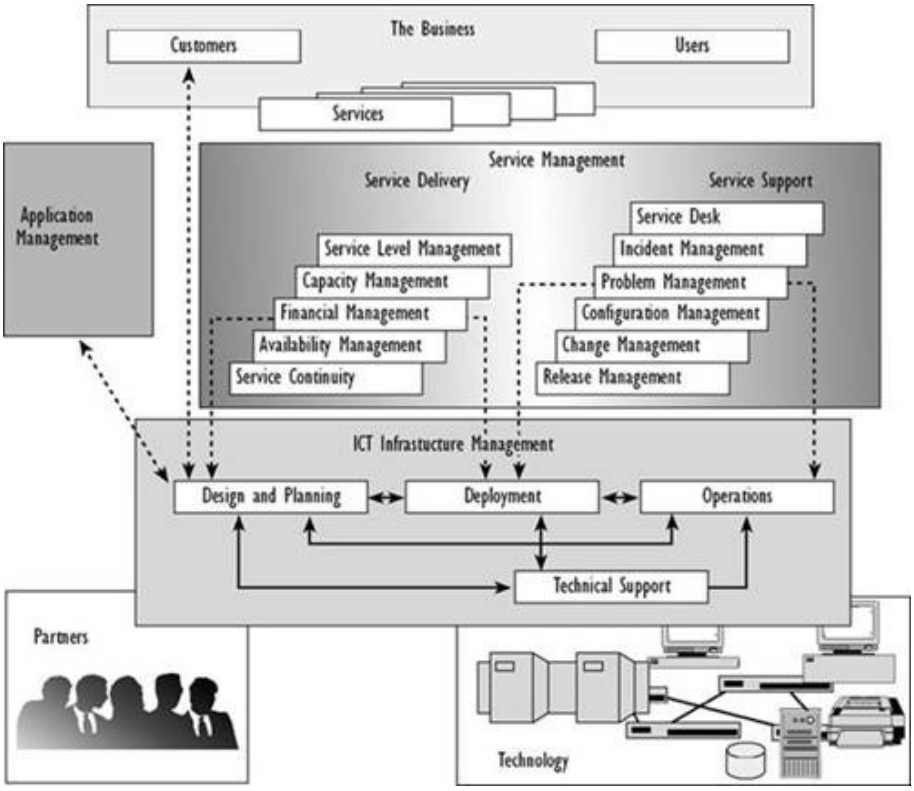


Fig 1:ITIL's high level structure

Fig 2: Microsoft Operations framework

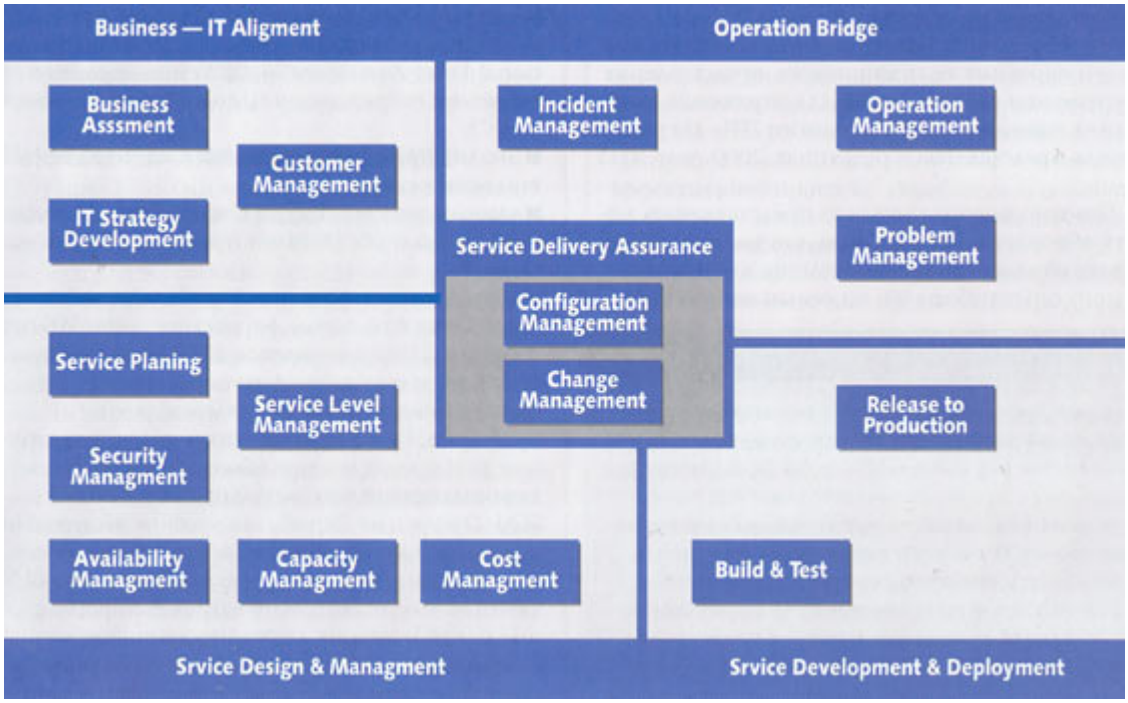


Fig 3: HP IT Service Management framework

B. Mercury ITG

This section presents a conceptual overview and some screen shots of the ITPM tool which was analyzed in the case study, helping to demonstrate its great potential.

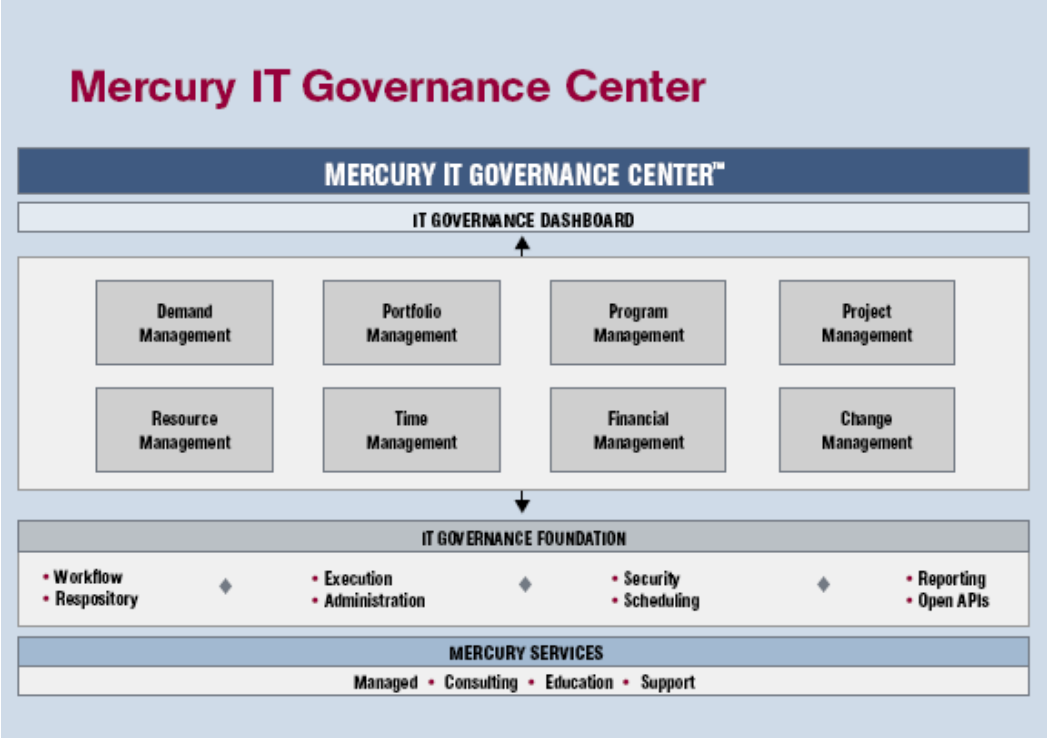


Fig 4: The different modules of the package

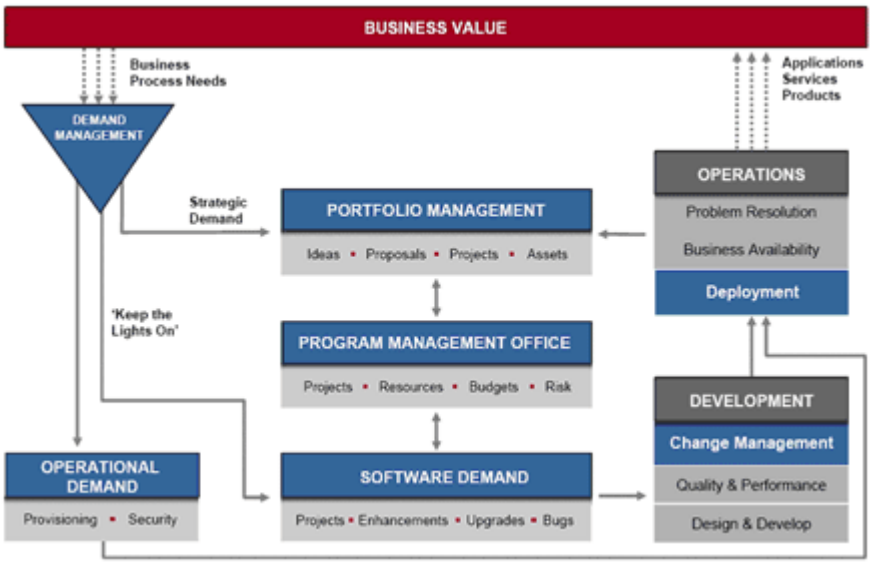


Fig 5: The whole IT Governance process that the tool has natively.

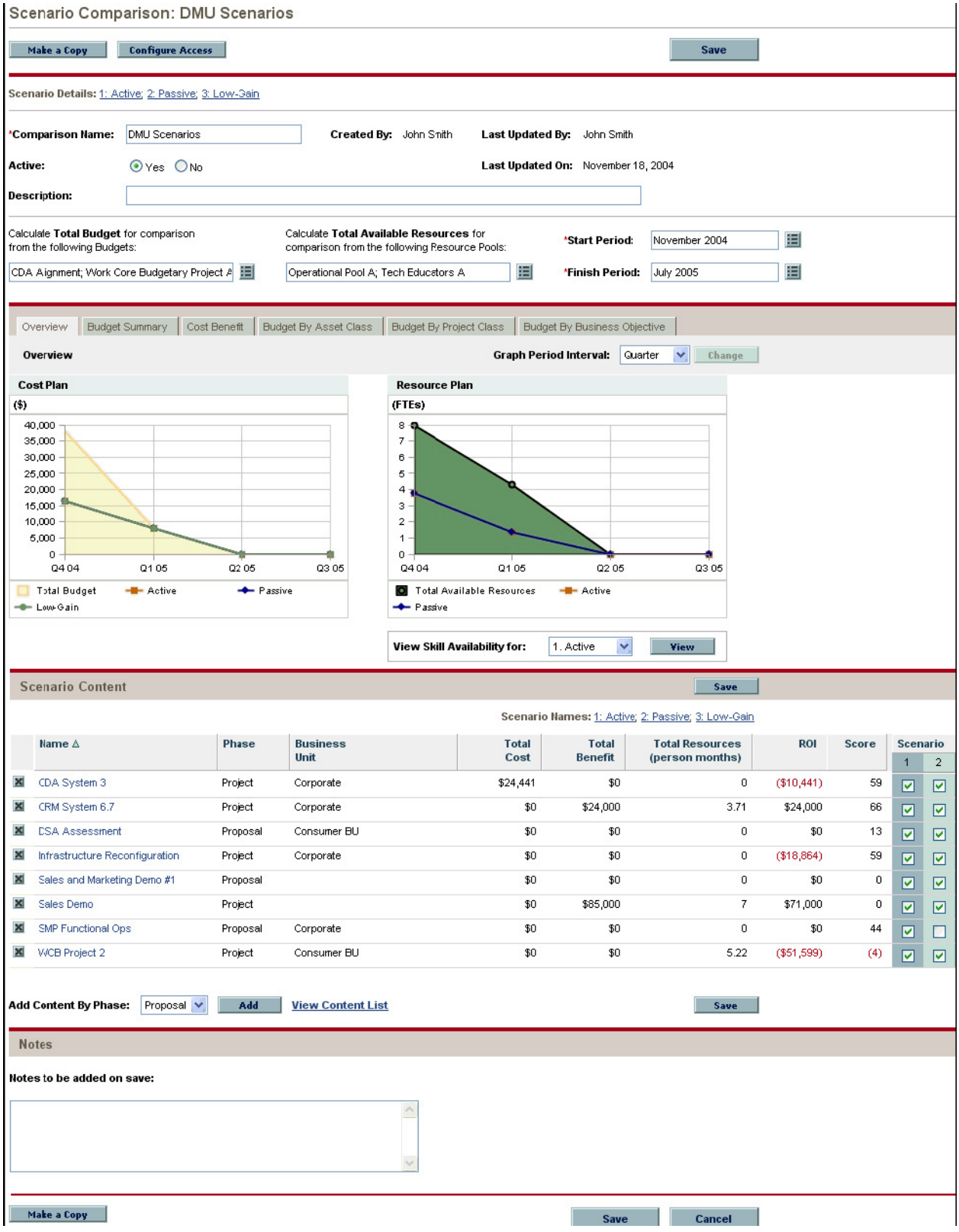


Fig 6: Example of a *what-if* scenario

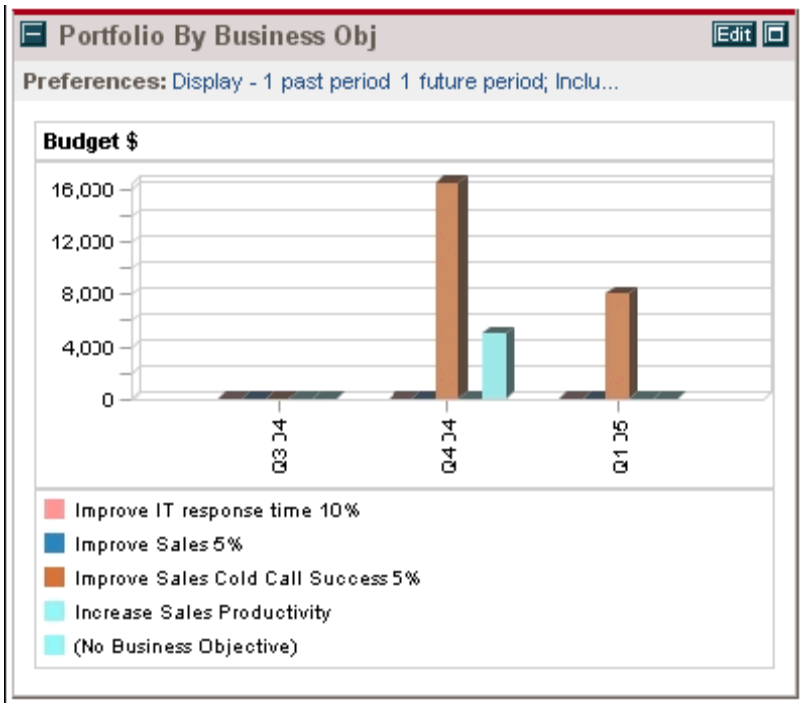


Fig 7: Vision of the IT portfolio by category portlet

C. QPR Process Guide

A picture of a process modeled in QPR, the process modeling tool of the organization, is shown.

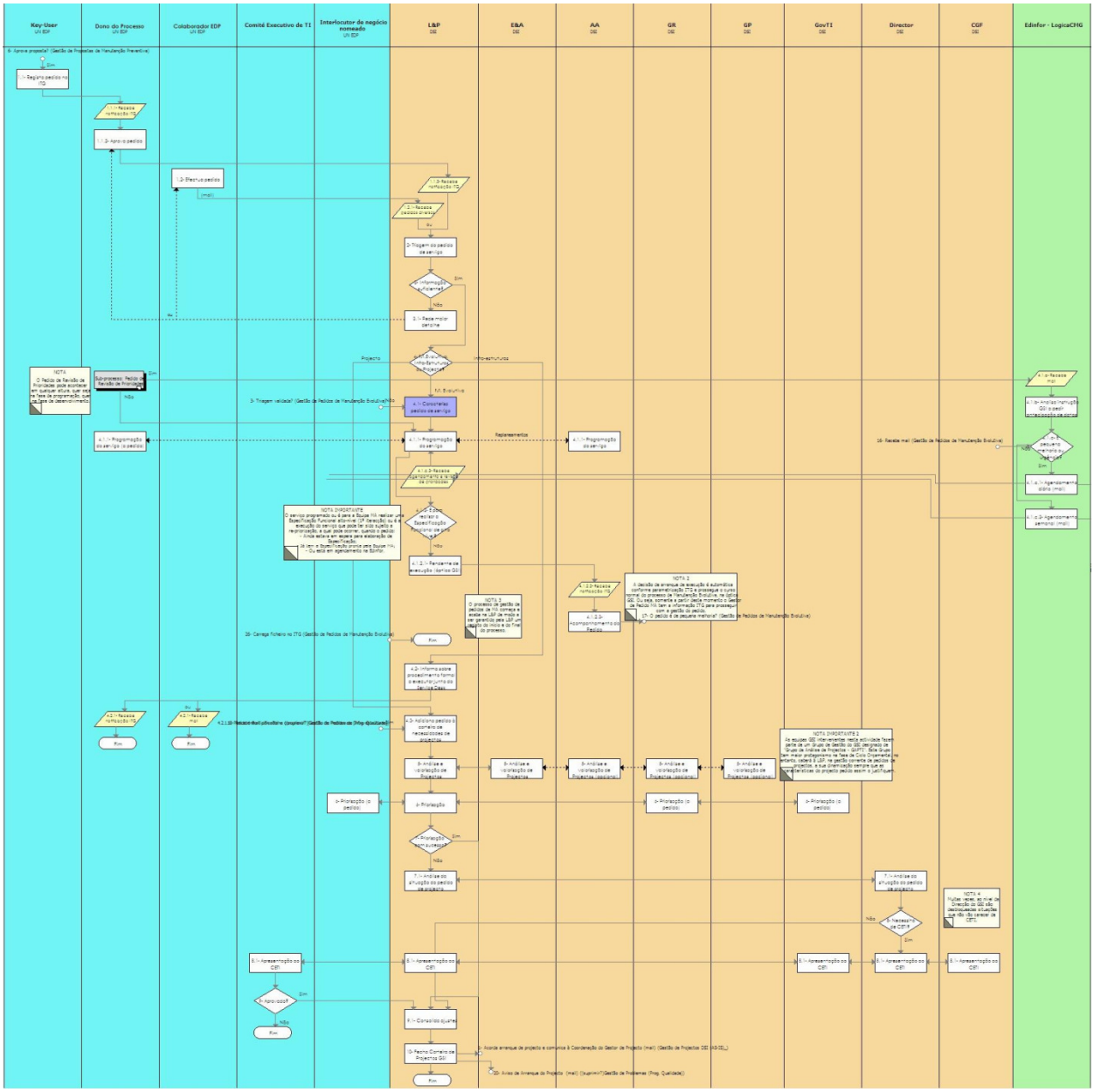


Fig 8: Process modeled in QPR