IT Projects Performance Indicators

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Many software and IT projects fail or succeed in achieving theirs objectives because different causes of which the management of the projects has a high weight. In order to have successfully projects, lessons learned have to be used, historical data to be collected and metrics and indicators have to be computed and used to compare them with past projects and avoid failure to happen. This paper presents some indicators that can be used for the measurement of IT project management performances.
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1 Introduction

The main objective of the research project *System of indicator for the IT Project Management Evaluation* is to develop a system of indicators to evaluate the status of the IT projects that are under analysis. The continuous IT implementation in Romania, through the development of information systems, the new computational technologies, the improvement of IT infrastructure, is done through projects. Based on statistical studies is shown that a reduced percentage of IT projects are successfully implemented, their management having a decisive role. This research will determine the main factors that influence the IT projects management and will quantify them, and, based on them, the system of indicators will be developed. Project manager competences, project context, project specific characteristics, methods and techniques used are taken into account. Using the indicators on new or running projects, their success chances are measured on earlier stages, giving the possibility to determine the corrective actions in case of deviation from the established values.

Project management is a new way to manage in order to complete the goals having the cost minimized in different domains like industry, constructions, medicine, education, research. The management of a project involves several sub-processes: planning, coordination (project implementation), project end, and on a regular basis project control [10]. Different projects management standards are presented in [14], [15], and [16].

Project initiation (project start) is usually organized as a workshop, after the project manager was assigned. The project's plans are developed in this process. Project coordination/implementation is a continuous process, and it is based on the plans developed in the project start process. Periodically is done the control process, in order to assure that the project is according to the plans. The close-down process is the last project management process, where all the project information is transferred to the organization.

IT projects include the development or the implementation of software and hardware systems, data communication, video, voice or integrated systems [1].

Such examples of IT projects are:

- the development of a new software
- hardware equipments acquisition
- software acquisition
- designing and installing a network computers in a company
- the maintenance of an existing system
- implementation of a software system.

IT project failure, especially on software projects, occurs frequently. In order to reduce the degree of failure for new projects, data have to be collected and metrics to be computed.

The developed indicators are grouped in a system of indicators. The indicators are grouped based on how they describe various projects states

2. PMO and Project Management Metrics

Every IT company based on projects has to have a special department for the management of its portfolio of projects. This department is known as Project Management Office or Project Portfolio Group. The PMO has many functions into a project oriented company. As functions of the PMO could be enumerated [8]:

- training
- coaching
- consultancy
- resource management
- project portfolio management: projects selection, audit
- metrics development
- maintain projects history (projects archive)

The PMO makes the link between the executive management and the projects. The PMO monitors the projects and the resource pools (experts, software and hardware assets). PMO offers support to projects through coaching, training, information and resource allocation.

In project oriented organizations, the PMO is very important for knowledge management. Having in mind the knowledge management, the PMO has new roles within the organization as respects knowledge creation, recording, distribution and reuse. All PMO responsibilities and roles should be integrated with the knowledge management system. PMO will use for knowledge transfer formal and informal methods, in order to get the best performances. One important role of PMO is to collect data about projects, to define indicators and metrics and to use them to analyze the project management in the organization.

The metrics are classified in qualitative and quantitative, based on how the project's influence factors are quantified

Quantitative metrics are considered those that are based on factors that can be easily measured or counted. Such metrics include: work productivity, project/portfolio value, resource usage, costs etc.

Qualitative metrics are based on subjective evaluation of the factors that depend on. These include quality of work, personnel quality, degree of satisfaction etc.

Defining the metrics for IT projects consists of building models and indicators that start from values measured with objectivity, such as the number of objectives, number of milestones, budget, number of modules, number of phases, number of activities etc.

Managing the knowledge within project-oriented companies is very important and has benefic results for the company and for the people that are involved in the projects. In order to do that, data, information and knowledge from previous projects have to be collected, managed, improved, and reused in the actual and future organization's projects. The organization's culture influences the knowledge management processes.

PMO is the key factor in knowledge management success within project oriented organizations. The management of PMO and the importance of this department for the executive managers are among the factors that influences how knowledge management is implemented in the organization.

3. IT Projects Performances

Poor management is a very important factor in the failure of IT projects. The completion of a project can take place through the achievements of all objectives, but unprofitable financially. Instead, other advantages can be obtained, like the increase team or organization prestige or the experience gained. Some projects, even they fail in the objectives achievement, can return through gained experience, new team members, some positive results etc.

The quality of the project deliverables cannot be obtained without a high quality process, but a quality process does not guarantee quality products. The quality of the process is certified through quality standards.

Also good trained personnel do not guarantee the quality of deliverables. In order to obtain quality results, the organization has to have trained and educated personnel, and standardized project management and technological processes.

Equilibrium has to be obtained between: resource allocation for projects, risk and profit, long term and short term projects, research and development projects, internal or external projects. In figure 1 is depicted a situation from an organization with some projects showing the associated risks, value and profit.

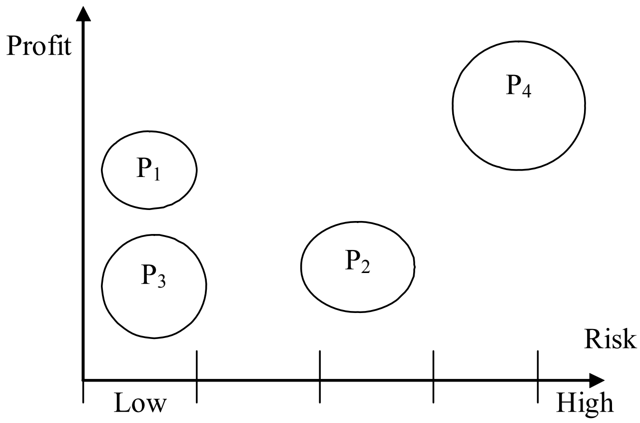

Fig.1. Projects by risk and profit

The degree of objectives achievement is calculated as: $GA = \frac{OA}{TO}$, where: OA – the number of achieved objectives; TO – the total number of established objectives.
If the indicator value is greater than one, is considered that the project achieved more objectives than were planed initially.
The ratio between the achieved deliverables and the planned deliverables can be also calculated for each project phase, where deliverables from one phase are inputs for the next phase.
The *degree of satisfaction* can be computed as:

$$DS = \frac{\sum_{i=1}^{p} DSR_i}{TR}$$

where:
DSR – the degree of satisfaction for the requirement i;
TR – total number of requirements;
p – the number of requirements.
The degree of satisfaction for a customer of executive requirement is a value from 0 (no satisfaction) to 1 (fully satisfied).
Work productivity based on inputs is given by:

$$W_1 = \frac{\sum_{i=1}^{n} O_i}{\sum_{j=1}^{m} Ij}$$

where:
Oi – the output *i* (deliverables, results);
Ij – the input *j* (manpower, resources per time unit);
n – the number of outputs;
m – the number of inputs.
Work productivity based on time:

$$W_2 = \frac{\sum_{i=1}^{n} O_i}{T}$$

where:
T – period of time.
The *cost of resources* takes into account the category of resources and the cost per unit for each category:

$$C = \sum_{i=1}^{w} NR_i d_i p_i$$

where:
NR_i – number of resource from the category i;
pi – price per unit for the resource category i;
di – units of usage for the resource category i.
The total cost of project can be defined as:

$$C_T = \sum_{i=1}^{k} c_i ,$$

where
k – the number of project phases;
c_i, - the cost of all resources from the phase i;
The number of reworks because of no concordances between the specifications and the results measure the team performance in doing their work.
A *project portfolio value* at a given moment of time is computed as:

$$PPV^s(t) = \sum_{i=1}^{k_s} VP_i^s(t)$$

where:
$PPV^s(t)$ – project portfolio *s* value at the given moment *t*;
VP_i^s – the value of project i from the portfolio

s;
k_s – the number of projects in the portfolio *s*.
Other indicators are developed to measure the performances of IT projects. In order to use them, data have to be collected from various projects and they have to be validated.

4. The Indicators Validation

In order to develop indicators for the IT projects quality, the following sets are identified [5]:

- the factors that influence the characteristics;
- the variables associated to the factors and the procedures for measuring them;
- the projects used to measure the variables that influences the characteristics.

The indicators have an analytical form that could be simple or complex. That depends on the number of influence factors, influences intensity and of the degree of reuse for structures of already defined and used indicators. The indicators have a variety of analytical forms, from ratio of homogeneous expressions to expressions that include exponential and logarithmic functions.

The analytical form of indicators has to be developed so the indicators simultaneously have the following characteristics:

- *sensitive*; low variations of influencing factors leads to low variations of the results; high variations of influencing factors leads to high variations of the results
- *non-compensatory*; different sets of factors variation does not have the same values for the results;
- *non-catastrophic*; low variation of factors does not lead to extremely high variation of the indicator value;
- *representative*; defines the quality of being accepted by the users in doing analysis assuring the results' signification.

Analysis data set are gathered in order to determine if an indicator is sensitive, non-catastrophic, non-compensatory and representative.

For example, the indicator C_T used for measure of total cost of a project, given by the formula $C_T = \sum_{i=1}^{k} c_i$, where k is the number of project's phases and c_i the cost of all resources for each phase, is sensitive because a for a variation from c_1 to c_1', with $c_1' = c_1 + \gamma_1$ and from c_k to c_k', with $c_k' = c_k + \gamma_k$ results:

$$\mathrm{CT} = \mathrm{CT}' + \sum_{i=1}^{k} \gamma_i \ .$$

This indicator is compensatory for all situations where $\sum_{i=1}^{k} \gamma_i = 0$.

The indicator C_T is non-catastrophic because at a low variation of c_i factors, the indicators variations are not high. Also, there are no situations where the total cost cannot be calculated, like the ratio type indicators (I = N/D) where the value of denominator vanish.

The indicator quality is another side that has to be considered starting with the metric's definition phase.

After that, the indicator is tested and validated through behavioral analysis correlated with the variation of project's global qualitative level and specific qualitative level.

5. Conclusions

The indicators and metrics used in IT projects evaluation creates a general view over a diversity of IT projects aspects, like resources consumption, costs, performance, risks.

The uses of metrics and indicators for IT project management evaluation have the advantage of providing rigorous information regarding the required effort and the boundaries of the IT deliverables. Also, a basis for analysis and classification of process and result is created.

There are also some disadvantages. They are due that data contains errors and the metrics quality depends on the quality of data used in models. Also, if the conditions the models are based on are modifying, the actual context could not be valid.

Starting from the system of indicators based on historical data regarding projects that have been run in the past there can be easily created a system that allows releasing information related to the chances that a running project can be successfully completed. There also can be determined the stage of the subject in relation to the projects that have been undertaken in similar conditions and thus action can be taken based on the records of these projects using the

lessons learned from those projects.
The management of the IT projects evaluation from the perspective of the user is aiming to ensure the client's satisfaction through the maximization of the coverage of its needs.
The indicators allow for fundament the decisions and the marking of the structural elements. They should stand for a system which allows an overall appreciation of all the aspects concerning IT projects. This system should render an image of all the resources used and of all of them that will benefit from in the future.
The extension of the system of indicators and the use of very large data series converge to a reference system used to make decisions with effect on the further social and economical development from the point of view of the very important sector of information technologies and communication.
The system of indicators is developed in steps and it is further to be improved with specific data from other projects in other fields, thus being consequent to the methodological rules required for a comprehensive knowledge of the elements related to the characteristics of the modern society.

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