PROYEVA: System to Evaluate the Projects Quality in Contests

System for the Technical Evaluation of Product Quality and Projects Participating in Invention Contests and Innovation Through the use of an External Metric and Quality in-use Plan

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Abstract: **PROYEVA is a system based upon international standards and Mexican models that allows for a comparative analysis of different projects and products involved in innovation, invention and creativity contests-based on the following characteristics: quality in-use, functionality and usability through an external metrics and quality in-use metrics plan in a visual environment. PROJEVA software is a practical application of the PROYEVA model. It allows a general quality evaluation of projects and products in technical competitions. It provides support for judges and facilitates a more objective and impartial evaluation. It also provides guidance on the ranking evaluation procedures and documentation. PROJEVA is directed to organizations, companies and end-users who need to easily select products or projects, with the highest quality among the contesters to be pronounced as winners.**

Keywords: contests; creativity; invention; innovation; system.

I. INTRODUCTION

Currently, it is not easy for an evaluator to render a judgment on projects which are outside the evaluator's field of expertise. In many cases, he or she has to make hasty decisions and determine the quality in-use of a project based on subjective criteria, which does not allow for objective evaluation of the different aspects comprised.

There are several standard models that provide guidance for organizations in the measurement of the characteristics which give them access to a high quality level in their products and projects. In theory and in practice, it is necessary to adjust the models to obtain a qualimetric model with the aim of evaluating and measuring the quality characteristics. Often, these models are used for different purposes, such as buying, renting, using and adapting projects and products.

A project can be defined in terms of its distinctive characteristics: it is a temporary endeavor undertaken to create a unique product or service, developed at all levels of the organization, and can involve one person or thousands. They may involve just a single unit of an organization or the combined efforts of several. Projects are often critical components of the business strategy of the organization that has developed them; their durations are finite. Projects are not successive efforts; they involve doing something that has not been done before. Therefore, they are unique.

Because the product of each project is unique, the characteristics that distinguish the product or service should be developed progressively, which means "step-by-step procedures," "continued progress by increments" while elaborated means "worked with attention to detail – "fully developed" [1].

In these cases, a comparative analysis of various products and projects helps one decide which to select as the best as far as its quality in-use.

As such, a methodology and quality in-use technical evaluation method for participating projects in creativity, invention and innovation contests through the implementation of Quality Metrics Models, external as well as quality in-use, and the use of supplementary software in support of the judges is proposed so said judges are able to issue a more accurate decision.

Thus, the PROYEVA model is introduced, based on international standards IEEE610 [2], IEEE1061 [3], ISO 9000-3 [4], ISO / IEC 9126 [5], ISO / IEC 14598 [6], ISO 9001 [7], Project SQUARE (ISO 25000) [8], SUMI [9] as well as in other Mexican models (MECHDAV [11-14], [16-18], MECRAD [19]).

The paper is distributed in the following way: Section II includes a short background; Section III explains in a general way the characteristics of the contests where the proposed system have been used; Section IV details the system's methodology; Section V describes through figures the operation of the system; Section VI explains the final evaluation report, and finally Section VII includes the results, conclusions and future works.

II. BACKGROUND

The first project competitions have been geared mostly toward ``Experiments and Devices" projects organized year after year, for several decades by various academic bodies. These play a positive role by encouraging the contestants to demonstrate their ability and creative genius by submitting projects on the design of experiments, display or educational devices. In addition to inducing participants to research and learn, the presentation of projects helps in reaching practical objectives. It could be said that they are relevant to today's society which needs to motivate and stimulate the creative potential and capacity of professionals and students at all levels [10].

This type of event, on the other hand, also serves as a starting point to familiarize, the public, with the knowledge

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of what science generates, and is therefore an element in making this an integral part of popular culture.

To compete, the contestant must first make and take into account a systematic study on the feasibility of a particular project, and should take into consideration some of the following useful aspects.

Due to the importance of having high-level professionals, teachers, developers and individuals capable of providing technical scientific benefit to society, events to motivate their creativity are organized.

III. CONTESTS

Anyone who has an innovative idea to be made into a development project may participate. The idea should preferably be supported or based on technology and may be the result of the ingenuity of a person or group. There must be a Technical Committee, which reserves the right to evaluate and support the ideas presented and must not accept ideas that are not aligned with the specific objectives and spirit of the initiative of the contest in question. There are no restrictions on the participation of a group or one of the members nor the number of ideas presented, i.e. there may be several innovative ideas for a group or by some members of the group.

A. Current National Prototype Competitions

The technological, scientific and technical prototype exposition has been booming since the nineties. Creativity competitions are very important both for the institutions that choose an award, as major companies and entrepreneurs are looking for new ideas and services that provide added value to their production management.

B. State of the art

We conducted a thorough investigation on the possibility of the existence of systems (software) for the evaluation of projects in terms of quality concerns, focusing on this important issue in quality competition contests such as creativity, innovation and invention, or when assessing a technological, scientific, social, cultural, environmental project to be approved by and for society.

The investigation found that there is an issue about the contests, but the postulates are loosely based for example, there are degrees specializing in the field of project quality assessment, for determining the magnitude of the results of the evaluations, which are a fundamental element of cost-benefit analysis and cost-effective, widely used in project evaluation [10].

There were no courses that prepare and certify judges to evaluate projects involved in creative competitions to channel the above benefits and better prepare people as project quality evaluators.

Currently there is some software dedicated to the evaluation of projects. Among them are: evalAS [18] (Software for Investment Project Production Evaluation). The purpose of this software is to determine, in the best of cases, financial feasibility. It can also be used to determine profitability of industrial production projects, agriculture and forestry. In Intecplan [17], which only evaluates investment projects, both references have a totally different approach to evaluating projects in order to obtain a score to determine the best of its kind in creativity contests. The only previous software tool found, are the papers known as "Software for assessing quality in-use project with a plan for external quality metrics [15], which showed an initiation protocol of this investigation."

Vargas-Pérez et al. [20] describes an intermediate step in the project, and refers to the completion of the first stage of the project.

IV. METHODOLOGY

In order to evaluate projects - products participating in creativity, innovation and invention contests, the application of a metric plan within the framework of a methodology and a technical evaluation model of the quality of software products for visual environments, MECHDAV is required, which is derived from this proposal to evaluate products and projects participating in the contests mentioned in software in a visual environment.

The metrics program is reflected in a new model, with its methodology and evaluation software, PROYEVA Model Methodology and Quality Technical Assessment Project participant's creativity contests, which will guide the evaluation results obtained on quality in-use of a project, and propose actions to improve the process. In addition, it will control the process established for ensuring the quality of the evaluation of these projects to support the judges in the competitions for creativity, innovation and invention.

A. Metric Oriented to Quality Products Projects

It is important that product measurement (products) be done easily and economically, and that the measurement result is interpreted in the same way. The way in which quality characteristics have been defined does not permit them to be measured directly, so it is necessary to establish metrics that correlate these features in a product (project). Each internal and external quantifiable attribute interacts with its environment and is correlated with a feature that can be established as a metric. The basis on which the metrics are selected depends on the product, project priorities and needs of the evaluator.

A set of product metrics that can be applied to the quantitative assessment of the quality of projects is examined. In all the cases, the metrics represent indirect measures, and never really measure quality, but a manifestation of it. The complicating factor is the exact relationship between the variable measured and the quality of the product, which can be measured based on the classification of quality in use metrics. Quality in-use is the user's view of the quality of a system (project or product) and is measured in terms of the result of using it, instead of the properties of the product itself.

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It is the combined effect of the characteristics of product quality as perceived by the user.

B. Requirements analysis

According to data collected by the potential users of products, different people involved, both as judges and competitors in creativity contests, have provided some of the requirements which when tested, refined and synthesized, provide components and parameters of the system to be implemented.

C. Evaluation Process Applied

To assess the quality of a product, the results of the evaluation of the different features need to be summarized. The evaluator must prepare a procedure for this which separates criteria for different quality characteristics, each of which may be in terms of individual sub-characteristics, or a combination of both. The procedure includes other aspects such as the specification's evaluation. In this part the scope of measurement is established, that is, the characteristics and sub-features set forth in the proposed quality model, which determine the starting point for the selection of attributes and metrics for evaluation.

Evaluation Metrics are grouped according to the corresponding sub-characteristics and attributes, and will serve to carry out the assessment.

Types of measurement are used to compare the quality in-use of the various products, and/or projects to be evaluated. They are represented by discrete evaluation variables of two types: binary discrete elemental evaluation variables and multilevel discrete evaluation variables. The numerical ranking scale for each of the metrics is presented in TablLe 1 [11-16], [20-26].

TABLE I. METRIC LEVELS RANGES

Value	% Compliance	Meaning / Interpretation	Range
1.0	90-100	Excellent / Always	A
0.8	70-89	Satisfactory / Often	B
0.6	50-69	Acceptable / Regularly	C
0.4	30-49	Poor / sometimes	D
0.0	0-29	Unacceptable / Never or rarely	E

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Translating the partial or total results of the evaluation of the quality of products projects is not an easy task, so a simple and understandable format to get a quick and reliable assessment of the quality of the different project representations should be selected. Checklists, **control matrix** and simple relationship tables are often chosen for this reason. Characteristic-Factor / Sub-Factor / Attribute / Metric. Figure 1 shows a documentation sample of one of the 42 combinations listed [20]-[26] and Table 2 shows the model PROYEVA arrayed in its 42 combinations [20-[26]

D. Metrics Proposed for this Model

Each component of the model requirements and methodology employed are divided into sub-components and parameters, which are represented by a metric, according to the application of the MECHDAV assessment model, which refers to this process. To calculate the metrics of each component and subcomponent mentioned, apply each of the formulas with their respective parameters described below:

1. Identify the area locating the project to be evaluated among the following four possibilities, corresponding to the most relevant project. The projects involved in creative competitions can be classified as follows: I. - Science - Technology. II. - Health and Environment. III. - Socio-economic, administrative and educational. IV. - Craft and Cultural.
2. Once the location of the project area is chosen, we suggest using the general procedure model proposed by PROYEVA (derived from MECHDAV) for 10 properties (factors), 26 sub-features (sub-factors), 42 attributes-metrics, which is fully represented by type I, then (somewhat fewer metrics) by type II, III and finally IV, which lacks several components of the model elements (attributes, metrics and sub-factors), in four levels of quality.
3. A score is assigned to each category or project type according to the PROYEVA compliance percentage for each combination of factors / sub-factors / attributes / metrics that apply, depending on the type of project. The first score assigned is the first metric that is calculated, which is given as follows for each of the types: I = 1.0, II = 0.9, III = 0.8, IV = 0.7.

Characteristic: ***Factor 9 (F9)*** Documentation showed.
Subcharacteristic: Subfactor 9.2 Report
Attribute: 9.22 Complete final prototype.
Metric: Determine the level of completeness of the final prototype required by the user of the product or project.
Method: Analyze each part of the prototype to determine the Completeness of the final prototype to be considered complete and finished.
Measure: C= Level of completeness of the final prototype
Formula: X=C (measure or metric)
Evaluation: E(x)={(0,0), (0.4, 40), (0.6, 60), (0.8,80), (1, 100)}
Interpretation: Level of completeness of all parts of the final prototype.
0 <= X <=1 ; the closer to 1 the better
Source of reference: ***MECHDAV,*** ISO/IEC 9126

Formula to calculate the score of the total Characteristic Factor F9.
(A,B)= {(0.4, 40), (0.8, 80),(1,100)} D={(0,0), (1,100)}
Formula: **A*[C+D]*B metric**

Figure 1. Documentation about the 42 metrics used in PROYEVA

In the final grade for a project participant for each judge in any category, PROYEVA calculated metrics (equations) of each of the specified points, depending on the type of

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project that applies: the value assigned to each assessment, combined with the remaining fraction of each factor evaluated, accumulating the partial values, thereby calculating the result of each of the 10 factors. Finally, an equation is applied which represents the evaluation of all factors to be considered by the judges, for the project participant. The final score of a project is the combination of the recommendations given by all judges involved.

Finally, an equation is applied which represents the evaluation of all factors, enabling the judges to submit their opinion to the project. The final score of a project is the combination of the recommendations given by all of the judges involved.

TABLE II. MODEL PROYEVA

Characteristic / Factor	Subfeatures / Sub-Factor	Attribute / Attribute	Metric / Metric
1.1.1.1 F1	Project I	Science and Technology	/A
1.2.1.1 F1	Project II	Health and Environment	/B
1.3.1.1 F1	Project III	Social-Economic-Education	/C
1.4.1.1 F1	Project IV	Artisan-Cultural	/D
2.1.1.1 F2	Identification	Delimitation	/A1
2.1.2.1 F2	Identification	Hiposetis	/B1
2.2.1.1 F2	Objectives	General	/A2
2.2.2.1 F2	Objectives	Particles	/B2
2.3.1.1 F2	Scope	Techniques	/A3
2.3.2.1 F2	Scope	Socioeconomic	/B3
2.4.1.1 F2	Limitations	Techniques	/A4
2.4.2.1 F2	Limitations	Socioeconomic	/B4
3.1.1.1 F3	Originality	Invention	/A
3.2.1.1 F3	Originality	Innovation	/B
3.3.1.1 F3	Originality	Creativity	/C
4.1.1.1 F4	Feasibility	Financial	/A
4.2.1.1 F4	Feasibility	Tecnica	/B
5.1.1.1 F5	Justification	Socioeconomic	/A
5.2.1.1 F5	Justification	Tecnica	/B
6.1.1.1 F6	Formality	Level	/A
6.2.1.1 F6	Formality	Level of Complexity	/B
6.3.1.1 F6	Formality	Mathematical model	/C
6.4.1.1 F6	Formality	Graphic model	/D
7.1.1.1 F7	Registration	Pat	/A
7.2.1.1 F7	Registration	INDAUTOR	/B
7.3.1.1 F7	Registration	Utility model	/C
7.4.1.1 F7	Registration	Industrial Design	/D
7.5.1.1 F7	Registration	Integrated Circuit Layout	/E
8.1.1.1 F8	Level	Coverage	/A
8.2.1.1 F8	Level	Exhibition	/B
8.3.1.1 F8	Level	Contest	/C
8.4.1.1 F8	Level	Forum	/D
9.1.1.1 F9	Product	Over	/A
9.2.1.1 F9	Report	Full	/B
9.2.2.1 F9	Report	Prototype	/C
9.2.3.1 F9	Report	Manuals	/D
9.2.4.1 F9	Report	Models	/E
10.1.1.1 F10	Presentation	Item domain	/A

V. MAIN SCREENS OF THE PROTOTYPE PROYEVA

Figures 2, 3, 4, 5, 6 and 7 show some of the main screens that describe the operation of the system [20-26].

VI. FINAL EVALUATION REPORT

When the respective values of the selected project evaluation as well as the rate of quality compliance are obtained, a final evaluation report is generated in which the final results and the compliance percentages are given.

An outline is provided showing what the points are, where the product-producers stand out in quality as well as those which do not. It also dictates what level of quality is achieved according to the relevant points, and, if required, recommends changes so this draft is accepted as a draft-quality product.

Figure 2. Welcome Screen and Start at the PROJEVA System.

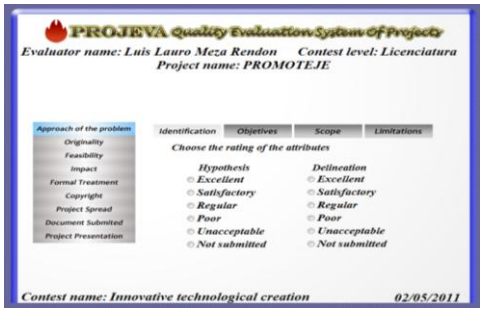

Figure 3. View of a screen with points for evaluating the troubleshooting rubric.

Figure 4. View of evaluation results of a project.

VII. RESULTS, CONCLUSIONS AND FUTURE WORKS

The preliminary phase of the PROYEVA project has been completed, covering the complete model and methodology for the technical evaluation of the quality of the projects participating in creativity, invention and innovation contests through the application of quality in-use metrics. In it, the first prototype of this type of software was developed, which is the proposed tool for a panel of judges to efficiently evaluate the quality in-use of the project participants in a particular creativity contest, [Copyright SEP INDAUTOR 03-2007-03201059300-01, and 03-2007-091813015000-01] (mathematical model and software) [23] [24] [25] [26] [27].

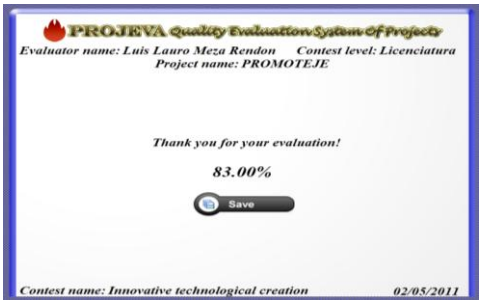

Figure 5. View results of project evaluation.

Figure 6. Pproject list of participants in a contest.

Figure 7. List of projects evaluated by a jury in a contest.

There is also an English version PROJEVA for presentations abroad. The software will permit a very generic technical assessment, based on the quality in-use, creativity and project implementation. The assessment is very general, so it may issue an opinion on any project in any discipline and any level of competition: local, regional, state and national level, giving a reliable decision as a judge in creativity contests.

PROJEVA system is a service created for project quality in use evaluation, within innovation, invention and creativity contests, for different government agencies, industries and services that require an easy, fast and objective evaluation process which will help in the selection of a winning project in different categories.

This prototype is proposed for the creative competitions that take place in the National System of Higher Education Technology, for the state competitions organized by different universities, and national competitions organized by the National Institute for Women, National competitions of thesis, National Contests and Exhibition Projects Linking the different government sectors, among others. Additional formats are provided for manual evaluation of these contests. PROJEVA system can be adapted to various contests, for different juries as required. Projects may be installed in a multiuser environment for several judges, for various academic levels: primary, secondary, high school, undergraduate and graduate, and in a WEB environment. It will have the mobility to interact virtually any mobile device having WI-FI and it is in the range of broadband network provided by the host institute of the competition.

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