ISCTE IUL
Instituto Universitário de Lisboa

Department of Sciences and Information Technologies

Data Driven Decision Support Systems as a Critical Success Factor for IT-Governance
an Application in the Financial Sector

By

João Filipe Marques Costa

A Dissertation presented in partial fulfilment of the Requirements for the Degree of
Master in Integrated Decision Support Systems

Supervisor:
PhD Henrique O'Neill,
Professor at ISCTE

October, 2009

Acknowledgements

First of all I would like to thank Professor Henrique O'Neill for teaching me how to develop a dissertation and to make me aware of the importance of developing research in enterprises. Surely without is time, patience and encouragement this dissertation wouldn't be a reality. Thank you.

I would also like to thank the enormous support I have received from my colleagues at the company I work for: Nicolau Romão and Joaquim Calhau for making my studies financially possible and for giving me the time and corporate knowledge needed to better align research with corporate needs; Rui Costa for supporting the Case Study and for believing that doing thinks right is researching, studying and implementing a real aligned solution with best practises, frameworks and body of knowledge; Telmo Henriques and Nuno Perry for his wisdom on research and for is enormous support when time, patience and other priorities almost made this research a second priority; Tito Torres for his knowledge on IT-Governance best practises and for believing this is a true important topic that deserved more research; Carlos Gouveia for his belief in the project and for is support on making meetings happen with all parties involved in the project. I would also like to thank a big friend of mine that shares the same passion for Data Driven Decision Support Systems for is contribution in validating the model even when is time balance was already negative.

Last but surely not the least, Maria José Trigueiros, for her enthusiast and belief that Decision Support Systems are a key topic in every single day of our life, as she sometimes say, "Decide, but decide wisely". Maria, your enthusiast will always be here with us (Master Degree students) and we have all, somehow, plan to widespread that passion of yours.

Data Driven Decision Support Systems as Critical Success Factor for IT-Governance – Application in the Financial Sector

by Costa J., ISCTE Lisbon University Institute, Lisbon, Portugal.

Abstract:

IT-Governance has a major impact not only on IT management but also and foremost in the Enterprises performance and control.

Business uses IT agility, flexibility and innovation to pursue its objectives and to sustain its strategy. However being it more critical to the business, compliance forces IT on the opposite way of predictability, stability and regulations. Adding the current economical environment and the fact that most of the times IT departments are considered cost centres, IT-Governance decisions become more important and critical.

Current IT-Governance research and practise is mainly based on management techniques and principles, leaving a gap for the contribution of information systems to IT-Governance enhancement.

This research intends to provide an answer to IT-Governance requirements using Data Driven Decision Support Systems based on dimensional models. This seems a key factor to improve the IT-Governance decision making process.

To address this research opportunity we have considered IT-Governance research (Peter Weill), best practises (ITIL), Body of Knowledge (PMBOK) and frameworks (COBIT).

Key IT-Governance processes (Change Management, Incident Management, Project Development and Service Desk Management) were studied and key process stakeholders were interviewed. Based on the facts gathered, dimensional models (data marts) were modelled and developed to answer to key improvement requirements on each IT-Governance process. A Unified Dimensional Model (IT-Governance Data warehouse) was materialized.

To assess the Unified Dimensional Model, the model was applied in a bank in real working conditions. The resulting model implementation was them assessed against Peter Weill's Governance IT Principles.

Assessment results revealed that the model satisfies all the IT-Governance Principles.

The research project enables to conclude that the success of IT-Governance implementation may be fostered by Data Driven Decision Support Systems implemented using Unified Dimensional Model concepts and based on best practises, frameworks and body of knowledge that enable process oriented, data driven decision support.

Key words: IT-Governance, Data Driven Decision Support Systems, Peter Weill's IT Principles, ITIL, PMBOK, COBIT, Financial Sector

Index

1. Introduction

1.1. Scope

IT-Governance has a major impact not only on IT management but also and foremost in Enterprises performance and control.

IT-Governance research is mainly based on management techniques and principles. This research intents to create the bridge between IT-Governance best practises (ITIL), Body of Knowledge (PMBOK), frameworks (COBIT) and principles (Peter Weill IT-Governance principles) and decision support systems, revealing the importance, up to critical success factors, of Data Driven Decision Support Systems.

1.2. Problem

Business uses IT agility, flexibility and innovation to pursue its strategy but at the same time, with IT being more critical to business, compliance forces IT on the opposite way, predictability, stability and regulations. Adding the current economical environment and the fact that most of the times IT departments are considered cost centres, IT-Governance decisions become more important and critical.

To adopt DD-DSS using dimensional models is a unique opportunity to improve IT-Governance decision making process.

1.3. Objectives

1. Analyze IT-Governance
2. Best Practices and Frameworks;
3. Identify key IT-Governance Processes;
4. Understand the role of Decision Support Systems in Financial Sector and IT-Governance;
5. Understand Role of Decision Support Systems in IT-Governance;
6. Develop a Data Driven Dimensional Model for selected IT Governance Processes;

7. Evaluate the model based on a real world implementation and on IT Governance Principles;

1.4. Methodology

1. Analyze IT-Governance frameworks, best practices and bodies of knowledge;
2. Identify IT-Governance principles and problems;
3. Analyze IT-Governance key processes;
4. Propose and use an Implementation Methodology for Data Driven Decision Support Systems (DD-DSS) in IT-Governance scenarios (based on DD-DSS implementation methodologies);
5. Design a Unified Dimensional Model (UDM) based on IT-Governance selected processes. The UDM needs to answer the identified IT-Governance problems and enhance IT-Governance principles;
6. Deploy the model in a Real World Scenario in a financial group:
    a. Understand the differences between Best Practice/Frameworks/Standards and Real World Implementations;
    b. Develop and deploy Extract, Transform and Load (ETL) packages to feed model;
    c. Evaluate the Real World Scenario implementation model implementation (what could not be deployed based on process maturity or operational information);
7. Understand what IT-Governance principles can be satisfied with the proposed DD-DSS model and real case implementation;
8. Understand what challenges the model deployment has raised;

1.5. Structure

1. Introduction (this chapter)
2. State of Art – Enterprise, Corporate and IT-Governance research. ITIL, COBIT and PMBOK concepts. Financial sector IT-Governance and DSS are also researched in this chapter.
3. IT Governance DD DSS Proposition
4. Proposition Assessment

5. Conclusions and Recommendations

1.6. Contribution

As a result of this research the following deliverables have been developed:

1. This research document;
2. IT-Governance Unified Dimensional Model (Data Warehouse Bus Matrix) and specific Dimensional Model Details for Change Management, Incident Management, Project Development and Service Desk Management;
3. Metadata specification for the IT-Governance Unified Dimensional Model (including around 650 attributes and dimensions used in the model)
4. IT-Governance Dashboard application used in Real Case Scenario (including 4 dashboards for each process and another dashboard for IT senior managers)

All these deliverables will become available in a dedicated initiative names IT-Governance Decision Support Systems at http://www.itgovernancebi.com. It is also important to mention that this research topic, including some of the topics mentioned in the "Further research recommendations", will be addressed in this initiative.

2. State of the art

2.1. Enterprise Governance

Enterprise Governance is an emerging subject that Chartered Institute of Management Accountants (CIMA) and others use to describe a "...framework that covers both the corporate governance and the business management aspects of the organization..."(International Federation of Accountants, 2004). Achieving good corporate governance that is linked strategically with performance management will enable companies to focus on the key drivers that move their business forward. "The set of responsibilities and practices exercised by the board and executive management with the goal of providing strategic direction, ensuring that objectives are achieved, ascertaining that risks are managed appropriately and verifying that the organisation resources are used responsibly" (IT Governance Institute, 2004).Illustration 1

This holistic definition has several benefits.

a) It reflects the dual role of the board of directors in both monitoring and strategy, and acknowledges the inherent short and long term relationships between governance and value creation.
b) It emphasizes the role of the executive management team.
c) It covers the internal activities of the organization as well as the outward facing aspects.
d) It may help to demonstrate the importance of the different emphasis of the roles of the chairman and chief executive officer (CEO) – and therefore why they need to be apart.
e) It helps to illustrate the multiple roles of the accountant.
f) It can demonstrate the importance of substance over form.
g) It can accommodate the different governance models across the world.

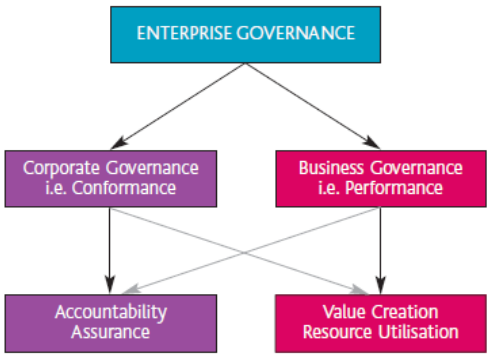


Illustration 1 - Enterprise Governance as Corporate Governance and Business Governance

2.2. Corporate Governance

The conformance dimension of enterprise governance has had significant coverage in recent years and, in particular, in the last years following the various corporate governance failures.

Corporate Governance "provides the structure for determining organizational objectives and monitoring performance to ensure that objectives are attained"(Organization for Economic Cooperation and Development, 2004)

It is normally called "corporate governance" and covers issues such as:

a) the roles of the chairman and CEO;
b) the board of directors, e.g., composition, non-executive directors, training etc;
c) board committees e.g., audit, remuneration and nominations committees;
d) internal controls in an organization;
e) risk management and internal audit;
f) executive remuneration.

Within the conformance dimension, the role of the professional accountant in business is that of control to ensure accountability; and of internal audit to assure that the controls are effective. The primary role of the external auditors is to give an

independent opinion on the truth and fairness of the financial statements of the enterprise. Depending on the jurisdiction in which the enterprise is based, they may also be required to give an independent opinion on the enterprise compliance with certain requirements of the law and regulations. In fulfilling their role, the external auditors will work closely with those in charge with the governance of the enterprise; in particular with the auditing committee, where one exists. There are well-established oversight mechanisms for the board to ensure that good corporate governance processes are effective, e.g., committees mainly or wholly composed of independent (non-executive) directors and, in particular, the audit committee. Similar mechanisms are typically in place in countries where a separate audit committee does not exist.

There are two perspectives for corporate governance:

a) Behavioural: Corporate Governance encompasses the relationships and ensuing patterns of behaviour between different agents in a limited liability corporation; the way managers and shareholders but also employees, creditors, key customers, and communities interact with each other to establish the strategy of the company
b) Normative: Corporate governance also refers to the set of rules that frame these relationships and private behaviours, thus shaping corporate strategy formation. These can be the company law, securities regulation, listing requirements. But they may also be private self-regulation

2.3. Business Governance

The performance dimension does not lend itself in an easy way to a regime of standards and audit. Instead, it is desirable to develop a range of best practice tools and techniques that need to be applied intelligently within different types of organization.

The focus here is on helping the board to:

a) make strategic decisions;
b) understand its appetite for risk and its key drivers of performance, and;
c) identify the critical points at which it needs to make decisions.

Business Governance, as a component of Enterprise Governance, can be seen in tools like Balanced Scorecards, where financial perspective is one of four others (Customer, Internal business processes and Learning and growth). According to Kaplan & Norton "BSC Strategies differed so that the organisational changes differed from company to company. The common feature, however, was that very strategy-focused organisation put strategy at the centre of its change and management processes. By clearly defining the strategy, communicating it consistently, and linking it to the drivers of change, a performance-based culture emerged that linked everyone and every unit to the unique feature of the strategy"(Kaplan & Norton, 2000).

This tool would allow not only strategic alignment but also the ability to drive performance in a balanced way. Illustration 2

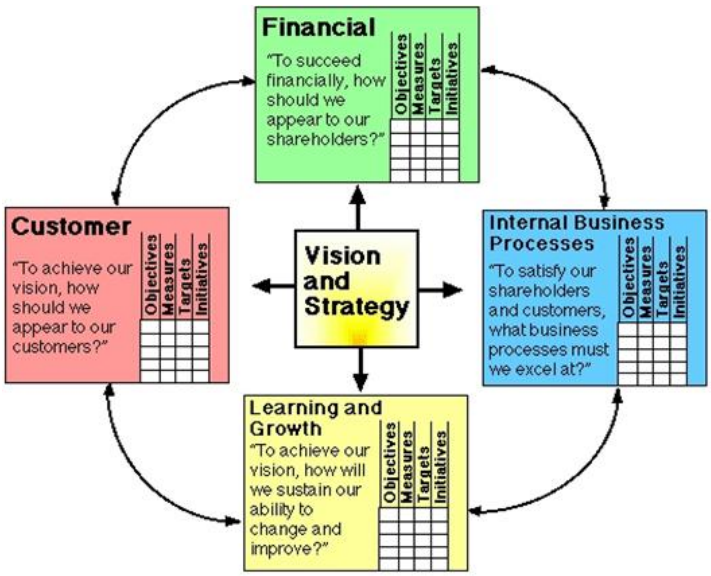


Illustration 2 - Balanced Scorecard as tool for Enterprise Governance

The connection between Corporate Governance and Business Governance has been mentioned in frameworks that were originally made to satisfy risk management, like Corporate Governance issues like Committee of Sponsoring Organizations of the Treadway Commission (COSO) were "risk management is as a tool to provide reasonable assurance regarding the achievement of entity objectives,", a clear focus on objectives and thereby performance.

There are also suggestions that despite most companies treat Corporate Governance and Business Governance separately and tend to implement it as a compliance measure(Gates, 2006), when asked about the benefits of risk management, these same sample companies hint primarily at performance benefits, such as allowing them to make better-informed decisions, to obtain greater management consensus, to improve management accountability, to better meet strategic goals and to use risk as a competitive tool.

2.4. IT Governance

2.4.1. Concepts

IT Governance is part of both Corporate and Business Governance. As in Enterprise Governance beginnings, the focus was mainly in Corporate Governance because IT was managing business information consequent its risks.

Recognition of the importance to decrease the distance between these two concepts was made when in 1998 the Information Systems Audit and Control Association (ISACA), an association related to IT Corporate Governance, created the Information Technology Governance Institute (ITGI) an institute that would broaden the intervention area to the Business Governance perspective.

"ITGI aims to benefit enterprises by assisting enterprise leaders in their responsibility to make IT successful in supporting the enterprise mission and goals"(ITGI, 2009).

IT Governance definitions come from Frameworks (ISACA/ITGI COBIT, TOGAF), Enablers (ISACA/ITGI), standards (ISO 38500, ISO 20000) and researchers (Peter Weill).

ITGI defines IT-Governance as "integral part of enterprise governance and consists of the leadership and organisational structures and processes that ensure that the organisation sustains and extends the organisation's strategies and objectives. IT governance is the responsibility of the board of directors and executive management."(IT Governance Institute, 2004).

The Open Group Architecture Framework (TOGAF) states that "IT governance provides the framework and structure that links IT resources and information to enterprise goals and strategies. Furthermore, IT governance institutionalizes best practices for planning, acquiring, implementing, and monitoring IT performance, to ensure that the enterprise IT assets support its business objectives."(The Open Group, 2009)

ISO 38500 defines "Corporate Governance of Information and Communication Technology (ICT) is the system by which the current and future use of ICT is directed

and controlled. It involves evaluating and directing the plans for the use of ICT to support the organization and monitoring this use to achieve plans. It includes the strategy and policies for using ICT within an organization"(ISO/IEC, 2008).

Peter Weill defines IT Governance as "Specifying the decision rights and accountability framework to encourage desirable behaviour in the use of IT... IT governance is not about what specific decisions are made. That is management. Rather, governance is about systematically determining who makes each type of decision (a decision right), who has input to a decision (an input right) and how these people (or groups) are held accountable for their role. Good IT governance draws on corporate governance principles to manage and use IT to achieve corporate performance goals."(Weill, 2004)

We consider Peter Weill the most up to date researcher in this field and also consider is research work to be the most comprehensive and accurate to the current IT scenario. We have also taken in consideration the work done by Allen E. Brown Gerald G. Grant in Framing the Frameworks: A Review of IT-Governance concepts were they concluded that "...historical work in this area can be divided into two separate streams: IT governance forms, and IT governance contingency analysis. From this framework, we concluded that the Weill and Ross' contemporary framework signals the beginning of an amalgamation of the two streams of previous IT governance research."(Allen E. Brown, 2005).

This research will focus on IT Governance concepts from Peter Weill including is Framework, the six Key Assets and its 10 Principles. Although we consider the remaining of its research important, to the scope of this Master Degree Thesis we will focus mainly in these aspects.

2.4.2. IT Governance Framework

Peter Weill proposes a framework for linking corporate and IT Governance Illustration 3.

Senior executive team has a major role in executing corporate strategy by inducing a desirable behaviour. To Peter Weill "Strategies are a set of choices (who are the target customers, what are the products and services offerings) and desirable behaviour are the beliefs and culture of the organization embodied by corporate structure, values, mission and vision statements"(Weill, 2004).

According to this author, the behaviours are the ones that enable value creation, they are also the key for effective governance.

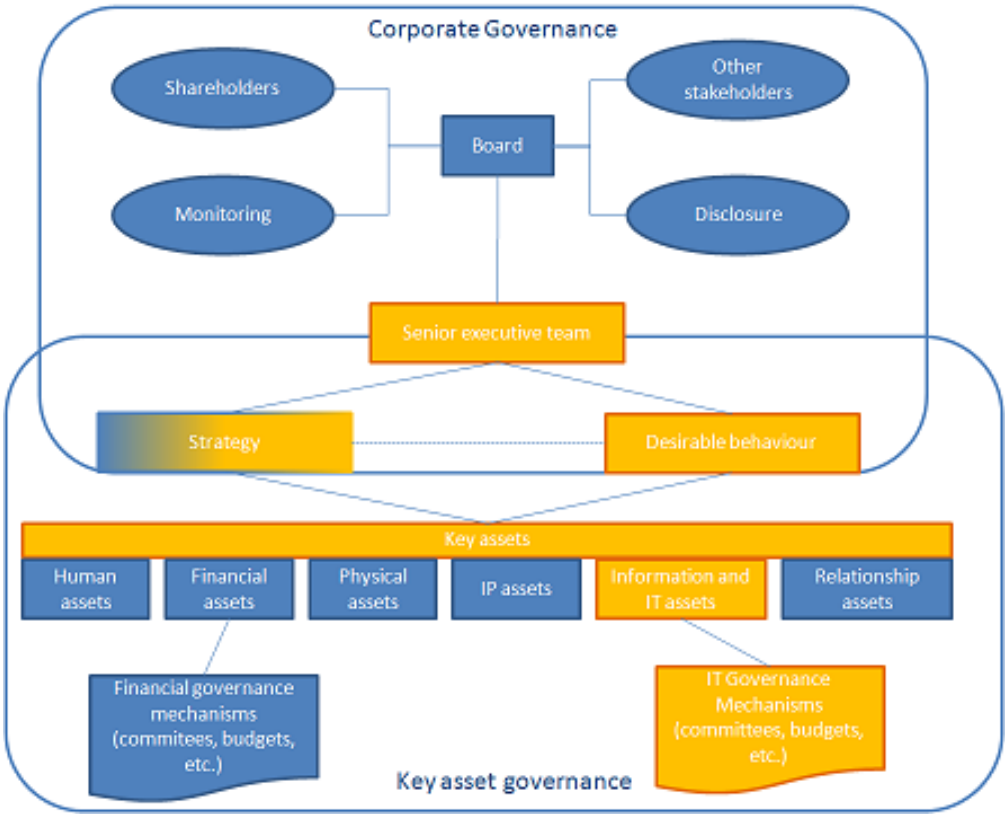


Illustration 3 - Peter Weill IT-Governance Framework (Weill, 2004)

2.4.3. IT Governance 6 Key Assets

Also according to Peter Weill (Weill, 2004), managers need to create mechanisms to manage six key assets that will drive enterprises to accomplish their strategies.

The six key assets are:

1. Human Assets – people, skills, career paths, training, reporting, mentoring, competencies, and so on
2. Financial assets – cash, investments, liabilities, cash flow, receivables, and so on
3. Physical assets – buildings, plant, equipment, maintenance, security, utilization, and so on
4. IP assets: Intellectual Property (IP) including product, services, and processes know how formally patented, copyrighted, or embedded in enterprises' people and systems
5. Information and IT assets: Digitized data, information, and knowledge about customers, processes performance, finances, information systems, and so on
6. Relationship assets: Relationships within the enterprise as well as relationships, brand, and reputation with customers, suppliers, business units, regulators, competitors channel partners, and so on

As we will understand with the 10 IT-Governance principles, these 6 assets have to be managed to develop desired behaviours that in turn, will generate more value to the corporation.

The success on managing the six assets is not only related to the capacity to develop management and control mechanisms but also to the ability to create mechanisms that cross more than one asset. This allows more synergies between each asset and an integrated view of the asset value creation.

IT-Governance is specifying the decision rights and accountability framework to encourage desirable behaviour.

Governance and desired behaviour must work together to create value. If a desired behaviour is not accompanied by the right structure to support the decisions a conflict will raise and value will be lost.

Peter Weill also recognizes that there are two perspectives for Corporate Governance, the Normative and the Behavioural.

Having this in mind, IT-Governance must address these three questions:

1. What decisions must be made to ensure effective management and use of IT?
2. Who should make these decisions?
3. How will these decisions be made and monitored?

Based on these questions and in answers to questionnaires made to IT management, Peter Weill and his team identified common IT problems and subsequently 10 major principals for IT-Governance.

2.4.4. IT Governance Problems

Key IT problems are resumed in as followed:

a. Failure to align IT with business

IT as a company management process has a primary goal to support the primary processes and other support activities (human resources, financial management, legal affairs, facilities and others). In order to become a value added process, this support must be aligned with business strategy. This alignment needs a constant and systematic analysis of the needs and requires setting tradeoffs. Without that analysis no IT strategy can ever be aligned and adjusted to the business strategy.

Some authors even consider IT is now a commodity available to everyone and no longer has IT conveyed any distinctive competitive advantage (Carr, 2004). Therefore it does not matter strategically. This perspective stimulated other authors, like Mark Lutchen, to develop articles and studies on how IT should be managed, as a strategic asset (Lutchen, 2003).

Also related with business alignment is the fact that IT must have a considerable knowledge on business but most of the times that knowledge is not well managed (Calder, IT Governance: Guidelines for Directors, 2005). A key principle of Knowledge Management is the ability to “identify, create, represent, distribute and enable adoption of insights and experiences”(Nonaka, 1991), to satisfy the company needs requiring, at least, to keep a controlled database of their business and IT concepts.

b. Failure to manage projects (Lientz, 2004) , (McManus, 2003)

Failure being considered as those projects that do not meet the original time, cost and (quality) requirements criteria The main reasons why a project fails are(McManus, 2003):

- "..many project managers plan for failure rather than success..."
- "...complexity of risk associated with software project delivery..."
- "...leadership, stakeholder and risk management issues are not factored into projects early on and in many instances cannot formally be written down for political reasons and are rarely discussed openly at project board or steering group meetings although they may be discussed at length behind closed doors..."
- "...considerable proportion of delivery effort results in systems that do not meet user expectations and are subsequently cancelled..."
- "...very few organisations have the infrastructure, education, training, or management discipline to bring projects to successful completion...."
- "...total reliance placed on project and development methodologies... absence of leadership within the delivery process..."
- Unmanaged "...frequent Requests for Changes by users..."
- "Users' Lack of Understanding of their Own Requirements..."
- "Overlooked Tasks"
- "Insufficient Communication"
- "Poor or imprecise requirements definition"
- "Lack of adequate methodology and guidelines for estimating (costs, time and resources usage)"
- "Lack of co-coordinating of systems development"
- "Changes in information systems development personnel"
- "Insufficient time for testing"
- "Lack of preparation"
- "...project performance is predicted by individual capability, not organizational capability."

Quoting Professor Manny Lehman of Imperial College, London:

"Development is neither easy nor certain. There's been a lot of progress in software process improvement and we can develop systems that are up to twice an order of magnitude larger and more complex than we could 20 years ago. Yet we still see a trail of disasters and overruns." (Wood-Harper, 2003)

c. Failure to manage risk

"Every organization has a mission. In this digital era, as organizations use automated information technology (IT) systems to process their information for better support of their missions, risk management plays a critical role in protecting an organization information assets, and therefore its mission, from IT-related risk. An effective risk management process is an important component of a successful IT security program. The principal goal of an organization risk management process should be to protect the organization and its ability to perform their mission, not just its IT assets. Therefore, the risk management process should not be treated primarily as a technical function carried out by the IT experts who operate and manage the IT system, but as an essential management function of the organization"(Gary Stoneburner, 2002)

"The proliferation of increasingly complex, sophisticated and global threats to information security, in combination with the compliance requirements of a flood of computer- and privacy-related regulation around the world, is driving organizations to take a more strategic view of information security. It has become clear that hardware-, software- or vendor-driven solutions to individual information security challenges are, on their own, dangerously inadequate."(Calder, Managing Risk In Information Technology, 2006)

d. Failure to manage Outsourcing and Co-Sourcing

"Selective outsourcing of IT capability can be a very effective management strategy...however, some outsourcing decision result from frustration with IT. Concerned about IT costs and lack of value, managers turn to outsourcing as a quick fix to control their problem"(Weill, 2004)

e. Failure of IT Operations

Operations deal with ongoing systems maintenance. This maintenance can be for:

- Hardware renovation
- Software licensing (from 15% to 20% is used to support maintenance costs)
- Space occupation
- Support infrastructure (power, heating, ventilating and air conditioning, racks and others)
- Network connectivity
- Operational maintenance software e related (monitoring, security, backup, batches)
- Staff (datacenter, help desk, application specialists, senior engineers, IT relationship managers, contract managers)

Managing the service lifecycle has everything to do with this problem, poor managed services leads to poor IT operations management and to the decrease of resources for these activities that must be executed. In the current crisis environment many companies are now decreasing their IT costs, reducing the amount of services available and therefore reducing the IT operation costs.

All these problems need important inputs in terms of information. IT Management Information is considered a key asset for business and process performance improvement.

Most IT departments start with Business projects that, at some point, need Information Technology. These IT projects, as mentioned before, tend to emerge themselves as simple disconnected projects. Their information is also something considered and managed in a project narrow perspective. That vision, sometimes not even process scoped (ex: Project Management Process), needs to connect with the rest of the service lifecycle to enable a wider perspective of the project contribution to the enterprise and not only to the specific business need.

Choosing to face the above identified problems without IT Management Information Integration will increase the probability of unsuccessful initiatives on IT governance.

2.4.5. IT Governance Principles

Peter Weill proposes 10 IT Governance principles (Weill, 2004):

1. Actively design governance

   Many firms have created disparate IT governance mechanisms. These uncoordinated mechanisms result from governance by default—introducing mechanisms one at a time to address a particular need (for example, architecture problems, overspending or duplication). Patching up problems as they arise is a defensive tactic that limits opportunities for strategic impact from IT. Instead, management should actively design IT governance around the enterprise objectives and performance goals.

   Not only does overall governance require active design, but each mechanism also needs regular review. Many enterprises with effective IT governance have between six and ten integrated and well-functioning mechanisms. . One goal of any governance redesign should be to assess, improve, and then consolidate the number of mechanisms. Early in the learning cycle, mechanisms may involve large numbers of managers. Typically, as senior managers better understand IT value and the role of IT, a smaller set of managers can represent enterprise needs.

2. Know when to redesign

   Rethinking the whole governance structure requires that individuals learn new roles and relationships. Learning takes time. Thus, governance redesign should be infrequent; change in governance is required with a change in desirable behaviour.

   In these types of transformation, IT governance can be used as one of the levers to encourage change.

3. Involve senior managers

   CIOs must be effectively involved in IT governance for success. Other senior managers must participate in the committees, the approval processes, and performance reviews. For many enterprises, this involvement is a natural extension of senior management normal activities. The Information Management Steering Group (IMSG) is one of fourteen strategic committees that connect to the top-level executive committee. This interlocking committee structure ensures senior management attention to IT in the context of the whole enterprise. Many senior managers are willing to be involved but are not sure where to best contribute. It is very helpful for the CIO and his or her staff to communicate IT governance on one page with a picture like the Governance Arrangements Matrix (GAM). The matrix provides a vehicle for discussing each senior manager role and any concerns they have.

4. Make choices

   It is not possible for IT governance to meet every goal, but governance can and should highlight conflicting goals for debate. As the number of tradeoffs increases, governance becomes more complex. Top-performing enterprises handle goal conflicts with a few clear business principles. The resulting IT principles reflect these business principles.

5. Clarify the exception handling process

   Exceptions are how enterprises learn. In IT terms, exceptions challenge the status quo, particularly the IT architecture and infrastructure. Some requests for exceptions are frivolous, but most come from a true desire to meet business needs. If the exception proposed by a business unit has value, a change to the IT architecture could benefit the entire enterprise.

   Exception handling process critical success factors are:

   a) Clearly defined process that is understood by all. Clear criteria and fast escalation encourage only business units with a strong case to pursue an exception.

b) Few stages that quickly move the issue up to senior management. Thus, the process minimizes the chance that architecture standards will delay project implementation.

c) Adoption of successful exceptions into the enterprise architecture, completing the organizational learning process.

A manager become frustrated if they are told they cannot do something they are sure is good for business. Pressure increases and the exceptions process provide a transparent vehicle to release the frustration without threatening the governance process.

6. Provide right incentives

   A common problem Weill encountered in studying IT governance was a misalignment of incentive and reward systems with the behaviours the IT governance arrangements were designed to encourage. IT governance is less effective when incentive and reward systems are not aligned with organizational goals. If IT governance is designed to encourage business unit synergy, autonomy, or some combination, the incentives of the executives must also be aligned.

7. Assign ownership and accountability for IT governance

   Like any major organizational initiatives, IT governance must have an owner and accountabilities. Ultimately, the board is responsible for all governance, but the board will expect or delegate an individual (probably the CEO or CIO) or group to be accountable for IT governance design, implementation, and performance.

8. Design IT governance at multiple organizational levels

   In large multi-business unit enterprises it is necessary to consider IT governance at several levels. The starting point is enterprise-wide IT governance driven by a small number of enterprise-wide strategies and goals. Enterprises with separate

IT functions in divisions, business units, or geographies require a separate but connected layer of IT governance.

Usually the demand for synergies increases at the lower levels, whereas the need for autonomy between units is greatest at the top of the organization.

The lower levels of governance are influenced by mechanisms designed for higher levels. Thus, Peter Weill advocates starting with the enterprise-wide IT governance, as it will have implications for the other levels of governance. However, starting enterprise-wide is sometimes not possible for political or focus reasons, and starting at the business unit level can be practical. Assembling the governance arrangements matrixes for the multiple levels in an enterprise makes explicit the connections and pressure points.

9. Provide transparency and education

   The more transparency of the governance processes, the more confidence in the governance. Many firms like State Street Corporation use portals or intranets to communicate IT governance. Normally these portals include tools and resources, such as a glossary of IT terms and acronyms and the "Computer Contract Checklist." Often portals include lists of approved or recommended products. Templates for proposing IT investments complete with spreadsheets to calculate the IT business value are often available. The less transparent the governance processes are, the less people follow them. The more special deals are made, the less confidence there is in the process and the more workarounds are used. The less confidence there is in the governance, the less willingness there is to play by rules designed to lead to increased firm-wide performance. Special deals and nontransparent governance set off a downward spiral in governance effectiveness.

10. Implement common mechanisms across six key assets

    Enterprises using the same mechanisms to govern more than one of the six key assets have better governance. Each asset may be expertly governed, but the opportunity for synergetic value is lost. Many enterprises successfully

coordinate the six assets within a project but not across the enterprise via governance. In designing IT Governance it is important to review the mechanisms used to govern the other key assets and consider broadening their charter to IT rather than creating a new, independent IT mechanism.

2.5. IT Governance Best Practises, Frameworks, Body of Knowledge and Standards

IT Governance has been a focus of interest groups for many years and many initiatives have been developed to support some of its main issues. A list of major initiatives can be found at Annex 1 - IT Governance related initiatives.

Based on the Master Degree Thesis proposal we will focus on one best practise, Information Technology Infrastructure Library (ITIL), one Body of Knowledge and standard, Project Management Institute Book Of Knowledge (PMBOK, IEEE Std 1490™-2003[1]) and one framework, Control Objectives for Information and related Technology (COBIT).

ITIL is mostly a process best practise that will be used to align the Data Driven Decision Support System with key IT processes.

PMBOK is used to align IT Project Development process. Considered one of the most important processes of IT it is important to map it with a specific Body Of Knowledge.

COBIT as a control framework, close related with audit initiatives, is not going to be used in the model but it is important to better understand next steps of this research.

[1] Adoption of PMI StandardA Guide to the Project Management Body of Knowledge

2.5.1. Information Technology Infrastructure Library (ITIL) best practise (Alison Cartlidge, 2007)

ITIL is a public framework that describes Best Practice in IT service management. It provides a framework for the governance of IT, the 'service wrap', and focuses on the continual measurement and improvement of the quality of IT service delivered, from both a business and a customer perspective.

Consisting of five core books covering the service lifecycle, together with the Official Introduction, it covers each stage of the service lifecycle (Illustration 4), from the initial definition and analysis of business requirements in Service Strategy and Service Design, through migration into the live environment within Service Transition, to live operation and improvement in Service Operation and Continual Service Improvement.

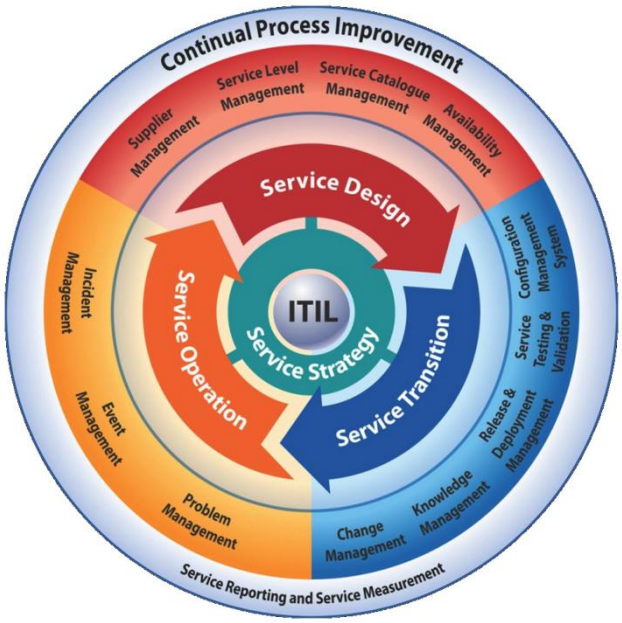


Illustration 4 - ITIL Lifecycle

All service solutions and activities should be driven by business needs and requirements. Within this context they must also reflect the strategies and policies of the service provider organization (Illustration 5).

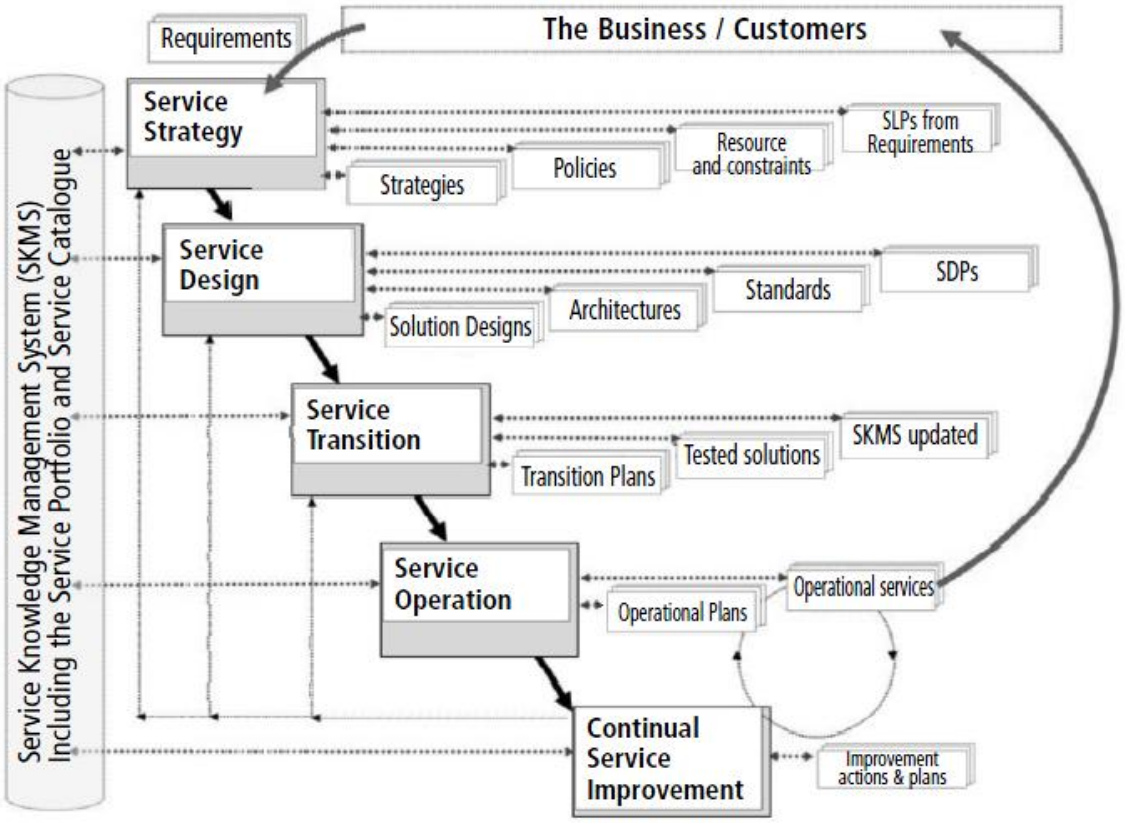


Illustration 5 - ITIL - Key links, inputs & outputs of the service lifecycle stages

Simplified version of the lifecycle can be the following:

1. Business stimulates the process by enrolling new requirements;
2. Service Strategy scopes the new requirements, defining the resources and constraints and creating a SLP – Service Level Package and a set of business outcomes;
3. After the Service Strategy agreement the Service Design stage creates the solution that is specified in a SDP – Service Design Package;
4. Service Transition receives the SDP and evaluates the service, tests and validates, the Service Knowledge Management System (SKMS) is updated, and the service is transitioned into the live environment, where it enters the Service Operation stage;

5. Wherever possible, Continual Service Improvement identifies opportunities for the improvement of weaknesses or failures anywhere within any of the lifecycle stages.

2.5.1.1. Service Strategy

IT Service Strategy helps senior managers understand how their organization will differ from competing alternatives and thereby satisfy both customers and stakeholders. Provides guidance on how to design, develop and implement service management not only as an organizational capacity but also as a strategic asset.

Raises the following questions:

a) what services should be offered
b) to whom the services should be offered
c) how the internal and external market places for their services should be developed
d) existing and potential competition in these marketplaces, and the objectives that will differentiate the value of what you do or how you do it
e) how the customers and stakeholders will perceive and measure value, and how this value will be created
f) how customers will make service sourcing decisions with respect to use of different types of service providers
g) how visibility and control over value creation will be achieved through financial management
h) how robust business cases will be created to secure strategic investment in service assets and service management capabilities
i) how the allocation of available resources will be tuned to optimal effect across the portfolio of services
j) how service performance will be measured

Processes

a) Financial Management – Managing an IT Service Provider Budgeting, Accounting and Charging Requirements (answers to question g)
b) Service Portfolio Management (SPM) - proactive management of the investment across the service lifecycle, including those services in the concept, design and transition pipeline, as well as live services defined in the various service catalogues and retired services (answers to questions b, c, d, h, i, j);
c) Demand Management - understand and influence customer demand for services and the provision of capacity to meet these demands (a, b, f).

2.5.1.2. Service Design

This phase takes in consideration business requirements to create services and supporting practises that meet business needs for quality, reliability and flexibility.

Objectives

a) design services to meet agreed business outcomes
b) design processes to support the service lifecycle
c) identify and manage risks
d) design secure and resilient IT infrastructures, environments, applications and data/information resources and capability
e) design measurement methods and metrics
f) produce and maintain plans, processes, policies, standards, architectures, frameworks and documents to support the design of quality IT solutions
g) develop skills and capability within IT
h) contribute to the overall improvement in IT service quality.

Processes

a) Service Catalogue Management
b) Service Level Management

c) Capacity Management
d) Availability Management
e) IT Service Continuity Management
f) Information Security Management
g) Supplier Management

2.5.1.3. Service Transition

Deliver services that are required by the business into operational use. Focuses on implementing all aspects of the service, not just the application and how it is used in 'normal' circumstances. It needs to ensure that the service can operate in foreseeable extreme or abnormal circumstances, and that support for failure or errors is available.

Principles:

a) Understanding all services, their utility and warranties;
b) Establishing a formal policy and common framework for implementation of all required changes
c) Supporting knowledge transfer, decision support and re-use of processes, systems and other elements
d) Supporting knowledge transfer, decision support and re-use of processes, systems and other elements
e) Ensuring involvement of Service Transition and Service Transition requirements throughout the service lifecycle.

Processes

a) Change Management - CM
b) Service Asset and Configuration Management - SACM
c) Knowledge Management – KM
d) Transition Planning and Support[2]
e) Release and Deployment Management[2]

[2] Not exclusive of this stage

f) Service Validation and Testing[2]

g) Evaluation[2]

2.5.1.4. Service Operation

Deliver agreed levels of service to users and customers, and to manage the applications, technology and infrastructure that support delivery of the services. It is only during this stage of the lifecycle that services actually deliver value to the business, and it is the responsibility of Service Operation staff to ensure that this value is delivered.

Processes

a) Event Management
b) Incident Management
c) Request Fulfilment
d) Access Management
e) Problem Management

2.5.1.5. Continual Service Improvement

CSI is concerned with maintaining value for customers through the continual evaluation and improvement of the quality of services and the overall maturity of the Information Technology Service Management (ITSM) service lifecycle and underlying processes.

CSI combines principles, practices and methods from quality management, Change Management and capability improvement, working to improve each stage in the service lifecycle, as well as the current services, processes, and related activities and technology.

Key activities:

a) 7 step improvement process (Illustration 6)
b) Service Measurement

c) Service Reporting

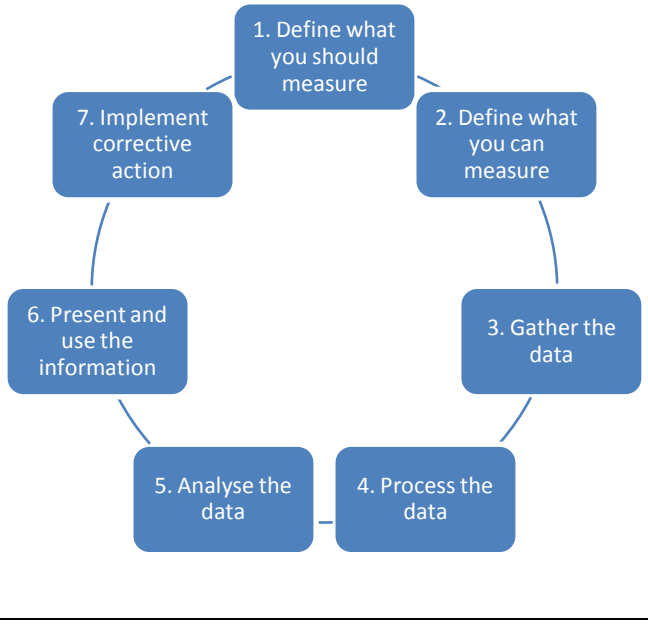


Illustration 6- ITIL - 7 method for Continual Service Improvement

2.5.2. Project Management Body of Knowledge (PMBOK)

The Project Management Body of Knowledge (PMBOK) is a collection of processes and knowledge areas generally accepted as best practice within the project management discipline.

As an internationally recognised standard (IEEE Std 1490-2003) it provides the fundamentals of project management, irrespective of the type of project be it construction, software, engineering, automotive etc.

PMI launched "A Guide to the Project Management Body of Knowledge (PMBOK® Guide)" (currently in its fourth edition) to serve as a reference for Project Management Professionals.

PMBOK recognises 5 basic process groups (Illustration 7) and 9 knowledge areas (Table 1) typical of almost all projects. The basic concepts are applicable to projects, programs and operations.

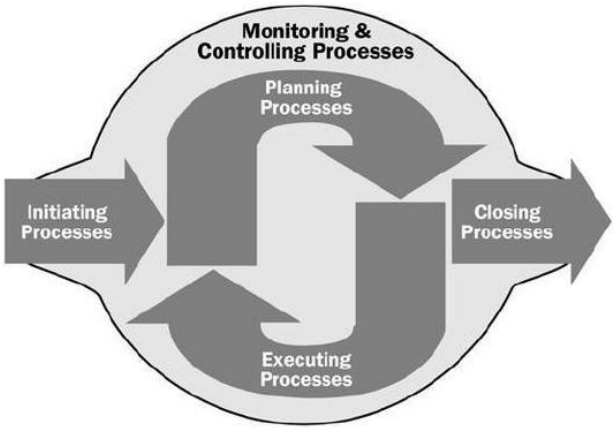


Illustration 7 - PMBOK - Process Groups

Processes overlap and interact throughout a project or phase. Processes are described in terms of:

- Inputs (documents, plans, designs, etc.)
- Tools and Techniques (mechanisms applied to inputs)
- Outputs (documents, products, etc.)

In the PMBOK there were identified nine knowledge areas (Table 1)

Knowledge Areas	Project Management Process Groups				
	Initiating Process Group	Planning Process Group	Executing Process Group	Monitoring & Controlling Process Group	Closing Process Group
4. Project Integration Management	4.1 Develop Project Charter	4.2 Develop Project Management Plan	4.3 Direct and Manage Project Execution	4.4 Monitor and Control Project Work 4.5 Perform Integrated Change Control	4.6 Close Project or Phase
5. Project Scope Management		5.1 Collect Requirements 5.2 Define Scope 5.3 Create WBS		5.4 Verify Scope 5.5 Control Scope	
6. Project Time Management		6.1 Define Activities 6.2 Sequence Activities 6.3 Estimate Activity Resources 6.4 Estimate Activity Durations 6.5 Develop Schedule		6.6 Control Schedule	
7. Project Cost Management		7.1 Estimate Costs 7.2 Determine Budget		7.3 Control Costs	
8. Project Quality Management		8.1 Plan Quality	8.2 Perform Quality Assurance	8.3 Perform Quality Control	
9. Project Human Resource Management		9.1 Develop Human Resource Plan	9.2 Acquire Project Team 9.3 Develop Project Team 9.4 Manage Project Team		
10. Project Communications Management	10.1 Identify Stakeholders	10.2 Plan Communications	10.3 Distribute Information 10.4 Manage Stakeholder Expectations	10.5 Report Performance	
11. Project Risk Management		11.1 Plan Risk Management 11.2 Identify Risks 11.3 Perform Qualitative Risk Analysis 11.4 Perform Quantitative Risk Analysis 11.5 Plan Risk Responses		11.6 Monitor and Control Risks	
12. Project Procurement Management		12.1 Plan Procurements	12.2 Conduct Procurements	12.3 Administer Procurements	12.4 Close Procurements

Table 1 - PMBOK - Knowledge Areas and process groups

1. Project Integration Management
2. Project Scope Management
3. Project Time Management
4. Project Cost Management
5. Project Quality Management
6. Project Human Resource Management
7. Project Communications Management
8. Project Risk Management
9. Project Procurement Management

Each of the 39 processes included are divided in 5 process groups (Illustration 8):

1. Initiating processes
2. Planning processes
3. Controlling processes
4. Executing processes
5. Closing processes

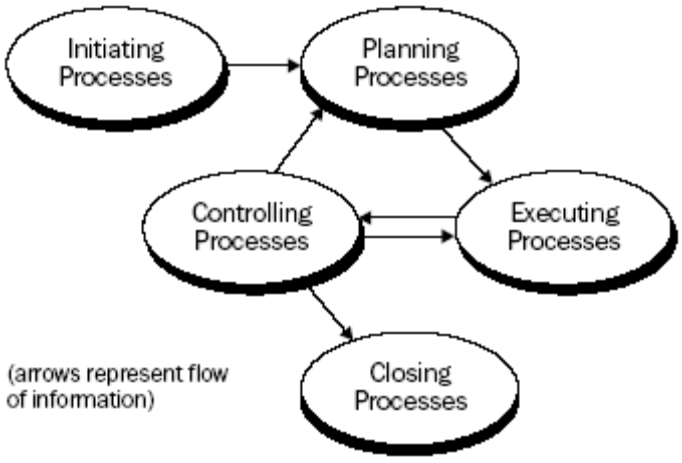


Illustration 8 - PMBOK - Process Groups

2.5.3. Control Objectives for Information and related Technology (COBIT) (IT Governance Institute, 2007)

Control Objectives for Information and related Technology (COBIT®) provides good practices across a domain and process framework and presents activities in a manageable and logical structure. They are strongly focused more on control, less on execution. These practices will help optimise IT-enabled investments, ensure service delivery and provide a measure against which to judge when things do go wrong.

COBIT Mission: To research, develop, publicise and promote an authoritative, up-to-date, internationally accepted IT governance control framework for adoption by enterprises and day-to-day use by business managers, IT professionals and assurance professionals.

COBIT is a framework for control over IT that fits with and supports the Committee of Sponsoring Organisations of the Treadway Commission's (COSO's) Internal Control—Integrated Framework, the widely accepted control framework for enterprise governance and risk management, and similar compliant frameworks.

COBIT is an internal control system or framework that contributes to:

1. Making a link to the business requirements
2. Organising IT activities into a generally accepted process model
3. Identifying the major IT resources to be leveraged
4. Defining the management control objectives to be considered

COBIT consists of linking business goals to IT goals, providing metrics and maturity models to measure their achievement, and identifying the associated responsibilities of business and IT process owners.

IT is divided into four domains and 34 processes in line with the responsibility areas of plan, build, run and monitor, providing an end-to-end view of IT. Enterprise architecture concepts help identifies the resources essential for process success, i.e., applications, information, infrastructure and people (Illustration 9, Illustration 10).

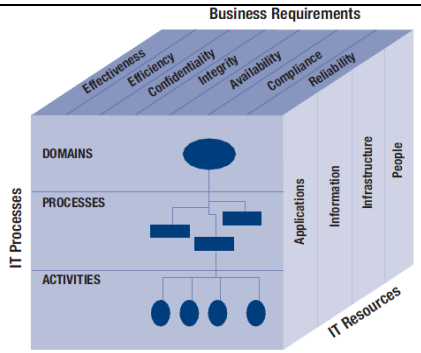


Illustration 9 - COBIT Cube

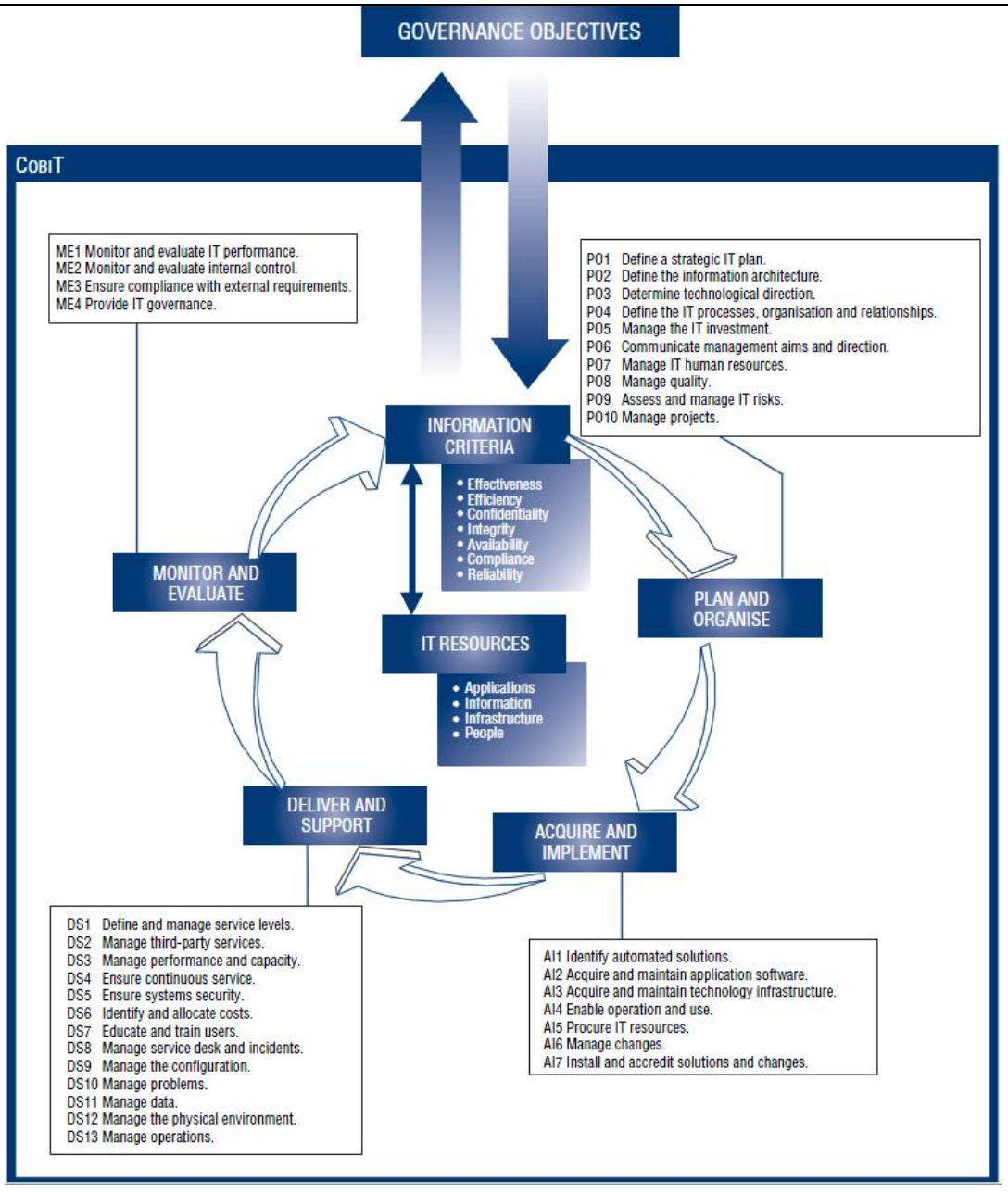


Illustration 10 - COBIT Framework

2.6. IT Governance in Financial Services

2.6.1. Regulatory entities

All countries that take part of the Economic and Monetary Union have agreed to create a system to relate all central banks, the European System of Central Banks (ESCB).

According to the European Union (EU) treaty, the "primary objective of the ESCB shall be to maintain price stability"(ECB).

Another important mission specifically assigned to the Bank is to "provide for the stability of the domestic financial system, performing for the purpose the function of lender of last resort"(ECB). This goal is achieved through the supervision of credit institutions and financial companies.

Central Banks, in accordance to the ESCB, are creating initiatives of better regulation, focusing in Information Systems and their control (as an example, Portuguese National Council of Financial Supervision has recently issued an initiative named Better Regulation, this initiative states new forms of data integration and reporting and some articles state the need for Information systems control)(Portugal, 2009).

2.6.2. IT Auditing

Audit companies are called to regularly financial audit the financial institutions. With the events of Operation Risk (BASEL II) the auditing companies need to audit not only financial but also information systems.

IT Operational Risks focus not only on IT Security but also on many other IT domains. COBIT, since the first versions, has been used by Auditing Companies to structure the domains and processes that should be audited, what level of maturity they should have and what controls should be implemented.

2.7. Decision Support Systems in Financial Sector

According to Dan Power (Power, 2002), Decision Support Systems (DSS) are "...interactive computer-based system or subsystem intended to help decision makers use communications technologies, data, documents, knowledge and/or models to identify and solve problems, complete decision process tasks, and make decisions. Decision Support System is a general term for any computer application that enhances a person or group's ability to make decisions. ... In general, Decision Support Systems are a class of computerized information system that support decision-making activities".

According to P.J. Stevens in Decision Support Systems in Banking (P.J, 1991), the evolutionary stages of Decision Support System in Financial sector are:

1. Gaining access to corporate data
2. Development of management information systems
3. 'what-if' models
4. Sophisticated interpretative models
5. Knowledge based models

Because the financial sector is mostly a services sector, heavily based on information analysis, we see many uses for DSS in challenges faced by financial sector (Table 2).

Challenge	**DSS systems, related concepts, current research examples**
Compliance	DSS for IS Compliance (Hussami, 2009) From Regulatory Policies to Event Monitoring Rules: Towards Model-Driven Compliance Automation (Giblin, Mueller, & Pfitzmann, 2007) Taming Compliance with Sarbanes-Oxley Internal Controls Using Database Technology (Rakesh Agrawal, 2006)
Credit Concession	Credit Risk Assessment (Tansel & Yurdakul, 2009), (Burak E, Oralb, Reismanb, & Yolalana, 2003), (Kuo,

	2004)
Customer Loyalty	Churn Prediction and Expected Life Time Value (Neslin, Gupta, Kamakura, Lu, & Mason, 2004)
Customer Understanding	Credit Card Analysis (Christopher H. Jolly), (Chan, Fan, Prodromidis, & Stolfo, 1999), (Tsai, 2009) Analytical CRM (Onut, Erdem, & Hosver, 2002) Customer Clustering (Durkin, 2004) Market Analysis (Rigopoulos, Psarras, & Askounis, 2005)
Fraud Analysis and Detection	(Chan, Fan, Prodromidis, & Stolfo, 1999)
Information Security	(Schlienger & Stephanie, 2005)
IT-Governance	Charge Back Model (SAS Intelligence - Change Management) Resource Management (SAS IT Intelligence - IT Resource) Service Level Management (SAS IT Intelligence - Service Level Management)
Money Laundering	(Gao & Xu, 2006)
Performance and Optimization	Bank sector Evaluation (Brans, 1993), (Seçme, Bayrakdaroğlu, & Kahraman, 2009) Geographic analysis (Ioannou & Mavri, 2007) Others (Kumar C. N., 2007)
Portfolio Management	(Tseng & P., 2002), (P., et al., 2009), (J., H.S., S., K., & X., 2004), (Poh, 2000), (Shane, Fry, & Toro, 1987)
Risk Management	(Eisenberg & C., 2007), (Kumar & Turner, 2006)

Table 2 - Financial Challenges and Decision Support Systems solutions

2.8. IT Governance in Financial Sector DSS

According to the research made in previous topic, we found no mention or paper on Data Driven Decision Support Systems to address key IT-Governance issues. It is a topic were frameworks; best practises; body of knowledge and standards develop most of known knowledge of the topic. The only mention found to Decision Support Systems and IT-Governance was concerning the governance of Decision Support Systems.

IT-Governance is still struggling with operational and some tactical information systems but no DSS has yet been studied and developed.

The only concept that is mostly discussed about in IT-Governance, more specifically ITIL Best Practise, that has some degree to do with managing information is CMDB – Configuration Management Database (CMDB), "...in the ITIL context, represents the authorized configuration of the significant components of the IT environment... A key goal of a CMDB is to help an organization understand the relationships between these components and track their configuration. The CMDB is a fundamental component of the ITIL framework's Configuration Management process. CMDB implementations often involve integration with other systems, such as Asset Management Systems. These integrations may make use of either a real-time, federated design or an ETL (extract, transform, and load) solution."(Workgroup).

As the name implies the concept is more of a database with Configuration Items information enabling, in some cases, the relationship between these Configuration Items. It is my understanding that this concept and its objectives, although can be helped with Business Intelligence discipline, is focused in objects and their relationships instead of processes and their relationships to address 10 principles of IT Governance (Weill, 2004).

It is also my understanding that these concepts, if looked in a management perspective, will soon re-focus and broaden its perspective to IT-Governance processes. This is the real opportunity of this Master Degree Thesis, to study and understand how a process driven approach based on Decision Support Systems can help IT-Governance principles.

3. IT Governance DD-DSS Proposition

3.1. Proposition

In order to defend the statement that Decision Support Systems are a Critical Success Factor for IT-Governance Initiatives in Financial Sector we focused this research in three of the most important processes of IT-Governance.

The chosen processes where Incident and Help Desk Management, Change Management and Project Management. The selection of these processes was made because:

- In the IT-Value Chain Incident, Help Desk and Change Management are part of the primary activities (more specifically Primary activity – service support) (Betz, 2006);
- Existence of Best Practises (ITIL), Body of Knowledge (PMBOK), frameworks (COBIT) and standards (ISO 20000 and ISO 38500) that have a good rationale on these processes;
- These processes have a close relationship with operational risk – BASEL II, a key topic in IT-Governance in financial sector (Spremic & Popovic, 2008);
- Most financial institutions have high maturity level for the selected processes (between Maturity Level 3, 4 and 5 of COBIT);
- Banking regulations on IT-Governance are mainly focusing on the selected processes (Portugal, 2009)

The proposition will include:

- Methodology to analyse, develop and deploy an IT-Governance Unified Data Model (UDM);
- UDM for the proposed processes based on Best Practises, Body of Knowledge, Frameworks and Standards identified in State of Art section;
- Metadata for the UDM;
- Data warehouse Matrix for all identified IT-Governance processes (including assessment on selected processes implementation in Real world implementation);

- Real world implementation in a Financial group with assessment and some presentation layer print screens;
- Evaluation of the model using IT-Governance principles (Weill, 2004)

3.2. Methodology

For the model development we have taken in consideration the Project Lifecycle for Decision-Support Applications by Larissa Moss (Moss & Atre, 2003) and made some adjustments to better adhere to the reality of DSS in IT-Governance (Illustration 11).

As part of the methodology we used a real case scenario to evaluate the model and to better understand how this model could be adjusted to the reality of a company in financial sector (the initials CS - Case Scenario mean is that that stage was made specifically to create the real case scenario).

To help further implementations, real number of days used for each stage is also present in the methodology illustration. The number of days used is only a reference since these values can change according to IT-Governance process being analyzed and organization maturity on key concepts related to that process.

Stage 1 IT-Governance (10 days)	• Step 1 - IT Governance Concepts • Step 2 - Process Analysis (according to best practises, frameworks, Books and standards)
Stage 2 Planning (7 days)	• Step 3- Enterprise Infrastructure Evaluation (RCS) • Step 4- Project Planning (RCS)
Stage 3 Business Analysis (15 days)	• Step 5 - Project Requirements Definition • Step 6- Data Analysis (RCS) • Step 7- Application Prototyping (RCS) • Step 8- Metadata Repository Analysis
Stage 4 Design Stage (30 days)	• Step 9 - Database Design • Step 10 - Extract , Transact and Load Design(RCS) • Step 11 - Metadata Repository Design
Stage 5 Construction (60 days)	• Step 12 - Extract Transact and Load Development (RCS) • Step 13- Application Development - Analytical Tools (RCS) • Step 14 - Data Mining (ND) • Step 15 - Meta Data Repository Development
Stage 6 Implementation (60 days)	• Step 16 - Deployment (RCS)
Stage 7 Evaluate Model (30 days)	• Step 17 - Assess IT Governance 10 Principles agains model • Step 18 - Process owners analysis

Illustration 11 - Methodology to deploy DSS in IT-Governance

3.3. Model

3.3.1. Data Warehouse Bus Architecture

"By defining a standard bus interface for the data warehouse environment, separate data marts can be implemented by different groups at different times. The separate data marts can be plugged together and usefully coexist if they adhere to the standard" (Kimball, 2002). This concept is the base for the Data warehouse bus architecture. This architecture allows us to develop a business process architecture, where common dimensions allow processes to relate to each other, building a complete and related value chain for the IT business.

In the following topics we will develop the selected processes of IT Governance Value Chain. In the model the dimensions will allow a Value Chain perspective increasing the model capacity to understand behaviour in more than one process at a time.

The tool used to create, document, and communicate the bus architecture is the data warehouse bus matrix (Kimball, 2002).

3.3.2. Data warehouse Bus Matrix

The IT-Governance Data warehouse Bus Matrix was based on:

- IT-Governance concepts taken from literature (mainly Peter Weill (Weill, 2004));
- IT-Governance best practises and frameworks (Alison Cartlidge, 2007), (IT Governance Institute, 2007) ;
- Project Management Body of Knowledge;
- Real World financial group experts (including interviews with process owners, information managers and C Level Management);
- Real World implementation assessment;

Data warehouse bus matrix for IT-Governance can be found in Annex 2 - IT Governance Datawarehouse Bus Matri.

3.3.3. Metadata

As mentioned in the Methodology, Metadata is one of the project major deliverables. It is also important to mention that one of Peter Weill's principles, principle 9, Metadata plays an important role. We have taken special consideration when designing the Metadata structure to include metadata types, with broader perspective then simple data types but also business entities (like Corporate Employee Number) and examples to better illustrate and validate information.

Technical and Business metadata can be found at Annex 4 - IT-Governance Metadata.

3.3.4. Data marts and dimensions

According to the IT-Governance Data warehouse bus matrix we have 20 processes, and we will focus on four of them, Change Management, Service Desk Management (sometimes called Help Desk Management), Incident Management and Project Development.

3.3.4.1. Change Management

Change Management ensures that changes are recorded, evaluated, authorized, prioritized, planned, tested, implemented, documented and reviewed in a controlled manner. The purpose of the Change Management process is to ensure that standardized methods are used for the efficient and prompt handling of all changes, that all changes are recorded in the Configuration Management System and that overall business risk is optimized. The process addresses all service change. Therefore change management is relevant across the whole lifecycle, applying to all levels of service management – strategic, tactical and operational. Change management delivers, to the business, reduced errors in new or changed services and faster, more accurate implementation of changes; it allows restricted funds and resources to be focused on those changes to achieve greatest benefit to the business.(Alison Cartlidge, 2007)

Change Managements normal process flow stages are (Annex 5):

1. Request for authorization - Change is created and sent for approval. The Change is normally created by a Change Requestor that sends to a Change Manager for validation;
2. Request for Change - if Change Manager approves the change then it is created a Request for Change that is sent to Change Approver;
3. Planning in progress - Change Approver approves the Change, and then it is time for change planning. At this stage it is defined a plan and schedule (cycle were the change is planned for implementation).
4. Schedule for review - if the change has determined characteristics, it has to be scheduled for approval; else, it is scheduled in corresponding cycle. This stage is Change Managers responsibility.
5. Schedule for approval - if the change has determined characteristics it has to be approved by an advisory team (normal Change Advisory Board team meeting).
6. Scheduled - when change gets to this stage it means it has been approved and scheduled and is waiting for its implementation (based on scheduled date).
7. Implementation in progress - at this stage the change is currently being implemented. This stage is performed by Change Implementer.
8. Completed - the change is complete when the Change Implementer has completed its work and closed the technical implementation of the change.
9. Closed- changes have to be assessed by Change Requesters before they can finish (in this case closed). Normally this stage is associated with the submission of a quality questionnaire for later analysis.

The data mart created to answer Change Management challenges can be found in (Illustration 12). More detailed information can be found in Metadata, where Dimensions, Fact tables, Attributes and Metrics can be found and analysed (Annex 4).

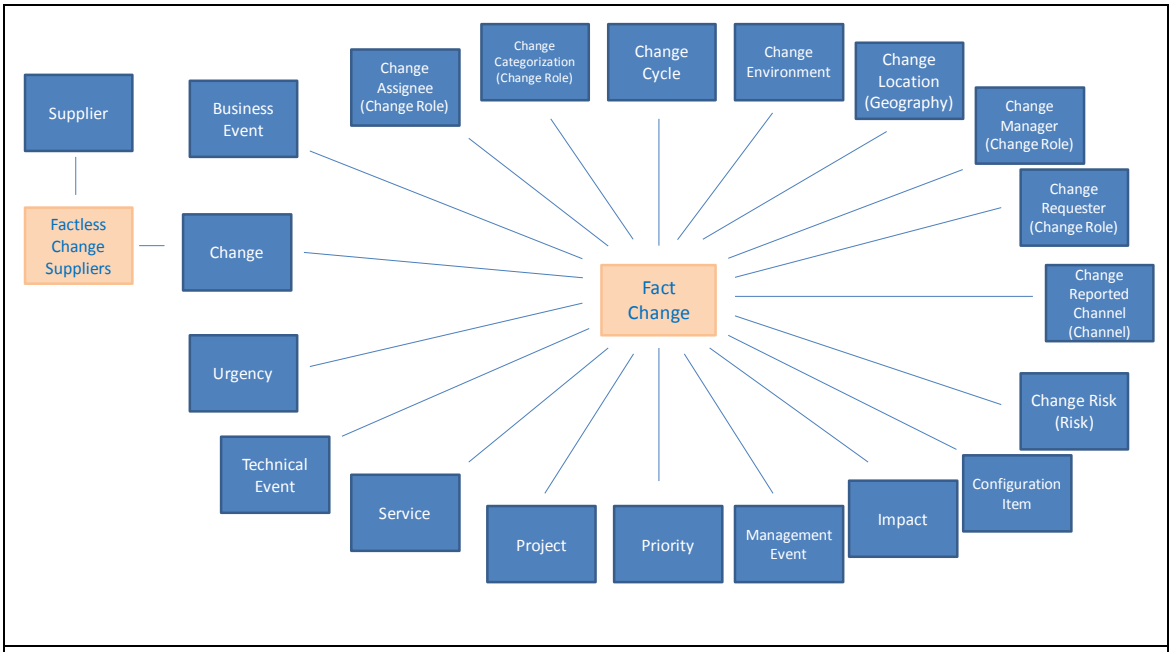


Illustration 12 - IT-Governance Data mart Change Management Process

3.3.4.2. Service Desk Management

The Service Desk provides a single central point of contact for all users of IT.

The Service Desk usually logs and manages all incidents, service requests and access requests and provides an interface for all other Service Operation processes and activities.

Specific Service Desk responsibilities include:

- logging all incidents and requests, categorizing and prioritizing them
- first-line investigation and diagnosis
- managing the lifecycle of incidents and requests, escalating as appropriate and closing them when the user is satisfied
- keeping users informed of the status of services, incidents and requests.

There are many ways of structuring and organizing service desks, including:

- local service desk: physically close to the users
- centralized service desk: allows fewer staff to deal with a higher volume of calls

- virtual service desk: staff are in many locations but appear to the users to be a single team
- follow the sun: Service Desks in different time zones give 24-hour coverage by passing calls to a location where staff are working. (Alison Cartlidge, 2007)

The data mart created to answer Service Desk Management challenges can be found in (Illustration 13). More detailed information can be found in Metadata, where Dimensions, Fact tables, Attributes and Metrics can be found and analysed (Annex 4).

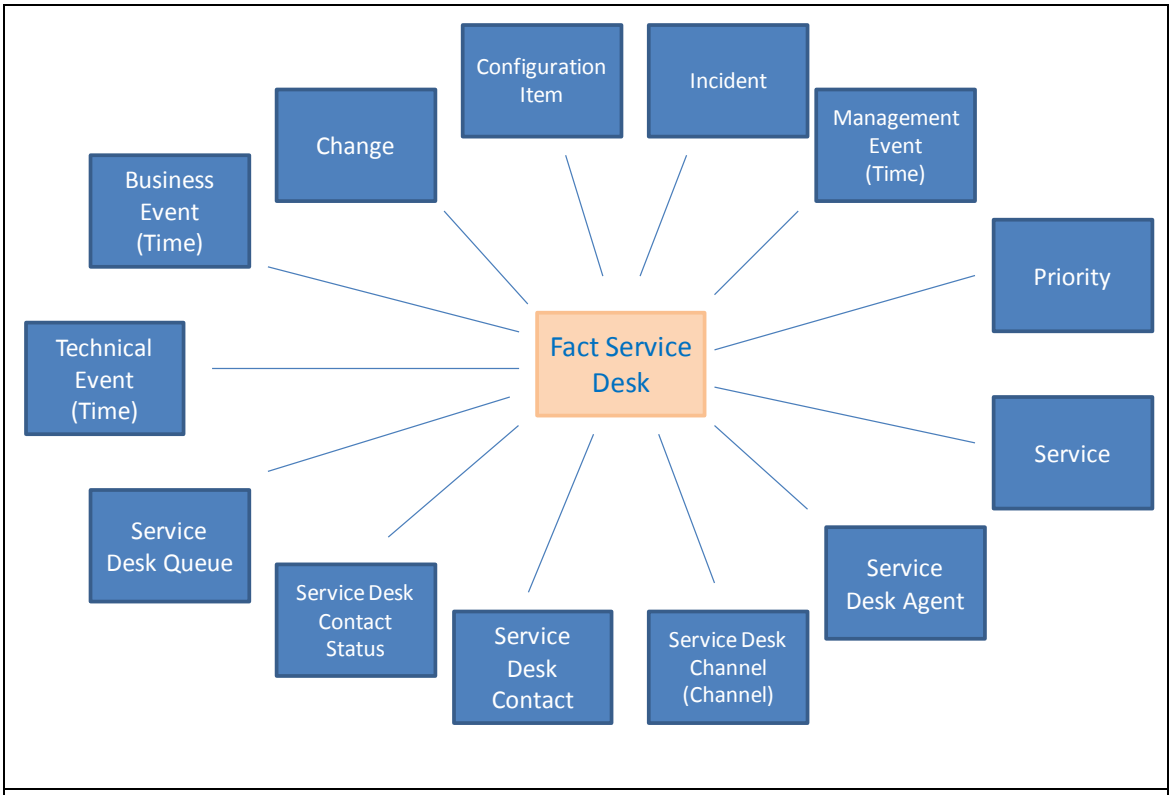


Illustration 13 - IT-Governance Data mart Service Desk Management Process

3.3.4.3. Incident Management

The purpose of Incident Management is to restore normal service as quickly as possible, and to minimize the adverse impact on business operations.

Incidents are often detected by event management, or by users contacting the service desk. Incidents are categorized to identify who should work on them and for trend analysis, and they are prioritized according to urgency and business impact.

If an incident cannot be resolved quickly, it may be escalated. Functional escalation passes the incident to a technical support team with appropriate skills; hierarchical escalation engages appropriate levels of management.

After the incident has been investigated and diagnosed, and the resolution has been tested, the Service Desk should ensure that the user is satisfied before the incident is closed.

An Incident Management tool is essential for recording and managing incident information. (Alison Cartlidge, 2007)

Incident Managements normal process flow stages are (Annex 6):

1. Identification and Recording – Service Desk is warned or detects and incident (if a monitoring team is available, incidents can be opened directly by this team). All incidents are recorded in Incident management Transaction Processing System (TPS). This stage is normally done by Incident Agent, Service Desk Agent or a Monitoring Agent;
2. Investigation and Diagnostics – if Incident agent, Service Desk Agent or Monitoring agent cannot resolve the incident, an Incident Analyst receives the incident information and investigates and diagnoses incident causes;
3. Resolution and Recovery – at this stage Incident Analyst has discovered a resolution and is undergoing its implementation;
4. Incident Closure – when technically the incident is closed. At this stage Service Desk Agent, Incident Agent or Monitoring Agent are informed of technical closure by Incident Analyst;
5. Closed – Incident Agent, Service Desk Agent or monitoring Agent evaluate if the incident is correctly closed. Customer verification might be necessary. At the end a Quality questionnaire is normally sent to the involved to better understand points of improvement.

The data mart created to answer Incident Management challenges can be found in (Illustration 14). More detailed information can be found in Metadata, where Dimensions, Fact tables, Attributes and Metrics can be found and analysed (Annex 4).

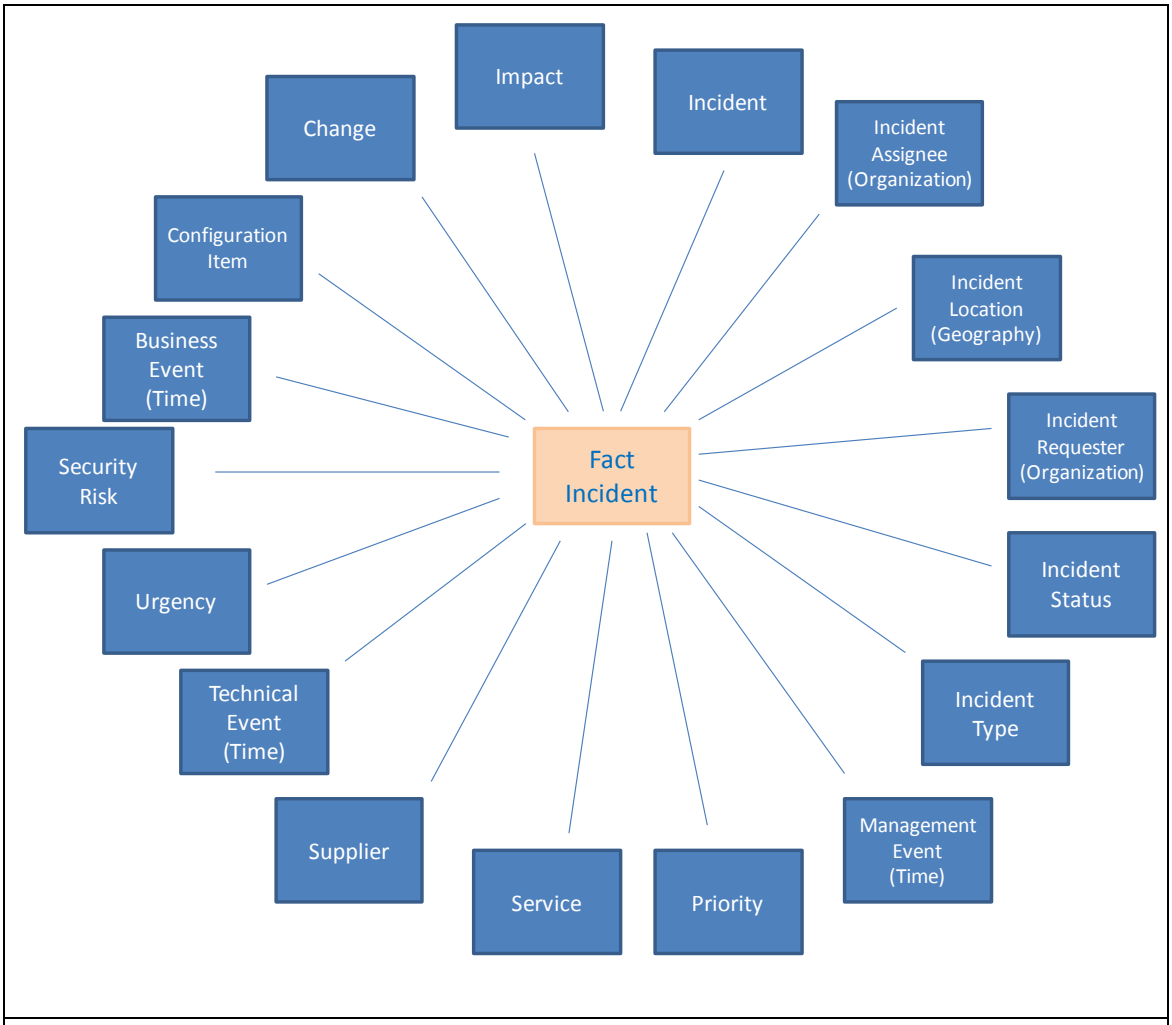


Illustration 14 - IT-Governance Data mart Incident Management Process

3.3.4.4. Project Management

Project Management is the application of knowledge, skills, tools, and techniques to project activities to meet project requirements. (A Guide to the Project Management Body of Knowledge, 2004).

The proposed project Lifecycle by Project Management Institute can be found at Annex 7 - Project Management Project LifeCycle Phases .

The data mart created to answer Project Management challenges can be found in (Illustration 15). More detailed information can be found in Metadata, where Dimensions, Fact tables, Attributes and Metrics can be found and analysed (Annex 4).

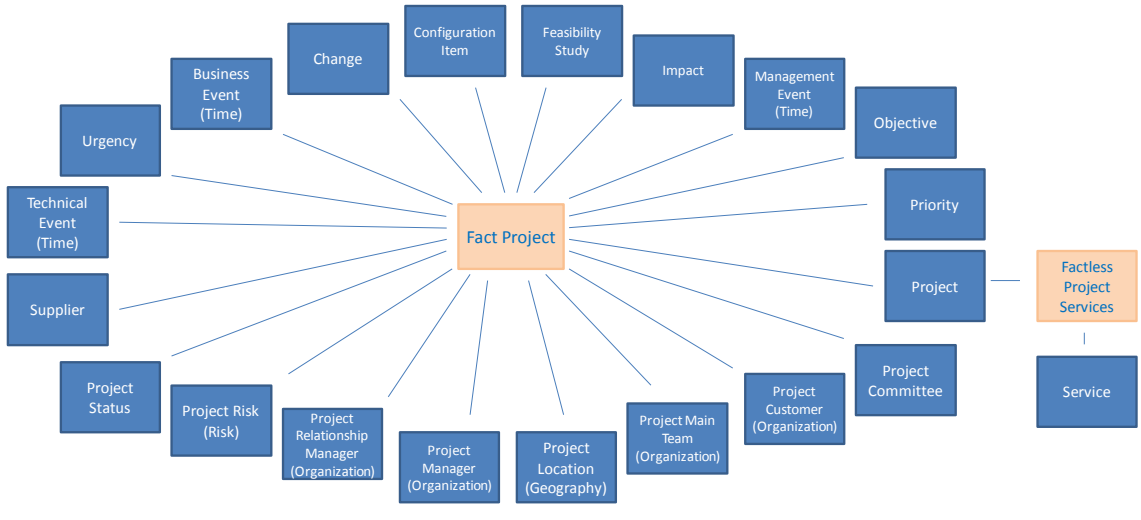


Illustration 15 - IT-Governance Data mart Project Development Process

3.3.4.5. Process relations

These processes have related analysis dimensions with each other. These dimensions can then be used to connect each process to each other. Enabling this connection is the first step to enable cross process analysis. Table 3 - IT-Governance Data mart - Dimensions Usage shows, for each process, the related dimensions. According to Kimball (Kimball, 2002) these dimensions are afterwards Role Played to each of the process concepts.

	Change Management	Service Desk Management	Incident Management	Project Development
Time				
Business Event				
Channel				
Configuration Item				
Customer				
Impact				
Incident				
Management Event				
Priority				
Project				
Service				
Supplier				
Technical Event				
Urgency				

Table 3 - IT-Governance Data mart - Dimensions Usage

One of the most important dimensions is Configuration Item (CI), this dimension, because it is connected across all processes, enables complete CI lifecycle analysis, from its concept and development (Project Development), deployment (Change Management) and operation (Service Desk, Incident Management and Change management).

3.4. IT-Governance DD-DSS

3.4.1. Architecture

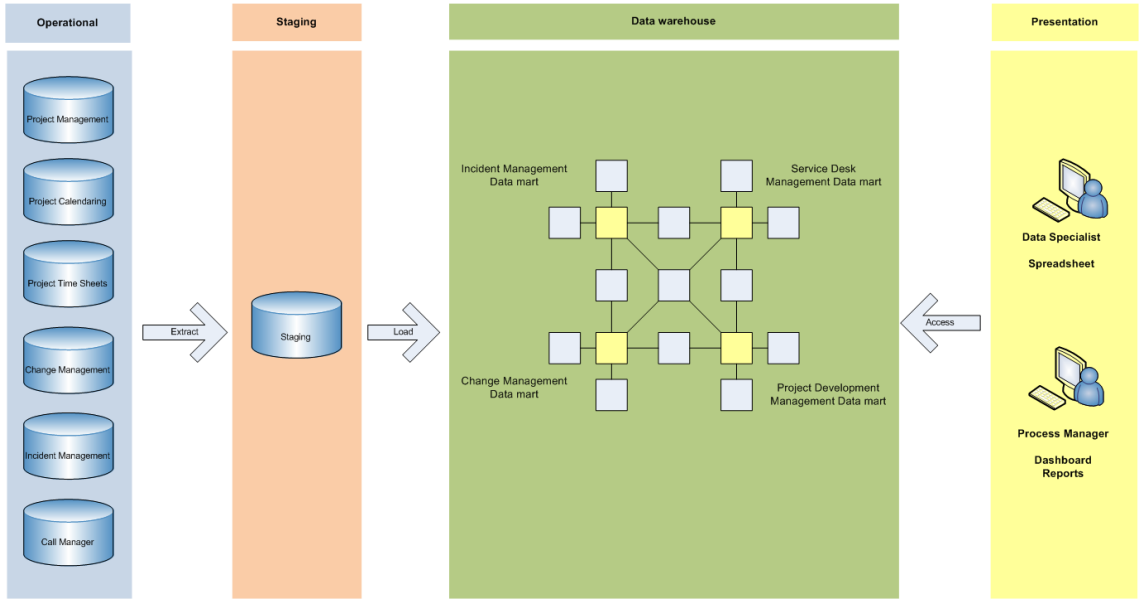


Illustration 16 – IT-Governance DD-DSS Architecture

3.4.2. Technologies

Technologies used to develop the Real Case Study were identified according to the methodology but subject to Licence Agreements and availability (Table 4 - Real Case Study Technologies).

Function	**Technology**
Extract Transact and Load	Microsoft SQL Server Integration Services 2008 Microsoft SQL Server Database Services 2008
Data mart development	Microsoft SQL Server Database Services 2008 Microsoft SQL Server Analysis Services
Dashboards	QlikTech Qlikview 9.0

Reports	Microsoft SQL Server 2008 Reporting Services QlikTech Qlikview 9.0

Table 4 - Real Case Study Technologies

3.5. Real Case Study

To validate that Data Driven Decision Support Systems are a Critical Success Factor for IT-Governance implementation we are focusing on IT-Governance Principles by Peter Weill in a Real Case Study.

Because in this real world scenario the Help Desk Management has no connection with Incident Management (based on ITIL and COBIT the connection should exist but in most financial groups this integration is not developed), we have chosen to separate them.

Taking in consideration that the real world has a limited scope, in this case a financial institution, it will not be possible to implement all the proposed dimensions. The ones not being implemented (identified in the Bus Matrix - Annex 2) will surely be mentioned in the suggestions section were the importance of their implementation will be emphasised.

The chosen financial group company has international operations and has also an intermediate maturity on IT-Governance concepts (frameworks like ITIL are very mature and most IT personal is certified in that Best Practise).

The real case study is used to assess if the model can adhere to the reality of a financial group with intermediate maturity on IT-Governance. This will also allow a better judgement on what fields should be improved and what fields are not being addressed.

Regarding this specific implementation, we have noticed that many other initiatives have been developed to manage IT-Governance issues. Many of these initiatives had to do with control mechanisms, mainly pressured by managers need to control and

monitor. All the above mentioned initiatives addressed IT-Governance information in a company structure basis, that is, they controlled department functions but not processes.

Another mistake made by the implementations was that the data architecture was developed taking in consideration performance indicators and not analytics. This strategy only enabled performance indicators analysis and lacked the analyst perspective.

Project began in first trimester of 2008 with sponsorship of CIO support department. Nowadays it is under deployment for the mentioned processes (Change Management, Incident Management, Service Desk Management and Project Development) and two more processes (Budget Management – not ITIL process; Capacity Management). All stakeholders involved in the process consider this to be a key success factor for their process management functions and to IT-Governance.

4. Proposition Assessment - Model added value to IT-Governance 10 Principles and Case Study

The proposed model evaluation will be made with the 10 principles of IT-Governance mentioned in the state of arte chapter (Weill, 2004).

Alongside these principles there will be references to the case study implementation. With this implementation we will aim prove that DD-DSS are critical success factors for major IT Governance decisions. The model presents itself as a starting point to a DD-DSS approach. However it may be improved to address additional IT-Governance processes.

For each principle we state key points given by Peter Weill, we analyze the proposed model and finally the benefits it brings up to being a critical success factor.

4.1.1. Principle 1 - Actively design governance

Key points

"... uncoordinated mechanism "silos" result from governance by default—introducing mechanisms one at a time to address a particular need."

"... Patching up problems as they arise is a defensive tactic that limits opportunities for strategic impact from IT..."

"... design IT governance around the enterprise's objectives and performance goals...."

"... each mechanism also needs regular review..."

"... One goal of any governance redesign should be to assess, improve, and then consolidate the number of mechanisms..."

Model Analysis

As mentioned by Peter Weill, management should pass from silo management to integrated business objectives driven management. Transforming information from a "silos" perspective to a more integrated view requires management information integration and the ability to understand the relationship between business objectives and IT contribution.

The DD-DSS enables not only data integration but also a business perspective of information. Dimensional modelling is based on specific business problems and the model is to be used by business users.

In order to understand the contribution that IT is giving to business, it is important to be able to map Business Goals down to IT initiatives. IT initiatives, that can also be called IT Projects, are the outputs of IT that contribute to the success or failure of the business goals. Connect all these perspectives is part of IT-Governance but building data models to support these decisions has to be done using DD-DSS.

The DD-DSS enables not only data integration but also a unified business perspective of information. Dimensional modelling is based on specific business problems and the model is to be used by business users.

In order to understand the contribution that IT is giving to business, it is important to be able to map Business Goals down to IT initiatives. IT initiatives, that can also be called IT Projects, are the outputs of IT that contribute to the success or failure of the business goals. Connect all these perspectives is part of IT-Governance but building data models to support these decisions has to be done using DD-DSS.

The proposed model provides the link between the Business Objectives, Business Initiatives, IT Objectives, IT Initiatives/Project, Configuration Items and the Incidents and Changes related to the Configuration Items (Illustration 17).

Because we have these relationships we can understand the IT contribution to Business Objectives during the initiative development (Project Development process) and during

operation (Change, Incident and Service Desk processes), enhanced the Configuration Item lifecycle understanding and control.

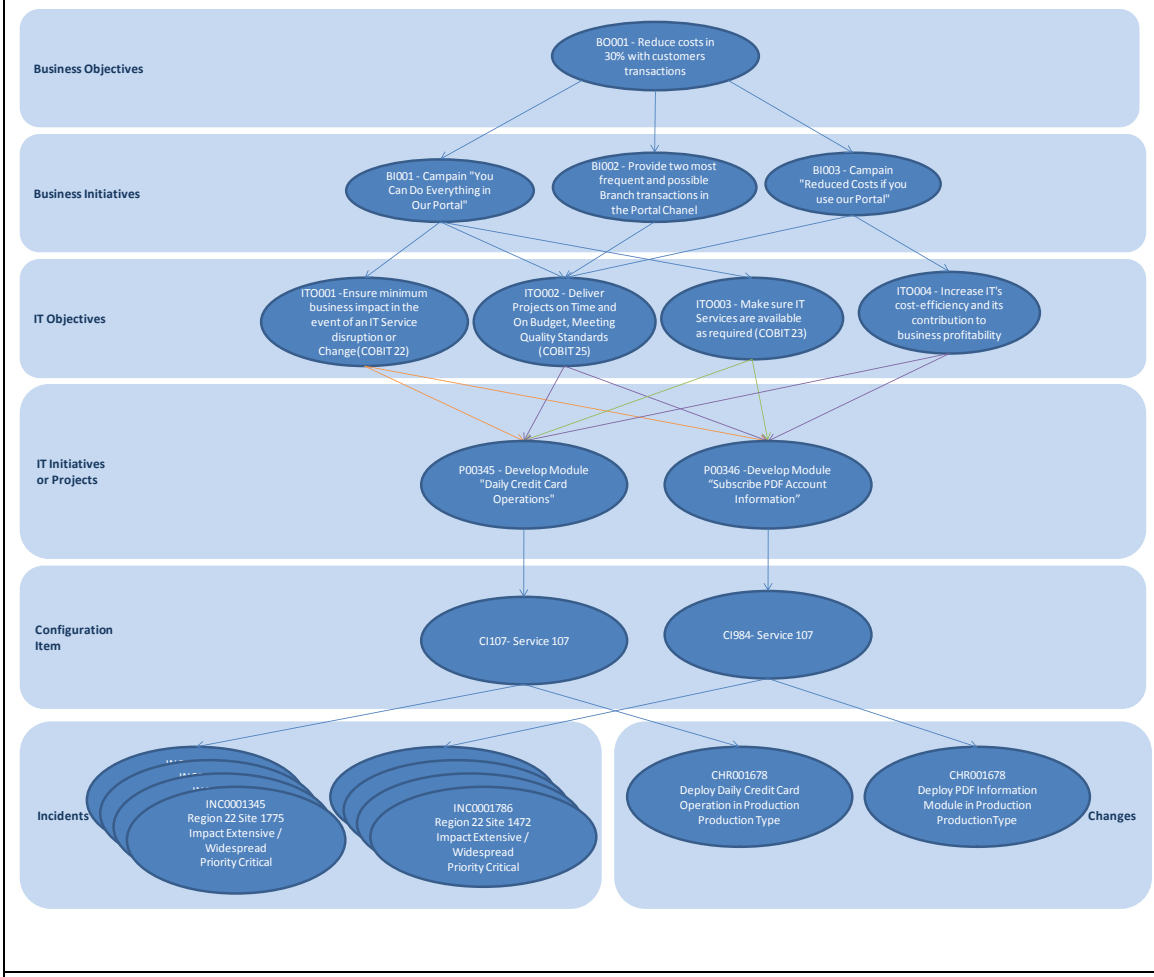


Illustration 17 - Principle 1 - Business and IT alignment

With the model we may:

1. Analyse Project Development metrics like Cost Performance Index (CPI) and Schedule Performance Index (SPI) for specific Business Objectives;
2. Analyse Configuration Items (CI) behaviour related to specific Business Objectives;
3. Evaluate trends during different phases of the initiatives as the model has information on the Business Initiative, IT Projects, Incidents and Changes start and end dates;

4. Understand if an IT Project development is delivering as expected;
5. Understand if the Configuration Item usage is delivering as expected;

To illustrate point 2 of the above list refer to the DD-DSS dashboard (Illustration 18)

In this dashboard an IT decision maker can map business strategy with it strategy and analyze IT initiatives behaviour. In the example we are analyzing incidents in a given IT Service and what business and IT objective it affects.

A. Time Filters – Time Dimension;
B. Filters for Year (2009), Incident Type (INCIDENT), IT Projects (P00345 and P0346) – Time Dimension, Incident Dimension and Project Dimension;
C. Business Objectives and Initiatives – Objective Dimension
D. IT Objectives and Initiatives/Projects – Objective Dimension;
E. IT Global Division Index for the selected Filters;
F. Number of Incidents;
G. Configuration Items – Configuration Item Dimension;
H. Historic Evolution of Incidents with relation to the Projects concerned – Incident Dimension and Project Dimension (and Factless tables needed for relationship);
I. Impact and Priority of the Incidents – Incident Dimension;
J. Incidents Region and Site – Geography Dimension

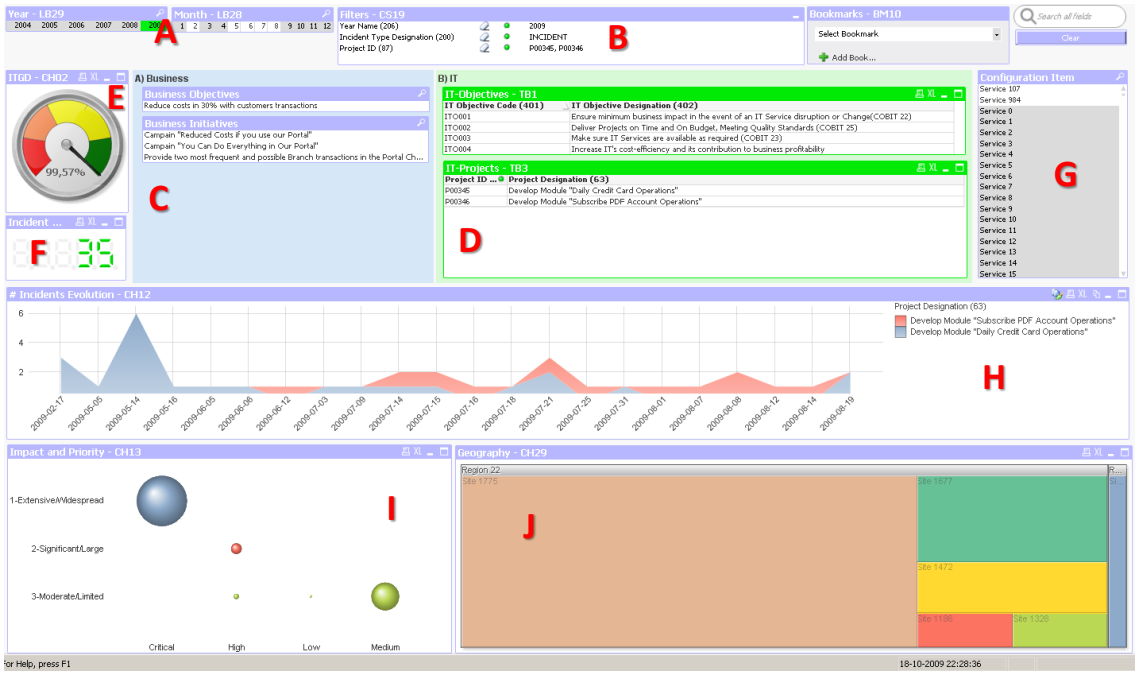


Illustration 18 - Principle 1 - Configuration Items behaviour related to specific Business Objectives

4.1.2. Principle 2 - Know when to redesign

Key points

"Rethinking the whole governance structure requires that individuals learn new roles and relationships. Learning takes time."

"...governance redesign should be infrequent … change in governance is required with a change in desirable behaviour."

Model Analysis

Redesign is made to encourage change in behaviours. These behaviours must be monitored and analysed. An integrated DD-DSS that spans across multiple integrated IT processes enables the analysis of company behaviour.

Understanding behaviour in organizations has to do with understanding how employees adhere to processes and the way they manage to achieve their objectives.

Study and analyse behaviours using process outputs (Business value, Time, Cost and Quality stated in Service Level Agreements) can only be accomplished if historical information is available and if all process states and paths can be analyzed separately. DD-DSS are a tool to better understand process outputs in different perspectives (in this case process state and paths).

With the model we can:

1. Understand Process Service Level Agreements;
2. Evaluate Time and Cost of each process;
   In Project development we used two Indexes from PMI, Cost Performance Index (CI) and Schedule Performance Index (SPI);
   In Incident Management and Change Management we do not have specific indexes but nonetheless there are metrics available for Time, Cost and Quality.
3. Responsible, Accountable, Consulted and Informed (RACI) model analysis;
   This model states that a matrix with all these roles (RACI) per process must be created. Mapping this matrix with process outputs can help better assign Roles to responsibilities in specific process paths and stages.

4. Calculate and understand Service Levels using analysis tools;

To illustrate the above list refer to the dashboard (Illustration 19). This dashboard has information on Change Management process stages and employee behaviour (in this case their objectives translated in Service Level Agreements - SLA). Evaluating the SLA we can understand when a process stage needs to be re-designed and the way employees address these changes to seek their goals.

A. Filters for Change Cycle (05-May) – Change Cycle Dimension;
B. Change Cycles – Change Cycle Dimension
C. Change Manager or Change Process Accountable in RACI Model – Change Role Dimension;

D. Change Count Evolution – Change Dimension;
E. Number of Changes – Fact Changes Fact Table;
F. Class and Operational Categorization – Change Dimension;
G. Configuration Item – Configuration Item Dimension;
H. Time Spent on each process stage – Fact Change facts table;
I. Service Level Agreement state on each stage – Fact Change facts table;

Illustration 19 - Principle 2 - Change Management Dashboard

4.1.3. Principle 3 - Involve senior managers

Key points

"CIOs must be effectively involved in IT governance for success."

"...senior managers must participate in the committees, the approval processes, and performance reviews."

"Information Management Steering Group (IMSG) is one of fourteen strategic committees that connect to the top-level executive committee. "

"Many senior managers are willing to be involved but are not sure where to best contribute"

Model Analysis

Senior managers need structured, integrated and aggregated information in order to make decisions. Senior managers normally receive information from mid management in form of scorecards and dashboards of Key Performance Indicators (KPI). Senior manager decision making process cannot be address using only control mechanisms but also using more detailed and integrated information.

In order to better involve senior managers it is important to define a set of information that will allow them to focus not on operational issues (as they normally tend to do when control mechanisms do not satisfy their information needs) but on more tactical to strategic decisions. Because senior managers are constantly being questioned by business managers it is important to develop the needed bridge between business and IT objectives. Most of the times this bridge cannot be developed because business strategy and objectives are not mapped with IT strategy and objectives. Normally this alignment is present but not used and controlled. DD-DSS can help create this bridge by integrating information from multiple sources and help categorize an IT initiative in terms of business. DD-DSS do not solve the categorization issue but enable business and IT management information to be mapped when it exists.

Most of the time, because senior managers do not have this integrated view, they tend to decide on specific operational issues. This approach has a number of problems associated, from simple lack of knowledge on most operational specific details to the un-empowerment of their intermediate managers.

With the DD-DSS we can integrate information from multiple processes and develop Key Performance Indicators that will enable a higher, more integrated view of management information. This does not reduce the capability of intermediate managers to drill down the information from this more integrated set to a more operational set (if

good information system analysis took place the information granularity would allow this drill down to the desired level).

With the model we can:

1. Evaluate KPI information based on multiple processes information;
2. Drill down information to the specific granularity
   In the case study the granularity is:
   - Incident
   - Change
   - Project
   - Service desk call redirection (each time a call is redirected to different phone station it is considered a Call redirection)

To illustrate the above list refer to the dashboard (Illustration 20). This dashboards has Senior Management focused information translated in Key Performance Indicators and enables drill down to the project level, were the manager can see what projects are affecting/enabling the KPI. It is also available a wide range of filters to understand KPI in different perspectives instead of the traditional static perspective of KPI.

A. Time filters (based on different stages of the project) – Time Dimension
B. Project ID and Description filters – Project Dimension;
C. Project Team Filters (Main Team; Application Managers; Relationship Managers) – Implementation of the RACI model;
D. Project Status – Project Dimension;
E. Key Performance Indicators (KPI) for each Project;
F. Drill down to the projects that the KPI mentions;

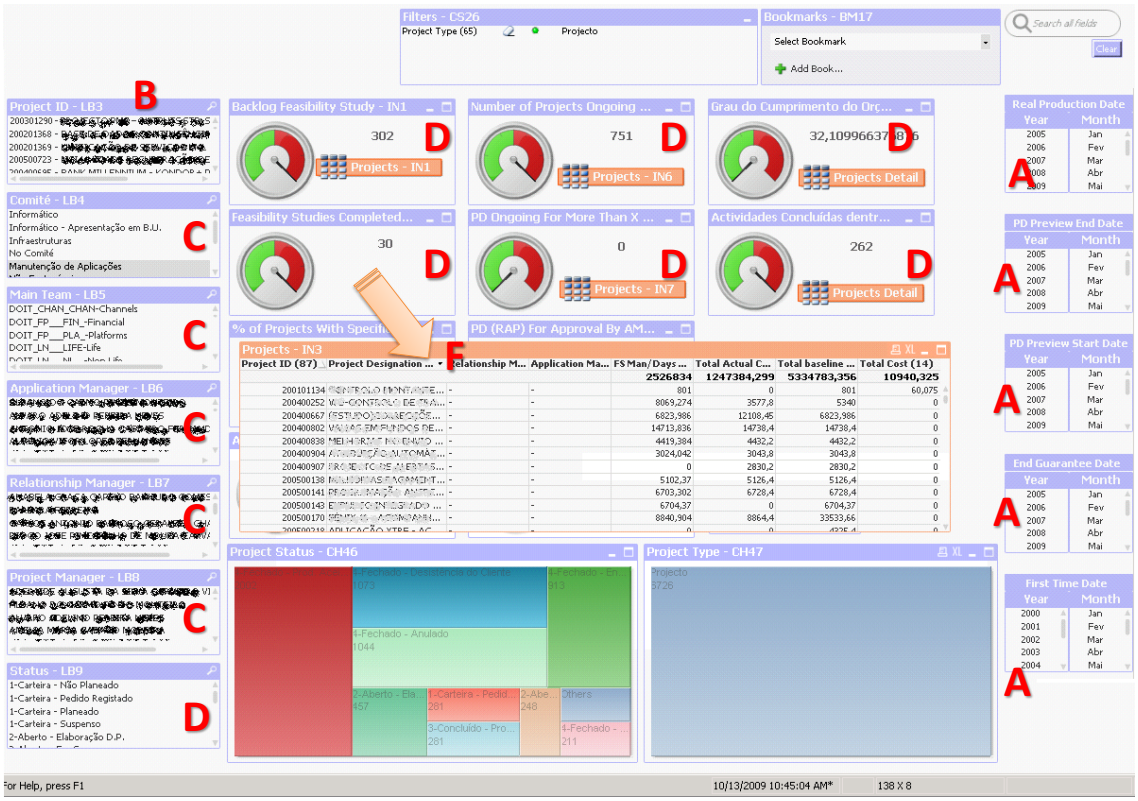


Illustration 20 - Principle 3 - Project Management Dashboard – KPI and drill down

4.1.4. Principle 4 - Make choices

Key points

"...governance can and should highlight conflicting goals for debate..."

"...As the number of tradeoffs increases, governance becomes more complex..."

Model Analysis

Making choices is the key aspect of Decision Support Systems. The proposed model, in every single process, enables decision making by allowing the analysis of conflicting goals.

IT-Governance complexity is due to the fact that many decisions affect IT objects but most of the times we cannot relate the cause effect of decisions.

In this model, because it is focused on aligning IT processes with best practices and frameworks, and because we have analysis dimensions that relate most of these processes, we can understand when a decision taken in one process affects another process.

One of the dimensions that better illustrates the capacity to understand cause effect relationships within an IT process framework is Configuration Item (CI).

The Configuration Item exists in most IT processes and understanding what happens in its life cycle, from its conception (from Business Objectives to IT Initiative), creation (Project Development) and production (from Change needed to place it in production to the Changes needed to make the Configuration Item adjusted to the business environment to its incidents).

Because IT is a complex environment, any decision taken need to be analyzed and understood is all IT objects and across all processes.

Some examples of decision that can be made with the proposed model[3]:

1. **Incident Management**

a. Understand Team incident resolution efficiency (based on time and cost variables);
b. Evaluate if chosen employees assigned in the RACI model (specially the Responsibility and Accountability aspects) are behaving as expected;
c. Understand if there is a pattern in incidents (with data mining models this pattern analysis can be better evaluated, but for the purpose of historic analysis the current model can satisfy simple pattern analysis made by process owners);
d. Understand geography incident behaviour;

[3] Some of these examples are explored in other IT-Governance principles

e. Incidents life cycle analysis, from Change to Incident and from Incident to Change;

2. Change Management

a. Process re-engineering (based on SLA behaviour across the process stages);
b. Change life cycle analysis, from Change to Incident and from Incident to Change;
c. Understand change behaviour across multiple change Cycles;

3. Project Development

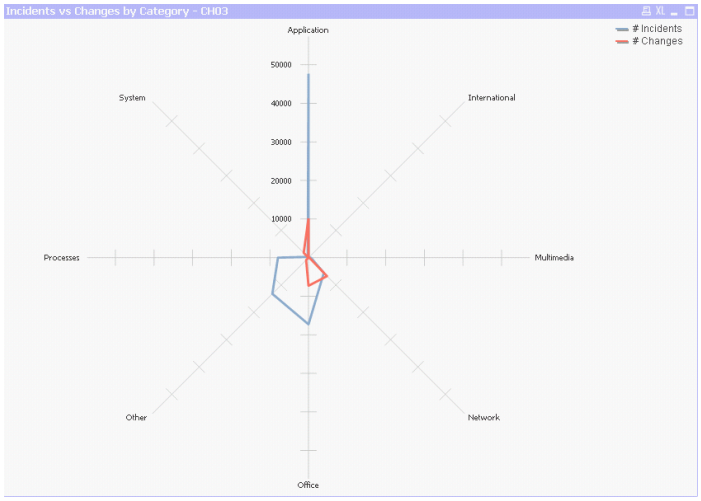
a. Process abandon decision (based on CPI and SPI historic analysis, even if we do not have an advanced module to predict project effort – time and cost – we can understand the CPI and SPI evolution during the project and decide on that historic tendency);
b. Business value of implemented initiatives and projects;
c. Enable on time CPI and SPI index evaluation;
d. Develop the CPI-SPI Matrix evaluation and their contribution to business objectives (using key Project Management metrics and evaluating Project delivery – time, cost and feasibility);
e. Analyze impact of project team changes;
f. Analyze impact of project scope changes;

4. Service Desk Management

a. Understand when to change a team member;
b. Understand when to increase the amount of employees in determined Queues at determined times of the day;
c. Evaluate what Configuration Items need more attention in education sessions (connecting the Configuration Item to the Service Desk interaction, we can evaluate if a given CI is constantly taking more time that others, meaning its more complex or even that Service Desk cannot solve those incidents and they should be sent directly to second level).
d. Evaluate Change impact in customer attention (if a given CI changes we need to understand the effort needed to support that change);

In the case study, as you can see in the Data warehouse Bus Matrix (Annex 2 - IT Governance Datawarehouse Bus Matri), we can relate Configuration Items in Change and Incident Management.

One of the perspectives we can illustrate in the case study is the effect of change management in incident management. If Changes to specific types of Configuration items are creating an increased amount of Incidents, or, using other words, if the rhythm of changes is affecting the ability to deliver well (Illustration 21) .



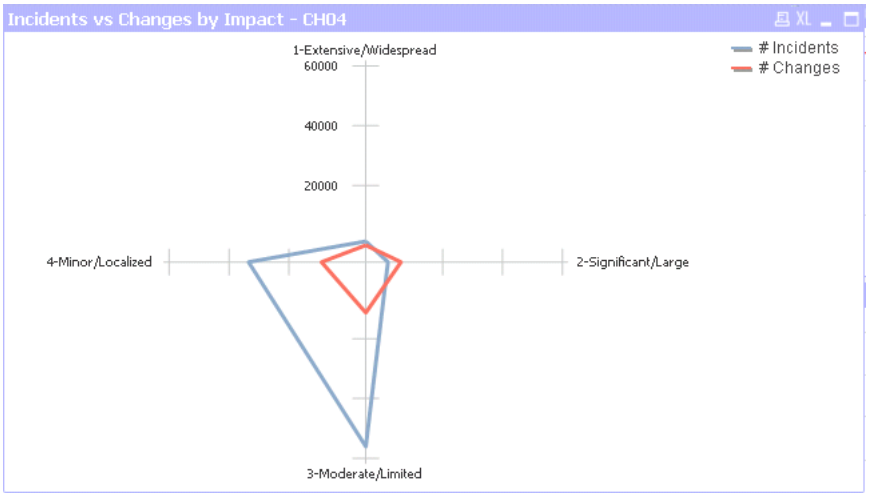


Illustration 21 - Principle 4 - Change Dashboard – Change rhythm pressure in delivering – Configuration Item/Category[4]

[4] The incidents scope of time and categorization is the same and stable for the given analysis

By observing the first illustration (Illustration 21) we see that changes being made to Network are affecting the amount of incidents being raised.

On the second illustration we can see that although Significant/Large and Minor/Localized changes are mostly the same, we do not see that happening in incidents, were the Significant/Large are not raised in the same level, being the Moderate/Limited the ones that increase (meaning incidents impact more than changes categorization to impact).

4.1.5. Principle 5 - Clarify the exception handling process

Key points

"Some requests for exceptions are frivolous, but most come from a true desire to meet business needs. If the exception proposed by a business unit has value, a change to the IT architecture could benefit the entire enterprise."

"A manager become frustrated if they are told they cannot do something they are sure is good for business."

"Pressure increases and the exceptions process provide a transparent vehicle to release the frustration without threatening the governance process."

Model Analysis

Exceptions are, if well managed, important to process re-engineering. Processes are constantly being tested with day to day requests from business. A coherent evaluation of their performance and adaptability to business needs is a very important issue.

IT-Governance practises state that process measurement and benchmarking is made using maturity models like CMMI) (IT Governance Institute, 2007). According to COBIT view on SEI CMM we can have 6 maturity levels:

0 Non-existent - The enterprise has not even recognised that there is an issue to be addressed.

1 Initial/Ad Hoc - There is evidence that the enterprise has recognised that the issues exist and need to be addressed...however, no standardised processes ... there are ad hoc approaches that tend to be applied on an individual or case-by-case basis. The overall approach to management is disorganised.

2 Repeatable but Intuitive - Processes have developed to the stage where similar procedures are followed by different people undertaking the same task ... no formal training or communication of standard procedures, and responsibility is left to the individual ... high degree of reliance on the knowledge of individuals and, therefore, errors are likely.

3 Defined Process - Procedures have been standardised and documented, and communicated through training. It is mandated that these processes should be followed; however, it is unlikely that deviations will be detected. The procedures themselves are not sophisticated but are the formalisation of existing practices.

4 Managed and Measurable - Management monitors and measures compliance with procedures and takes action where processes appear not to be working effectively. Processes are under constant improvement and provide good practice. Automation and tools are used in a limited or fragmented way.

5 Optimised - Processes have been refined to a level of good practice, based on the results of continuous improvement and maturity modelling with other enterprises. IT is used in an integrated way to automate the workflow, providing tools to improve quality and effectiveness, making the enterprise quick to adapt.

Exception handling can only be managed and detected if we are between maturity level 4 and 5. In any other maturity levels it is very hard to detect and take advantage of an exception handling process because there is no way to capture and control exceptions.

Process evolution needs process information, and process information must be developed according to the process and all the processes it interacts with, meaning the process owner needs information not only on its process but also on all related processes.

Developing a DD-DS based on Data warehouse Bus Matrix, where processes are related in common dimensions is a way to enable enterprise wide process information analysis.

Exceptions can be a source for process re-engineering and consequently be the source for better processes. DD-DSS can be a vehicle for that process exception analysis. If an exception is to be opened, for example, not to approve a determined Change before implementing it (skip the "Request for Approval" stage) we must understand what the effect was.

We could then analyse and decide whether or not that stage could be ignored (according to specific Change Characteristics) or exception lead to a standard in the organization.

For exception analysis we consider to be important in a model the following capabilities:

1. Be able to identify exceptions;
2. Gather cost and time information of those exceptions;
3. Evaluate process performance after and before exceptions.

The proposed model has fields to identify if a given Change, Incident, Project or Service Desk interaction were exceptions (e.g. Incident Management - Is an Exception (679); Exception details (680); Exception type (681); Exception approver employee ID (682); Exception approver employee name (683)) . These fields allow process owners the identification of behaviours of those exceptions.

Because the model has information on cost and time of each process object (for each Incident, Change, Project and Service Desk call), we can gather the required information for point 2 of the exception analysis.

Also because the model is historically trended, as every DD-DSS should be, we can evaluate before and after exception implementations, that is, if a determined process is re-engineered because of a given exception we can understand if the decision of an exception becoming a standard was well taken.

To illustrate the model capabilities in real case scenario, we could get the example of the last point, a re-engineering of Change Management process was caused by an exception analysis and the process owner could then see the differences between the previous cycle (were the exception was still considered an exception) and the current cycle (after the exception was integrated as a standard) (Illustration 22).

The process owner could, filtering information to the Changes that were affected by the process re-engineering, analyze if the percentage of successful changes raised or decreased, if the quality assessment of the change was within the required SLA, if the time taken in each stage is within the SLA and many other types of process analysis.

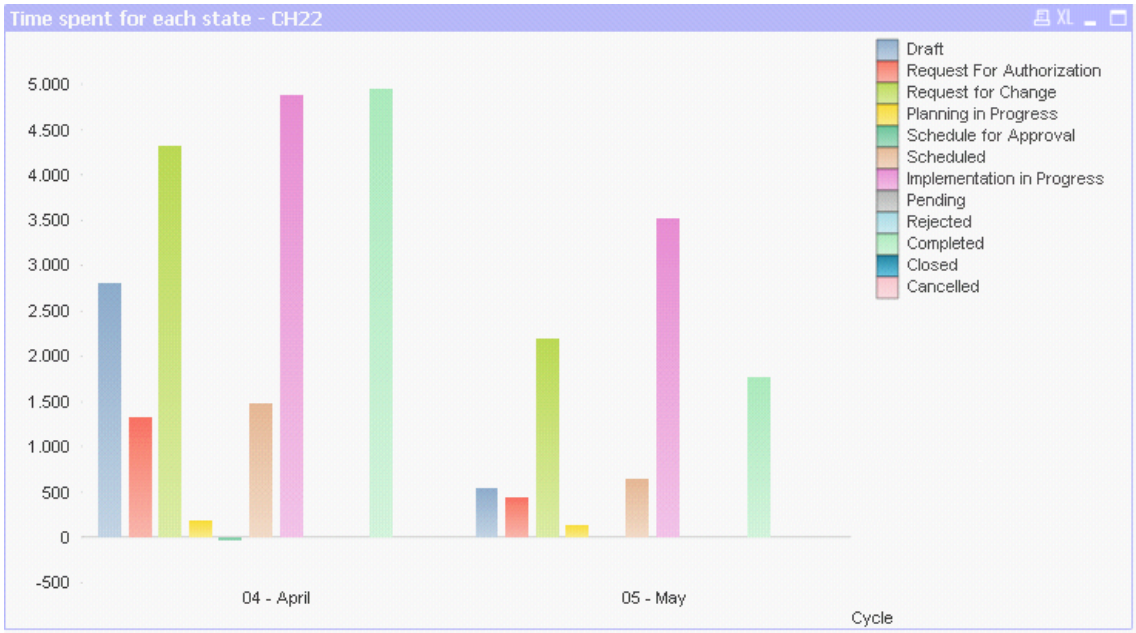


Illustration 22 - Principle 5 - Change Dashboard – Evaluate time spent in each change stage

In this example we can see that the time taken to prepare the change was drastically reduced and the time to implement was also reduced. This process re-engineering enabled a true reduction on time spent to deploy a Change, from its Draft phase to the deployment. Alongside this analysis, Process owners could also understand the Cost and Quality perspectives of the implementation of this exception, that is, if the exception resulted in better quality and reduced costs.

4.1.6. Principle 6 - Provide right incentives

Key points

"...misalignment of incentive and reward systems with the behaviours the IT governance arrangements were designed to encourage"

"...If IT governance is designed to encourage business unit synergy, autonomy, or some combination, the incentives of the executives must also be aligned."

Model Analysis

Incentives, as stated, must be given to encourage behaviour toward business objectives.

Understanding a common and transversal (in responsibility and incentives) Key Performance Indicator down to the employee level is a very important tool to correctly assign and analyse incentives.

If we cannot assign a determined performance down to the employee level, the decision maker has to deliver incentives based on averages.

Delivering incentives based on averages discourages above average performers because they are harder to detect and subsequently to compensate.

With the proposed model it is possible to:

1. Supply indicators information in a structured and centralized platform;
2. Deliver indicators information down to the employee level;

3. Performance indicators (Cost , Time and Quality)
4. Deliver historic analysis to better understand before, during and after an incentives assignment (the model has Management Events, Business Events and Technical Events to flexibly allow Process Owners to analyse periods during which these events occurred) ;

To illustrate the model capabilities, considering the case study, we can have a dashboard with (Illustration 23):

A. Filters for Time – Time Dimension;
B. Call Status – Help Desk Call Dimension (information in Portuguese);
C. Queue Type – Help Desk Call Type;
D. Agents – Help Desk Agents;
E. Management Events – Time Dimension

   The Management Events (334) allows IT Managers to understand cause effect outputs, in this case we have set a reference for 2009 first incentives delivery and then to 2009 second incentives delivery, and, as you can see in object H, from first to the second incentives distribution we have noticed a reduction on "On Hold", down to the level were its SLA is not reached;
F. Number of Calls and Average Duration – Fact Help Desk Calls;
G. Call Average Duration by Queue – Help Desk Calls Queue;
H. Number of On Hold Calls with reference for 2 Management events, 2009 (19) Incentives Delivery and 2009 (2) Incentives Delivery – Help Desk Call Dimension;
I. Call Average Duration by Help Desk Queue – Help Desk Queue Dimension;
J. Number of Calls by hour – Time Dimension;
K. Call Duration by Queue Status – Help Desk Queue Dimension, Fact Help Desk Calls;

Illustration 23 - Principle 6 - Service Desk Dashboard –Management Events related to SLA

In this particular case we can see that given two Management Events (E), "2009 (1) Incentives Delivery" and "2009 (2) Incentives Delivery" we can analyze if the Service Level Agreement "Help Desk Number of Calls" for On Hold Calls (H) was affected by the incentives delivery. In this case, we can see that the SLA is 5500 calls and that before incentives it was around 7000 and after the incentives delivery is less than 5500. In this case it is also possible to filter for each Service Desk Agent (D) to better understand what agents were responsible for accomplishing the SLA.

4.1.7. Principle 7 - Assign ownership and accountability for IT governance

Key points

"...Like any major organizational initiatives, IT governance must have an owner and accountabilities..."

"Ultimately the board is responsible for all Governance, but the board will expect or delegate an individual (probably the CEO or CIO) or group to be accountable for IT governance design, implementation, and performance..."

Model Analysis

In order to assign ownership and accountability for IT Governance, managers need to have information on their specific responsibilities. The challenge becomes bigger when the information is analysed and treated to better suit the information requester analysis perspective. In that step, normally, new information is derived and some is discarded. When the C-Level manager's request integrated information, the treated and adapted information builders are unable to show a clear integrated view because they tend to discard information about other processes leaving a fragmented view of the enterprise wide process framework.

Given this, the assignment and accountability must take place in an integrated information environment, where analysis dimensions must be common and where an integrated view of information can be built and deployed with data confidence and with the overall process perspective.

Ownership is established by management using the Responsible, Accountable, Consulted and Informed model (RACI)(Alison Cartlidge, 2007). The RACI model identifies the Responsible, Accountable, Consulted and Informed people for each action taken. Assignment of these roles is part of IT decision making and supporting this decision, before and after it is taken, can be done using this DD-DSS.

A way to support this information is by analyzing IT Events and the RACI model employees that support them.

With the proposed model it is possible to:

1. Identify who is Responsible, Accountable, Consulted and Informed for each process iteration;

2. Analyse key process indexes (Quality, Cost and Time) for each Employee to each given IT-Event;
3. Understand Management Events related to RACI matrix changes (e.g. enterprise re-structuring) repercussions to the key process indexes;

In the case study it was not possible to gather information related to RACI model. Given that it is not possible to show a dashboard that illustrates an analysis of ownership and accountability. With the real case implementation it is possible to select specific roles in some processes (e.g. Change Roles – Change Assignee) but not on all processes.

4.1.8. Principle 8 - Design IT governance at multiple organizational levels

Key points

"...point is enterprise-wide IT governance driven by a small number of enterprise-wide strategies and goals..."

"Enterprises with separate IT functions in divisions, business units, or geographies require a separate but connected layer of IT governance..."

"...starting enterprise-wide is sometimes not possible for political or focus reasons, and starting at the business unit level can be practical. Assembling the governance arrangements matrixes for the multiple levels in an enterprise makes explicit the connections and pressure points..."

Model Analysis

"...starting point is enterprise-wide IT governance driven by a small number of enterprise-wide strategies and goals." means all strategies and goals must have an information system to support them. This information system, managed by different levels of IT, must be integrated and process oriented.

The major risk of this segmentation is not being able to understand the enterprise-wide behaviours and the individual contribution of each IT level.

An UDM responds to these challenges and enables the IT, even when it is divided in multiple levels, to be able to deploy integrated management information to the enterprise-wide strategies and goals. An important step in this analysis might be the geographic and IT level dimensions, where the C-Level managers can have a perspective on how different levels are behaving.

Connecting information from multiple departments and geographies with different cultures into common data architecture without losing the source of the information is the challenge raised in this principle. If these departments and geographies have different environments the analysis must be made independently but connected enterprise wide.

DD-DSS allow disparate operational systems data gathering and data quality without losing the sources of information specific details.

This common view of information allows IT decision makers to understand the overall perspective and still be able to drill down to specific IT-level decisions.

With this model it is possible to:

1. Gather information from multiple disconnected operational systems;
2. DD-DSS allow information gaps to be filled in case one operational system does not support the same amount of information another operational system supports (based on different implementations of the same process);
3. Enable cultural analysis using an Organization Dimension;
4. Enable Geography Analysis;

In the particular case of the case study, and because the information we analysed is based on the same operational systems and process implementation was made to all geographies and IT-Levels in a standard way, there is no point in understanding the process differences.

4.1.9. Principle 9 - Provide transparency and education

Key points

“Many firms ... use portals or intranets to communicate IT governance”

“Normally these portals include tools and resources, such as a glossary of IT terms and acronyms and the "Computer Contract Checklist." ”

Model Analysis

DD-DSS need business and technical metadata to be developed. Although the output is a simple list of business and technical definitions, the work behind it and the importance it has for decision making is very high. While gathering these definitions we find ourselves dealing with:

1. Definitions that are the same but with different names;
2. Definitions that result from a misinterpretation of the standards, best practises, frameworks of IT-Governance;
3. Definitions made up by some departments but that does not make sense in terms of IT-Governance;
4. No definitions at all

All these are opportunities to review IT-Governance concepts, re-align them and create a closer relationship between decision makers and these concepts. It is also an opportunity to create closer and more enterprise wide view of IT-Governance.

In our model, we have developed a Metadata repository that can be found in the Annex 4 - IT-Governance Metadata.

The metadata was developed according to Kimball Group view on Metadata strategy (Thornthwaite).

These definitions because they total more than 600 are also uniquely identified and are used for other initiatives like KPI definitions.

Metadata repository is published in the internal IT portal of the case study and all information has management team and update process.

4.1.10. Principle 10 - Implement common mechanisms across six key assets

Key points

"..Enterprises using the same mechanism to govern more than one of the six key assets have getter governance"

"Many enterprises successfully coordinate their six assets within a project but not across the enterprise via governance."

Model Analysis

According to Peter Weill the 6 key assets are Human, Financial, Physical, IP, Information and IT and Relationship. Also according to Peter Weill, enabling control mechanisms across more than one asset is a critical success factor for good governance, including IT-Governance.

The proposed model has taken in consideration all of these assets by allowing Decision Makers to understand Asset behaviour whenever they are related to an IT process.

It is not the purpose of this model to respond to specific needs of each asset, e.g. Human Assets deals with People, skills, career paths, training, reporting, mentoring, competences and so on, in our model we enabled the analysis of a determined Human Asset to be better understood, a Service Desk Agent is identified and, if the Human Asset management systems needs, it can relate a determined asset control (if the Service Desk Agent is competent) with mode inputs from the model (if the SLA assigned to that determined Service Desk Agent is respected), enabling better decision making (increase

training for that Service Desk Agent in determined fields were we takes more time to answer).

With this model it is possible to:

1. Understand IT-Processes connection with 6 key assets;
2. Enable other Asset Managers to gather more information for their control mechanisms;
    a. Human Assets control in the processes:
        i. Change Management (Change Manager Dimension, Change Requestor Dimension)
        ii. Help Desk Management (Help Desk Agent Dimension)
        iii. Incident Management (Incident Dimension)
        iv. Project Development (Project Manager Dimension and Relationship Manager Dimension)
        v. Knowledge Management
    b. Financial Assets control using the Financial Management process
    c. Physical Assets control using Capacity Management, Demand Management, Information Security Management, IT Service Continuity Management, Service Asset and Configuration Management)
    d. IP asset control with Knowledge Management process;
3. Understand, historically, if a determined action made based on a control analysis had the expected result in IT-Governance processes.

5. Conclusions

The research project fulfilled all the objectives initially set. It enabled to confirm that Data Driven Decision Support Systems are a Critical Success Factor for IT-Governance.

In fact the developed model, based on 4 IT-Governance processes mapped with recognized best practises, frameworks and body of knowledge, was able to answer the 10 IT Governance Principles that Peter Weill identifies in his research, considered the most complete, on IT-Governance.

It's also important to mention that the model is providing a valuable contribution to the financial institution where it was implemented and where it is working on a regular basis.

Financial institutions are very competitive and deeply dependent on IT. They consider IT as one of the most important assets, and their approach to IT-Governance is also very close to best practises, frameworks, body of knowledge and researchers like Peter Weill. Choosing this sector enabled a closer and more accurate evaluation of the model, crossing the boundaries of a study and entering the field of real application.

Based on the success of this initiative we are already engaging new initiatives like IT-Balanced Scorecards and Benefits Management, sponsored by key stakeholders of the financial institution.

6. Recommendations

As previously mentioned, this approach to decision making in IT-Governance is, at this moment, a new topic not explored by researchers. Decision Support Systems has many fields of study and studying its relationship with IT-Governance results in many recommendations.

We have two types of recommendations, one for the implementation of the model in the real world scenario (with recommendations to what should be done to enhance the decision making process) and another set to recommend the following research steps in this field.

6.1. Recommendations to the real world implementation

The implementation of this model to a real world scenario has raised some issues that management needs to address. These issues, some already known and some were found while the research and implementation took place, are being analyzed by the project sponsors.

1	**Include events dimensions**
	Events dimensions - Management, Technical and Business - may include information on date and time where specific events occurred. Having this information enables mid and top managers to analyze IT assets behaviour during those events. Making decisions with these key environment inputs is a key aspect of IT-Governance principles.
2	**Include customer perspective in all processes**
	Service oriented IT needs to focus on customers. Although only one (Service Desk Management) out of four identified processes didn't have the customer dimension, this perspective should always be clarified and implemented in the model. Service Desk is the customer entry point for IT (Alison Cartlidge, 2007), so input on customer at this

	stage is considered critical.
3	**Connection between Service Desk and other processes**
	Service Desk Management should have more connections with other processes, in this case using Configuration Item, Customer and what event was triggered (Change, Incident, others). This connection enables complete customer Lifecycle analysis from its first contact with IT up to the specific interaction he has with other IT-Processes.
4	**Service Oriented Analysis implementing a Service Dimension**
	Service Dimension was not present because Service Catalogue was not implemented. The company is undergoing a project to implement an IT Service Catalogue. The need to focus on Service oriented analysis is present on most IT-Governance principles.
5	**Supplier Oriented Analysis**
	With constant Outsourcing/Co-Sourcing and cost reduction initiatives Supplier Oriented Analysis is an important perspective to IT decision makers. Normally this is introduced with Contract Management processes.
6	**Strategic Alignment Analysis**
	As mentioned in IT-Governance Principle 1, Strategic Alignment analysis is of most importance to top IT management. This alignment is a major challenge and, in our opinion, can only be achieved if top IT management focuses its efforts on strategic alignment tools like Balanced Scorecards, in this case, IT-balanced scorecards. Deploying a top down perspective, from Business Objectives, to IT Objectives. With this kind of perspectives it is possible to map Business Objectives, to IT Objectives, to IT Initiatives and to IT Configuration Items and Events (this model was tested in the case study but without real live data).

7	**More information on quality, costs and time**
	Some operational processes do not address these three variables in a consistent way. They have perspectives on these fields but they are not materialized.
8	**Benefit assessment**
	Some operational processes do not address these three variables in a consistent way. They have perspectives on these fields but they are not materialized.

6.2. Further research recommendations

After the research made on IT-Governance and Decision Support Systems, and considering the research maturity of this field, we have a considerable amount of topics we consider important to better understand and support IT-Governance decisions.

1	**Materialize IT-Governance complete UDM**
	We have explored 4 of the 21 IT-Governance processes. The result was successful to prove that DD-DSS are a Critical Success Factor for IT-Governance and to develop a first approach to an IT-Governance UDM. New researches could lead into the materialization of the complete UDM for IT-Governance.
2	**Clustering, classifying, estimating and predicting on IT-Governance problems (Data mining)**
	Data mining, as a way to "…seek to find unexpected patterns in the data..."(Kimball, 2002), has many applications in the amount of problems IT-Governance faces. We also consider that, given the maturity of IT processes and the availability and quality IT management tools have, it is time to start researching on how data mining can help. Some examples where data mining could help (on selected IT-Processes):

	1. Understand what characteristics are most important for Service Availability; 2. Understand what characteristics are most important to make a Change successful. Important to support decisions at Change Advisory Board meetings; 3. Model to rank Change Team Assignment based on Change success output variable and Change characteristics; 4. Model to output an Incident Team Assignment ranking based on Incident resolution success output variable and Incident characteristics; 5. Service Risk Level prediction; 6. IT Project success prediction (cost, time and quality criteria);
3	**IT Balanced Scorecard contribution to IT-Governance**
	Understanding how the cascading of the Business Balanced Scorecard to the IT Balanced Score card can help IT-Governance. The contribution of this work in gathering information is also an important bridge to develop a case study on IT-Balanced Scorecards and their importance to IT-Governance.

7. Bibliography

A Guide to the Project Management Body of Knowledge. (2004). Project Management Institute.

Alison Cartlidge, A. H. (2007). An Introduction Overview of ITIL v3. The UK Chapter of the itSMF.

Allen E. Brown, G. G. (2005). Framing the frameworks: A review of IT Governance Research. Association for Information Systems , 15, 696-712.

Basel Committee on Banking Supervision. (2006). International Convergence of Capital Measurement and Capital Standards - A Revised Framework Comprehensive Version. Bank of International Settlements.

Betz, C. T. (2006). Architecture and Patterns for IT Service Management, Resource Planning, and Governance: Making Shoes for the Cobbler's Children. Morgan Kaufmann.

Brans, J.-P. M. (1993). BANKS: a decision support system for the evaluation of the complex international banking sector. Systems, Man and Cybernetics, 1993. 'Systems Engineering in the Service of Humans', Conference Proceedings., International Conference , 659-663.

British Standards Institute. (s.d.). British Standards Institute. Obtain in October of 2009, from http://www.bsigroup.com/en/About-BSI/

Burak E, A., Oralb, M., Reismanb, A., & Yolalana, R. (June de 2003). A credit scoring approach for the commercial banking sector. 37 (2) , 103-123.

Calder, A. (2005). IT Governance: Guidelines for Directors. IT Governance Publishing.

Calder, A. (2006). Managing Risk In Information Technology. IT Pro News .

Carr, N. G. (2004). Does IT matter? Information technology and the corrosion of competitive advantage. (H. B. Press, Ed.) Boston, United States of America: Harvard Business Press.

Chan, P. K., Fan, W., Prodromidis, A. L., & Stolfo, S. J. (1999). Distributed Data Mining in Credit Card Fraud Detection. IEEE .

Christopher H. Jolly, M. S. (s.d.). A Classification Problem in the Credit Card Industry: A Comparison of Three Solutions . Indian Institute of Technology .

COSO - About Us. (s.d.). Obtain in October of 2009, from Committee of Sponsoring Organizations of the Treadway Commission website: http://www.coso.org

Durkin, M. (2004). In search of the Internet-banking customer - Exploring the use of decision styles. The International Journal of Bank Marketing .

ECB. (s.d.). Obtain in October of 2009, from European Central Bank website: http://www.ecb.int

Eisenberg, L., & C., H. (2007). Implementing risk management systems with a benchmark: a Web-Based DSS approach. International Journal of Electronic Finance , I (3), 293-303.

Gao, C., & Xu, D. (June de 2006). Conceptual Modelling and Development of an Intelligent Agent-Assisted Decision Support System for Anti-Money Laundering.

Gary Stoneburner, A. G. (2002). Risk Management Guide for Information Technology Systems. National Institute of Standards and Technololgies.

Gates, S. (2006). Incorporating Strategic Risk into Enterprise Risk Management: A Survey of Current Corporate Practice. New York City: Journal of Applied Corporate Finance.

Giblin, C. J., Mueller, S., & Pfitzmann, B. (2007). From Regulatory Policies to Event Monitoring Rules: Towards Model-Driven Compliance Automation. IBM Research .

Hussami, L. (2009). A decision-support system for IS compliance. Lausanne, Institute of Information Systems.

IBM Service Management - IBM Tivoli Unified Process. (s.d.). Obtain in October of 2009, from IBM: http://www-01.ibm.com/software/tivoli/governance/servicemanagement/itup/tool.html

IEC - About. (s.d.). Obtain in October of 2009, from Commission Electrotechnique Internationale: http://www.iec.ch/

International Federation of Accountants. (2004). Enterprise Governance - Getting the Balance Right. International Federation of Accountants, PAIB Technical Manager. New York: International Federation of Accountants.

Ioannou, G., & Mavri, M. (2007). Performance-Net: A Decision Support System for Reconfiguring a Bank's Branch Network. Omega , 190-201.

ISACA - About. (s.d.). Obtain in October of 2009, from Information Systems Audit and Control Association Web site: http://www.isaca.org/Content/NavigationMenu/About_ISACA/Overview_and_History/Overview_and_History.htm

ISACA - COBIT. (s.d.). Obtain in October of 2009, from Information Systems Audit and Control Association Web site: http://www.isaca.org/Template.cfm?Section=COBIT6&Template=/TaggedPage/TaggedPageDisplay.cfm&TPLID=55&ContentID=31519

ISO. (s.d.). Obtain in October of 2009, from ISO - About: http://www.iso.org/iso/about/discover-iso_the-iso-brand.htm

ISO/IEC. (2008). ISO 38500:2008. ISO 38500:2008 .

IT Governance Institute. (2004). Board Briefing on IT Governance. IT Governance Institute. Illinois: Board Briefing on IT Governance.

IT Governance Institute. (2007). COBIT 4.1 - Framework Control Objectives, Management Guidelines and Maturity Models. Illinois.

It Process Maps. (s.d.). Obtain in October of 2009, from http://wiki.en.it-processmaps.com/index.php/Availability_Management

ITGI. (2009). ITGI About Site Section. Illinois, United States of America.

J., D., H.S., D., S., W., K., C., & X., D. (2004). A framework of web-based decision support systems for portfolio selection with OLAP and PVM. Decision Support Systems , 37 (3), 367 - 376.

Kaplan, R. S., & Norton, D. P. (2000). The Strategy-Focused Organization: How Balanced Scorecard Companies Thrive in the New Business Environment. Boston, United States of America: Harvard Business Press.

Kaplan, R. S., & Norton, D. (1996). The Balanced Scorecard: Translating Strategy into Action. Harvard Business Press.

Kimball, R. (2002). The Data Warehouse Toolkit: The Complete Guide to Dimensional Modeling. Wiley.

Kumar, C. N. (2007). A decision support system for the reserve bank of India to forecast currency requirements at currency chests. Industrial Engineering and Engineering Management, 2007 IEEE International Conference , 857-861.

Kumar, S., & Turner, L. (2006). Real-world real options: a powerful decision technology tool for managing risk and flexibility in capital investment projects. International Journal of Electronic Finance , 68-93.

Kuo, H.-C. (2004). Cognitive Management System Based Support for Bank Credit Granting Decision: An Integrated and Practical Design for Taiwan. Journal of Systems Integration , 77-91.

Lientz, B. a. (2004). Manage IT as a business: how to achieve alignment and data value to the company. Amsterdam: Elsevier/Butterworth-Heinemann.

Lutchen, M. (2003). Managing IT as a Business: A Survival Guide for CEOs. Wiley.

McManus, J. W.-H. (May de 2003). Information systems project management: The price of failure. Management Services .

Microsoft Operations Framework 4.0. (s.d.). Obtain in October of 2009, from MOF 4.0 - About: http://technet.microsoft.com/en-us/library/cc506049.aspx

Moss, L. T., & Atre, S. (2003). Business Intelligence Roadmap: The Complete Project Lifecycle for Decision-Support Applications. Addison-Wesley Professional.

Neslin, S. A., Gupta, S., Kamakura, W., Lu, J., & Mason, C. (2004). Defection Detection: Improving Predictive Accuracy of Customer Churn Models.

Nonaka, I. (1991). The knowledge creating company (Vols. N. 69 - 6 Nov-Dec). Harvard Business Review.

Onut, S., Erdem, I., & Hosver, B. (2002). Customer Relationship Management in Banking Sector and A Model Design for Banking Performance Enhancement.

Organization for Economic Cooperation and Development. (2004). OECD Principles of Corporate Governance. Paris, France: OECD Publications Service.

P., X., E., E., K., E., K., M., D., A., G., M., et al. (2009). On the selection of equity securities: An expert systems methodology and an application on the Athens Stock Exchange. Expert Systems with Applications: An International Journal , 11966-11980.

P.J, S. (1991). Decision support systems in banking, Stevens. IEE Colloquium , pp. 3/1 - 3/4 .

Poh, K. L. (2000). An intelligent decision support system for investment analysis. Knowledge and Information Systems , 340 - 358 .

Portugal, B. d. (2009). Aviso n.5 Banco de Portugal. Lisboa.

Power, D. (2002). Decision Support Systems: Concepts and Resources for Managers. Greenwood Press.

Rakesh Agrawal, C. J. (2006). Taming Compliance with Sarbanes-Oxley Internal Controls Using Database Technology. IBM Almaden Research Center, University of Stuttgart.

Rigopoulos, G., Psarras, J., & Askounis, D. (2005). A Proposed Architecture for Intelligent Decision Support in Digital Payments Market Based on Multiagent Simulation. Computational Intelligence for Modelling, Control and Automation, 2005 and International Conference on Intelligent Agents, Web Technologies and Internet Commerce, International Conference , II, 964 - 967.

S., T., Gary, C., & Spalding, G. (2004). ITIL V3 - Reference Book - Continual Service Improvement. The Stationary Office.

SAS Intelligence - Change Management. (s.d.). Obtain in October of 2009, from http://www.sas.com/solutions/itcharge/index.html

SAS IT Intelligence - IT Resource. (s.d.). Obtain in October of 2009, from http://www.sas.com/solutions/itresource/index.html

SAS IT Intelligence - Service Level Management. (s.d.). Obtain in October of 2009, from http://www.sas.com/solutions/itslm/index.html

Schlienger, T., & Stephanie, T. (2005). Tool Supported Management of Information Security Culture - Application in a Private Bank. IFIP International Federation for Information Processing , 181, 65-77.

Seçme, N., Bayrakdaroğlu, A., & Kahraman, C. (2009). Fuzzy performance evaluation in Turkish Banking Sector using Analytic Hierarchy Process and TOPSIS. Expert Systems with Applications: An International Journal , 36 (9), 11699-11709.

Shane, B., Fry, M., & Toro, R. (1987). The design of an investment portfolio selection decision support system using two expert systems and a consulting system. Journal of Management Information Systems , 79 - 92.

Software Engineering Institute - Carnegie Mellon. (s.d.). SEI - CMMI. Obtain in October of 2009, from http://www.sei.cmu.edu/cmmi/index.cfm

Spremic, M. (s.d.). IT Governance and IT Risk Management Principles and Methods for Supporting 'Always-On' Enterprise Information Systems. University of Zagreb .

Spremic, M., & Popovic, M. (2008). Emerging issues in IT governance: implementing the corporate IT risks management model. WSEAS TRANSACTIONS on SYSTEMS , 7 (3), 219-228.

Tansel, Y., & Yurdakul, M. (May de 2009). Development of a quick credibility scoring decision support system using fuzzy TOPSIS . Department of Industrial Engineering, Faculty of Engineering, Baskent University.

The Open Group. (2009). The Open Group - TOGAF 9. Obtain in 2009, from The Open Group - TOGAF 9: http://www.opengroup.org/architecture/togaf9-doc

Thornthwaite, W. (s.d.). KimballGroup. Obtain in October of 2009, from KimballGroup: http://www.kimballgroup.com/html/designtipsPDF/DesignTips2006/KU75CreatingMetadataStrategy.pdf

Tsai, C.-Y. (2009). A Hybrid Data Mining Approach for Credit Card Usage Behavior Analysis. E-business and Telecommunications, Communications in Computer and Information Science , 85.

Tseng, C. C., & P., G. (2002). Real Time Decision Support System for Portfolio Management. Proceedings of the 35th Annual Hawaii International Conference on System Sciences , 79.

Weill, P. &. (2004). IT Governance: How Top Performers Manage IT Decision Rights for Superior Results. Boston: Havard Business School Press.

Wikipedia. (s.d.). Obtain in October of 2009, from IEC: http://en.wikipedia.org/wiki/International_Electrotechnical_Commission

Wikipedia - PDCA. (s.d.). Obtain in October of 2009, from Wikipedia: http://en.wikipedia.org/wiki/PDCA

Wood-Harper, T. (2003). All Business. Obtain from Information systems project management: The price of failure: http://www.allbusiness.com/management/1096163-1.html

Workgroup, C. F. (s.d.). Configuration Management Database Federation (CMDBf). Obtain in October of 2009, from Distributed Management Task Force, Inc.: http://www.dmtf.org/standards/cmdbf/

8. Glossary

A

Actual Cost (AC) – (Project Management) – total cost incurred in accomplished work on the schedule activity or Work Breakdown Structure component during a given time period. This AC must correspond in definition and coverage to whatever was budgeted for the Planned Value (PV) and Earned Value (EV). See Earned Value (EV), Planned Value (PV), Cost Performance Index (CPI) and Schedule Performance Index (SPI). (A Guide to the Project Management Body of Knowledge, 2004)

Audit - general definition of an audit is an evaluation of a person, organization, system, process, project or product. Audits are performed to ascertain the validity and reliability of information; also to provide an assessment of a system's internal control. The goal of an audit is to express an opinion on the person / organization/system (etc) in question, under evaluation based on work done on a test basis. Due to practical constraints, an audit seeks to provide only reasonable assurance that the statements are free from material error. Hence, statistical sampling is often adopted in audits. In the case of financial audits, a set of financial statements are said to be true and fair when they are free of material misstatements - a concept influenced by both quantitative and qualitative factors.

Australian Standard (AS) - Standards Australia was established in 1922 and is recognised through a Memorandum of Understanding with the Commonwealth Government as the peak non-government standards development body in Australia. It is a company limited by guarantee, with 72 members representing groups interested in the development and application of standards and related products and services. Through its Memorandum of Understanding with the Australian Government, it is Australia's member of the two major international standardising organisations, the International Organization for Standardization (ISO) and the International Electrotechnical Commission (the IEC).

Availability Management (AM) – The Process responsible for defining, analysing, Planning, measuring and improving all aspects of the Availability of IT services.

Availability Management is responsible for ensuring that all IT Infrastructure, Processes, Tools, Roles, etc. are appropriate for the agreed Service level targets for Availability. (S., Gary, & Spalding, 2004)

Availability Management Information System (AMIS) - A virtual repository of all Availability Management data, usually stored in multiple physical locations.(It Process Maps)

B

Balanced Scorecard (BSC) – "The Balanced Scorecard translates an organization's mission and strategy into a comprehensive set of performance measures that provides the framework for a strategic measurement and management system. The Balanced Scorecard retains an emphasis on achieving financial objectives, but also includes performance drivers of these financial objectives. The scorecard measures organizational performance across four balanced perspectives: financial, customers, internal business processes, and learning and growth. The BSC enables companies to track financial results while simultaneously monitoring progress in building the capabilities and acquiring the intangible assets they need for future growth."(Kaplan & Norton, 1996)

BASEL II Framework – "describes a more comprehensive measure and minimum standard for capital adequacy that national supervisory authorities are now working to implement through domestic rule-making and adoption procedures. It seeks to improve on the existing rules by aligning regulatory capital requirements more closely to the underlying risks that banks face. In addition, the Basel II Framework is intended to promote a more forward-looking approach to capital supervision, one that encourages banks to identify the risks they may face, today and in the future, and to develop or improve their ability to manage those risks. As a result, it is intended to be more flexible and better able to evolve with advances in markets and risk management practices."(Basel Committee on Banking Supervision, 2006). June 2004 the agreed text

was released, July 2005 the first revision was made available and in 2006 the committee issued a comprehensive version for better understanding.

Best Practise - Proven Activities or Processes that have been successfully used by multiple Organizations. ITIL is an example of Best Practice. (S., Gary, & Spalding, 2004)

British Standard (BS) - (British Standards Institute) Since its foundation in 1901 as the Engineering Standards Committee, BSI Group has grown into a leading global independent business services organization providing standard-based solutions in more than 120 countries.

BSI Group:

- develops private, national and international standards
- certifies management systems and products
- provides product testing services
- provides training and information on standards and international trade and
- provides performance management software solutions

C

Capacity Maturity Model Integration (CMMI) – "is a process improvement approach that provides organizations with the essential elements of effective processes that ultimately improve their performance. CMMI can be used to guide process improvement across a project, a division, or an entire organization. It helps integrate traditionally separate organizational functions, set process improvement goals and priorities, provide guidance for quality processes, and provide a point of reference for appraising current processes. CMMI can be used in three different areas of interest:

- Product and service development (CMMI for Development)
- Service establishment, management, and delivery (CMMI for Services)

- Product and service acquisition (CMMI for Acquisition)

CMMI models are collections of best practices that you can compare to your organization's best practices and guide improvement to your processes. A formal comparison of a CMMI model to your processes is called an appraisal. The Standard CMMI Appraisal Method for Process Improvement (SCAMPI) incorporates the best ideas of several process improvement appraisal methods."(Software Engineering Institute - Carnegie Mellon).

In terms of IT-Governance COBIT uses CMMI to evaluate process maturity. Illustration 24 - CMMI - Maturity Levels (COBIT view)Illustration 24 shows the maturity levels used by COBIT and Illustration 25 has an example of how to display information on a process maturity evaluation taken in consideration industry, enterprise actual maturity level and target.

Figure 13—Generic Maturity Model

0 Non-existent—Complete lack of any recognisable processes. The enterprise has not even recognised that there is an issue to be addressed.

1 Initial/*Ad Hoc*—There is evidence that the enterprise has recognised that the issues exist and need to be addressed. There are, however, no standardised processes; instead, there are *ad hoc* approaches that tend to be applied on an individual or case-by-case basis. The overall approach to management is disorganised.

2 Repeatable but Intuitive—Processes have developed to the stage where similar procedures are followed by different people undertaking the same task. There is no formal training or communication of standard procedures, and responsibility is left to the individual. There is a high degree of reliance on the knowledge of individuals and, therefore, errors are likely.

3 Defined Process—Procedures have been standardised and documented, and communicated through training. It is mandated that these processes should be followed; however, it is unlikely that deviations will be detected. The procedures themselves are not sophisticated but are the formalisation of existing practices.

4 Managed and Measurable—Management monitors and measures compliance with procedures and takes action where processes appear not to be working effectively. Processes are under constant improvement and provide good practice. Automation and tools are used in a limited or fragmented way.

5 Optimised—Processes have been refined to a level of good practice, based on the results of continuous improvement and maturity modelling with other enterprises. IT is used in an integrated way to automate the workflow, providing tools to improve quality and effectiveness, making the enterprise quick to adapt.

Illustration 24 - CMMI - Maturity Levels (COBIT view)

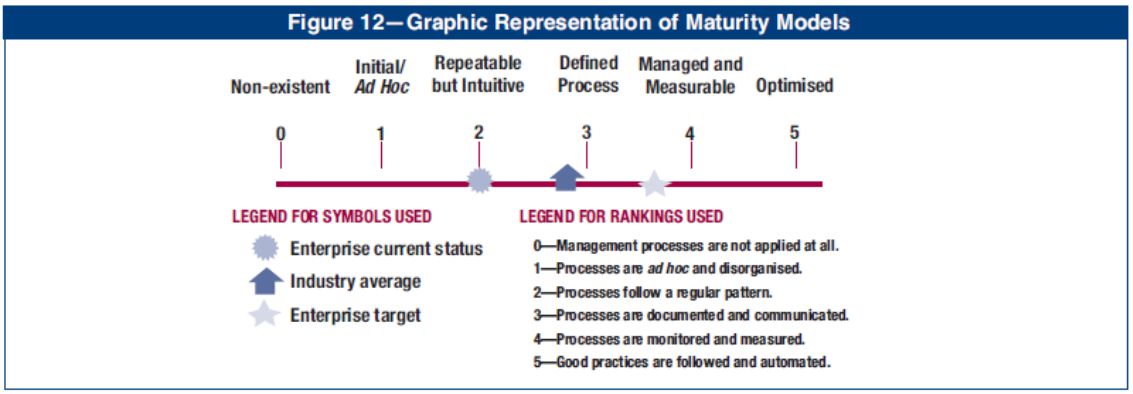


Illustration 25 - CMMI - Maturity Levels, industry, target and company status (COBIT perspective)

Central Computer and Telecommunications Agency (CCTA) - UK government agency providing computer and telecoms support to Government departments. In 2000 CCTA was fully subsumed into the Office of Government Commerce.

Change - The addition, modification or removal of anything that could have an effect on IT Services. The Scope should include all IT Services, Configuration Items, Processes, Documentation, etc. (S., Gary, & Spalding, 2004)

Change Advisory Board (CAB) - delivers support to the Change Management team by approving requested changes and assisting in the assessment and prioritization of changes. This body is generally made up of IT and Business representatives that include: the Change Manager, User managers and groups, technical experts, possible third parties and customers (if required).

The CAB members should selectively be chosen to ensure that the requested changes are thoroughly checked and assessed from both a technical and business perspective. The considered change will dictate the required personnel to convene in a CAB meeting. These entities are not required to meet face-to-face on each requested change, but rather use electronic support and communication tools as a medium. It is however advised that a quarterly meeting is scheduled to review outstanding changes, sign-off on approved changes and discuss any future major changes. (S., Gary, & Spalding, 2004)

Change Management (CM) – The Process responsible for controlling the Lifecycle of all Changes. The primary objective of Change Management is to enable beneficial Changes to be made, with minimum disruption to IT Services. (S., Gary, & Spalding, 2004)

Also ensures that changes are recorded, evaluated, authorized, prioritized, planned, tested, implemented, documented and reviewed in a controlled manner. The objective is the optimization of business risk.

Chartered Institute of Management Accountants (CIMA) - UK based professional body offering training and qualification in management accountancy and related subjects, focused on accounting for business; together with ongoing support for members. CIMA is one of a number of professional associations for accountants in the UK and Ireland. Its particular emphasis is on developing the management accounting profession within the UK and worldwide. CIMA is a member of the Consultative Committee of Accountancy Bodies and the International Federation of Accountants.

Churn - customer switches to another provider. The propensity of customers to cease doing business with a company in a given time period. These include publishing, investment services, insurance, electric utilities, health care providers, credit card providers, financial, Internet service providers, telephone service providers, online services, and cable services operators.

Committee of Sponsoring Organizations of the Treadway Commission (COSO) - formed in 1985 to sponsor the National Commission on Fraudulent Financial Reporting, an independent private-sector initiative which studied the causal factors that can lead to fraudulent financial reporting. It also developed recommendations for public companies and their independent auditors, for the SEC and other regulators, and for educational institutions.

The National Commission was sponsored jointly by five major professional associations headquartered in the United States: the American Accounting Association (AAA), the American Institute of Certified Public Accountants (AICPA), Financial Executives International (FEI), The Institute of Internal Auditors (IIA), and the National

Association of Accountants (now the Institute of Management Accountants [IMA]). Wholly independent of each of the sponsoring organizations, the Commission contained representatives from industry, public accounting, investment firms, and the New York Stock Exchange. (COSO - About Us)

Common Criteria for Information Technology Security Evaluation (CC) - is an international standard (ISO/IEC 15408) for computer security certification.

Configuration Item - any Component that needs to be managed in order to deliver an IT Service. Information about each CI is recorded in a Configuration Record within the Configuration Management System and is maintained throughout its Lifecycle by Configuration Management. CIs are under the control of Change Management. CIs typically include IT Services, hardware, software, buildings, people, and formal documentation such as Process documentation and SLAs. (S., Gary, & Spalding, 2004)

Configuration Management Database (CMDB) - database that tracks and records configuration items associated with the IT infrastructure and the relationships between them. Strictly speaking, the ITIL CMDB contains a record of the expected configuration of the IT environment, as authorized and controlled through the change management and configuration management processes. (Alison Cartlidge, 2007)

Configuration Management Database Federation Workgroup (CMDBf) - (Workgroup) CMDBf was originally developed by a consortium of BMC Software, CA, Fujitsu, HP, IBM and Microsoft, and published on cmdbf.org. CMDB Federation describes the architecture and interactions for federating data repositories together to behave as a data store that satisfies the role of a Configuration Management Database (CMDB). The federation provides an aggregate view of a resource even though the data and underlying repositories are heterogeneous. A query interface is defined for external clients to access these data.

Implementing the CMDBf standard simplifies the process of managing related configuration data stored in multiple CMDBs and MDRs and supports the creation of an ITIL v3 Configuration Management System (CMS). It also provides IT personnel with a more complete picture of their entire IT environment, allowing them to more effectively

manage the components in their IT environment and better utilize configuration data to streamline management tasks and resolve issues without the need of creating a single monolithic repository of configuration data.

With a standard way for vendors and tools to share and access configuration data, organizations can use their CMDBs to:

- Keep track of changes to an IT environment
- Better understand the impact of proposed changes to the IT environment.

Configuration Management System (CMS) – manage services and infra-structures that support IT.

Continual Service Improvement (CSI) - A stage in the Lifecycle of an IT Service and the title of one of the Core ITIL publications. Continual Service Improvement is responsible for managing improvements to IT Service Management Processes and IT Services. The Performance of the IT Service provider is continually measured and improvements are made to Processes, IT Services and IT Infrastructure in order to increase Efficiency, Effectiveness, and Cost Effectiveness. (S., Gary, & Spalding, 2004)

Control Objectives for Information and related Technology (COBIT) – is an IT governance framework and supporting toolset that allows managers to bridge the gap between control requirements, technical issues and business risks. COBIT enables clear policy development and good practice for IT control throughout organizations. COBIT emphasizes regulatory compliance, helps organizations to increase the value attained from IT, enables alignment and simplifies implementation of the COBIT framework. (ISACA - COBIT)

COBIT is published by the IT Governance Institute.

Cost Performance Index (CPI) – A measure of cost efficiency on a project. It is the ratio of Earned Value (EV) to actual costs (AC). CPI=EV divided by AC. A value equal to or greater than one indicates a favourable condition and a value less than one indicate an unfavourable condition. (A Guide to the Project Management Body of Knowledge, 2004)

D

Data Information Knowledge Wisdom Structure (DIKWS) – structure made out of Asset and Configuration Information that, integrated, allows it to be useful for service understanding

Data Mining - A class of undirected queries, often against the most atomic data, that seek to find unexpected patterns in the data. The most valuable results from data mining are clustering, classifying, estimating, predicting, and finding things that occur together. There are many kinds of tools that play a role in data mining. The principal tools include decision trees, neural networks, memory- and cased-based reasoning tools, visualization tools, genetic algorithms, fuzzy logic, and classical statistics. Generally, data mining is a client of the data warehouse.(Kimball, 2002)

Decision Support Systems (DSS) - interactive computer-based system or subsystem intended to help decision makers use communications technologies, data, documents, knowledge and/or models to identify and solve problems, complete decision process tasks, and make decisions. Decision Support System is a general term for any computer application that enhances a person or group's ability to make decisions. ... In general, Decision Support Systems are a class of computerized information system that support decision-making activities (Power, 2002).

Demand Management - Activities that understand and influence Customer demand for Services and the provision of Capacity to meet these demands. At a Strategic level Demand Management can involve analysis of Patterns of Business Activity and User Profiles. At a tactical level it can involve use of Differential Charging to encourage

Customers to use IT Services at less busy times. See also Capacity Management. (S., Gary, & Spalding, 2004)

E

Earned Value (EV) – (Project Management) Earned Value Technique measures performance of the project as it moves from project initiation through project closure. The earned value management methodology also provides a means to forecast performance level based upon past performance. Earned Value is the budgeted amount for the work actually completed on the schedule activity or Work Breakdown Structure component during a given time.

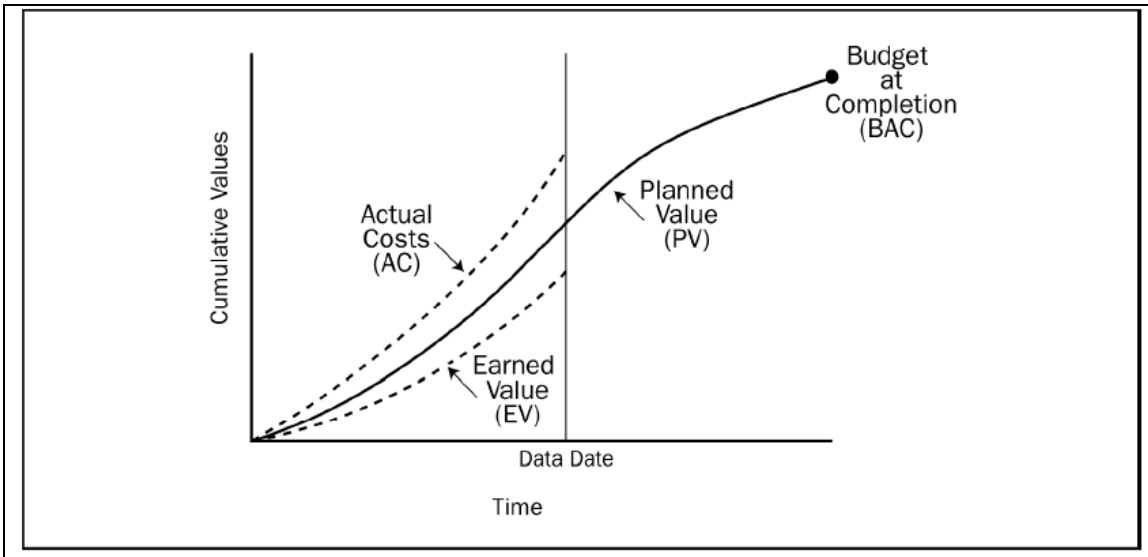


Illustration 26 - PMBOK - Earned Value, Actual Cost, Planned Value and Budget At Completion

Illustration 26 shows that normally Earned Value is lower than the Actual Costs and Planned Value (project progress is lower than Planned and Actual Costs are higher than the corresponding Earned and Planned). (A Guide to the Project Management Body of Knowledge, 2004)

European System of Central Banks (ESCB) - central bank for Europe's single currency, the euro. The ECB's main task is to maintain the euro's purchasing power and thus price stability in the euro area. The euro area comprises the 16 European Union countries that have introduced the euro since 1999.

Evaluation - ensuring that the service will continue to be relevant by establishing appropriate metrics and measurement techniques. Evaluation considers the input to Service Transition, addressing the relevance of the service design, the transition approach itself, and the suitability of the new or changed service for the actual operational and business environments encountered and expected.

Event - A change of state that has significance for the management of a Configuration Item or IT Service. The term Event is also used to mean an Alert or notification created by any IT Service, Configuration Item or Monitoring tool. Events typically require IT Operations personnel to take actions, and often lead to Incidents being logged. (S., Gary, & Spalding, 2004)

F

Financial Audit (FA) - financial audit, or more accurately, an audit of financial statements, is the review of the financial statements of a company or any other legal entity (including governments), resulting in the publication of an independent opinion on whether or not those financial statements are relevant, accurate, complete, and fairly presented. Financial audits are typically performed by firms of practicing accountants due to the specialist financial reporting knowledge they require. The financial audit is one of many assurance or attestation functions provided by accounting and auditing firms, whereby the firm provides an independent opinion on published information. Many organisations separately employ or hire internal auditors, who do not attest to financial reports but focus mainly on the internal controls of the organization. External auditors may choose to place limited reliance on the work of internal auditors.

G

Governance Archetypes (Weill, 2004) – describe the combinations of people who have either decision rights or inputs to IT decisions:

- Business Monarchy – senior business executives make IT decisions affecting entire enterprise (CxOs). Includes committees of senior business executives (may include CIO). Excludes IT executives acting independently
- IT Monarchy – Individuals or groups of IT executives
- Feudal – Business Unit leaders, key process owners or their delegates
- Federal – C-level executives and business groups (e.g. business unit or processes); may also include IT executives as additional participants. Equivalent of the central and state government working together
- IT-Duopoly – IT executives and one other group (e.g. CxO or business unit or process leaders)
- Anarchy (Each individual user)

Governance Arrangements Matrix (GAM) (Weill, 2004) **–** what decisions must be made and who should make them. Relates Information Technology Decisions (IT Principles, IT Architecture, IT Infrastructure Strategies, Business Application Needs and IT Investments) that relate to each other (from left to right, IT principles drive IT Architecture that is needed to develop IT Infrastructure Strategies and so on) to Governance Archetypes to specify decision rights (Business monarch, IT monarchy, feudal, federal, IT duopoly and anarchy).

Decision Archetype	IT Principles		IT Architecture		IT Infrastructure Strategies		Business Application Needs		IT Investment	
	Input	Decision	Input	Decision	Input	Decision	Input	Decision	Input	Decision
Business Monarchy	0	27	0	6	0	7	1	12	1	30
IT Monarchy	1	18	20	73	10	59	0	8	0	9
Feudal	0	3	0	0	1	2	1	18	0	3
Federal	83	14	46	4	59	6	81	30	93	27
Duopoly	15	36	34	15	30	23	17	27	6	30
Anarchy	0	0	0	1	0	1	0	3	0	1
No Data or Don't Know	1	2	0	1	0	2	0	2	0	0

Illustration 27 - GAM - MIT Sloan Center for Inormation Research (CISR) GAM Matrix for 256 surveyed

I

Incident - an unplanned interruption to an IT Service or reduction in the Quality of an IT Service. Failure of a Configuration Item that has not yet affected Service is also an Incident. For example, Failure of one disk from a mirror set. (S., Gary, & Spalding, 2004)

Incident Management - process responsible for managing the Lifecycle of all Incidents. The primary Objective of Incident Management is to return the IT Service to Customers as quickly as possible. (S., Gary, & Spalding, 2004)

Information Management Steering Group (IMSG) – Reports to each of three group – Management Board, Performance Committee, and Resource Committee. Acts as investment committee enterprise wide budget for IT-related projects, project/program board. It is a Governance mechanisms used in Scotland Yard Governance Framework(Weill, 2004).

Information Security Management (ISM) - set of policies concerned with information security management. The idiom arises primarily out of ISO/IEC 27001. The key concept of ISMS is for an organization to design, implement and maintain a coherent suite of processes and systems for effectively managing information accessibility, thus ensuring the confidentiality, integrity and availability of information assets and minimizing information security risks.

As with all management processes, an ISMS must remain effective and efficient in the long term, adapting to changes in the internal organization and external environment.

ISO/IEC 27001 therefore this incorporates the typical "Plan-Do-Check-Act" (PDCA) Deming approach to continuous improvement.

The best known ISMS is described in ISO/IEC 27001 and ISO/IEC 27002 and related standards published jointly by ISO and IEC. Another competing ISMS is Information Security Forum's Standard of Good Practice (SOGP). It is more best practice-based as it comes from ISF's industry experiences. Other frameworks such as COBIT and ITIL touch on security issues, but are mainly geared toward creating a governance framework for information and IT more generally. Information Security Management Maturity Model (known as ISM-cubed or ISM3) is another form of ISMS. ISM3 builds on standards such as ISO 20000, ISO 9001, CMM, ISO/IEC 27001, and general information governance and security concepts. ISM3 can be used as a template for an ISO 9001-compliant ISMS. While ISO/IEC 27001 is controls based, ISM3 is process based and includes process metrics.

(ITIL) - The Process that ensures the Confidentiality, Integrity and Availability of an Organization's Assets, information, data and IT Services. Information Security Management usually forms part of an Organizational approach to Security Management that has a wider scope than the IT Service provider, and includes handling of paper, building access, phone calls, etc., for the entire Organization. (S., Gary, & Spalding, 2004)

Information Systems Audit and Control Association (ISACA) - international professional association that deals with IT Governance. It is an affiliate member of IFAC. Previously known as the Information Systems Audit and Control Association, ISACA now goes by its acronym only, to reflect the broad range of IT governance professionals it serves. (ISACA - About)

The ISACA was founded in the USA in 1967 [3], when a group of individuals with jobs auditing controls in the computer systems, which were becoming increasingly critical to the operations of their organizations, recognized the need for a centralized source of information and guidance in the field. In 1969, Stuart Tyrnauer, employed by the (then) Douglas Aircraft Company, incorporated the entity as the EDP Auditors Association, serving as its founding Chairman for the first three years. In 1976 the association

formed an education foundation to undertake large-scale research efforts to expand the knowledge and value of the IT governance and control field.

ISACA currently serves more than 86,000 constituents (members and professionals holding ISACA certifications) in more than 160 countries. The job titles of members are such as IS auditor, consultant, educator, IS security professional, regulator, chief information officer and internal auditor. They work in nearly all industry categories. There is a network of ISACA chapters with 170 chapters established in over 60 countries. Chapters provide education, resource sharing, advocacy, networking and other benefits.

Major publications: Standards, Guidelines and Procedures for information system auditing (Guideline co-developed with IFAC); COBIT; Val IT (Getting best value from IT investments); Information System Control Journal

Certification: Certified Information Systems Auditor (CISA); Certified Information Security Manager (CISM); Certified in the Governance of Enterprise IT (CGEIT)

Information Technology Decisions (Weill, 2004) – five interrelated Information technology decisions that cannot be made in isolation.

- IT Principles
- IT architecture
- IT infrastructure
- Business application needs
- IT investments and prioritization

Information Technology Governance Institute (ITGI) –The IT Governance Institute (ITGI) strives to assist enterprise leaders in their responsibility to make IT successful in supporting the enterprise's mission and goals. Its goals are to raise awareness and understanding among and provide guidance and tools to boards of directors, executive management and chief information officers (CIOs) such that they are able to ensure within their enterprises that IT meets and exceeds expectations and its risks are mitigated.

Information Technology Infrastructure Library (ITIL) - public framework that describes Best Practice in IT service management. It provides a framework for the governance of IT, the 'service wrap', and focuses on the continual measurement and improvement of the quality of IT service delivered, from both a business and a customer perspective. This focus is a major factor in ITIL's worldwide success and has contributed to its prolific usage and to the key benefits obtained by those organizations deploying the techniques and processes throughout their organizations.

ITIL was published between 1989 and 1995 by Her Majesty's Stationery Office (HMSO) in the UK on behalf of the Central Communications and Telecommunications Agency (CCTA) – now subsumed within the Office of Government Commerce (OGC). Its early use was principally confined to the UK and Netherlands. A second version of ITIL was published as a set of revised books between 2000 and 2004. (S., Gary, & Spalding, 2004)

Information Technology Service Continuity Management (ITSMC) - risk reduction measures and recovery options. Accomplished by regular completion of Business Impact Analysis and Risk Management exercises. purpose of ITSCM is to maintain the appropriate on-going recovery capability within IT services to match the agreed needs, requirements and timescales of the business. ITSCM includes a series of activities throughout the lifecycle to ensure that, once service continuity and recovery plans have been developed, they are kept aligned with Business Continuity Plans and business priorities. The maintenance of appropriate ITSCM policy strategies and ITSCM plans aligned with business plans is key to the success of an ITSCM process. This can be accomplished by the regular completion of Business Impact Analysis and Risk Management exercises. (S., Gary, & Spalding, 2004)

Information Technology Service Management (ITSM) – discipline for managing information technology (IT) systems, focused on the customer's perspective of IT's contribution to the business. ITSM stands in deliberate contrast to technology-focused approaches to IT management and business interaction.

The primary standard for IT Service Management is ISO/IEC 20000. The standard and ITIL are aligned and continue to be aligned, although the standard is currently to be extended with the development of Parts 3 and 4:

- ISO/IEC 20000-1:2005 Part 1: Specification - Defines the requirements for Service Management
- ISO/IEC 20000-2:2005 Part 2: Code of Practice - Provides guidance and recommendations on how to meet the requirements in Part 1
- ISO/IEC 20000-3:2007 Part 3: Scoping and applicability
- ISO/IEC 20000-4:2007 Part 3: Service Management Process Reference Model
- BIP 0005 : A Manager's Guide to Service Management
- BIP 0015 IT Service Management: Self-assessment Workbook

These documents provide a standard against which organizations can be assessed and certified with regard to the quality of their IT Service Management processes. (S., Gary, & Spalding, 2004)

Information Technology Service Management forum (ITSMf) – itSMF is the only truly independent and internationally recognized forum for IT Service Management professionals worldwide. This not-for-profit organization is a prominent player in the on-going development and promotion of IT Service Management "best practice", standards and qualifications and has been since 1991.

Globally, the itSMF now boasts over 6000 member companies, blue chip and public sector alike, covering in excess of 70,000 individuals spread over 40+ international Chapters.

Each chapter is a separate legal entity and is largely autonomous. The UK Chapter has over 16,000 members: it offers a flourishing annual conference, online bookstore, regular regional meetings and special interest groups and numerous other benefits for members. Its website is at www.itsmf.co.uk.

There is a separate International entity that provides an overall steering and support function to existing and emerging chapters. It has its own website at www.itsmf.org. (S., Gary, & Spalding, 2004)

International Business Machines Tivoli Unified Process (ITUP) - Web-based tool that provides detailed documentation of service management processes based on industry best practices, including the recently released ITIL® V3 best practices. ITUP enables practitioners to understand processes, the relationships between processes, and the roles and tools involved in an efficient process implementation. ITUP represents the collective experience of IBM experts based on thousands of customer engagements. (IBM Service Management - IBM Tivoli Unified Process)

International Electrotechnical Commission (IEC) - a not-for-profit, non-governmental international standards organization that prepares and publishes International Standards for all electrical, electronic and related technologies — collectively known as "electrotechnology". IEC also manages conformity assessment systems that certify that equipment, systems or components conform to its International Standards. (Wikipedia) (IEC - About)

International Organization for Standardization (ISO) - network of the national standards institutes of 162 countries, one member per country, with a Central Secretariat in Geneva, Switzerland, that coordinates the system.

ISO is a non-governmental organization that forms a bridge between the public and private sectors. On the one hand, many of its member institutes are part of the governmental structure of their countries, or are mandated by their government. On the other hand, other members have their roots uniquely in the private sector, having been set up by national partnerships of industry associations. (ISO)

M

Microsoft Operations Framework (MOF) - (Microsoft Operations Framework 4.0) delivers practical guidance for everyday IT practices and activities, helping users

establish and implement reliable, cost-effective IT services. It encompasses the entire IT lifecycle by integrating:

- Community-generated processes for planning, delivering, operating, and managing IT.
- Governance, risk, and compliance activities.
- Management reviews.
- Microsoft Solutions Framework (MSF) best practices.

O

Operational Level Agreement (OLA) - (S., Gary, & Spalding, 2004) an Agreement between an IT Service provider and another part of the same Organization. An OLA supports the IT Service provider's delivery of IT Services to Customers. The OLA defines the goods or Services to be provided and the responsibilities of both parties. For example there could be an OLA:

- Between the IT Service provider and a procurement department to obtain hardware in agreed times
- Between the Service Desk and a Support group to provide Incident Resolution in agreed times.

P

Plan Do Check Act (PDCA) - (Wikipedia - PDCA) iterative four-step problem-solving process typically used in business process improvement. It is also known as the Deming cycle, Shewhart cycle, Deming wheel, or plan-do-study-act.

PDCA was made popular by Dr. W. Edwards Deming, who is considered by many to be the father of modern quality control; however it was always referred to by him as the "Shewhart cycle." Later in Deming's career, he modified PDCA to "Plan, Do, Study, Act" (PDSA) so as to better describe his recommendations.

PLAN - Establish the objectives and processes necessary to deliver results in accordance with the expected output. By making the expected output the focus, it differs from other techniques in that the completeness and accuracy of the specification is also part of the improvement.

DO - Implement the new processes. Often on a small scale if possible.

CHECK - Measure the new processes and compare the results against the expected results to ascertain any differences.

ACT - Analyze the differences to determine their cause. Each will be part of either one or more of the P-D-C-A steps. Determine where to apply changes that will include improvement. When a pass through these four steps does not result in the need to improve, refine the scope to which PDCA is applied until there is a plan that involves improvement.

Planned Value (PV) – (Project Management) budgeted cost for the work scheduled to be completed on an activity or Work Breakdown Structure component during a given period. The authorized budget assigned to the scheduled work to be accomplished for a scheduled activity or work breakdown structure component. Also referred to as the budgeted cost of work scheduled (BCWS).

Priority (ITIL) - Category used to identify the relative importance of an Incident, Problem or Change. Priority is based on Impact and Urgency, and is used to identify required times for actions to be taken. For example, the SLA may state that Priority 2 Incidents must be resolved within 12 hours. (S., Gary, & Spalding, 2004)

Process – (ITIL) structured set of Activities designed to accomplish a specific Objective. A Process takes one or more defined inputs and turns them into defined outputs. A Process may include any of the Roles, responsibilities, tools and management Controls required to reliably deliver the outputs. A Process may define Policies, Standards, Guidelines, Activities, and Work Instructions if they are needed. (S., Gary, & Spalding, 2004)

Project – a temporary endeavour undertaken to create a unique product, service, or result. (A Guide to the Project Management Body of Knowledge, 2004)

Project Management Body of Knowledge (PMBOK) – sum of knowledge within the profession of project management. Includes proven traditional practises that are widely applied, as well as innovate practises that are emerging in the profession, including published and unpublished material. (A Guide to the Project Management Body of Knowledge, 2004)

R

Responsible, Accountable, Consulted and Informed Model (RACI Model) –also called authority matrix, is often used within organizations indicating roles and responsibilities in relation to processes and activities. While there are many variations of the authority matrix, the RACI model states:

Responsibility – correct execution of process and activities

Accountability – ownership of quality, and end result of process

Consulted – involvement through input of knowledge and information

Informed – receiving information about process execution and quality

The authority matrix clarifies to all involved which activities they are expected to fulfil, as well as identifying any gaps in service delivery and responsibilities. It is especially helpful in clarifying the staffing model necessary for improvement.

Experience teaches us that using an authority matrix helps with two major activities that are often overlooked or hard to identify. One is that all the 'Rs' on an RACI matrix typically represent potential OLA opportunities. The second is that identifying roles that must be kept informed helps to expose communication and workflow paths. This can be

very helpful when defining the communication procedures in the Continual Service Improvement process.

Release and Deployment Management – assemble and position all aspects of services into production and establish effective use of new or changed services.

Role - A set of responsibilities, Activities and authorities granted to a person or team. A Role is defined in a Process. One person or team may have multiple Roles, for example the Roles of Configuration Manager and Change Manager may be carried out by a single person. (S., Gary, & Spalding, 2004)

Role-playing – (DD-DSS) occurs when a single physical dimension appears several times in a fact table, each represented as a separate logical table with unique column names through views. (Kimball, 2002)

S

Schedule Performance Index (SPI) – measure of schedule efficiency on a project, It is the ratio of Earned Value (EV) to Planned Value (PV). The SPI=EV divided by PV. An SPI equal to or greater than one indicates a favourable condition and a value of less than one indicates an unfavourable condition. (A Guide to the Project Management Body of Knowledge, 2004)

Service - means of delivering value to Customers by facilitating Outcomes Customers want to achieve without the ownership of specific Costs and Risks. (S., Gary, & Spalding, 2004)

Service Asset and Configuration Management (SACM) – provides accurate information and control across all assets and relationships that make up an organization's infrastructure. Purpose of SACM is to identify, control and account for service assets and configuration items (CI), protecting and ensuring their integrity across the service lifecycle. Scope of SACM also extends to non-IT assets and to internal and external service providers, where shared assets need to be controlled.

Service Catalogue (SC) - A database or structured Document with information about all Live IT Services, including those available for Deployment. The Service Catalogue is the only part of the Service Portfolio published to Customers, and is used to support the sale and delivery of IT Services. The Service Catalogue includes information about deliverables, prices, contact points, ordering and request Processes. (S., Gary, & Spalding, 2004)

Service Design Package (SDP) - ITIL output developed in the Service Design stage that specifies the solution to implement

Service Level Agreement (SLA) - An Agreement between an IT Service provider and a Customer. The SLA describes the IT Service, documents Service level targets, and specifies the responsibilities of the IT Service provider and the Customer. A single SLA may cover multiple IT Services or multiple customers. See also Operational Level Agreement. (S., Gary, & Spalding, 2004)

Service Level Management (SLM) – Process responsible for negotiating Service Level Agreements, and ensuring that these are met. SLM is responsible for ensuring that all IT Service Management Processes, Operational Level Agreements, and Underpinning Contracts, are appropriate for the agreed Service level targets. SLM monitors and reports on Service levels, and holds regular Customer reviews. (S., Gary, & Spalding, 2004)

Service Validation and Testing - service is tested explicitly against the utilities and warranties set out in the service design package, including business functionality, availability, continuity, security, usability and regression testing.

Standard CMMI Appraisal Method for Process Improvement (SCAMPI) - is the official SEI (Software Engineering Institute – Carnegie Mellon University) method to provide benchmark-quality ratings relative to CMMI models.

Supplier Contract Database (SCD) - information on suppliers and contracts and should contain all of the information necessary for the management of suppliers, contracts and their associated services.

Supplier Management (SM) - Supplier Management process ensures that suppliers and the services they provide are managed to support IT service targets and business expectations.

T

The Open Group Architecture Framework (TOGAF) – it is a framework developed and maintained by members of The Open Group, working within the Architecture Forum (refer to www.opengroup.org/architecture). The original development of TOGAF Version 1 in 1995 was based on the Technical Architecture Framework for Information Management (TAFIM), developed by the US Department of Defense (DoD). The DoD gave The Open Group explicit permission and encouragement to create TOGAF by building on the TAFIM, which itself was the result of many years of development effort and many millions of dollars of US Government investment.

Transition Planning and Support - plan and coordinate resources to ensure that the requirements of Service Strategy encoded in Service Design are effectively realized in Service Operations and identify, manage and control the risks of failure and disruption across transition activities.

Transaction Processing System (TPS) - set of information which process the data transaction in database system that monitors transaction programs (a special kind of program). The essence of a transaction program is that it manages data that must be left in a consistent state.

U

Urgency - measure of how long it will be until an Incident, Problem or Change has a significant Impact on the Business. For example a high Impact Incident may have low Urgency, if the Impact will not affect the Business until the end of the financial year. Impact and Urgency are used to assign Priority. (S., Gary, & Spalding, 2004)

9. Index of Illustrations

10. Index of Tables

11. Annex

Annex 1 - IT Governance related initiatives

Date	Entity	Initiative	Contributions
1974		Managing the Data Resource Function	**First non technological approach to IT Management**
1984	IBM	A Management System for Information Systems	Known as the **Yellow Books** Four volumes that where the **basis for ITIL**
1987	SEI	CMM - Capacity Maturity Model	Model of the maturity of the capability of certain business processes. Collection of elements that describe certain aspects of maturity in an organization, and aids in the definition and understanding of an organization's processes. Though it comes from the area of software development, it is also being applied as a generally applicable model to assist in understanding the process capability maturity of organizations in diverse areas. **Five levels** of process maturity for an organization: 1. **Initial** (chaotic, ad hoc, heroic) the starting point for use of a new process. 2. **Repeatable** (project management, process discipline) the process is used repeatedly. 3. **Defined** (institutionalized) the process is defined/confirmed as a standard business process. 4. **Managed** (quantified) process management and measurement takes place. 5. **Optimizing** (process improvement) process management includes deliberate process optimization/improvement. Each of these maturity levels are Key Process Areas (KPAs) which characterize that level, and for each KPA there are five definitions identified: 1. **Goals** 2. **Commitment** 3. **Ability** 4. **Measurement** 5. **Verification**

1990	CCTA	ITIL v1 Information Technology Infrastructure Library	Best practices for IT Service Management (ITSM)
1992	COSO	Internal Control - Integrated Framework	Internal control as a process that involves people across the entire organization Reasonable assurance in the following categories: - **Effectiveness and efficiency of operations**; - **Reliability of financial reporting** - **Compliance with applicable laws and regulations**
1996	ISACA - ISACF	COBIT 1 Control Objectives for information and related Technology	**Emphasis in Audit**
1999	ISACA- ISACF	COBIT 2 Control Objectives for information and related Technology	**Emphasis in Control**
1999	ISO IEC	CC v1 Common Criteria	Provides **assurance that the process of specification, implementation and evaluation of a computer security product has been conducted in a rigorous and standard manner**. Official name is Evaluation Criteria for Information Technology Security.
2000	ISACA- **ITGI**	COBIT 3 Control Objectives for information and related Technology	**Emphasis in Management**
2002	SEI	CMMI v1.1 Capacity Maturity Model Integration	Process improvement approach that provides organizations with the essential elements for effective process improvement. An organization is appraised (e.g., using an appraisal method like SCAMPI) and is awarded a 1-5 level rating
2004	COSO	Enterprise Risk Management	Four categories of objectives:

			- **Operations** - **Reporting** - **Compliance** - **Strategic Objectives** **Level of risk a company is willing to take to achieve its goals** All events are identified (events that hold negative impact are considered risks) Categories of risk response: - **Avoid** - **Reduce** - **Share** - **Accept** Considers historical information and expands the responsibility to the board of directors
2004	ISO IEC	CC v2 Common Criteria	
2005	ISACA- ITGI	COBIT 4 Control Objectives for information and related Technology	**Emphasis in Governance** The complete COBIT package consists of: 1. Executive Summary 2. Governance and Control Framework 3. Control Objectives 4. Management Guidelines 5. Implementation Guide 6. IT Assurance Guide
2005- 2007	ISO/IEC	27000 27001 27002 27003	Best practice standards on Information Security Management Systems (ISMS), risks and controls within the context of an overall Information Security Management System Scoped to all companies and based in PDCA (Plan Do Check and Act - Deming) 127 information security guidelines structured in **10 major headings** (**security policy, security**

		27004 27005 27006	**organization, asset classification and control, personnel security, physical and environment security, communications and operations management, access control, system development and maintenance, business continuity management, compliance**) 27000 – vocabulary and definitions 27001 - standard for the establishment**, implementation, control and improvement of the Information Security Management System** 27002 - **code of practice providing good practice advice** on ISMS 27003 – **implementation guide** (under development) 27004 – **Information Security Management Metrics and Measurements** (under development) 27005 - assist the satisfactory implementation of information security based on a risk management approach 27006 - guide to the certification/registration process
2005	ISO IEC	20000 20000-1 20000-2	First standard for ITSM **Combination of ITIL Service Support and ITIL Service Delivery** volumes are generally equivalent to the scope of the ISO/IEC 20000 20000-1 - **Promotes the adoption of an integrated process approach to effectively deliver managed services to meet the business and customer requirements** 20000-2 – code of practice
2005	AS	8015 – 2005 Corporate Governance of ICT	Framework for effective governance of the use of IT by an organization. Compromises a model, guiding principles and vocabulary. clarify the link and context for the management standards for security (ISO 27000), quality (ISO 9000), service delivery (ISO 200000), **project management and audit** **Six Principles for Good Governance of ICT** 1. **Establish Clearly Understood Responsibilities for ICT** (e.g., ensure individuals understand and accept their responsibilities) 2. **Plan ICT to best support the organization** (e.g., ensure ICT plans fit current and future needs and the

			organization's corporate plans) 3. **Acquire ICT validly** (e.g., ICT acquisitions should be made for approved reasons and in the approved way; on the basis of ongoing analysis) 4. **Ensure that ICT performs well, whenever required** (e.g., ensure ICT is fit for its purpose and is responsive to changing requirements) 5. **Ensure ICT conforms with formal rules** (e.g., ensure compliance with external regulations and internal policies and practices) 6. **Ensure ICT respects human factors** (e.g., ensure ICT meets the evolving needs of the 'people in the process') **Categorizes ICT activities into projects and operations**. **Later made an ISO Standard ISO 38500**.
2006	SEI	CMMI v1.2	
2006	ISO IEC	CC v3	
2007	OGC	Information Technology Infrastructure Library v3	Has 5 main subjects: **1. Service Strategy** **2. Service Design** **3. Service Transition** **4. Service Operation** **5. Continual Service Improvement**
2008	ISO IEC	38500	**Corporate Governance of information technology.** Based on AS 8015.
	IBM	IBM Tivoli Unified Process	
	Microsoft	Microsoft Operations Framework	Proprietary Framework based on ITIL
	OGC	Information Technology Infrastructure Library v2	Has 8 main subjects: 1. Service Delivery 2. Service Support

			3. ICT Infrastructure Management 4. Security Management 5. The Business Perspective 6. Application Management 7. Software Asset Management 8. Planning to Implement Service Management
	HP	IT Service Management Reference Model	

Annex 2 - IT Governance Datawarehouse Bus Matrix – Referencing Role Playing and Real Implementation

	Business Event	Channel	Change	Change Assignee	Change Categorization	Change Cycle	Change Environment	Change Location	Change Manager	Change Requester	Change Reported Channel	Change Risk	Configuration Item	Contract	Customer	DRP Drill	Feasibility Study	Geography	Heading	Impact	Incident	Incident Assignee	Incident Location	Incident Requester	Incident Status	Incident Type	Invoice	Management Event	Objective	Organization	Priority	Project	Project Committee	Project Customer	Project Main Team	Project Location	Project Manager	Relationship Manager	Project Risk	Project Status	Service	Service Desk Agent	Service Desk Channel	Service Desk Contact	Service Desk Contact Status	Service Desk Queue	Supplier	Technical Event	Time	Urgency	Security Risk	Service Access
Availability Management	X											X					X			X	X						X		X									X							X	X			X
Capacity Management	X											X	X				X			X							X		X									X							X	X			X
Change Management	X		X	X	X	X	X	X	X	X	X	X		X						X							X			X	X							X						M	X	X	X		
Demand Management	X											X		X													X	X	X						X				X							X	X			X
Evaluation / Service Validation and Testing	X											X		X		X											X		X									X							X	X			
Financial Management	X												X	X		X		X								X	X	X		X								X							X	X	X		X
Service Desk Management	X	X	X									X		X							X						X			X									X	X	X	X	X	X		X	X	X		
Incident Management	X	X	X									X		X						X	X	X	X	X	X	X	X			X									X						X	X	X	X	X	
Information Security Management	X		X									X								X	X				X	X	X		X									X							X	X	X	X	X
IT Service Continuity Management	X											X	X		X					X							X		X									X							X	X			
Knowledge Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X	X	X
Project Development	X		X									X		X		X			X								X	X		X	X	X	X	X	X	X	X	M						X	X	X	X		
Release and Deployment Management	X		X									X		X			X										X		X		X								X							X	X			X
Service Asset and Configuration Management	X		X									X	X														X		X									X							X	X	X		X
Service Catalogue Management	X											X		X													X		X									X							X	X			X
Service Level Management	X		X									X	X							X							X		X									X							X	X			
Service Portfolio Management	X											X	X	X													X		X		X				X	X		X							X	X	X		
Service Validation and Testing	X											X	X	X													X		X		X							X							X	X			X
Supplier Management	X												X												X		X		X															X	X	X			
Transition Planning and Support	X		X									M		X						X							X		X		X							X							X	X	X			X

Case Study Annotations

Chosen and implemented processes
Information recognized but not available/usable
Information not recognized, not available but implemented

References

X	Single "Connection"
M	Multiple "Connections"

Annex 3 - IT Governance Datawarehouse Bus Matrix – Without Role Playing

	Channel	Change	Configuration Item	Contract	Customer	DRP Drill	Feasibility Study	Geography	Impact	Incident	Invoice	Objective	Organization	Priority	Project	Service	Risk	Supplier	Time	Urgency	Security Risk	Service Access
Availability Management			X					X	X	X			X			X			X			X
Capacity Management			X	X				X					X			X			X			X
Change Management	X	X	X		X			X	X				X	X	X	X	X	M	X	X			
Demand Management			X		X							X	X			X			X			X
Evaluation / Service Validation and Testing			X		X		X						X			X			X			
Financial Management				X	X		X				X	X	X		X	X		X	X			X
Service Desk Management	X	X	X		X					X			X	X		X			X	X		
Incident Management	X	X	X		X			X	X	X			X	X		X		X	X	X	X	
Information Security Management		X	X						X	X			X			X			X	X	X	X
IT Service Continuity Management			X	X		X			X				X			X			X			
Knowledge Management	X	X	X	X	X	X	X		X	X	X		X	X	X	X	X	X	X	X	X	X
Project Development		X	X		X		X	X	X			X	X	X	X	M	X	X	X	X		
Release and Deployment Management		X	X		X			X					X		X	X			X			X
Service Asset and Configuration Management		X	X	X									X			X		X	X			X
Service Catalogue Management			X		X								X			X			X			X
Service Level Management		X	X	X						X			X			X			X			
Service Portfolio Management			X	X	X								X		X	X		X	X			
Service Validation and Testing			X	X	X								X		X	X			X			X
Supplier Management				X									X					X	X			
Transition Planning and Support		X	M		X					X			X		X	X		X	X			X

Case Study Annotations

Chosen and implemented processes
Information recognized but not available/usable
Information recognized, not available but implemented

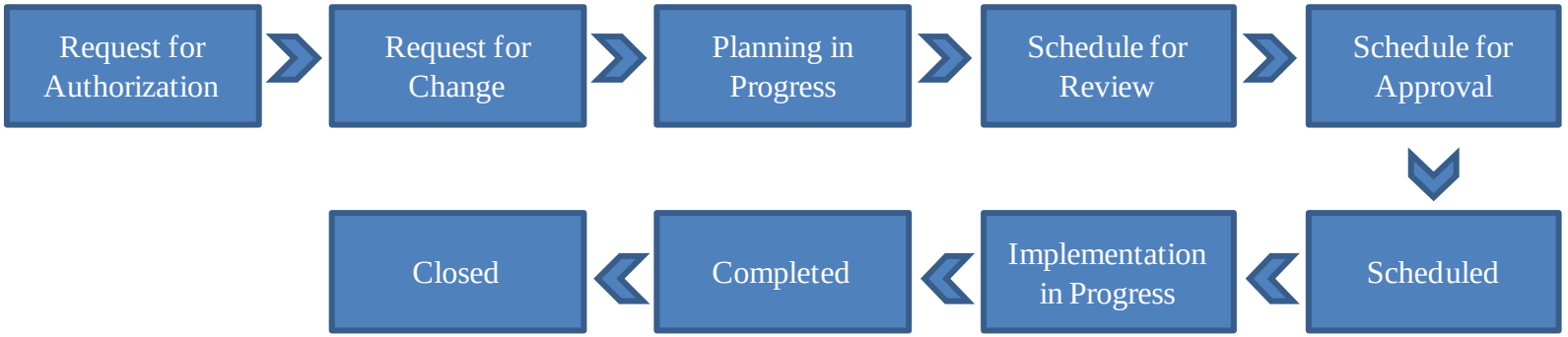
References

X	Single "Connection"
M	Multiple "Connections"

Annex 4 - IT-Governance Metadata

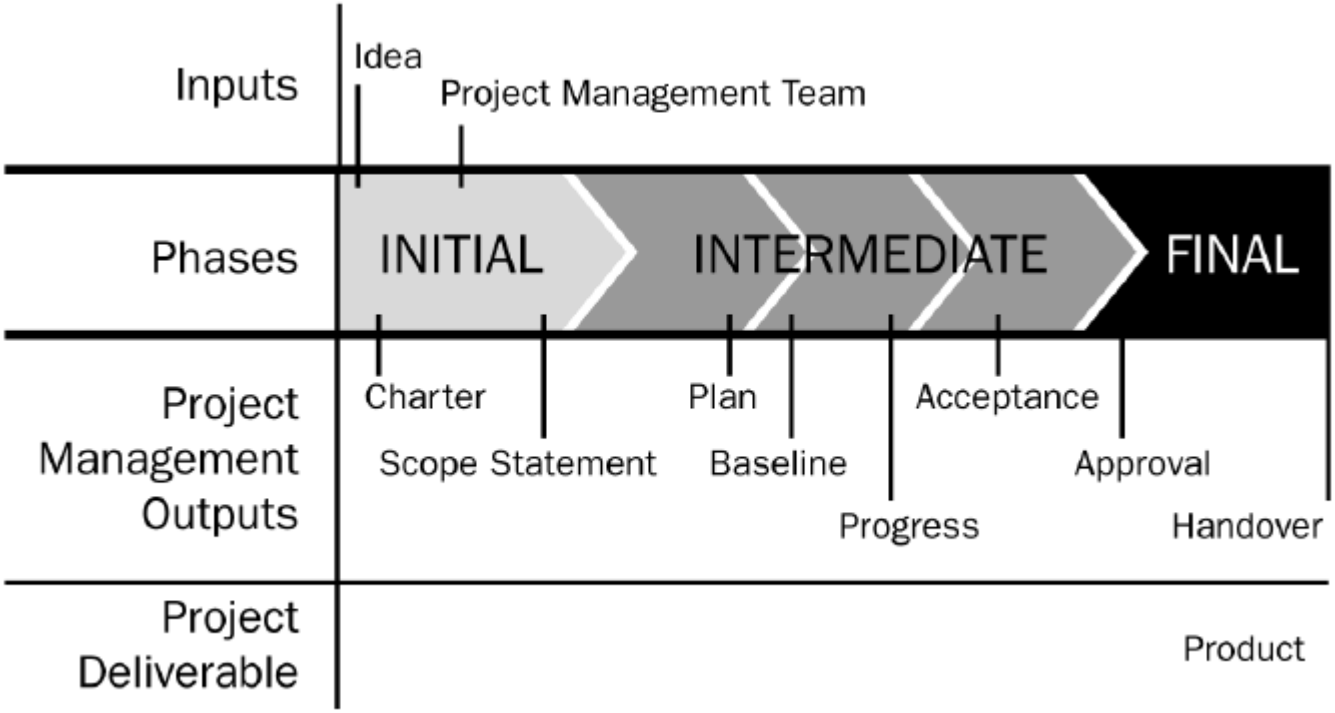
Due to size restrictions the metadata follows in electronic format.

Annex 5 - Change Management Generic Process Stages

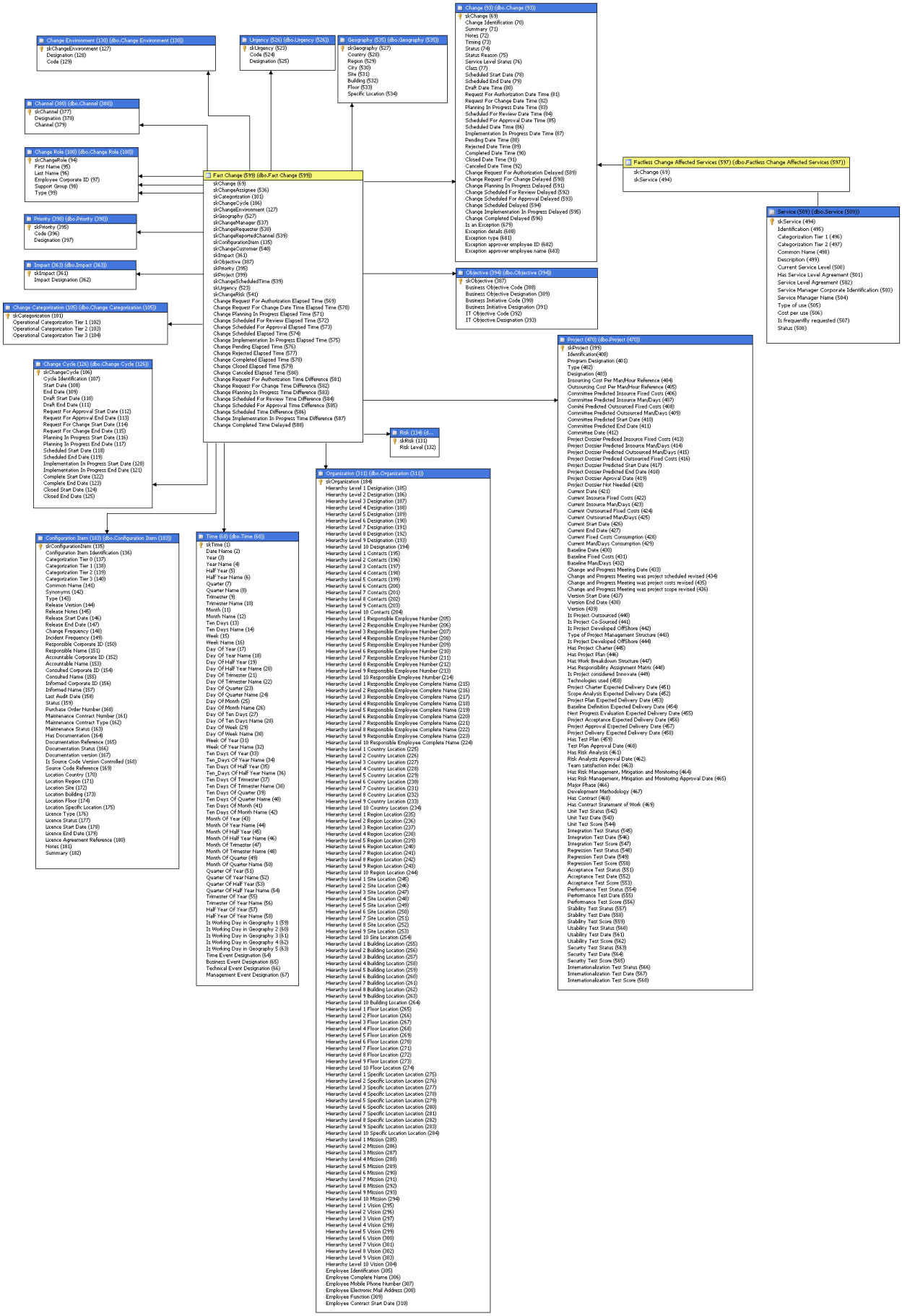


Annex 6 - Incident Management Generic Process Stages

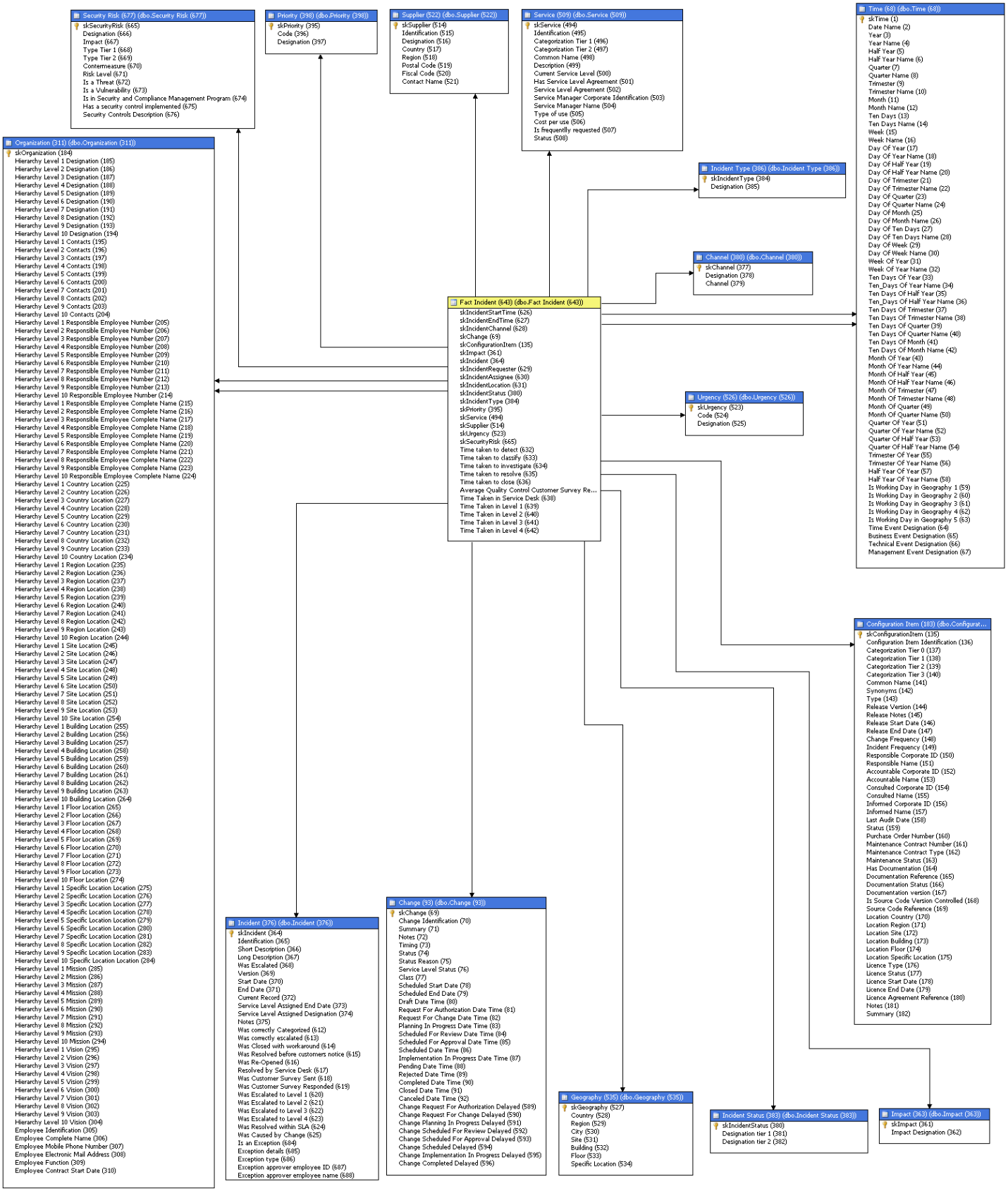
Annex 7 - Project Management Project LifeCycle Phases (A Guide to the Project Management Body of Knowledge, 2004)



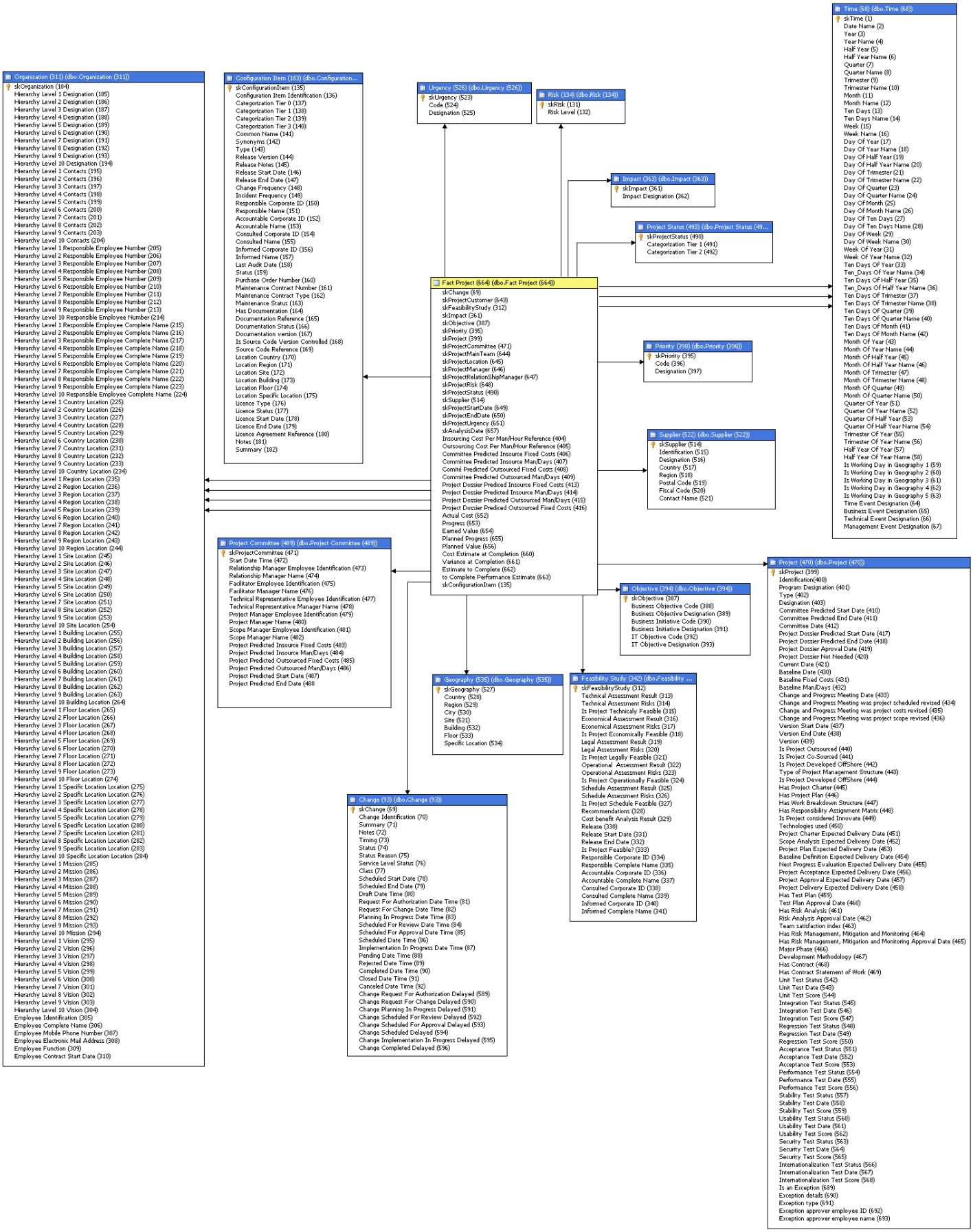
Annex 8 - Change Management Datamart Dimensional Model



Annex 9 - Incident Management Data mart Dimensional Model



Annex 10 - Project Development Data mart Dimensional Model



Annex 11- Service Desk Data mart Dimensional Model