Available online at www.sciencedirect.com

ScienceDirect

Procedia Computer Science 239 (2024) 947–953

Procedia Computer Science

www.elsevier.com/locate/procedia

CENTERIS – International Conference on ENTERprise Information Systems / ProjMAN – International Conference on Project MANagement / HCist – International Conference on Health and Social Care Information Systems and Technologies 2023

Decision-making models applied to IT Project selection considering intangible assets

Gil Peso[a]*, Pedro Malta[b], Vitor Santos[abc]

[abc]*Nova IMS, Campus de Campolide, 1070-312 Lisboa, Portugal*

Abstract

How to identify the best IT project to invest in? Investing means spending resources with the intention of obtaining future benefits. Can this evaluation be done in a sustained way that minimizes the failure of a wrong choice and, therefore, some way to guarantee those benefits? This study intends to help answer these questions by building a decision-making tool, based on the existing multipurpose and adapting it to the reality of the IT Project Portfolio. The tool design is based on an in-depth analysis of IT projects, valuing their tangible and intangible characteristics to facilitate the organization's management or decision-makers. Following an inductive thinking, the real decision making matrices shall be dissected to establish a future generalization in the form of a new tool to be applied to a specific scenario. A mixed strategy will be adopted (quantitative strategy to establish cause-effect relationships and qualitative strategy to understand the intangible factors associated with IT projects).

Keywords: Decision-making Models; Intangible; Portfolio; IT Project Selection.

* Corresponding author. Tel.: +0-000-000-0000 ; fax: +0-000-000-0000 .
E-mail address: m20201341@novaims.unl.pt

10.1016/j.procs.2024.06.256

1. Introduction

Intangibles' accounting associated with an IT project is not always done, with intangibles dully appreciated, dully evaluated. It is a process that consumes an enormous amount of time: do managers look to intangibles when looking at a project as an all, especially in an IT one? This question is related to the maturity level in decision making about the IT Project to choose from a existent portfolio, as each of them is in a different "stage of life cycle" [1].

From the Modern Portfolio Theory [2], the paradigm is to manage the portfolio of projects instead of a single one, supported in a centralized management: the result can be a simultaneously contribute face to an investment made or even an evident set of gains with the projects' existent diversity.

This means a primary concern in Portfolio Project Management, in two perspectives: 1) "… harmony with the strategies, resources, and executive oversight of the enterprise and provides the structure and processes for project portfolio governance." [3]; 2) "… compete for scarce resources and that are conducted to achieve strategic business objectives" [4].

These perspectives derive from a good resource management, when focus in strategic and competitive enhancement within decision making in a project choice supported in a set of rigorous criteria: trend of choosing commercial off-the-shelf (COTS) IT solutions packages pushed companies towards generic business models and therefore countless ways to diverge from a stakeholder point of view. The decision of a project adoption should follow basic principles such as business and stakeholders' strategic alignment, resources economy, leverage, and positive business competitiveness enhancement that impacts not only in minimizing a possible negative consequence of an unsuccessful choice but an assurance and a guarantee that the chosen project to invest is the wright one [5].

In a global demanding economy, characterized by competitive markets and the struggle to thrive, organizations need to up their strategies and competitiveness, especially aiming a good resource management, where each one can be Volatile, Uncertain, Complex and Ambiguity [6], even the intangible ones.

2. 2. Intangibles within IT Project Management

IT projects are projects that involve primarily the conception, development, or acquisition of a physical or logical IT solution destined to overcome an identified IT need. IT projects can be looked from two major perspectives: as those that are built in-house by software companies, with a dedicated software developing team, normally as part of the IT department and companies that acquire finalized products, customizable or not to its specific businesses processes, with its implementation to be considered.

Bigger the IT projects (involving more technology, more cost, more people…), more complex they are and harder to choose. It worsens if we must choose one in a basket, a portfolio with two, three or more. All projects laying on a portfolio may look feasible and profitable. Sometimes the establishment of the priority is made intuitively, unreasonably, rapidly. Whether is derailed from markets or stakeholders' pressure or the assumption that implementing a new project is better that to implement none. A cared decision would allow an improved positive impact in organizations, less project investments failure: only 39 percent of projects today are successful in adding value to the product and the organization investing in the project [7]. So, it is important to choose the right project to invest in: "The difficulty in product portfolio selection is compounded by the fact that not all projects for consideration in the process are at the same stage of their life cycle." [1]. It would be useful a Decision-Making Model capable of complexity treatment to critically inform the organization board of its liability, and its advantages among the projects in the portfolio.

As this requires technical knowledge to be able to indicate a good IT project to invest in, a project that will bring business success and profit, throughout a competitiveness concern: to identify tangible and intangible project management assets and competitive characteristics of the project management process. Looking to intangible recognized value [8], 8 out of 10 of the topmost valuable intangible assets are from the IT area. Intangibles are all assets that cannot be physically touched and therefore the difficulty of measure and quantify the value to the company [9] [10] [11]. Intangible assets are blends or combinations of procedures, practices, relationships, and culture [12] that create efficiency, enhance relations, and provide advantages.

So, the new decision-making model will encompass a look at the IT candidate projects and their attached intangible assets. Will the new IT project impact a change in the organization business processes? Will it be required

in the future to produce the same with less work? Or even produce more with less or the same work? Will it benefit HR daily quality work? Save time? Will it engage HR? Engage new clients? New stakeholders? Does it stand for a new disruptive product? Or a new disruptive way to do things? How can an organization equate future IT projects without a close look at intangibles?

3. Decision-making models to apply

Within the different approaches/methods applied to the selection criteria, building models that help in the decision-making process are explained in the literature. To comprise tangible and intangible assets from an IT Project, the Multi Criteria Decision Making (MCDM) model [13], better answer seemed to answer this research work. It includes the construction of a decision matrix, with criteria posted by the decision maker and alternatives to the chosen criteria. Examples of a MCDM are: Complex Proportional Assessment (COPRAS), Elimination and Choice Expressing the Reality (ELECTRE), the compromise ranking method VIKOR, Promethee, Tomada de Decisão Interativa Multicriterio (Portuguese acronym for Interactive Multi-Criteria Decision Making – TODIM), Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), Analytic Hierarchy Process (AHP).

AHP [14] as a recent and more used method, was applied: it has a better multi-criteria decision and consistency analysis method. Even, AHP´s methodology allows data crossing to find which alternatives are better based on pre-determined criteria: these criteria will be defined at distinct levels of the company, regarding the project weight and importance, always in the strategic perspective and alignment doctrine. Rai [15] stated: "The AHP has proved a theoretically sound and market tested and accepted methodology. It is almost universal adoption as a new paradigm for decision-making coupled with its ease of implementation and understanding constitute its success. More than that, it has proved to be a methodology capable of producing results that agree with perceptions and expectations."

AHP addresses challenges as to encompass a multi-criteria decision process and the treatment of qualitative data as quantitative data. In the literature review readings, clearly the gap was found. First the little awareness regarding the intangible assets, resources, and incomes that an IT project evolves. Second, to build a model that can help choose an IT project to invest with its intangible's evaluation.

3.1. AHP implementation method

The three bases of AHP are hierarchy construction, priority analysis, and consistency verification. To do so, a six steps process, are to be followed (Mu & Pereyra-Rojas, 2018, p.14):

- First step: Develop a model for the decision – Break down the decision into a hierarchy of goals, criteria, and alternatives.
- Second step: Derive priorities (weights) for the criteria – The importance of criteria is compared pairwise with respect to the desired goal to derive their weights. We then check the consistency of judgments; that is, a review of the judgments is done to ensure a reasonable level of consistency in terms of proportionality and transitivity.
- Third step: Derive local priorities (preferences) for the alternatives – Derive priorities or the alternatives with respect to each criterion separately (following a similar process as in the previous step, i.e., compare the alternatives pairwise with respect to each criterion). Check and adjust the consistency as required.
- Fourth step: Derive overall priorities (model synthesis) – All alternative priorities obtained are combined as a weighted sum to consider the weight of each criterion — to establish the overall priorities of the alternatives. The alternative with the highest overall priority constitutes the best choice.
- Fifth step: Perform sensitivity analysis – A study of how changes in the weights of the criteria could affect the result is done to understand the rationale behind the obtained results.
- Sixth step – Making a final decision: Based on the synthesis results and sensitivity analysis, a decision can be made.

Some assumptions were considered in AHP implementation:

- IT organizations have varied sizes, different organizational structures, Information systems, Human Resources.

- Each organization has different IT needs.

The number of variables can be added regarding the project components and their contribution to organizational objectives. The model is perfectly manageable to the inclusion of different variables, with proper weight analysis.

For variables it is understand criteria, preferences, weights. All that can be included following a perception of its strategic importance.

Moreover, within AHP, the three bases are hierarchy construction, priority analysis, and consistency verification. To do so, a six steps process, are to be followed (Mu & Pereyra-Rojas, 2018): develop a model for the decision, derive priorities (weights) for the criteria, derive local priorities (preferences) for the alternatives; derive overall priorities – perform sensitivity analysis (how changes in the weights of the criteria could affect the result) and make a final decision.

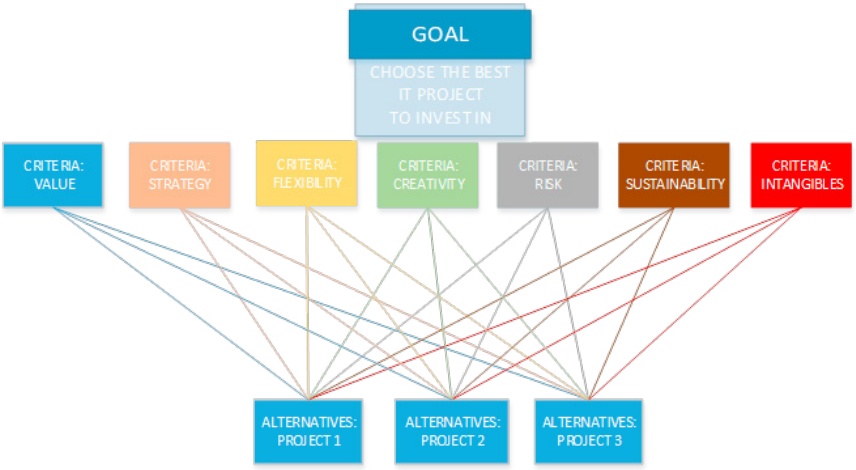

Fig. 1. Decision Model Goal, Criteria and Alternatives

To complement AHP implementation, a proposed model (Figure 2.) covering the three areas - IT Projects; Project Management; IT Project Portfolio – to encompass and rank, focused in finding the most indicated solution, based on structural vectors, such profitability, reward/risk balance and strategic alignment. A a project management office (PMO) should conducted desirably this model.

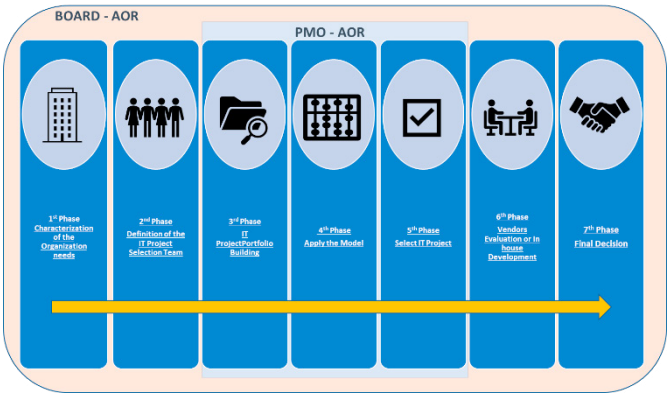

Fig. 2. Project Investment Decision Roadmap

4. Results from field work

To test our model, a portfolio with two IT projects of GMS, a Merchant Carrier Navy in Europe:

- Single Clinical Post (SCP): implement a software to support SCP Human Resource Health Care;
- School Management System (SMS): implement a software to support GMS School.

Applied the model using AHP to SCP project, the Decision Model Goal, Criteria and Alternatives output was:

Fig. 3. SCP Decision Model Goal, Criteria and Alternatives

Applied the model using AHP to SMS project, the Decision Model Goal, Criteria and Alternatives output was:

Fig. 4. SMS Decision Model Goal, Criteria and Alternatives

Combining both projects score in a matrix:

Table 1. Final projects criterion score

	Value	Strategy	Flexibility	Creativity	Risk	Sustainability	Intangibles
SCP	0.1944	0.1074	0.0765	0.0756	0.1295	0.0880	0.763
SMS	0.2268	0.1253	0.0680	0.0084	0.1110	0.0880	0.763

Converting the data to establish the simple multiplication of the matrixes with each project score and the criterion weights, we can extract the final grade for the projects:

$$\begin{bmatrix} 0,72 & 0,6 & 0,9 & 0,9 & 0,7 & 1 & 0,7 \\ 0,84 & 0,7 & 0,8 & 0,1 & 0,6 & 1 & 0,7 \end{bmatrix} * \begin{bmatrix} 0,27 \\ 0,179 \\ 0,085 \\ 0,084 \\ 0,185 \\ 0,88 \\ 0,109 \end{bmatrix} = \begin{bmatrix} 1,5397 \\ 1,4958 \end{bmatrix}$$

Fig. 5. Final projects scores

The decision-making model result: Project SCP has the higher score with 1.54, so a stronger fulfilment of the board´s vision. In the case of a limited budget and forced to decide on only one of the suggested projects, GMS should start by investing in SCP.

5. Conclusions

In answer to the question of what decision-making model to use, AHP was the one that served as basis to the artifact of the research. Its handling of qualitative data allowed the possibility of the quantification of intangibles. Regarding the basis of the proposed decision-making model that highlights as the main IT project characteristics when choosing an IT Project to invest from the portfolio, that have been poured into the criterions of the model: value, intangibles, all the characteristic of the project that boost flexibility, creativity, sustainability, lower the risk and last but not the least, aligned with the company strategy. We saw about intangibles question that they can be accounted in decision-making models, even in this work were not decisive as both projects were scored with the same number.

Concerning the appraisal of the main IT project characteristics, we entered also in the intangibles sphere: not only tangibles important characteristics were named, but also the importance of the identification of the intangible ones that could bring importance and profit to the business.

As a synthesis of the developed work, the issue was to endorse intangibles in a mathematical decision model to the selection of an IT project in a portfolio context. The work proved that the AHP was a model easily adapted to the task, for its simplicity and possibility que quantify and turn qualitative data (intangibles) to quantitative data.

Even so, one of the work's limitations was the extent of analysis that an IT project investment requires. The exposed practical cases were merely examples, and for instance only the analysis of the value and the risk criterions of the model would serve as a dissertation thesis. Secondly, the criteria definition. The definition of which criterions should be chosen and the weight of each criterion to the model are debatable, arguable. Tens of criterions more could be chosen and accounted for different strategic levels of the organizations. Though narrowed the scope to the IT environment, a lot more criterions could be of more importance for companies. The aim was always as an example

and to academic purposes. And third, the work stated for a methodology that produced a decision-making model, not an absolute law or doctrine. It gives a line of thinking, a way to calculate benefits over costs and to appreciate the mostly forgiven project intangibles and incorporate them in the calculus.

As a future work, the exploration of the criterions (each criterion can be deeply analyzed) and a further identification and maybe a different way of intangibles inclusion in the model, would be areas that need to be explored.

References

[1] Siddhartha Sampath. (2013). Towards More Intuitive Frameworks in Project Portfolio Selection. Journal of Chemical Information and Modeling, 53(9), 1689–1699. https://repository.asu.edu/attachments/201061/content/Sampath_asu_0010E_17752.pdf.

[2] Markowitz, H. (2007). Portfolio Selection - Harry Markowitz.pdf. The Journal of Finance, Vol. 7, No. 1. (Mar., 1952), Pp. 77-91., 7(1), 77–91. https://www.math.ust.hk/~maykwok/courses/ma362/07F/markowitz_JF.pdf

[3] Levine, H. A. (2005). Project Portfolio Management. Jossey-Bass A Wiley Imprint 989 Market Street, San Francisco, CA 94103-1741. https://doi.org/10.4018/978-1-7998-1760-4.ch030

[4] Curlee, W. (2014). Project Portfolio Management and Communication. In Effective Project Management: Traditional, Adamptive, Extreme.

[5] Cameron, B. (2011). IS Project and Portfolio Management. In Handbook of Research on Instructional Systems and Technology. https://doi.org/10.4018/978-1-59904-865-9.ch034

[6] Cuevas, R., Bodea, C.-N., & Torres-lima, P. (2021). Programme and Portfolio Management. Integrating Sustainability into Project Management.

[7] James, V. (2019). Leveraging Business Analysis for Project Success. In Business Expert Press. https://ebookcentral-proquest-com.torrens.idm.oclc.org/lib/think/reader.action?docID=5560094&ppg=64

[8] Institute, B. F. (2021). Gift 2021 (Issue September). https://brandirectory.com/download-report/brand-finance-gift-2021.pdf

[9] Hubbard, D. W. (2008). How to measure anything: finding the value of “intangibles” in business. In Choice Reviews Online (Vol. 45, Issue 12). https://doi.org/10.5860/choice.45-6882

[10] Cohen, J. A. (2013). Intangible assets valuation and economic benefit. In Journal of Chemical Information and Modeling (Vol. 53, Issue 9)

[11] Fuad, S. M., & Gomes, J. A. (2017). Investigating the Impact of Valuing Intangible Assets on Valuation Multiples. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.3016598

[12] Moberly, M. D. (2014). Safeguarding Intangible Assets. In Safeguarding Intangible Assets. https://doi.org/10.1016/C2013-0-15617-6

[13] Taherdoost, H.; Madanchian, M. Multi-Criteria Decision Making (MCDM) Methods and Concepts. Encyclopedia 2023, 3,77–87. https://doi.org/10.3390/encyclopedia3010006

[14] Mu, E., & Pereyra-Rojas, M. (2018). Practical Decision Making Using Super Decisions v3: an Introduction to the Analityc Hierarchy Process

[15] Rai, N. B. (2004). Strategic Decision Making Applying the Analytic Hierarchy Process. London: Springer