

A Decision Model for Change Management based on Multicriteria Methodology

Odecilia Barreira
University of Fortaleza
Graduate Program in Applied Informatics – MIA
Ceara, Brazil
odecilia@edu.unifor.br

Raimir Holanda Filho, Plácido Rogério Pinheiro
University of Fortaleza
Graduate Program in Applied Informatics – MIA
Ceara, Brazil
raimir@unifor.br, placido@unifor.br

Abstract— The Information Technology (IT) is an essential, strategic and competitive component, with key role within organizations, providing services and solutions that drive business forward, guiding the management of IT Services organizational needs, using good practices such as ITIL (Information Technology Infrastructure Library) and COBIT (Control Objectives for Information and related Technology), to analyze the impact of IT on business processes and vice versa. The relationship between IT and business, how IT services are targeted at organizational perspectives on value creation, the analysis of the IT impact services on business processes, the evaluation of techniques and decision tools that can be used to adapt requests of changes in strategic objectives and business processes, they all represent the approach BDIM (Business-driven IT Management), i.e., the management of IT services related to business prospects. Therefore, this paper aims to propose a model of decision support for the Change Management Process, substantiated by multicriteria methodology, judging what issues are the most relevant in relation to a set of RFC (Request for Change) to be examined, approved and implemented, identifying priorities of change and prioritizing the deployment order efficiently, according to optimized procedures in level management decision related to business rules.

Keywords— *BDIM, COBIT, ITIL, Changes, Multicriteria.*

I. INTRODUCTION

A holistic view of information technology has resulted in a change of mentality, where IT considers all business processes in relation to the representativeness of IT services. On the other hand, organizations tend to improve the application of IT for the benefit of business, analyzing the impacts and striving for continuous improvement of the services that are closely linked to organizational strategic objectives.

Organizations and their business processes over time has always benefited from technological developments due to the need of organizing and making service updated, available, efficient, fair, safe and with the best value. Associated with this desire, BDIM approach has been defined as "the application of a set of models, practices, techniques and tools that map and quantitatively evaluate interdependencies between IT services in the form of solutions for business performance in order to align and improve the quality of IT services getting the best results for organizational projects" [1].

The alignment of IT with business goes through several stages (changes, substitutions, transformations) to achieve the desired strategic objectives. It is necessary to plan, organize, share and have the support of senior management through authorizations and service level agreements (SLA - Service Level Agreement) well defined so the change is successful. It is advisable and necessary to use IT governance practices recognized as the best in the market, such as ITIL and COBIT, to support IT Management in Change Management to achieve the objectives desired by organizations.

However, the decision-making process regarding the implementation of changes in a given time window, in the best possible sequence for a specific group of experts is something very challenging and delicate, because a wrong and misjudged decision may cause unavailability of services and unpredictable costs. Therefore, in order to strengthen the proposal to develop a model that precedes the implementation of changes by analyzing criteria and constraints used by CAB (Change Advisory Board), i.e. the committee of changes which identifies the most efficient order to implement the changes, it will be used multicriteria methodology based on judgments of relevant issues for the organization, previously raised according to the degree of importance or attractiveness to business, reducing risks and unforeseen events that negatively represent impact on the organization.

The choice of multicriteria methodology to support the decision process depends directly on the issue in question. According to Pinheiro [2, 3, 4], the choice of method should be the result of an evaluation of the chosen parameters, the type and accuracy of the data, the decision maker's way of thinking, and their knowledge about the problem. When the choice of a determined alternative depends on the analysis of different views or "desires", the decision problem is considered a multicriteria problem [5].

The main objective of this work is to develop a decision model within the Change Management process according to BDIM approach, based on sets of rules and best practice in service management such as ITIL and COBIT, supported by multicriteria methodology to minimize risks while proposing optimized procedures in level of decision management addressed to business rules.

II. BDIM AND THE CURRENT STATE OF THE ART IN CHANGES MANAGEMENT

The BDIM relationship between organizational objectives and services provided by information technology is achieved due to several strategic, organizational and technological changes. It is necessary to evaluate the services IT offers the organization and adapt or innovate to add value to the business.

Whatever is the business model, the expectation of the organizations that have IT services is to achieve its goals by controlling the levels of services provided, ie, to control - defining policies, procedures, practices and organizational structures to provide reasonable assurance that business' objectives will be achieved and that undesired events will be prevented or detected and corrected. [6].

Thus in [7] is reported as one of the biggest challenges and with a high degree of relevance, to establish strategically a portfolio of services as proposed by ITIL, based on the need that organizations have to meet market's demand, proposing a model that quantifies the value of IT to organizational strategies. To the services that are meaningful, it is necessary to establish the business level objectives in form of indicators fully documented in service level agreements, but, as

mentioned in [8] SLAs (Service Level Objectives) are insufficient to ensure full alignment between IT and organizational goals, it is necessary to go further, it is essential to manage and monitor rates and levels of ability, availability and performance.

The result of the monitoring of services often requires changes to be made to ensure the continuous improvement of these services. Change requests can start from an improvement action, from requests for urgent changes due to some incident, from requests for update or deployment of new services, or records problems, which can also be a proactive cause like adaption processes and cost reduction.

Thus, BDIM supporting Change Management and, as suggested by ITIL, change management requires a strategic planning by identifying the causes of the problem that proposed the change, by analyzing the impact to the business, assessing and reassessing the team of experts appointed to the plan, decreasing risks of deploying and providing greater savings of time and money. Added to COBIT, which provides specific controls for IT, it provides metrics for service level management, improving the monitoring of services, minimizing the negative impact to the business and ensuring the quality of the service delivery.

Thus, in [9] the purpose is to achieve financial efficiency against possible losses caused by services shutdowns during the implementation of changes, based on parallel implementations, analyzing dependencies, reducing deployment time and optimizing the amount of changes to be more effectively implemented. In [10] it is shown how to deal with implantation failure and reversal models and in [11] the authors developed catalogs of changes to codify the best practices, refining the level of requests made by the organization.

All studies are inspiration for the proposed model, which is to identify the most efficient order of change implementation supported by multicriteria methodology, which should precede the implementation of the changes through a coherent decision-making process, based on analysis of conditions and restrictions previously raised and subsequently judged according to the degree of relevance to business, reducing risks and unforeseen events that negatively impact the organization during the deployment of a changes set.

III. CHANGE MANAGEMENT

Change Management aims to meet the changing requirements of businesses efficiently and effectively, reducing impacts, managing risks, optimizing time, avoiding rework and aligning IT to business needs with the best financial return.

According to ITIL [12], the changes must be properly ordered through RFCs (Request for Changes - Change requests) and can be originated by several reasons, both proactively, aimed at generating business benefits such as cost reduction and optimization of services, and reactively to resolve errors or adapt to changing circumstances.

COBIT [6] presents two processes directly related to Change Management within one of their domains: Acquire and Implement, which are: the AI-6 (Manage Changes) and AI-7 (Install and Homologate Solutions and Changes).

The AI-6 process assumes that all changes related to infrastructure and applications of the environment production must be formally managed and controlled through well defined processes. The process AI-7, defines that the changes to be homologated must pass through stages to ensure successful deployment, according to agreed outcomes and with the lowest impact possible.

Change management is something complex and it is related to other managements, mainly with configuration management and service assets, which defines and controls the components of services and infrastructure, keeping the history information accurate about

configuration items. Another important relationship is with the management of knowledge, because it is a determining factor for the improvement of change deployment models, as according to ITIL, the goal of this management is to enable organizations to improve quality in decision-making based on secure information and trusted experiences from tactics, values and judgments made by deployments which translate the maturity of processes.

According to [13] maturity depends mainly on management attitudes found in companies. And in [14] some characteristics are identified that differentiate immature from mature organizations such as: the mature organizations have the visible support of senior management and other managers, processes are defined, managed, documented, monitored and continuously improved and it has the disciplined use of Information Technology.

Through maturity of management changes, it is possible to reuse effective action plans, optimizing deployment time and reducing risks. An IT environment with good levels of maturity helps changing management to make decisions in short, medium and long terms.

IV. THE MULTICRITERIA METHODOLOGY

Decision making is a determining factor for organizational strategic alignment and the IT services, because from service requests, the company is suitable for business competitiveness. Therefore, the action of deciding involves analysis of what caused the change request, the impacts, contingencies, risks and criteria will be weighted, where one of the biggest challenges is to adjust the longings and desires translated into human decisions to technological resources through techniques and tools for the decision support.

Thus, the multicriteria methodology responds to the following question in a decision-making process: How to build a wide range of preferences from a set of options without forcing decision-makers to produce their preferences in a numerically direct way? [15]. As proposed by the methodology of decision support, MACBETH developed by [16], which assesses conditions and restrictions considering multiple criteria, analysis should be undertaken in relation to the context of the situation and to the reason that prompted the changes request, so that a robust model is developed, according to the scheme of the M-MACBETH tool, displayed in "Fig. 1".

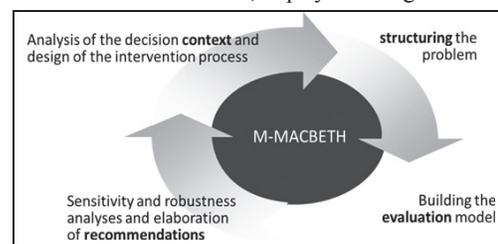


Fig. 1. Source: MACBETH - Phases of the MACBETH decision-aiding process

In the decision making process, the importance of subjectivity is influential because it involves aspects such as organizational culture, experience in dealing with problems informally, requirements of decision that identify potential alternatives and compares them in terms of importance and qualitative degree, composing a set of evaluation criteria.

According to [17], Methodologies of Multicriteria Decision Support use many features of quantitative psychology to express a preference regarding totally subjective aspects, such as comfort, desire, beauty or image of the company in the market.

So to minimize the use of subjectivity, the multicriteria methodology transforms the qualitative judgment on an array of judgments and cardinal value scales for the defined criteria. And to validate the analyzes results, tools and methodologies reflect the results

obtained in the form of graphs and cardinal values, such as M-MACBETH and Hiview [18], analyzing complex problems, evaluating and justify their preferences with sensibility analysis and robustness regarding the existing alternatives, obtaining the best solution adjusted to business needs.

V. PROPOSAL FOR MANAGEMENT OF CHANGES SUPPORTED BY MULTICRITERIA METHODOLOGY

The multicriteria methodology supports decision making in Change Management by allowing the definition of priorities and the best possible order of change deployment, taking into account available resources, impacts and unknown risks to the organization. Based on the analysis of pre-established criteria which are used by decision makers in a qualitative way, they ponder the degree of importance or attractiveness among the criteria, reaching quantitative results that consolidate the trial of order and priority of a set of changes to be implemented. According to [19], the results obtained by multicriteria analysis depend on the considered set of actions, data quality, choice and structuring of criteria, weighting the values assigned to the criteria, the used aggregation method and participation of different decision makers.

In order to alleviate the conflicting decision-making process, minimizing the degree of subjectivity and increasing the levels of success in the implementation, a Change Management model was developed based on multicriteria methodology, which the criteria used by the organization and the degree of importance between them are considered, reaching a prioritized list of deployments changes to be made.

To construct the model, we conducted interviews with experts in change management in a bank and in a State organ, which use the ITIL processes to manage IT services. They reported the main criteria considered when deciding which change is more important than another and thus set the order of change implementation. Then a questionnaire was sent to the trial of these criteria, validating the degree of importance or attractiveness among themselves according to the principles of multicriteria methodology. The evaluation model was inspired by the model proposed by MACBETH, suggesting the degree of attractiveness according to their respective weights, which are: Extremely Strong (5), Strong (4), Moderate (3), Weak (2) and No Importance (1). So we have a set of criteria with their respective set of subcriteria weighted as (1) and standardized according to "Fig. 2".

$$\bar{x}_p = \frac{\sum_{i=1}^n p_i \cdot x_i}{\sum_{i=1}^n p_i} \quad (1)$$

Ponder is synonymous with weight. In calculating the weighted average, multiply each value set by its "weight", that is, their relative importance. The weighted arithmetic (\bar{x}_p) mean of a set of numbers $x_1, x_2, x_3, \dots, x_n$, whose relative importance ("weight") is respectively $p_1, p_2, p_3, \dots, p_n$.

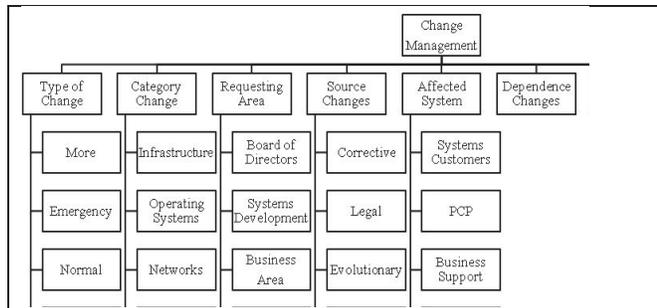


Fig. 2. Show Partial Standardization Criteria

The aim of the proposal is to suggest a model that streamlines the choice of priorities of the numerous requests for changes to be implemented, using a judgment model of standardized criteria to improve the decision-making process, affecting the organizational strategic objectives. Thus, the organizational criteria should be classified according to their degree of importance that impact directly on organizational processes, obtaining objective criteria and weighted.

As shown in "Fig. 3", the decision-making process model proposes that the CAB review change requests, records, approves them or not. The approved applications are judged according to the criteria and standardized organizational properly weighted to reflect the impact of the change before implementation of organizational strategies. To enforce the judgment, the criteria are added as MACBETH multicriteria tools and HIVIEW the qualitative judgment that translate into quantitative values, decreasing the degree of subjectivity in judgment exists, generating a prioritized list of changes, ensuring greater efficiency in sorting and ordering changes to be implemented.

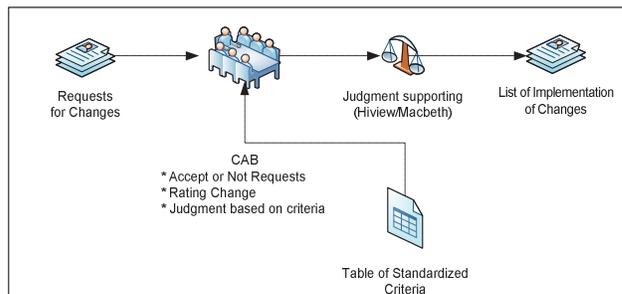


Fig. 3. The Decision Process

As [20] multicriteria analysis does not completely solve a decision problem, since numerous factors that guide it such as organizational culture and subjectivity. The proposal is to produce perceptions and to promote objectivity to assist in decision making. It is expected that with the maturity model and with future results, a decision support system is developed according to organizational criteria and to degrees of attractiveness consolidated by decision makers, it can be fed with change requests and as a result, to form the list of changes to be implemented in a more efficient and objective order.

VI. CASE STUDY: IMPLEMENTATION OF CHANGES AS MULTICRITERIA ANALYSIS

The implementation of change within organizations is crucial and challenging. During the research conducted with the Bank and the Public Liaison, it was very clear the difficulty in making decisions in front of so many factors to be considered when evaluating which change requests are more relevant than others, because the subjectivity factor added to the knowledge base of previous experiences contributed much to the decision making.

To assist in judging attractiveness among criteria and to define a standardized, objective and weighted list of organizational criteria and subcriteria, multicriteria tools were used, such as: MACBETH and Hiview to get faster and more accurate results, because these tools allow one to perform a qualitative judgment, resulting in quantitative data, allowing adjustments in scaling limits of each criterion to achieve results closer to the ones desired by the organization.

To validate the proposed model, we conducted a multicriteria judgment in a bank which has operations in the financial markets for over 20 years, with administrative headquarters in Fortaleza / CE and about 40 agencies spread throughout the country. The judgment was conducted specifically in a bank branch, based on organizational criteria, standardized and weighted by experts in change management, involving four change requests, they are: Change 01: Expand the

storage capacity of the mail servers that they have less than 10GB free space, (2) Change 02: Update in savings system, new rules dictated by the Federal Government, with determined time for deployment, (3) Change 03: Correct incident after implantation of change in the payroll system, (4) Change 04: Implement systems to monitor financial transactions via cell phone to the four directors of the company.

The judgment was conducted with the help of Hiview tool that has in its structure the tool supporting the MACBETH multicriteria model proposed, enabling the use of graphs, scales, sensitivity analysis and robustness that they provide, using the table of standardized organizational weighted criteria which considers the degree of attractiveness between them and change requests to be met. According to [21], the modeling helps decision-making, as it helps to make their goals explicit, forcing the identification of variables, the terms that are measurable and it also forces the recognition of limitations.

In “Fig. 4”, we have in the order of change implementation: Change-3, Change-4, Change-2 and Change-1.

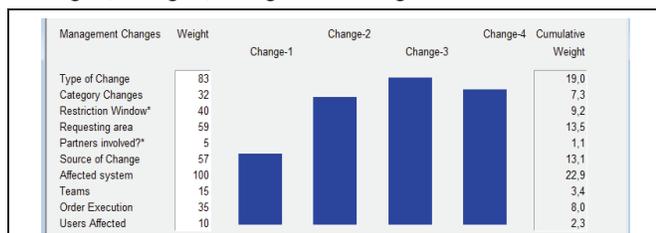


Fig. 4. Multicriteria Judgment

An interesting assessment was observed regarding the results obtained from the judgment, when there was no standardized and weighted criteria, the subjectivity factor was much stronger for decision making, which could lead to different results and sometimes not very efficient when compared to the proposed model supported by multicriteria methodology. As a result, we obtained an objective, fair, fast process of decision, with a list of changes implementation prioritized according to standardized organization criteria.

VII. CONCLUSION

The Change Management supported by BDIM and methodologies such as ITIL and COBIT optimizes the way how IT services are provided and handled by the organization. Because it is one of the most delicate and conflicting process, the change management is a focus of studies in both the academic and business.

For an organization use the proposed model it is essential know the provided services and their impacts, i.e., it is necessary to know the service portfolio, its impacts and to standardize the organizational criteria in a weighted way so it can be used in judgments of change requests.

The aim of this study is to propose a model that uses the multicriteria methodology and appropriate tools such as M-MACBETH and Hiview, so the deployments of changes might occur in optimized time windows with minimal errors, which can fatally affect the financial services and the health of the organization.

Thus, the model inspired by multicriteria methodology based on achieving defined and standardized organizational criteria by the team of experts in change management, increased the efficiency by defining the order of changes deployments, ensuring objective deployment, decreasing the percentage of errors and risks that directly impact and undertake organizational outcomes.

As future works, a system should be developed based on multicriteria methodology, powered by organizational criteria, optimizing time trial between change requests and consequently deployment time, achieving the results expected by the organization.

VIII. ACKNOWLEDGMENT

The authors are thankful to the University of Fortaleza (UNIFOR) who supported the research and the Foundation for Research Support Cearense (FUNCAP), which contributes to the scientific and technology in the state of Ceará. The third author is thankful to National Counsel of Technological and Scientific Development (CNPq) via Grants #305844/2011-3.

IX. REFERENCES

- [1] International Workshop on Business-driven IT Management, BDIM 2011, 6th IFIP/IEEE, 2011.
- [2] Pinheiro, Plácido R., Souza, Gilberto G. C. de, Castro, Ana K. A. de Estruturação do problema multicritério para produção de jornal. *Pesquisa Operacional*, 28(2), pp. 203-216, 2008
- [3] Castro, A. K. A., Pinheiro, P. R., Pinheiro, M. C. D., Tamanini, I.: “Towards the Applied Hybrid Model in Decision Making: A Neuropsychological Diagnosis of Alzheimer’s Disease Study Case”. *International Journal of Computational Intelligence Systems*, 4, pp. 89-99, (2011).
- [4] Tamanini, I., Pinheiro, P. R., Santos, C. N., “An Hybrid Approach of Verbal Decision Analysis and Machine Learning”. *Lecture Notes in Artificial Intelligence*, v. 7413, pp. 126-131 (2012)
- [5] Bana e Costa, C.A., De Corte, J.M., Vansnick, J.C. MACBETH, *International Journal of Information Technology and Decision Making*, 11(2), 359-387, 2012.
- [6] Governance Institute (ITGI) COBIT 4.1 Edition, Framework, Control Objectives, Management Guidelines, Maturity Models, 2007, Disponível em: <<http://www.isaca.org>>. Acesso em: 10 Jun. 2011.
- [7] J. A. Oliveira, J. Sauv , A. Moura, M. Queiroz, C. Bartolini and M. Hickey, “Value-driven IT Service Portfolio Selection under Uncertainty”, *IEEE/IFIP Network Operations and Management Symposium*, 2010.
- [8] J. Sauv , C. Bartolini, and J. A. B. Moura, “Looking at Business Through a Keyhole”, 4th IFIP/IEEE International Workshop on Business-driven IT Management, 2009
- [9] D. C. Oliveira and R. H. Filho, “A Time and Financial Loss Estimation using a Highly Parallel Scheduling Model for IT Change Management”, *International Workshop on Business-driven IT Management, BDIM 2011, 6th IFIP/IEEE*, 2009
- [10] Machado, G. S., da Costa Cordeiro, W. L., dos Santos, A. D., Wickboldt, J., Lunardi R. C., Andreis, F. G., Both, C. B., Gaspary, L. P., Granville, L. Z., Trastour, D., and Bartolini C.: “Refined Failure Remediation for IT Change Management Systems”. *International Symposium on Integrated Network Management (IM 2009)*. IFIP/IEEE, 2009.
- [11] Trastour, D., Fink, R., Liu, F.: ChangeRefinery: “Assist Refinement of High-Level IT Changes Requests”. *IEEE International Symposium on Policies for Distributed Systems and Networks*.
- [12] OGC (Office of Government Commerce), ITIL V3 PUBLICATIONS, Service Design, 2007.
- [13] Laurindo, F. J.B.;Carvalho, M. M.; Shimizu, T. Information Technology Strategy alignment: brazilian cases. In: Kangas, Kalle (Org). “Business strategies for information technology management”. Hershey, 2003. p. 186-199.
- [14] Paulk, M.C.; Weber, C. V.; Curtis, B.; Chrissis, M. B. “The Capability maturity model: guidelines for improving the software process / CMU / SEI”. Reading: Addison-Wesley, 1995.
- [15] Bana e Costa, C.A., Sanchez-Lopez, R., Vansnick, J.C., De Corte, J.M. “Introducción a MACBETH”, J.C. Leyva López (ed.), “Análisis Multicriterio para la Toma de Decisiones: Métodos y Aplicaciones”. Plaza y Valdés, México, p. 233-241, 2011.
- [16] Bana e Costa, C.A., De Corte, J.M., Vansnick, J.C. MACBETH, *International Journal of Information Technology and Decision Making*, 11(2), 359-387, 2012.
- [17] GOMES, Luiz Flávio Autran. “Tomadas de decisão são facilitadas com modelos matemáticos”. SBPC/Labjor, 2001.
- [18] Barclay, S. HIVEVIEW software package. London: London School of Business, 1984.
- [19] Soares, S. R.: “Análise multicritério com instrumento de gestão ambiental. Dissertação Mestrado”. Florianópolis: UFSC, 2003. Available: <www.ens.ufsc.br/~soares>.
- [20] KEENEY, R. L. “Value focused thinking: a path to creative decision making”. Cambridge:Harvard University Press, 1992.
- [21] Tamanini, I.; Castro, A. K. A.; Pinheiro, P. R.; Pinheiro, M. C. D.: “Verbal Decision Analysis Applied on the Optimization of Alzheimer’s Disease Diagnosis: A Study Case Based on Neuroimaging”, *Advances in Experimental Medicine and Biology*. 696(7), p. 555-564, (2010).