Project *Portfolio* Management using AHP

Edmilson Alves de Moraes,
edmilson@fei.edu.br
Centro Universitário da FEI
São Paulo, SP Brazil.

Roberto Carlos Bernardes,
bernardes@fei.edu.br
Centro Universitário da FEI
São Paulo, SP Brazil.

Roberto Camanho,
rcamanho@espm.br
ESPM - Escola Superior de Propaganda e Marketing
São Paulo, SP Brazil.

SUMMARY

This study presents the experience based on the utilization of AHP method for the prioritization of projects in the Information Technology Department (ITD) of a large food enterprise. The company was using a tabular system in order to calculate adjusted weights. Comparison between the two methods allowed company's decision makers to acquire greater conscience about their preferences and relative importances being attributed to relevant selection criteria. The pairwise comparison process required by the AHP allowed the team of decision makers to obtain greater understanding of their individual points of view, and opening space for dialog and argumentation which led to a high level of agreement. At the end, a result comparison of both processes and the study of found differences, made it possible, according to the decision makers, to prove the superiority of the AHP method in terms of specification and transparency of the process, therefore allowing them to audit their decisions and to execute the sensibility analysis of the results regarding the weights given to each criterion.

INTRODUCTION

By evaluating the nineties, we observe that such decade was distinguished by the evolution of diffusion, comprehension, and application of quality concepts. The only reservation to highlight, however, is that these concepts were always focused on the actions to be taken in quality management, while there was little attention given to the quality of decisions generated by those actions.

Decision making is the most important attitude and the one with greater capacity to transform our lives. Many executives still think that it is not necessary to have a logic and well structured approach to make a decision. However, research conducted in the last twenty years about decision making processes has demonstrated that training, technique, and a structured methodology are essential in order to obtain a better quality in terms of decisions.

Good sport coaches recognize that any athlete without proper training tends to commit characteristic mistakes. In the same way, the work developed by researchers about the decision making process shows that not trained decision makers show some characteristic mistakes, like defining the problem based on the solution he or she knows how to implement, or avoid collecting relevant factual information due to the excess of self-confidence in its own evaluations of the problem (FIOL, 2001).

In the same way sport coaches develop techniques to correct the most common mistakes of their athletes, decision making researchers are also improving the techniques for "decision makers".

Janis (1989) highlights that "a decision making process using simplistic strategies (affiliation rules, emotional rules, lack of organizational structure when gathering information, emphasis in intuition, etc.) have greater probability to drive to undesirable results than a high quality decision making process".

There is no doubt that the decision making process is the most difficult and essential task to be performed by any executive. According to Napoleon Bonaparte, 1804´s sayings, "Nothing is more difficult; therefore more precious, than being able to decide".

RESEARCH OBJECTIVES

The aim of this article is to approach the difficulties in Project Portfolio Management decision making, as well as introducing new possibilities, through the use of AHP methodology, to those interested in the quality of their own decisions.

By means of an IT Department case study of Portfolio Management on a large company, a comparison is made between the effectiveness of basic weighting systems for the selection of projects and the AHP methodology, emphasizing the difference between the results achieved, as well as the improvement in the decision quality, according to the decision makers themselves.

The intention of the AHP methodology is to turn decision rules as clear and explicit as possible, allowing all participants involved in the decision making process to have their opinions considered, therefore, making such process more transparent and auditable.

REASONS FOR THE WORK

Portfolio Management is a strategic activity for companies that want to compete in environments experiencing continuous and fast changes, through the development of technological innovations. Selection and prioritization of either research and development, or new product projects constitutes an essential and critical activity in order to achieve successful launching of new products and services.

THEORY REVIEW

1978 Nobel Prize in Economics, Herbert Simon, proposed the following phases to be considered in the decision making process (SIMON, 1960): intelligence, conception and choice.

Intelligence involves the identification of either the problem or the opportunity; conception refers to the definition or identification of alternatives that offer a solution to such problem or opportunity and choice involves the selection of an alternative or a combination of several alternatives.

Until recently, choice was almost always done intuitively and/or also supported by the pros and cons analysis of the relevant alternatives. However, due to the fact that today such analysis involves tangible and intangible factors, it is necessary to define a measurement criterion that can be supplied by the AHP methodology - Analytic Hierarchy Process, for example. This AHP process, is a general measurement theory currently used in decision making problems in order to establish measures of the most variable domains, being these tangible or intangible. This process will be explained in depth in the next chapter.

Difficulties to decide

Decisions to be taken by government leaders or corporate executives generally involve multiple criteria or objectives with a great variety of purposes or functions; many of them intangible or involving some level of risk. Examples of our day-to-day criteria or objectives are: maximize profit, satisfy customer demand, maximize employee satisfaction, satisfy stockholders, reduce production costs, satisfy government regulations, minimize tax payments, or maximize bonus.

Decisions become difficult especially when they involve objectives that compete with each other (satisfy government regulations "versus" minimize tax payments) and the greater the number of objectives, the more complex such decision will be. These kinds of decisions require the execution of *trade-offs* in order to choose the best possible option. The trade-off among objectives involving a decision making is a difficult and poorly understood process. Thus, reinforcing the need for application of methodologies and structured techniques capable of supporting a complete analysis of the available options.

Frequently, several people is involved in such judging processes and usually they do not fully agree with each other. How susceptible is the result of a diversity of opinions? How should a decision be taken when specialists are involved? How could a decision be taken through interaction, debate, and consensus of participants if there are no recognizes specialists?

This process allows individuals to match intangible evaluations with tangible ones, subjective with objective, and group the two of them to their purposes. It offers a way to integrate to the conditions of the environment, to select the correct objectives, to establish priorities, and to determine the global weight of each alternative solution. The AHP – Thomas Saaty Analytic Hierarchy Process (1990), uses a model of hierarchical decision with a solid mathematical basis.

Model – It is the representation of a phenomenon. It can be manipulated physically in the case of physical models, or mathematically in the case of a hierarchical model to identify the relevant influences. Then we apply what we learn in the real world.

Hierarchy – It is a structure of layered dominance that represents the extension of influences. As an example, the structure of a corporate organization, from the president to the vice-presidents, to the departments they control, downward to the employees; this is a hierarchical structure.

The AHP methodology offers a system where the elements of a problem are placed in a hierarchy, judgments are registered, and priorities are established for each action taken.

To capture all the complexity of a decision, it is important to have a large participation in order to build the model. One single decision may involve economic, political, technical, and other factors. In this way, when using a model with a well structured hierarchy, you will be more confident to act with the intuition, the rational, the irrational, as well as with the risks and doubts involved

AHP HYSTORICAL BACKGROUND

The Analytic Hierarchy Process (AHP) was developed in the United States in the Wharton School of Business, by Professor, Dr. Thomas Saaty, who describes the background of the methodology: "This theory has its origins back in the fall of 1971, when I was working in the planning of the Department of Defense. Its adolescence occurred in 1972 in a study related to the industries power shortage. The origins of the scale relating opinions to numbers goes back to the critical events occurred in June/July, 1972, in Cairo, while I was analyzing the effects of the "No Peace, No War" economic, political, and military situation of Egypt".

Maturity in the application of the theory arose with the Sudan Transport Study in 1973 that I managed. The enrichment of its theory occurred along the way and was intensified between 1974 and 1978. Until now, its applications were varied and uncountable.

The methodology is software structured (Decision Lens) and it is applied to: TQM, resource allocation, employee evaluation, marketing strategies, team decisions, cost/benefit analysis, formulation and evaluation of policies, and credit analysis among others. Users are government agencies in Brazil and overseas.

The method was used by IBM in the Application System/400 Project (AS/400) and according to the description done in "The Silverlake Project" book the use of AHP helped the company to obtain the "Malcolm Baldridge Quality Award". Other distinguished applications are: GM´s Advanced Engineering, Xerox Research and Development, 3M Strategic Planning, Diagnoses and Treatments in the Rochester General Hospital.

At Embratel, in Brazil, the method was introduced in 1986 and was used in the judging process of public biddings and in strategic planning as well.

HIERARCHICAL ANALYSIS PROCESS

According to Prof. Saaty in his book "Hierarchical Analysis Process", this theory reflects what seems to be a natural method of functioning of the human mind. When facing a big number of elements, controllable or not, comprising a complex situation, it splits them into groups, according to common properties. Our model of this brain function allows a repetition of this process when we consider these groups, or better, its common priorities of identification as elements of a new system level. At the same time, these elements can be grouped according to another set of properties, generating elements of another and more elevated level, until we are able to achieve a unique top element that may be, many times, identified as the objective of our decision process.

What we have just described, is generally called as hierarchy. This is, a system of stratified levels; each one of them constituted by many elements or factors.

The main question in terms of hierarchy is the following: With what weight the individual factors of the lower level of the hierarchy influence the top factor of the general objective? As long as this influence is not uniform in relation to its factors, we reach the identification of its intensity, or if we prefer, to its priorities.

This determination of priorities of lower factors in relation to the objective may be reduced to a sequence of priority problems, one for each level, and each one of these priority problems reduced to a sequence of paired comparisons. These comparisons continue to be the main ingredient of our theory.

Users of the methodology consider that the process catches the intuitive comprehension of a problem. Besides this, the psychological limits seem to be linked with the conditions for a mathematical stability of the results.

We need the notion of priority and its measure in order to represent the degree of importance of each objective, and each sub-objective in relation to the main objective. The comparison method in pairs derives from judgment. While it is difficult to justify weights that are arbitrarily attributed, it is relatively easy to justify judgments and the base (data, knowledge, experience) for the judgment.

Continuing with our example, we must judge which are the priorities of the sub-criteria of the quality criterion and, to establish intensities to this judgment, we will use the intensity scale developed by Saaty, designed to represent the preference intensity while judging alternatives and the importance intensity while judging criteria and sub-criteria. This scale is called Fundamental Scale.

NUMERICAL SCALE	VERBAL SCALE
1	Equal importance
3	Weak importance of one over the other
5	Essential or Strong Importance
7	Very Strong Importance
9	Absolute Importance
2,4,6,8	Intermediate Values

For this reason, we will be able to judge pairwise the sub-criteria of the quality criteria with the verbal scale, and from the verbal judgment we will substitute by numbers, creating the matrix that will be the calculation basis of the AHP method for its priorities.

RANKING SCALE

With the ranking scale it is possible to determine the exact mathematical interval between the types of values besides defining the order of alternatives as an ordinal scale (first, second, third...).

In the ranking scale the interval remains constant between the several values on the scale; such is the case of a Celsius or Fahrenheit temperature scales. These two scales don't have an absolute zero, and there is no scale 1,3 and 5, neither.

The temperature scale that has an absolute zero is the Kelvin scale. The interval from 0°C to 100°C and from 273K to 373K is divided in 100 equal parts and each of the divisions correspond to 1°C and 1K, respectively. In the Fahrenheit scale the interval of 32°F to 212°F is divided in 180 parts.

As Thomas Saaty mentions in the website (http://www.expertchoice.com/annie.person/home.htm), "The distance between points in these scales is consistent above or below the scale. Using Celsius degrees, how many degrees get hotter between 30 and 25 degrees? Five. How many degrees get hotter between 100 and 95 degrees? Five. How hotter get 40 degrees than 20 degrees? We are tempted to say "twice hotter", *but this is not true"*.

The Fahrenheit scale of temperature is also a ranking scale, as we mentioned above. The equivalent to 32.2 Celsius degrees are 90 Fahrenheit degrees and 7.2 Celsius degrees are 45 Fahrenheit degrees. Supplied with this data we are going to respond to the question: "How hotter get 90 degrees than 45 degrees?" If you are in the United States (°F) you can try to say "twice as hotter", but if you are in Brazil (°C) you will try to say "4.5 times hotter".

Which answer is the correct one? *None of them!* Since they both are a ranking scale, you can add and subtract numbers but you can not multiply or divide numbers in this type of scale. For example, (90-45)/45, cannot be done. In "reality you can, but **you mustn't** do it because the result doesn't have a mathematical meaning".

PROJECT PORTFOLIO MANAGEMENT

The importance of Project *Portfolio* alignment with the corporate strategy has been introduced more persistently as a critical activity for companies, taking Portfolio Management to

assume an important role in the competitive strategy and consequently, to present it self as an impacting factor in the long term result of the company (COOPER; EDGETT; KLEINSCHMIDT, 2001). A critical aspect in Portfolio Management is to evaluate which is the group of projects that maximizes the achievement of strategic objectives.

Portfolio Management is then a dynamic decision process in which an amount of new research products and development is constantly updated. This is the process responsible for the evaluation, selection and prioritization of new projects, as well as for the revision of priority, reduction or elimination of projects in progress (COOPER; EDGETT; KLEINSCHMIDT, 1998).

The difficulties of the implementation of Portfolio Management are associated to the uncertainties shown by turbulences in the market, rapid technological changes, and utilization of scarce resources shared among the several areas of the company (EISENHARDT; MARTIN, 2000, EISENHARDT; BROWN, 1998). In order to validate the possible execution of the *Portfolio* some aspects must be observed, such as: the complexity of the *Portfolio* evaluated that implies on verifying if there is availability for technology, human resources, and physical infra-structure for the execution of projects; the risks involved in the *Portfolio*, taking into account that the most important ones are those related to performance – to achieve the expected return, to cost – the deviation that may occur when calculating the cost of the project, to the Schedule- time planning, to the culture – impact of the culture in the attainment of results of the project; the strategic alignment – which one is the group of projects that are more aligned with the strategic objectives.

There are several methodologies for Portfolio Management. The most appropriate ones imply an activity of periodic selection of available project proposals, and the re-evaluation of existing projects that are in execution phase, therefore, allowing the compliance with the strategic objectives of the company without exceeding available resources, nor violating other business restrictions, and responding to the minimum requests of the organization according to the different criteria (ARCHER; GHASEMZADEH, 1999). Examples of such requests may be: potential profitability, potential acceptance, amount of investments, and others.

METHODOLOGY

The methodology used was the case study characterized as a type of research that focuses in the deep and exhaustive analysis of one or few objects, in such a way that they are able to reach an extensive and detailed knowledge of the object studied (GIL, 1987). Therefore, it looks for an examination of the environment, of a subject, or a particular situation (GODOY, 1995). This method is very useful when it tries to answer to questions such as "how" and "why" certain phenomenon occurs (YIN, 1989).

Case studies can be generalized for theoretical propositions but not for populations. In such manner, generalization may not be statistical but analytical (YIN, 1989).

It is intended in this case to study in detail the prioritization method used by the company researched by presenting and exploring some of its methodological faults. Following, the AHP methodology is presented and then its prioritization process is repeated and discussed.

CASE DESCRIPTION

The researched company belongs to the food industry and it will be referenced from now on as the "Company" in order to maintain the confidentiality of its real name.

The case will focus in the Information Technology sector that is responsible for the development of new software for the company, and the maintenance of the software installed base, networks and hardware. The Company sent the activity demands to the Information Technology Department in the following way: products (new developments), services (maintenance or repairs in the installed base) and infrastructure (maintenance of networks and hardware).

Our focus of analysis will be the product portfolio (new developments) that we will call as IT projects. As in the majority of companies, demands exceed the capacities of execution referring to financial resources as well as to human resources. For this reason, it is necessary to do the prioritization according to the criteria that is important for the company and maximize the utilization of available resources.

The method developed by the company included three phases. First, a mapping of the prioritization criteria considered important by the company was done. Then, a determined weight was attributed to each one of them. And finally, each alternative was evaluated and a score was given to represent how much it attended to each criteria. The closing was done through a weighted average in which the scores were multiplied by the weights of the criteria, therefore, obtaining punctuation for

the project. Projects with higher punctuation were selected. Below, find the detailed methodology that was used, as well as the criteria considered important for the Company.

Projects were evaluated in relation to 6 criteria defined by the ITD – Information Technology Directory. They are:

Infrastructure – Level of needs for technological infrastructure.

Human Resources – Need of specialization for people who will participate on the project.

Complexity of the Solution – Conditions for the conclusion of the project

Alignment with the IT directive – How the project or its final product is aligned with the strategy of the corporation and the IT area.

Coverage of the Solution - Coverage of the solution proposed by the project.

Urgency of the Project - Need of the requesting area in relation to the project's results.

These criteria received their relative weights from the ITD, applying a scale with weights 1, 3 e 5, meaning that the criteria is either low, medium, or very important, respectively. The weights attributed were as follows:

Criteria	Infrastructure	Human Resources	Complexity of the Solution	Alignment with the IT directive	Coverage of the Solution	Quality of the Project
Weights	3	3	3	5	3	5

All the projects in the sequence were evaluated in function of all the criteria. The score for each project was given according to how much it impacts on each criterion. This score is given by applying a scale 1, 3 and 5. The meaning of scores is different for each criterion, and it is shown in the next table:

| Criteria for prioritization of IT projects	Evaluation scale
Infrastructure – Level of needs for technological infrastructure	1 – A technological infrastructure must be developed and implemented to execute the project. 3 – The infrastructure requires up-grade to attend the necessities of the project 5- The necessary infrastructure already exists and it does not require any modification
Human Resources – Need of specialization for people who will participate on the project	1 None – Project only requires either internal or external technicians or trainees 3- Specialization – Generally, requires senior or plain analysts, available internally 5- High Specialization – Requires personnel highly specialized, possibly external (generally, consulting companies or specialized service providers), due to the internal availability and degree of risk involved
Complexity of the Solution - Conditions for the conclusion of the project	1- High – The project requires high degree of complexity of infrastructure (hardware and / or software) for its execution, possesses a big number of interfaces with systems and processes already in operation and requires highly specialized personnel 3- Medium – Necessary infrastructure (hardware and / or software) is already in domain of the project team 5- Low – There are no complex prerequisites for the execution of the project
Alignment with the I.T directive – How the project or its final product is aligned with the strategy of the corporation and the IT area.	1- High Upgrade – The project or final product is not aligned with the current strategy of the IT area, however it is necessary to respond to the business requirements of the requesting area; (Obs.: avoided to use 'not aligned'); 3- Partial – The project attends a strategy of the IT area, but introduces new concepts or processes that responds to the needs of the business that require re-evaluation of the Action Program; 5- Totally Aligned – The project attends to a corporate strategy explicit in the A.P. or it is included in the Action Program of the IT Area

Coverage of the Solution – Coverage of the solution proposed by the project	1- Personal – The project is a requirement of an executive or manager with a specific need: 3- Departmental – The project responds to an identified need of an area or business unit: 5- Corporate – The project attends to a company's necessity with impact in various areas and / or business units.
Urgency of the Project - Need of the requesting area in relation to the project's results.	1- Low – The requesting area will benefit from the result of the project to implement improvements in their processes; 3- Medium – The requesting area needs the execution of the project on a mid-term basis to correct deviations in their processes; 5- High – The requesting area requires the project to be executed in a short term to continue its operations or correct a large deviation.

At the end, each project received a total punctuation which is the addition of its score by weighted criteria, times the weight of the criteria, divided by the total of the sum of the weights of each criterion. Below, is an example showing the evaluation of projects from number 1 to 7.

Criteria	Infrastructure	Human Resources	Complexity of the Solution	Alignment with the IT directive	Coverage of the Solution	Quality of the Project	
Weights	3	3	3	5	3	5	Total
PROJ. 01	1	3	5	3	3	1	2.545
PROJ. 02	5	5	5	3	3	3	3.818
PROJ. 03	3	3	1	3	3	1	2.273
PROJ. 04	1	3	1	3	5	3	1.909
PROJ. 05	3	3	5	5	3	3	4.000
PROJ. 06	5	5	3	3	5	5	2.818
PROJ. 07	5	3	1	3	5	3	2.636

The scale one, three and five used by the Company is a ranking scale with all the limitations attached to this type of scale discussed in the theory review of this study.

Besides the aspect of the scale used being a ranking scale when applying it, the tendency is to obtain results that group projects, instead of obtaining a discriminatory analysis of them. Based on the data of the projects and its current scores, we proved that this grouping occurs, making more difficult the discrimination of each project, according to the illustration below:
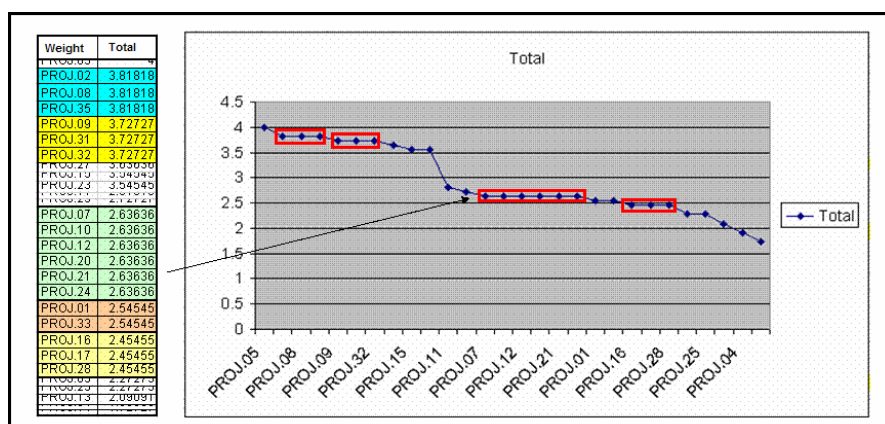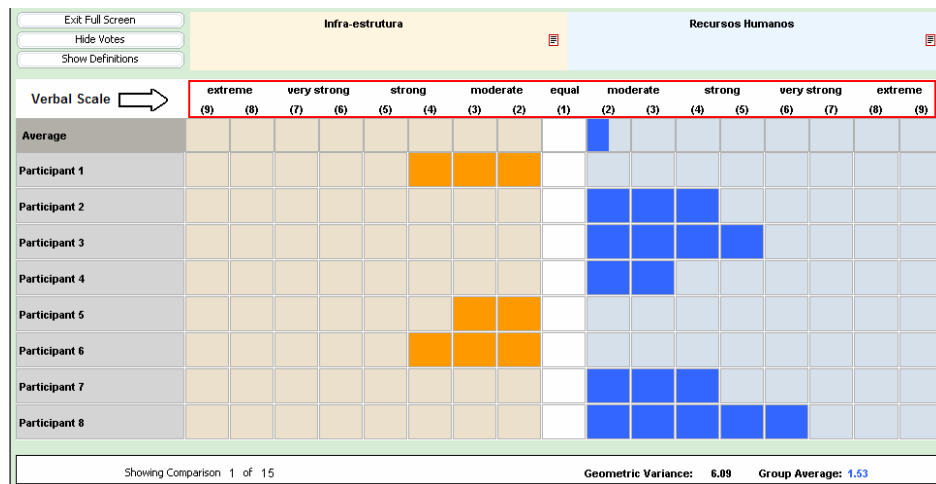

It can be observed by the graphic that using this methodology, several projects match their punctuation. This fact represents a limitation of the method because it does not allow discrimination between them; therefore, it limits the power of prioritization. An important aspect to be highlighted is that a scale 1, 3, and 5 limits and difficults the possibility of punctuation of the project evaluator.

To by-pass the calculation issue by the weighted average, an AHP structured approach was used in order to look for a process that was able to discriminate projects more accurately, allowing a better evaluation of the choices made and a transparency in the auditing process, as well. The

operable condition of the AHP methodology was done with the use of the Decision Lens software (www.decisionlens.com).

The first important aspect in the use of the AHP methodology was the re-evaluation, along with the ITD, of the relative weights of the adopted criteria, once giving only weights 1, 3, and 5 for the criteria limits the vision of relativity of such criteria weights. Due to this, it is easy to fall into the trap of giving a higher weight to the information readily available. In other words, weights may be given according to scenarios momentarily experienced. For example, if there is a significant list of projects in b*acklog,* there will be a higher tendency to give a weight 5 to the Quality of the Project criterion.

The AHP methodology made the decision makers compare the entire criteria among them, therefore creating a punctuation matrix based in the verbal scale. For example, when doing the comparison between Infrastructure and Human Resources in the Figure below, it is observed that initially there is no consensus of relative importance for these two criterions.

	Infra-estrutura								Recursos Humanos							
Verbal Scale	extreme (9)	(8)	very strong (7)	(6)	strong (5)	(4)	moderate (3)	(2)	equal (1)	moderate (2)	(3)	strong (4)	(5)	very strong (6)	(7)	extreme (8) (9)
Average										■						
Participant 1							■ ■ ■									
Participant 2										■ ■ ■						
Participant 3										■ ■	■	■				
Participant 4										■ ■						
Participant 5							■ ■									
Participant 6						■	■ ■									
Participant 7										■ ■ ■						
Participant 8										■ ■	■	■	■			

Showing Comparison 1 of 15 — Geometric Variance: 6.09 — Group Average: 1.53

While conducting the meeting with the decision makers indicated by the ITD, we asked participants 1, 5, and 6 to justify their votes, as well as the intensity given to them. This made knowledge and vision to flow among them, allowing the equalization of understanding and priorities of the criteria in which the projects should be aligned.

The alignment phase of the criteria weights is critical because knowledge and perceptions are shared, and they allow the transparency of the process. The AHP methodology also permits the calculation of the rate of inconsistency of the weights given to the criterion. In other words, if criterion A is considered twice more important than criterion B, and criterion B is twice more important than criterion C, then criterion A must be 4 times more important than criterion C. If this does not occur, it means that there was an inconsistency in the evaluation done by the decision makers. It is usual to accept an inconsistency no greater than 10%.

In practice, inconsistency serves as a signal for the level of understanding and alignment for the decision makers. If the final result of the relative weight of the criteria represents the vision of the decision makers and the inconsistency exceeds a little over 10%, then the result is considered accepted because the objective is not consistently wrong.

The result of this phase with the decision makers resulted in the weights shown in the figure below with a rate of inconsistency of 7.8%, considered satisfactory.
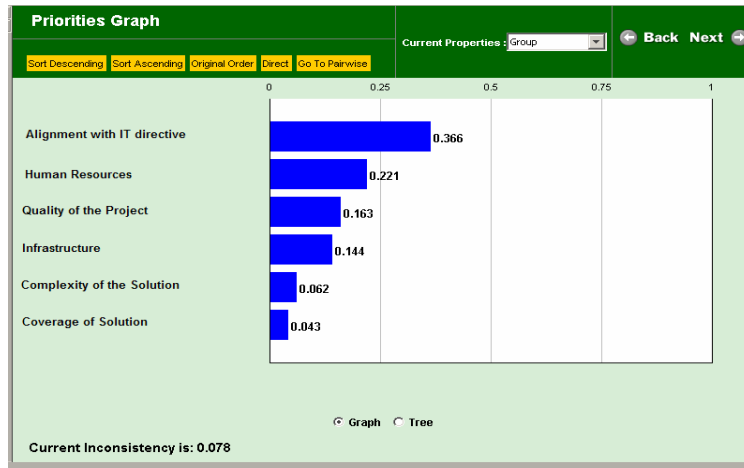
For comparison purposes, the original weights were normalized and they are shown in the Table below.

Criteria	Infrastructure	Human Resources	Complexity of the Solution	Alignment with the IT directive	Coverage of the Solution	Urgency of the Project
Weights	**3**	**3**	**3**	**5**	**3**	**5**
Normaliz.	0.1364	0.1364	0.1364	0.2273	0.1364	0.2273

We can observe that in the pairwise comparison, the decision makers discussed and represented the relative weights of the criteria in a better way. In the paired comparison the Human Resources criterion was characterized as an important factor for the execution of the projects, having its weight considerably elevated.

In the Decision Lens it is recommended to define a rating scale for each criterion. In this way, an intensity scale was created in order to evaluate how much each project impacts in each criterion. Here, the scale 1, 3, 5 could be used as previously, however, we choose to create rating scales that contained a zero, meaning that it is possible to specify that there are projects with no impact in a criterion. If we preserved the scale starting at 1, we would not get the information about how many projects do not attend a specific criterion, which is an important information for Project Portfolio Management.

In the Table below it is shown as an example a comparison between the evaluation scale 1-3-5 and the rating scale for the Infrastructure criterion.

| Criteria for prioritization of IT projects	Evaluation Scale	Rating Scale
Infrastructure – Level needs for technological infrastructure	1 – Technological infrastructure must be developed and implemented in order to execute the project. 3 – Infrastructure requires up-grade to attend the needs of the project 5- The necessary infrastructure already exists and does not require alterations	Available – The necessary infrastructure already exists and does not require alterations Small Upgrade – Infrastructure requires a small upgrade to respon to the needs of the project Large Upgrade – Infrastructure must suffer a large upgrade to respond to the needs of the project New – Technological infrastructure must be developed and implemented in order to execute the project.

Observe that when defining a rating scale it is important to apply such scale with the regular and most comfortable terminology for the decision makers. Notice that several scoring may exist. In this case 4 intensities were chosen: Available, Small Upgrade, Large Upgrade and New.

The value of each intensity can be defined by comparing them in a pairwise basis. This means that it is questioned how much an available infrastructure is more important than one that needs a small upgrade, and so on, until comparing all the intensities among them. Another way also accepted but not too convenient is to adopt a linear scale that for 4 intensities could be zero; 0,33; 0,66; 1,0. The implementation in the Decision Lens is presented below:
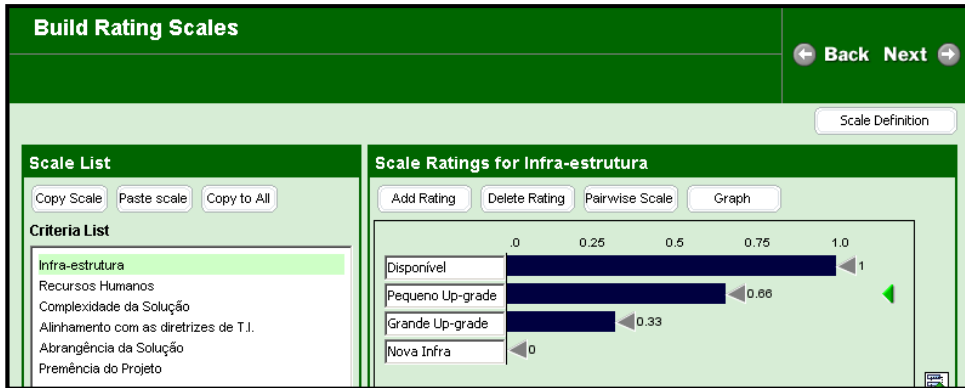
In these conditions, being the Infrastructure a criterion with weight of 14,4% in relation to other criterion, a project that needs a Small Up-grade of 0.66, and multiplied by 14.4%, will give as a result for the evaluated project a total of 9,504% (result of 14,4%* 0,66).

The following figure shows the final result of prioritization, as well as the intensity in which the factors used in the selection of projects are impacted.
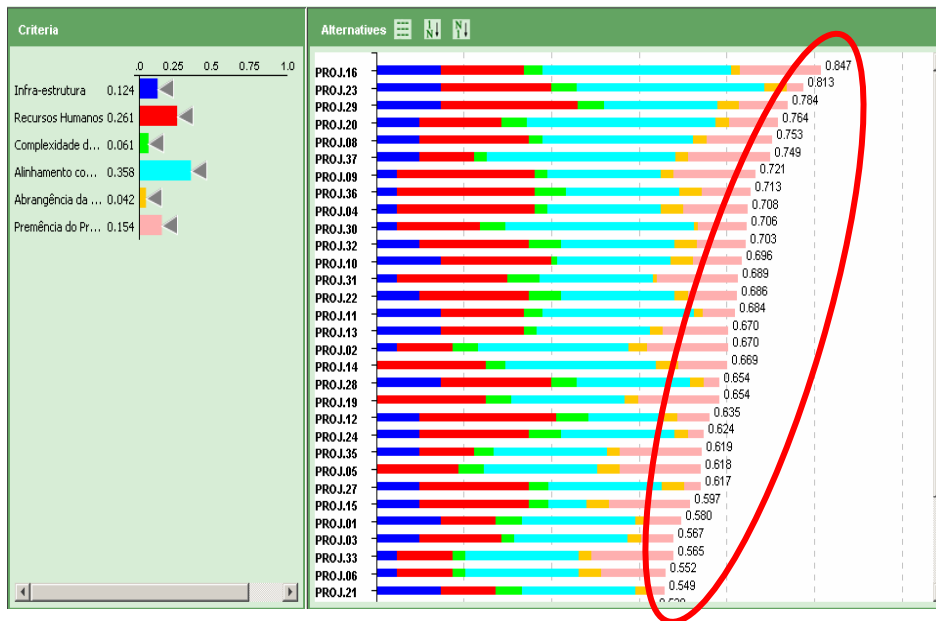
When composing the results of the evaluations of all projects, it was possible to observe a greater discrimination of each project, as well as the possibility of a first global analysis of the *Portfolio* and its contribution to each criterion; therefore, allowing greater transparency in the selection process.

CONCLUSION

A comparison between two methods for project prioritization was done, being that the first one was already implemented in the company studied and it was based in a simple weighted process. The second one tested by the authors was the AHP method.

The allocation done by the simple weighted method in the case studied was re-done by using the AHP. The results achieved by the two processes were compared and the decision makers analyzed

the projects that had great variation in the ranking of the two processes. They were able to identify the factors that generated such differences throughout the procedure of sensibility analysis, allowing them according to their words to learn about their preferences and priorities. They also proved that a simple weighting for ranking was inefficient to explore all the complexity of the factors that they were considering.

The pairwise comparison process of the criterion allowed interaction and discussion to the group in regards to the importance of the criteria for each one of them. It was also possible to detail their preferences and explain the reason of such choices. The depth of the discussions was considered uncommon in the company because it allowed a large and detailed dialog throughout reasoning and discussions that created a greater level of agreement and a lower rate of inconsistency.

According to the decision makers who participated on the research, the results achieved by the AHP method allowed greater understanding of the projects selection process, allowing them to make their choices with more confidence and consciousness about the importance of the criteria that took them to such decisions.

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