AN APPLICABILITY IN VERBAL DECISION ANALYSIS FOR SELECTING APPROACHES FROM FRAMEWORK SCRUM

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ABSTRACT

Decision-making is a human behavior aiming at the selection of an alternative from a groups of real alternatives. Considering that agile methodologies, in focus Framework SCRUM, are always more popular in Development Software Companies, and noticing that the mentioned companies cannot always apply every characteristics of the framework, this paper presents an hybrid application of methodologies from Verbal Decision Analysis (VDA) framework to select some of the SCRUM approaches to be applied in the company, considering the elicitation of preferences of a decision maker. The paper consists on an application of a questionnaire in a group of experienced ScrumMasters, aiming to characterize the alternatives. The hybrid application consists in the division of SCRUM approaches in groups applying the methodology ORCLASS, using the developed tool, and then generate a rank of preferences by applying ZAPROS-LM.

KEYWORDS. Verbal Decision Analysis, ORCLASS, ZAPROS-LM, Framework Scrum

ADM - Multicriteria Decision Support

RESUMO

A tomada de decisão é um comportamento humano com objetivo de selecionar uma alternativa dentre um grupo de alternativas reais. Considerando que as metodologias ágies, em foco o Framework SCRUM, estão se tornando cada vez mais comuns em empresas de desenvolvimento de Software, e observando que estas empresas podem não ser capazes de aplicar cada característica deste framework, este artigo apresenta uma aplicação hibrida de metodologias do framework de Análise Verbal de Decisão (VDA) para selecionar algumas abordagens do SCRUM a serem aplicadas em empresas, considerando a elicitação de preferencias de um decisor. O artigo consiste na aplicação de um questionário com um grupo de experientes ScrumMasters, afim de caracterizar as alternativas. A aplicação hibrida consiste na divisão de abordagens do SCRUM em grupos aplicando a metodologia ORCLASS, através da ferramenta desenvolvida, e então gerar um rank de preferencias aplicando ZAPROS-LM.

PALAVARAS CHAVE. Análise Verbal de Decisão, ORCLASS, ZAPROS-LM, Framework Scrum

ADM - Multicriteria Decision Support

1. Introduction

Decision making is a special activity of human behavior aimed at the conclusion of an objective. It consists in a result of a process of choice from an identified problem or from an opportunity of creation, optimization or improve in an environment. The conclusion of a decision making process is the selection of an alternative from a group of alternatives that can be applied to solve the problem.

Many decisions involve several factors that can be measured or not and influence in the decision. It means that the decision is taken according to the decision maker preferences. There are tools available to support the decision making process [17]. According to [15], Decision Support Systems are efficient if they assist users in their decision-making in a timely manner.

The use of agile methodologies for managing projects became more popular between Development Software Enterprises, aiming to create high quality products in less time and spending less documentation. The paper selects a specific agile methodology for studying: framework SCRUM. This framework is applicable for managing the development of software's, group the monitoring, provide feedback to the team and correction of impediments. SCRUM is composed by steps and practices to apply.

The problem is that, usually, the organizations are not capable of implementing every SCRUM's characteristic. Hence, which would be the best practices of it to be implemented by the organization? First, experienced ScrumMasters were interviewed through a questionnaire. Thus, it was possible to characterize the SCRUM practices, according to the experience of 6 professionals [14].

The SCRUM practices can be described qualitatively, based on a set of multiple criteria. Therefore, the paper is involved in an area called Multicriteria, which is an approach to support the process of decision making [6]. The characteristics were evaluated qualitatively, applying verbal decision analysis. The methods [6] ORCLASS and ZAPROS-LM, which belong to the Verbal Decision Analysis (VDA) framework, were used [4] for solving problems that has qualitative nature and difficult to be formalized, called unstructured [19].

The first mentioned method has the objective to classify alternatives in different groups. The division into groups will be responsible to identify which SCRUM practices should be considered by the organization to implement part of this project management framework.

The second mentioned method has the objective to rank a group of alternatives from the best to the inferior one. The ranking will be valuable to organizations to choose as many SCRUM practices as its necessity, being certain of a list of preferences.

2. Framework SCRUM

Considered recent, the *agile* term for software development emerged in 2001, as a response for the traditional models of software development. The bigger concept for agile is *Agile Manifest* [3], which defines some important characterizations:

We are uncovering better ways of developing software by doing it and helping others do it. Through this work we have come to value:

- Individuals and interactions over processes and tools
- Working software over comprehensive documentation
- Customer collaboration over contract negotiation
- Responding to change over following a plan

That is, while there is value in the items on the right, we value the items on the left more. Framework SCRUM is an agile method different from the others for focusing on project management, not development. It was developed by Ken Schwaber and Jeff Sutherland to help organizations to carry complex projects [5].

3. Interview

Aiming to collect information and opinion with a high number of ScrumMasters, a questionnaire was developed and applied with 6 experienced professionals with the framework SCRUM. As the first part of the questionnaire, we qualified the professionals. There were

selected the answers of ScrumMasters which has similar experiences in projects. The answers considered for the research were the ones which the professional has the following characteristics:

- Leading SCRUM projects until 3 years of experience;
- Leading until 6 projects applying SCRUM;
- Has ever led team with no experience and moderate experience with the framework SCRUM;

The questionnaire aims to characterize the alternatives, which are a list practices of the framework SCRUM. All the interviewed analyzed the SCRUM practices according to a group of criteria and criteria values.

In the end of each response, it was possible to create a table expressing the interviewee's choices as opinion about the relation between the SCRUM practice and the criteria values.The answers obtained with the questionnaires were analyzed and created a new table with the summary of responses. For each SCRUM practice, the final table was composed by the answer with major quantity of interviewee's choices.

4. Verbal Decision Analysis

Decision making is a special kind of human activity aimed at the conclusion of an objective for people and for organizations. In the human world, emotions and reason become hard to separate. In personal decisions or when the consequences reach them, the emotions often influences the decision making process [1].

According to [16] in the majority of multi-criteria problems, exists a set of alternatives, which can be evaluated against the same set of characteristics (called criteria or attributes). These multi-criteria (or multi-attribute) descriptions of alternatives will be used to define the necessary solution.

The Verbal Decision Analysis (VDA) framework is structured on the assurance that most decision making problems can be qualitatively described. The Verbal Decision Analysis supports the decision making process by the verbal representation of problems [7],[8],[10],[11],[12],[13],[20],[21],[2],[24].

According to [6], the methods of verbal decision analysis methodologies are: ZAPROS-III, ZAPROS-LM, PACOM and ORCLASS. The first three have the goal to establish a ranking of the alternatives from some order of preference. The last is the only methodology for classification from the VDA framework. There are more DSS available, which does not belong to the same group of Verbal Decision Analysis framework defined by LARICHEV and MOSHKOVICH [6] (ZAPROS-III, ZAPROS-LM, PACOM, ORCLASS), which are: SAC, DIFCLASS and CYCLE for classification, and PARK for ranking [22].

Figure 1 introduces an easy visualization of Verbal Decision Analysis methodologies from the framework according to their objectives.

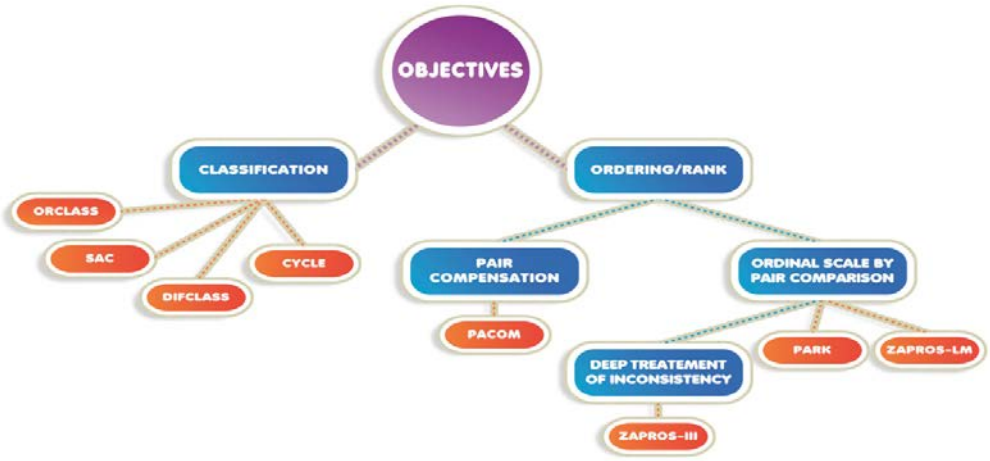

Fig 1 - Methodologies from VDA framework visualization.

5. Methodology ORCLASS – Overview and Structure

The ORCLASS methodology (Ordinal Classification) [6], [17] differs from the other verbal decision analysis methods (ZAPROS, PACOM) because it does not consist of ordering alternatives in rank, but aims at classifying the multi-criteria alternatives of a given set: the decision maker only needs these alternatives to be categorized into a small number of decision classes or groups; generally two groups [1].

The method ORCLASS allows to elicit information in traditional form for human being: through verbal description of decision groups and criteria scales, about the verbal representation of problems. One of the main advantages of the method is: dialog easily with the decision maker using verbal criteria values.

According to [17], Figure 2 presents the structure to apply the VDA method ORCLASS. In accordance with the scheme described in Figure 2, the application of the method can be divided in three stages: Problem Formulation, Structuring of the Classification Rule and Analysis of the Information Obtained.

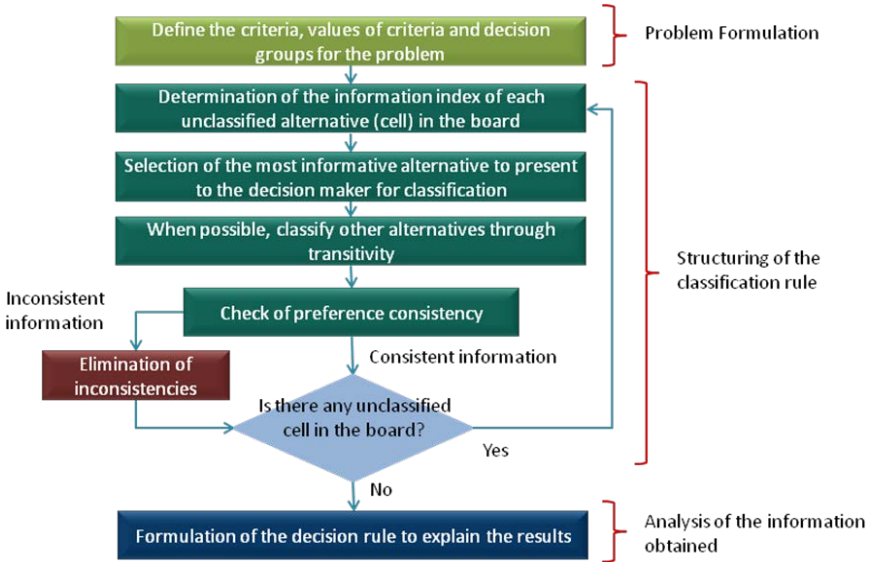

Fig 2 - Procedure to apply the ORCLASS method

5.1 Explaining the application

Initially, an ORCLASS matrix may be created with the main decision rules.

The standard decision rule for any application of the method follows:

- An alternative composed by the best characteristics ([A1,B1,C1]), will always belong to Class I.
- An alternative composed by the worst characteristics ([A3,B3,C3]), will always belong to Class II.

As defined in [16], if it is presented for the decision maker to judge the possible alternative composed by the criterion values [A1,B1,C3], for example, in this case, if the decision maker chooses the alternative for the first group, then the better alternative [A1, B1, C2] certainly belongs to the first group, since the second one is naturally more preferable than the previous. This response results in filling two cells from the board.

However, if the decision maker judges that the alternative from the example [A1,B1,C3] must be chosen for the second group, then the worst alternatives also do. It means that the alternatives [A1,B2,C3], [A1,B3,C3], [A2,B1,C3], [A2,B2,C3], [A2,B3,C3], [A3,B1,C3], [A3,B2,C3] will belong to the second decision group, since they are naturally less preferable than the previous. This response results in filling eight cells from the board.

Below is shown the classification board to illustrate and better visualize how many cells can be filled according to the decision maker elicitation of preferences.

Table 1. Classification boards composed by the quantities of generated information.

C1

	B1	B2	B3
A1	I	1+17	2+8
A2	1+17	3+11	5+5
A3	2+8	5+5	8+2

C2

	B1	B2	B3
A1	1+17	3+11	5+5
A2	3+11	7+7	11+3
A3	5+5	11+3	17+1

C3

	B1	B2	B3
A1	2+8	5+5	8+2
A2	5+5	11+3	17+1
A3	8+2	17+1	II

This particularity of the methodology ORCLASS is called Property Transitivity which has the objective to generate information avoiding to question the decision maker unnecessarily.

In conclusion, the most informative alternative is the cell [A2,B2,C2] [6] (which enables seven new classifications for either answer), which is the best option to be presented to the decision maker for classification.

6. Application of Method ORCLASS

6.1 Tool ORCLASSWEB

In order to facilitate the decision making process using ORCLASS and perform it consistently, observing its rules and aiming at making it accessible, it is presented a tool developed in platform Java Web for applying the methodology. The tool was made in a web environment in Platform Java 1.6, using JSF 2 and runs in server Tomcat 6.

ORCLASSWEB tool was proposed to automate the comparison process of alternatives and to provide the decision maker a concrete result for the problem, according to ORCLASS definition. ORCLASSWEB was developed divided in four stages:

1. Criteria and criteria values Definition
2. Alternatives Definition
3. Preferences Elicitation process
4. Result Obtained

Normally, the manual application of the system ORCLASS is made with the maximum of three criteria and three criteria values for each one, because the complexity of the application increases immensely.

The main advantage of ORCLASSWEB is that the complexity of the application is processed by the tool, which means that the user can apply ORCLASS for any quantity of criteria and criteria values.

ORCLASSWEB was developed adapting the rules to identify the most informative cell, after applying the rules defined by [6]:

- After the identification of the most informative index according to the rules, the tool verifies between all the others alternatives which present a larger number, for both indexes.

In conclusion, the adaptation was necessary to increase the method's comparison capacity, without giving away the adherence to the system ORCLASS. The interfaces stated for the tool and its features are presented in the following subsections, describing each stage of ORCLASS application, which the methodology application is described.

For desirable research, the tool can be reached at: http://runplanner.com.br/OrclassWeb/

6.2 Criteria definition

As the first step to apply ORCLASS, there were defined the criteria, which the alternatives are going to be evaluated against. For each criterion, there is a scale of values associated [8][9][18].

Below is presented the list of criteria and criteria values, which will be base to apply the methodology. The criteria values are described from the naturally most preferable to the less preferable one.

- **Criterion A:** Difficult degree for implementation

- **A1**. Low: Its implementation does not require experience with the framework SCRUM.
- **A2**. Medium: Its implementation requires a little experience with the framework SCRUM or can be learned on the job.
- **A3**. High: Its implementation requires experience (maturity) about framework SCRUM.

- **Criterion B:** Time consumption
  - **B1.** Gain: The consumption of time in the project for executing the activity is less than the process defined.
  - **B2.** Not changed: There is no extra time in project for executing the activity than the process defined.
  - **B3.** Lose: There is extra time in project for executing the activity comparing to the process defined.
- **Criterion C:** Cost for the project
  - **C1.** Gain: The new activities are able to provide to the project an economy of cost.
  - **C2.** Not changed: The new activities do not change the cost of the project.
  - **C3.** High cost: The new activities are able to increase the project new costs.

The definition of problem alternatives was made using the application ORCLASSWEB through "Criteria Definition Interface" screen in which the user will fill criteria name and criteria values description. The tool allows the user to insert all criteria necessary.

6.3 Alternatives, Definition of Groups and Characterizing the alternatives

The alternatives for the application will be the practices of SCRUM listed in Table 2.

Table 2. Identification of Alternatives Board.

ID	Alternatives
Prac1	Sprints (or iterations) with 1 to 4 weeks
Prac2	A product backlog and a sprint backlog creation and prioritization
Prac3	Planning meeting – part 1
Prac4	Planning meeting – part 2
Prac5	Daily Meeting
Prac6	Burn down chart and visible activities board
Prac7	Sprint Review
Prac8	Sprint Retrospective
Prac9	Release Planning

A set of decision groups must be defined:

- The first group was chosen to support the practices of framework SCRUM which will be selected after the application of ORCLASS, to be utilized by the organizations;
- The second group will support the set of practices that should not be utilized by the organization which desire to implement part of SCRUM.

Analyzing each questionnaire, a final board was created with the summary of the answers. Table 3 presents the sum of the interview's answers and finally the characterization of each alternative according to each criterion values, described as Final Vector.

Table 3. Characterization of Alternatives.

Criteria/ Alternatives	Difficult degree for implementation			Time consumption			Cost for the project			Final Vector
	A1	A2	A3	B1	B2	B3	C1	C2	C3	
Prac1	1	**5**	0	**5**	1	0	**4**	2	0	A2B1C1
Prac2	2	1	**3**	**3**	1	2	1	2	**3**	A3B1C3
Prac3	**3**	1	1	1	**3**	2	1	2	**3**	A1B2C3
Prac4	2	1	**3**	2	1	**3**	1	2	**3**	A3B3C3
Prac5	**4**	2	0	**5**	1	0	**5**	1	0	A1B1C1

Prac6	1	**3**	2	1	**5**	0	0	**6**	0	A2B2C2
Prac7	2	**3**	1	0	**4**	2	0	**5**	1	A2B2C2
Prac8	**3**	2	1	**3**	1	2	2	1	**3**	A1B1C3
Prac9	1	**3**	1	1	**3**	1	1	**4**	0	A2B2C2

For each alternative, the professionals interviewed evaluated the practice and stated their opinion. The practice was characterized by the criteria value which has the simple majority of choices.

The definition of problem alternatives was made using the application ORCLASSWEB through “Alternatives Definition Interface”. The tool presents a screen in which the user will fill alternative name and its characterization in criteria values, according to the criteria defined in the previous screen. The tool allows the user to insert all alternatives necessary.

7. Computational Results of ORCLASS

The elicitation of preferences step was made using the application ORCLASSWEB through “Preferences Elicitation Interface”. The tool calculates according to the rules of ORCLASS System which would be the next question to be answered by the decision maker. The rules are described in subsection [Explaining the application].

Afterwards, all the elicitation of preferences is done, according to the decision maker choices, the final result is structured in ORCLASSWEB and the same result can be visualized in Figure 3, in the final classification board:

	B_1	B_2	B_3
A_1	I	I	I
A_2	I	I	I
A_3	II	II	II

C_1

	B_1	B_2	B_3
A_1	I	I	I
A_2	I	I	II
A_3	II	II	II

C_2

	B_1	B_2	B_3
A_1	I	II	II
A_2	II	II	II
A_3	II	II	II

C_3

Fig 3 - Final classification boards updated after the entire elicitation of preferences

In conclusion, it was possible to select the following alternatives to compose the first group: **Pract1** Sprints (or iterations) with 1 to 4 weeks, **Pract5** Daily Meeting, **Pract6** Burn down chart and visible activities board, **Pract7** Sprint Review, **Pract8** Sprint Retrospective, **Pract9** Release Planning.

Class 2 is composed by following SCRUM approaches: **Pract2** A product backlog and a sprint backlog creation and prioritization, **Pract3** Planning meeting – part 1, **Pract4** Planning meeting – part 2.

8. Methodology ZAPROS-LM: Overview and Structure

As long as the other methods that belong to the Verbal Decision Analysis framework, methodology ZAPROS-LM is also applied to solve problems described qualitatively and supports the decision making process [6],[23].

Different from the methodology ORCLASS just applied, ZAPROS-LM was created aiming to establish a rank of alternatives from an initial set. Figure 4 presents the structure to apply the VDA method ZAPROS-LM. In accordance with the scheme described, the application of the method can be divided in three stages: Problem Formulation, Pair Comparison and Creation of Final Joint Ordinal Scale.

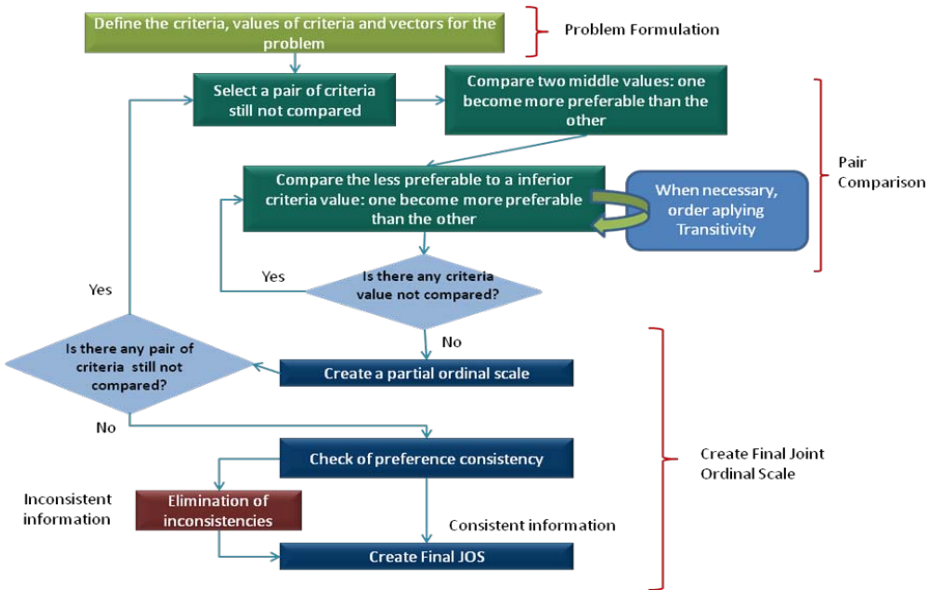

Fig 4 - Procedure to apply the ZAPROS-LM method

For applying the methodology, a pair of criteria was selected from the list to be compared. Thus, according to the decision maker's answers, the scale of criteria is created [6]. Afterwards, after answering the analogous comparison between all criteria, a final scale will be developed. To construct the joint ordinal scale, it is necessary to compare all possible pairs of values upon all criteria. Figure 5 presents a didactically explanation of the structure to select alternatives to be compared, according to ZAPROS-LM definition.

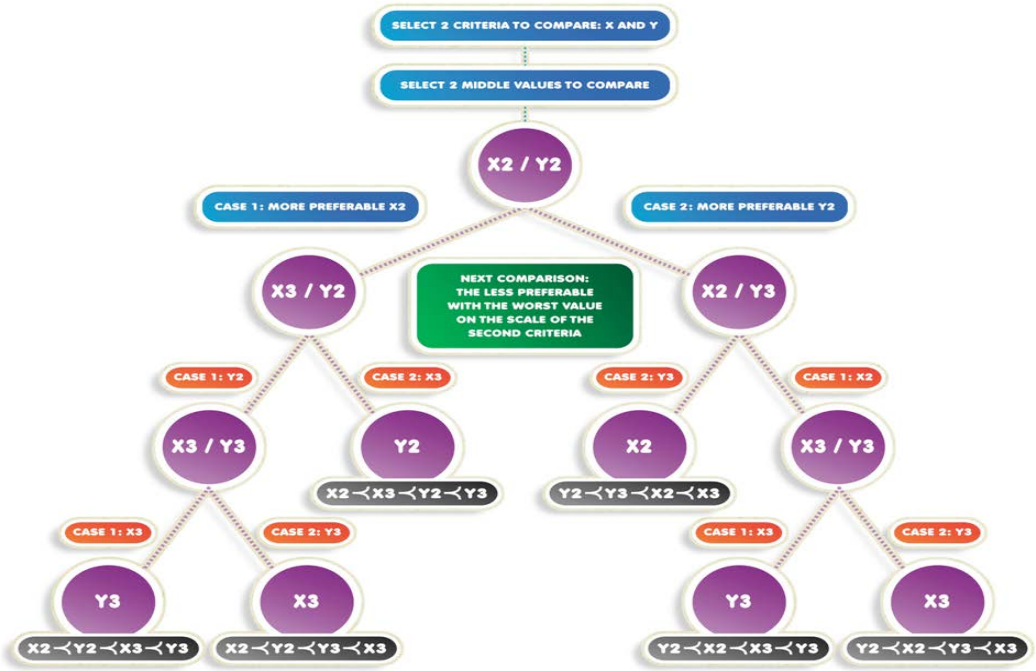

Fig 5 - Procedure to apply the ZAPROS-LM method

9. Application of ZAPROS-LM

9.1 Criteria definition and Alternatives

As the first step to apply ZAPROS-LM, the criteria and criteria values, which the alternatives are going to be evaluated against, were defined and associated. The criteria and criteria values are the same analyzed before.

The alternatives for the application will be the group of practices of SCRUM selected

after applying the methodology ORCLASS, which are described in Table 4.

The characterization of the alternatives for applying ZAPROS-LM is part of the Table 3, which characterized all the alternatives. Each alternative is defined by the sum of the interview's answers and described as Final Vector, following analysis at item 6.3 (Alternatives, Definition of Groups and Characterizing the alternatives).

Table 4 creates a vector for each alternative to be evaluated, in accordance to its characterization described above. Vector creation is the first step to apply the methodology.

Table 4. Characterization of Alternatives.

Criteria / Alternatives	Difficult degree for implementation	Time consumption	Cost for the project	Vector
Prac1	A2	B1	C1	(2, 1, 1)
Prac5	A1	B1	C1	(1, 1, 1)
Prac6	A2	B2	C2	(2, 2, 2)
Prac7	A2	B2	C2	(2, 2, 2)
Prac8	A1	B1	C3	(1, 1, 3)
Prac9	A2	B2	C2	(2, 2, 2)

9.2 Computational Results of ZAPROS-LM

The comparison is made for hypothetical alternatives, next to the best possible alternative (A1B1C1). The vector composed by the hypothetical alternatives is:

V = (211, 311, 121, 131, 112, 113)

For the first comparison, the criteria A and B were chosen. Then, the pair of criteria A and C was compared and after, the pair B and C was chosen. The ordering for the comparison followed the formulated rule described in section 8.1.

Ongoing the comparisons, a matrix could be filled with the decision maker responses. The matrix must be filled with the following values (Table 8):

- 0 : the elements were not compared;
- 1 : element in the row is MORE preferable than element in the column;
- 2 : element in the row is EQUALLY preferable than element in the column;
- 3 : element in the row is LESS preferable than element in the column;

Table 5. Matrix of comparison.

		A2	A3	B2	B3	C2	C3
		211	311	121	131	112	113
A2	211	2	1	1	1	1	1
A3	311		2	2	1	2	1
B2	121			2	1	2	1
B3	131				2	2	2
C2	112					2	1
C3	113						2

After all paired comparison, according to the matrix of responses, below is described the summary of partial scale of preferences for all the comparison:

A x B: A2 $\prec$ B2 $\prec$ A3 $\prec$ B3

A x C: A2 $\prec$ C2 $\prec$ A3 $\prec$ C3

B x C: C2 $\prec$ B2 $\prec$ C3 $\prec$ B3

Concluded the comparisons and created the partial rank of preferences, the next step for the application is the definition of a joint ordinal scale. Follows the generated joint ordinal scale:

A1B1C1 $\prec$ A2 $\prec$ C2 $\prec$ B2 $\prec$ A3 $\prec$ C3 $\prec$ B3

The joint ordinal scale is composed by all of hypothetical alternatives. For all the vectors of hypothetical alternatives, one rank value is assigned. Using this ranked scale, Table 10 assigns a relation between values from the scale and a rank of preference.

Table 6. Relation between Vectors and a Rank value.

Vector	Rank value
111	1
211	2
112	3
121	4
311	5
113	6
131	7

Each real alternative is composed by the vectors of hypothetical alternatives, example:

- SCRUM practice (real alternative) Prac1, which vector is 211 is composed by:
  - the hypothetical alternative 211 for criterion A;
  - the hypothetical alternative 111 for criterion B;
  - the hypothetical alternative 111 for criterion C;

Analogous, Table 11 shows the real alternatives and its respective rank values, followed by the rank value of real alternatives (from the lower value to the bigger one). The table presents an ordination of the final rank of real alternatives.

Table 7. Rank values for the real alternatives.

Alternative Prac1				
Vector	211	111	111	Final rank
Rank value	2	1	1	112
Alternative Prac5				
Vector	111	111	111	Final rank
Rank value	1	1	1	111
Alternative Prac6				
Vector	211	121	112	Final rank
Rank value	2	4	3	234
Alternative Prac7				
Vector	211	121	112	Final rank
Rank value	2	4	3	234
Alternative Prac8				
Vector	111	111	113	Final rank
Rank value	1	1	6	116
Alternative Prac9				
Vector	211	121	112	Final rank
Rank value	2	4	3	234

The next step for applying the methodology is a pair comparison between the rank values of real alternatives. A new rank needs to be created from the minor final rank to the major one. A Final Scale of Preferences can be done.

As result, the final scale of preferences with the real alternatives is:

Prac5 $\prec$ **Prac1** $\prec$ **Prac8** $\prec$ **Prac6 and Prac7 and Prac9**

10. Conclusions and Future Works

The framework SCRUM is an agile model for managing the development software process which is continuously discussed lately. It is composed by practices that can be described qualitatively, based on a set of multiple criteria. Therefore, the paper is involved in an area called Multicriteria, which is an approach to support the process for decision making [6]. The characteristics were evaluated qualitatively, applying verbal decision analysis.

This paper presents SCRUM practices for deciding, verbally, which should be implanted in a Software Development Company that cannot implement all the characteristics, according to Verbal Decision Analysis.

First of all, it was made an interview with experienced ScrumMasters, professionals

that lead teams and projects applying framework SCRUM. The results from the interview and its questionnaires were to characterize the alternatives (approaches from SCRUM) in accordance to a group of criteria.

The methods ORCLASS and ZAPROS-LM were applied as a hybrid application aiming to divide SCRUM approaches into different groups and rank the existent alternatives in the first group. A Final Rank of Preferences is generated in the end of the application to exhibit the preferable alternatives according to decision maker's elicitation of preferences

The paper contribution is to prove that verbal decision analysis methodologies can be applied in real problems of elicitation of preferences and decision making, helping Software Development Companies that desire to apply SCRUM practices and needs to identify which are the most preferable practices to be applied.

As future works, more research can be studying another SCRUM practices to increase the alternatives, or considering another criteria to evaluate the alternatives, or applying another hybrid methodologies for solving the problem [1].

More research will be done when the use of selected practices applied before the methodology in a real software development organization, to study the results of the SCRUM practices for projects. We are intended to apply Verbal Decision Analysis to capture more results of preferences with different criteria and compare both results. There is also a high intention to compare SCRUM practices and practices of defined process as CMMI, to identify which are the most preferable one to apply in determined projects.

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