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Support Platform for Decision-Making in Research and Technological Development in Public Health

Plataforma de Apoyo para la Toma de Decisiones en Investigación y Desarrollo Tecnológico para la Salud Pública

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Content

ABSTRACT:
Decision-making concerning Research and Development projects in health is an important activity in Brazil, since the amount of proposed projects is incompatible with the financial resources. For this, an application was developed in the programming language C++ that supports managers in decision-making processes, executing the evaluation of the proposed project based on some modeling variables.
Keywords: Support Platform, Decision Making, Public Health, Project Evaluation

RESUMEN:
El proceso de toma de decisiones relacionadas a proyectos de Investigación y Desarrollo en el ámbito de la salud es una actividad importante en Brasil, ya que la cantidad de proyectos propuestos supera a los recursos económicos que están disponibles. Para esto, una aplicación fue desarrollada en el lenguaje de programación C++ para apoyar a los gerentes en el proceso de toma de decisiones, ejecutando una evaluación de los proyectos propuestos basándose en modelaje de variables.
Palabras clave: Plataforma de apoyo, Toma de Decisiones, Salud Pública, Evaluación de Proyectos.

1. Introduction

The research and development (R&D) of technologies related to health in Brazil involves a large number of projects. In the year 2000 the estimate of investment directed to research and development was approximately R$ 13 billion, corresponding to 1.27% of GDP that year (Banco Mundial, 2012), being most of the amount assumed by the Brazilian government (Brasil, 2016).

But even all this investment is not enough to financially support the project demand in the country that has a GDP of approximately 57% of Germany's GDP (Banco Mundial, 2012).

In addition, a significant percentage of resources that are spent by the ministry of health (Gadelha et al., 2003) are intended to import technologies, particularly, chemical reagents and devices for diagnosis. These resources could be invested in R&D of homegrown technologies. However, local production does not occur, to some extent, due to the weakness and inadequacy of management processes of Brazilian public institutions. It is clear that the fact of having R&D institutions that cannot have or adopt appropriate management mechanisms, among which the monitoring and evaluation of projects are inherent, restrict the possibility of developing new products.

Thus, the purpose of this article is to propose a support platform for decision making that considers variables linked to the strategic development process for the implementation of a National Policy for Science, Technology and Innovation for Health, facing the development strategy of the Economic Industrial Health Care Complex, under the foundation Oswaldo Cruz - FIOCRUZ, especially regarding the use of the suggested platform for the decision-making process of FIOCRUZ Paraná. This proposal aims to provide support to professionals in the field of Information Technology and managers of the Institution of Science and Technology (ICT) so that they face more effectively the demand imposed by the dynamic evaluation of research projects, aiming ultimately to the development of new technologies to use in the National Health System - SUS.

In this context, the need of using Information Technology to coordinate the development of governmental systems, that support strategic decision in research and technological development in public health, becomes clear.

The health care industry has undergone significant changes considering the provision of health services, and the consumer needs and demands. Thus, health information managers must strive to find the proper tools to meet these new challenges (Greene, 2002).

It is observed that the process of making strategic decisions in research and development (R&D) is very complex in health and very important to allow Brazilian products to be produced and incorporated into the national health system.

In this sense, considering such complexity, the introduction or modification of Information Systems has a profound environmental and organizational impact. It transforms the way in which the various groups act and interact, changing the way the information is set, accessed, and used to manage the organization's resources, frequently leading to a new distribution of authority and power (Laudon e Laudon, 1994).

The adoption of appropriate computer tools leads to the interpretation of the motives and allows the identification of new directions for the development of strategic projects in the public health area, considering the main identified problems and the necessary corrective measures. Then, with the use of computer tools, results can be consolidated and analyzed by the strategic planning bodies of the institutions involved in the areas of research, technological development and innovation.

In recent decades, the technology has significantly affected the way individuals and organizations deal with information. In an irreversible process, paper records have been transformed into electronic records, allowing numerous advantages provided by this means. The same is happening in health care, where professionals and institutions, consonants to technological developments, have increasingly adopted electronic records in its activities (SBIS, 2014).

The Medical Informatics and Health Informatics is a fast developing scientific field that deals with storage, retrieval and use of information, data and biomedical knowledge for problem solving and decision making (Blois e Shortlife, 1990).

International literature shows that numerous studies emphasize the importance of the referred

study area, and the line where it appears that the information and communication technologies play an important role in health, affecting almost all aspects of clinical practice (Coeira, 1997).

In the same theoretical context, the development of information and electronic records in health systems need to take into account the information needs and behavior of all stakeholders, as well as health initiatives should actively involve users in the design, development , implementation and evaluation of systems (Bath, 2008).

Information systems have been used in various aspects of health, including risk prevention evaluation, clinical decision assistance, health monitoring at home, finance and resource allocation (Simpao et al., 2014).

Thus, it is clear that quality information is vital for decision making in public health, resource allocation, planning, monitoring and evaluation of public programs (WHO, 2014).

The current approaches to data management and sharing do not always meet the objective of supporting the public health practice efficiently, or not even allow the data presented could be used for decision making in health organizations.

Facing the theoretical evidence offered by the authors who discuss the subject, it is possible to conclude that the development of local solutions in the health field is necessary and opportune.

2. Methodology

The platform was applied in the FIOCRUZ at Paraná, considering that such public organization had the material conditions for the production of an evaluation model that could contemplate inherent aspects to the process of strategic decision-making.

In this context, present variables in the business rule were modeled as object of this case study. Through the classification of these variables the project in question can be evaluated, and this method will serve as support to the manager of Science and Technology Institution in the decision-making process related to the projects conducted by the research team of FIOCRUZ Paraná.

Once modeled, the variables were divided into two groups: the governance variables, where the manager must determine a rating for each item of the variable, and technical variables, where the manager should only select whether a variable has or not the necessary criterion. This way, the classification of the variables will determine an estimate of the success of the project, and consequently make an assessment of it.

In order to allow this assessment to be quickly and easily done, a software was proposed, being capable of producing the method and present results in a concise and simple visualization so that the manager can identify if the project has good success expectation.

Therefore, the proposed software was developed in C ++ programming language using the integrated development environment Microsoft Visual C ++ 2008 Express Edition, a free programming environment provided by Microsoft (Microsoft, 2012). Using the Windows Forms Application (API, 2012), an application of graphic programming interface, commonly known as Application Programming Interface (API), which allows the programmer to access the graphical elements of the windows interface.

During the platform development, targeting the ballast originated by the formal routine established for decision making, the evaluated variables resulting from the Excellence Model in Public Management (MEGP) proposed by the Ministry of Planning and Budget (MPOG) were considered, being these variables adopted by the National Program for Public Management and De-bureaucratization (GesPública).

Therefore, the governance variables chosen and used in the development of the platform were:

(i) Decision-Making In FIOCRUZ;

(ii) Organizational Values and Principles;

(iii) Organizational Risk;

(iv) Senior Management Accountability

(v) Dissemination of Organizational Values and Principles

(vi) Encouraging Organizational Learning.

All these variables are evaluated according to eight (8) items, which are: Adequacy, Proactivity, Dissemination, Continuity, Improvement, Consistency, Interrelation and Cooperation. Each item can be classified in the following data shown in tables 1, 2 and 3 below:

Table 1
From one to three items of each governance variable

Scores	**Governance Variable Items**		
	Adequacy	Proactivity	Interrelation
1	All	All	All
2	Almost all	Almost all	Almost all
3	Majority	Majority	None
4	Many	Many	
5	Some	Some	
6	Inadequate	Reactive	

Table 2
Four to six sections of each governance variable.

Scores	**Governance Variable Items**		
	Continuity	Cooperation	Consistency
1	All	Almost all	All
2	Almost all	Majority	Almost all
3	Majority	None	Majority
4	Many		None
5	Some		
6	Not Reported		

Table 3
Six to eight of each governance variable.

Scores	Governance Variable Items	
	Dissemination	Improvements
1	All	Majority
2	Almost all	Many
3	Majority	Some
4	Many	There is Implementation
5	Some	There are no mechanisms
6	Not disseminated	

Each variable classification will be made according to the manager's vision, being responsible of the classification of each item of the governance variable list.

Subsequently, based on the classification made by the manager, the governance variables evaluation system works as follows: from the classification of each item made by the user, the system eliminates a score, as shown in the previous tables. From the score of each item a percentage score is generated, calculated according to equation (1). The Maximum Score of the equation is the highest grade of each item as shown in previous tables.

$$Percentage\ Score = PS = \frac{Score}{Maximum\ Score} \qquad (1)$$

After the percentage score is obtained, the averaged of the eight percentage scores is calculated (*vg*) from the governance variables according to equation (2).

$$\overline{vg} = \frac{PS_1 + PS_2 + \cdots + PS_7 + PS_8}{8} \qquad (2)$$

The manager is in charge of choosing the significant coefficients for each governance variable. This significant coefficient (α) ranges from one to three; making possible to provide the user with more control over the evaluation platform, according to the significant criteria for each item (i.e.: α1.vg1, α2.vg2 etc.).

Thus, once the governance variables rating are completed, the user categorizes the technical variables, which are:

(i) Scientific and Technological Merit;

(ii) Conjunction with the Science & Technology policies (S&T) and Public Health;

(iii) Economic sustainability, technical feasibility and

(iv) Infrastructural conditions.

It becomes evident, that even with different impacts in the world, science and technology come together in some of the said variables. This junction must be applied considering the nature of the institution that will apply the support platform for decision-making.

In this sense, it is noteworthy that FIOCRUZ Paraná is an institution of Science and Technology - ICT, linked to the Ministry of Health. Its objective is to meet the goals of Science, Technology and Innovation for Health policies; and once such actions are contemplated as set of activities that contribute to the results given by the Unified Health System - SUS, the convergence of the chosen variables with the business rules linked to that institution will be observed.

The following Table 4 shows the score given to each technical variable according to their classification.

Table 4
Notes of each technical variable.

Variáveis Técnicas	Scores	
	Yes	No
Scientific and Technological Merit	100%	50%
Interaction with S&T Policies and Public Health	100%	50%
Economic sustainability	100%	50%
Technical feasibility and Infrastructural conditions	100%	50%

3. Results

These variables are classified considering the items yes or no, in case of not having the score ( ) the item is 100%, otherwise 50%. Unlike the governance variables, technical variables have a significant coefficient, standard and unique equivalent to one, in this case the user does not have much control of the evaluation as in the previous case.

In the adopted application hypothesis, technical variables have a grade of 50%, since otherwise, considering an infinitesimal value, these would distort dramatically the final result. If the score to consider were equal to 0% instead of 50%, this score would probably affect the outcome of the final estimate of project success.

At the end of the procedure of data recollection by the manager, the platform does the weighted calculation (3) of the variables of the two groups, being this result the so-called Total Estimate "Failure" (TEF).

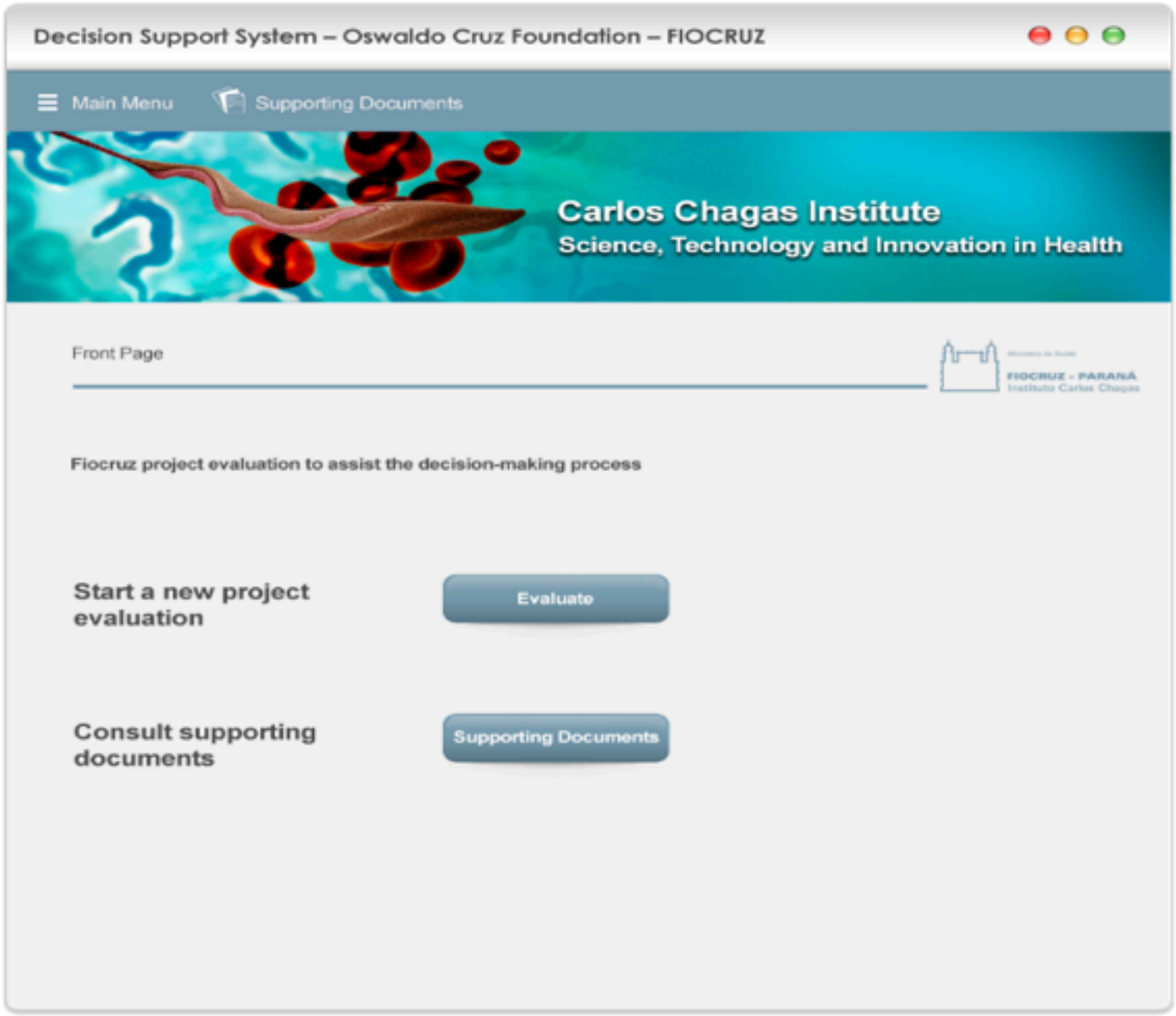
The TEF is a percentage calculation of the "failure" of the evaluated project, meaning that, the higher the value, the lower the chances of the project to work according to the program and its evaluation method.

The formulas used to calculate the TEF show that this result will never come to zero; this was done on purpose, since consensus among authors consider there is no project that can be evaluated with an estimated success of 100%.

The platform in C ++ was developed with the mentioned methods. For better organization of the content, the program was divided into four pages, as follows: Home Page, Evaluation, Result and Supporting Documents. The latter contains files that explain in greater detail the adopted variables, among other observations about the allocation of the scores parameters. In turn, the Home Page Fig. 1 provides brief instructions on the evaluation process of the research project, offering an overview of the functioning of the software.

Figure 1

Platform Home Page.



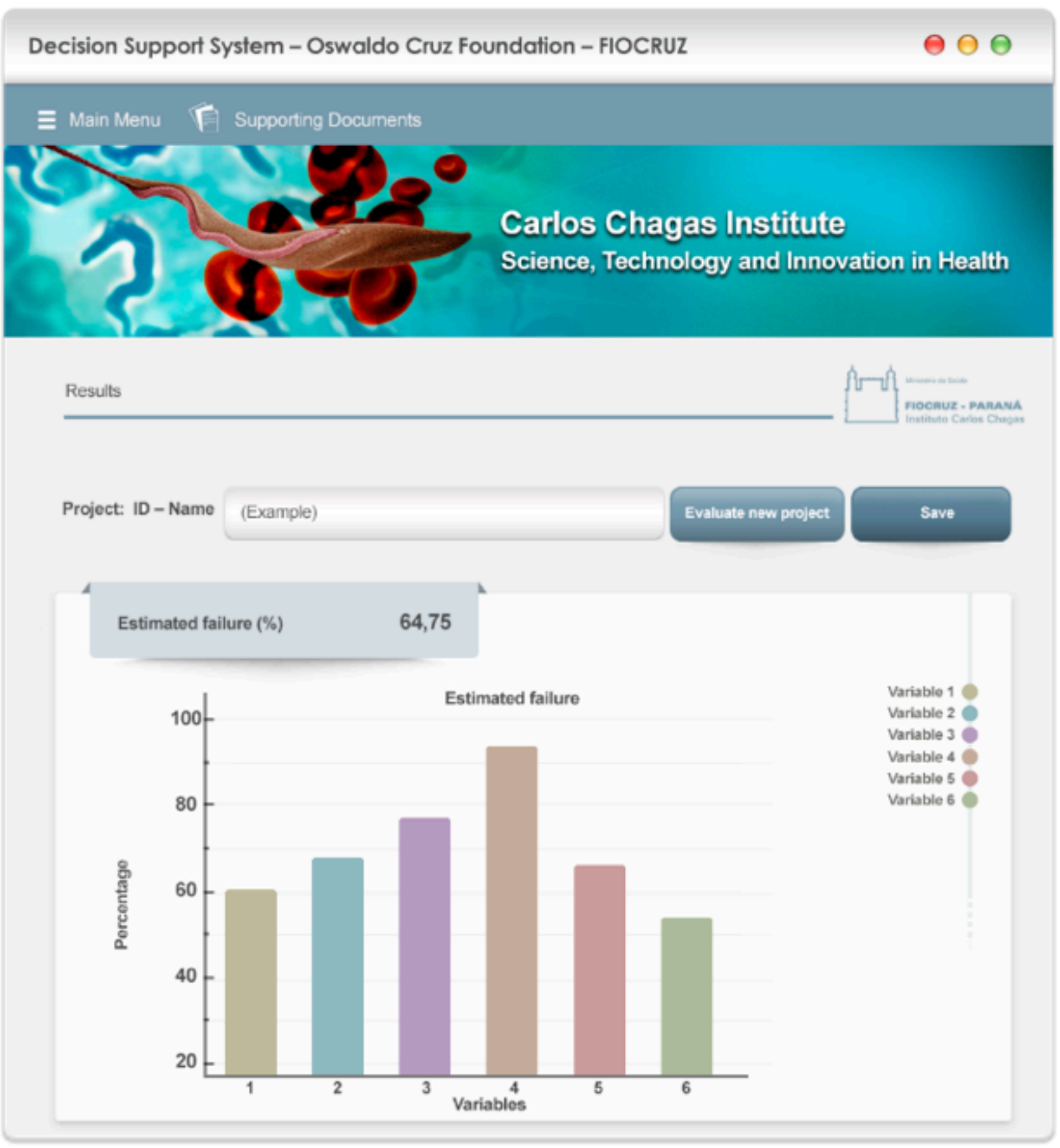
The evaluation method is contained in the 'Evaluate' page. This site contains the fields where the manager must classify each of the variables, choose their respective coefficients according to their weight, and finally add a name to the project. Fig. 2 below shows the “Evaluation” page.

Figure 2
Platform “Evaluation” page.

As can be seen in Fig. 3, the “Results” page shows the calculations obtained in the form of a total percentage amount, that is the TEF and a bar graph of the percentage values of each governance variable ( ).

Besides the value of the TEF, for better a visualization of the results by the user, the results page draws a bar graph with the percentage results of each governance variable; this feature was implemented with the free API *nPlot* (API, 2012).

Figure 3
Platform “Result” page.



It is possible to observe in Fig. 3 there is the option to save the evaluation. By selecting this option, the program removes all data coming from the evaluation and generates a text file containing all the data in a report format. This way the manager can save the evaluation data in a printed or digital manner, compatible with any computer; this way it is not necessary for the user to have the platform to display the calculated results.

4. Conclusions

Despite the possibility of including other variables, the support platform as the objective of this article presented adherence to the decision-making model, considering the standard set by the Model of Excellence in Public Management (MEGP). The inclusion of new functional requirements should be enhanced so managers can identify opportunities for improvement, considering such significance; the adopted method in the development of the platform provides said operation.

It was possible to observe that once the inherent variables to the process were proposed and selected the calculation methods of the evaluation, the platform could be successfully implemented in the C ++ programming language with the use of graphical elements of Windows.

Therefore the addition of more variables or more coefficients became necessary, turning the platform into a more robust and effective tool. Thus, FIOCRUZ managers may in fact use the support platform for project's routine evaluation. Furthermore, other ways of calculating and displaying the results proved to be more appropriate when using the software.

Being able to use the platform in an Institution of Science and Technology of the scale of FIOCRUZ, enables the adoption of the platform in other research units of the Ministry of Health, as well as other institutions concerned with similar activities; however, without disregarding the need for thorough verification of adherence to specific definitions of each business rule and also specifying the relevant requirements.

It was found that the platform could reduce the subjective decisions regarding the process of evaluating research projects, given its initial application on the FIOCRUZ projects portfolio.

This way it becomes evident that the support platform for decision-making concerning the field of health research and development is extremely useful for the manager.

For future researches, the adoption of specific requirements should be considered, comprising the guidelines that resulted in the new Legal Framework for Science, Technology and Innovation, in order to update the set of business rules, as well as the actors who participate in the decision-making process.

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