Local and Global Measures for Success and Reconstructive Determination of the Optimal Number of Partners in European Educational Projects

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Summary:

The present study is based on real data of 306 project proposals submitted for funding in 2013. The distribution of the project proposals by the countries of initiation and partnering countries is specifically considered in relation to the quality of the established consortia. A quality indicator is defined that determines whether a given project has the appropriate quality/ characteristics to meet the predefined quality requirements/criteria. On the basis of this indicator local and global measures for quantification of the project's success are introduced. The local and global measures for success along with the results obtained by "Quality of the consortium" evaluation criterion are used to calculate the statistical evaluation and the reconstruction of the optimal number of partners in a consortium,

ensuring success of the project application. The presented data were analysed by methods of applied statistics and relevant findings were made about the discussed topic and guidelines for further research and development are given.

Key words: monitoring, evaluation, European projects, success measures, mathematical modelling.

JEL classification: O22, H43, M10.

Introduction

Behind the development of a successful project lies the continued work on the preparation and design of the project proposal. The project should have a significant impact on the current status and should produce considerable project results on the implementation of the identified policies and strategies. It is essential that the project objectives are in line with the priorities of the call for proposal.

The objective of this paper is to introduce and evaluate measures of project success

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that can be quantified by relevant indicators. To achieve this objective, **the following tasks** have been implemented: first, a quality indicator is defined in order to capture appropriate project characteristics; second, local and global measures for quantification of project success are designed by utilizing this qualitative indicator; thirdly, results from a preliminary evaluation of selected project proposals by this method are presented and discussed. These measures for success allow the statistical evaluation and derivation of recommendations for reconstruction of the optimal number of partners in a perspective consortium.

The current study is based on the analysis of projects that are funded directly by the European Union, and their investigation expands our views on the possibilities of utilization of EU funds and on Bulgarian participation in large international partnership projects. This study applies local and global quantification measures that show the success of the corresponding country in its general performance. These measures may be extended to other qualitative spaces, e.g. for quantification of qualitative hypotheses. By solving the classical task for reconstruction, i.e. from the family of ill-posed problems, the optimal number of partners for participation in EU educational project is suggested.

1. Literature Review

The current topic was not researched comprehensively although the studies on project success and failure factors have a long standing history. These factors were first announced by (Rubin and Seeling, 1967) and further investigated by (Baker, Murphy and Fisher, 1983). Most often, technical performance was identified as a measure of success as well as the competence of the Measures for Success and Reconstructive Determination of the Optimal Number of Partners in EU Educational Projects

project manager. Effective project planning was also considered as directly linked to project success.

In general, previous research focuses on measurement of project success in respect of three criteria: meeting planned goals; delivering end-user benefits; providing partners' benefits. These criteria have been used by (Dvir, Raz and Shenhar, 2003) in their empirical analysis of which identified the planning as a central prerequisite of project management success - a significant positive relationship between the project planning efforts and the project success was found. Apart from planning, other core factors have been previously studied, e g. functional specifications, technical specifications, meeting schedule and budget goals, meeting the operational requirements, product usage, achieved improvement in beneficiaries' operational level, satisfaction of end-users, (Dvir, Lipovetsky, et al. 1998, p. 921)

Several attempts have been made to construct a more or less comprehensive list of critical success factors (Dvir 2005, Alexandrova and Ivanova, 2012). It was expected that such a list should facilitate both practitioners and researches in monitoring and evaluating particular project success or failure. Belassi and Tukel (Belassi and Tukel, 1996) have developed a new scheme for classification of critical factors and described the impacts of these factors on project performance. Their empirical study based on this framework identified many factors which were neglected at that time, e.g. team members' commitment and technical background, specific project attributes, and environmental factors.

The design of qualitative success measures for projects is a difficult task but

it is important for project management when managing complex and dynamic systems. Projects that have a low ambiguity level could be evaluated by applying quantitative success measures (e.g. time and cost performance, tangible end products, etc.). Atkinson, Crawford and Ward point out that "... projects at the soft end of the spectrum require different forms of performance evaluation that recognize the validity of different perspectives and worldviews. This calls for ability to develop sensitive performance evaluation frameworks that match the complexity of the project." (Atkinson, Crawford and Ward 2006: p.693).

A more specific issue in project management success is the effectiveness of teams and team working, and in particular, the role of this factor for multinational educational and research projects. (Bîzoil and al., 2009) have emphasized the communication aspects, such as informing partners, monitoring progress and problem solving, and their impact on project effectiveness. Two examples of collaborative platform usage within European educational projects were explored showing that the assignment of project tasks to partners and team members is an important element of the effective collaboration work. This is particularly valid in projects where a substantial part of the activities assumes extensive collaborative work of two or more partners. This is especially important for European educational projects which involve permanent communication, shared work, data exchange as well as utilization of contemporary ICT tools.

Being a complex and dynamic process, project partnering relates to how the different project actors interact to influence project success (Larson, 1997). For this reason the analysis of the partnership structure is crucial for the understanding and identification of critical preconditions necessary for success. In this respect, (Barnes, Pashby and Gibbons, 2002) develop a "Good Practice Model for Collaboration Management" in multinational projects. The model outlines a range of partnership factors that facilitate the project success. Among them, the evaluation of any new partner characteristics can generate key insights into the role of that partner within the collaboration, regarding its background experience and preferred way of operating.

Bresnen and Marshal explore two aspects of partnering: formal and informal. Their approach involves enquiring whether the understanding of the "technical apparati" of partnering (contracts, pricing mechanisms, agreements, etc.) is "... sufficient to recognize how partnering works and whether collaboration can be actively 'engineered' simply by applying these techniques" (Bresnen and Marshall, 2000: p.235). They emphasize also the questioning of whether trust and cooperation can be encouraged substantially in the context of intensified relationships between project partners of imbalanced economic power.

Comprehensive instruments for facilitating European project management success are provided by the "Survival Kit for European Project Management". The evaluation process emphasizes a variety of aspects, among which the "good transnational partnership". This criterion is decomposed into four main aspects that need to be evaluated (Bienzle, 2001, pp. 47-48):

 strong commitment to the project by each partner (each partner commits time and resources in line with the agreed work plan; each partner attends

meetings, courses and other events; each partner takes part in the agreed dissemination programme; each partner responds to requests for financial or other administrative material on time; each partner shows a willingness to solve problems; each partner looks for opportunities to enhance the project);

- agreement among partners (clear evidence for sharing of roles and responsibilities by each member of the partnership);
- effective communication among partners (takes into account any disparity in the provision of IT within the partnership; takes into account the language competence of the partners; unification does not favour any partner or exclude partners from important project information);
- development of trust and positive attitudes (project partners should develop a sense of ownership of the project).

2. Description and scope of data

The study covers 306 project proposals that were submitted to the EC in 2013 selection year and which have passed the eligibility check. The collected data both overall and by groups are sufficient to be considered a representative statistical sample ensuring statistical error less than 0.2%. For each project proposal the following data are known:

- General Project Data Project number, Project Type, Promoting organization; Applicant country; City, the headquarters of the promoting organization, Partners' organizations, Partners' countries; Partners from third countries (countries outside the European Union).
- Results from the preliminary qualitative evaluation of the project proposal

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according to the following qualitative criteria: "Relevance", "Quality of the work program", "Innovation", "Quality Consortium", "European added value", "The cost-benefit ratio", "Impact", "Quality of the valorisation plan", "Participation of the third countries" (where applicable).

The empirical data about the projects consists of evaluation marks obtained about each of the aforementioned eight criteria. During the assessment process each project proposal is evaluated by two independent external experts. These experts are selected by EC evaluation agency on the basis of their professional experience, background and competences in educational project management.

The assessment of each project on each criterion is done independently by the two assigned experts using a 5-point scale ranging from 1 (very weak: considerable disadvantages substantial non-compliance and with requirements) to 5 (very good: considerable advantages and substantial guality matching); zero points are given in case of full noncompliance or missing information on the criterion. The expert evaluates the degree at which the project proposal corresponds to preliminary formulated quality requirements. Each expert prepares a justification report with comments on the assessment marks. The final mark is obtained by a consensus of the two experts as a result of a detailed discussion (and not as an average of the two independent marks).

The data were analysed by the methods of the applied statistics generated by the system and user functions of the package Matlab ®, Mathworks Inc. Natic, USA, release 7.13 (2011b), and the corresponding conclusions were made and are given guidelines for the research continuation.

3. Research and analysis of results

The distribution of the project proposals according to the quality of the consortia (promoter's country, partners' countries) is a quantitative measure of quality impact. This determines whether a project has the appropriate qualities/characteristics to meet the predefined quality requirements/criteria.

The examined database consists of 306 project proposals that have passed the administrative capacity check and eligibility check. These projects are divided into two groups according to their overall consolidated qualitative assessment - *good projects* (projects with an overall score of 25 points or higher), i.e. those who are in the second half of the rating scale and *weak projects* (projects whose consolidated qualitative assessment is up to 24.5 points), i.e. projects that fall into the first half of the scale. Figure 1 represents the percentage ratio between good and weak projects that were submitted during the 2013 selection year: 68% - 32%.



Fig. 1. The ratio between the good and weak projects in 2013

The "Quality of the consortium" indicator assesses the intellectual capacity of the participants, in other words when there is a decision to look for financial support and development of a given idea and there is a real of European funds, what is the possibility to prepare a good project. The ratio (Thiessen, 2013) indicates the potential of good quality project proposals that are seeking funding and ways to develop innovative ideas. This ratio is evidence to the importance of the European programs as a tool for policy development in the field of education.

The first question to be considered is to determine the function's density for projects' distribution, divided by countries according to the evaluation scale. Figure 2 shows the carried out check of the distribution function when using 19 basic distribution functions (Blume, 1993).

Obviously the best match is with the exponential distribution, i.e. we can conclude that the projects by country are exponentially distributed according to the rating scale with parameter of distribution $\lambda = 1$. The type of the exponential distribution is:

$$f(x;\lambda) = \lambda e^{-\lambda x} \tag{1}$$

Let us return to figure 1. The result in this figure is normal and statistically predictable in view of the selected evaluation scale. The presented ratio of weak projects (the first half of the scale) compared to the all: 2/3 and good projects (the second half of the scale) compared to all: 1/3 is determined by the projects' exponential distribution into countries according to the evaluation scale (*Figure 2*).



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Fig. 2. Check of the projects' distribution according to countries compared to the evaluation scale

In order to assess the capacity of each European country to prepare and submit qualitative project proposals a study is carried out for the distribution of the best projects by country. (*Figure 3*)

Given the exponential distribution of projects according to the evaluation scale and the uniform tendency in the distribution of projects in all areas, from analytical point of view it can be expected that the percentage of success of the countries will be within the boundaries of 30 to 50 percent. The wide interval is statistically based (Brandimarte, 2006) due to the large number of countries with a small number of projects. For example, a country with 2 project proposals and 30%

success rate will actually achieve 50% success rate. For a country with 1 project and 30% average success rate we have 2 options - 100% or 0% real success, while the second option increases the chances of the other for a higher average success rate. Of course, within the statistical error there can be cases with high percentage of success rate, but they are expected to be only in the range of countries with a low number of projects. The analysis of figure 3 confirms the statistical estimates and shows the simple fact that the initiation of more projects provides a high chance of success. On Figure 4 is shown the number of quality project proposals per country. The two leading countries by the number



Fig. 3. Distribution of the (good) project proposal according to countries

of initiating projects (Italy and Spain) are the leading in the number of good project as well. The peculiar thing in this table is the step back on the third place of Greece (only 7 good project are ranked) and the very strong positions of two other countries (Germany and UK), which have a tradition in preparation and implementation of European projects. Countries such as Belgium, France and Austria also demonstrate presence of good project proposals.



Fig. 4. Rate of good projects in 2013 by initiating countries

Our country is still among the countries with 50% realization of the submitted project proposals (2 of 4 submitted project proposals which are rated over 25 points) and shows good intellectual potential for the preparation and presentation of qualitative and profitable projects. There is necessity to work harder to improve our initiative to present more projects in front of European institutions.

Figure 4 shows the proportion of good projects by country, in order to present what is this proportion compared to all projects. Unfortunately, after the leading participation of Spain and Italy (19.19%), Germany and the UK (10.10%), Bulgarian participation represents only 2.2% of all good projects, which is an unsatisfactory result, if we want actively to take part in the European funds' distribution.

Interesting is the investigation in to the ratio that exists between good and weak projects submitted by each country. It shows the intellectual capacity and the ability not Measures for Success and Reconstructive Determination of the Optimal Number of Partners in EU Educational Projects

only to generate ideas, but these ideas to be presented in the appropriate form in order to receive funding. Figure 5 shows the percentage success rate. The member states with 100% success rate on submitting project proposals are Switzerland, Luxembourg and Sweden (the submitted by them one project by country falls directly into the set of good proposals). Countries such as Bulgaria, Norway and Turkey have 50% success rate. Figure 5 clearly presents the confirmation of the previous statistical prognosis about the success between 30 and 50% (Brandimarte, 2006). It should be noted that the defined success is a local measure, i.e. it measures the success of the country itself taking into consideration only the applications submitted by every individual country.

As a global measure for success we will introduce (Cressie, 1993) the normalized and the percentage success rate by country (*Figure 6*).



good projects

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Fig. 6. Normalized success rate by country - global measure

The normalized and the percentage success rate are global quantified variables, showing the success of the country in the general performance. From this perspective, the position of Bulgaria is pretty good – we demonstrate 50% success rate, which is among the highest results. This shows that our country has significant potential and capacity to submit high-quality project proposals. According to the measure of global success, Bulgaria's score has increased from 1% among the participating projects to 5% among the successful ones!

Number of partners in a consortium

Once we have defined the local and the global measures of success based on the distribution of projects by country, we can spread these measures from the space of



Fig. 7. Gamma distribution of project proposals according to the number of participating countries in the consortium. The left graphic shows the distribution of all projects, and the right one – only of the good project proposals

a single country-initiator towards the space of the consortium. To achieve the target, the function of the distribution of projects according to the number of participants in the consortium should be examined and to transfer the measures by using the transfer function, which will lead to the exponential distribution of the projects by country-initiator within the distribution of projects according to the number of partners. Here we use the properties of a probability and the function of distribution as an integral spatial measure (Blume, 1993). Having conducted a similar study using the 19 standard features of the distribution, we reach the conclusion that the distribution of project proposals according to the number of participants in the consortium is a gamma distribution with parameters of the distribution $\theta = 1, k = 5$ (Figure 7)

The formula for the gamma distribution is the following:

$$f(x;k,\theta) = \frac{x^{k-1}e^{-\overline{\theta}}}{\theta^k(k-1)}$$
(2)

Since the exponential and the gamma distributions are standard, we could use the standard transfer function, translating the measures obtained in the first space to the relevant measures in the second space. From (1) and (2) we get:

$$\lambda e^{-\lambda x} T(x) = \frac{x^{k-1} e^{-\frac{x}{\theta}}}{\theta^k (k-1)}$$
(3)

By replacing in (3) in the open parameters of the distributions $\lambda = 1, \theta = 1, k = 5$ for the transfer function we get:

$$T(x) = \frac{x}{3} \left(\frac{x}{2}\right)^3 \tag{4}$$

After applying the transfer function (4)

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to the data (Dobrushin, 1968), we get the following separability (clusterification) of the project proposals (*Figure 8*):

After the realized transfer of data to the new rating scale we could simply answer the question about the optimizing the number of partners in the consortium (taking into account the total number of organizations plus the participation of third countries). Here we are not talking about organizations but about countries-participants, as our investigation undoubtedly shows that the presence of more than one participating organization from a given country sharply worsens the chances of success of the project, except for the case in which the organization is duplicating the countryinitiator.

Figure 9 reveals the standard deviation and the average number of participating organizations in the consortia in good and in poor projects respectively.

Apparently in good projects with a lower standard deviation the average number of partners is higher. That fact gives us sufficient reason to claim that to be a successful project proposal the optimal number of partners should range between 6 and 8, including the project promoter and the third countries (at this conclusion the standard deviation of the data is divided into two according to the theorem (Lüke, 1999)). The resulting assessment is based on a global measure of the success rate and therefore it is the global assessment for the optimal number of partners in the consortium. This global assessment shows only the trend of the optimal number of partners, i.e. to be actually used should be adjusted to other global assessment of the number of partners based not on the overall assessment of success rate but of



Fig. 8. Separability of projects with discrete continuation of the probabilistic measures (good versus weak). On the x-axis are placed projects, and on the ordinate is reported the value of the extended measure of success. In blue are marked the weak projects, and in red – the good ones. The two horizontal green lines indicate the range within which the threshold is selected for the severability



Fig. 9. Optimal number of organizations when establishing the consortium. Average and standard deviation of the number of participants in the consortium, based on the continued normalized success rate of all projects



std mean

Fig. 10. Optimal number of organizations when establishing consortium. Average and standard deviation of number of participating organizations in a consortium based on the normalized success rate according to criteria "Quality of consortium" (good against weak)

the specific quality assessment.

If we study the optimal number of partners in the consortium based not on the total quality evaluation, but on the specific "Quality of the consortium" evaluation criterion, we will get entirely different results *(Figure 10)*. The idea is to adjust the results in the direction determined by the global evaluation of the number of partners based on the overall assessment of performance. Thus we get an assessment reflecting the simultaneous operation of two key factors for project success.

In this study at should be taken into consideration that in the indicator "Quality of the consortium" is presented a summary evaluation, which includes not only the optimal number of participating organizations, but the territorial topography is assessed, the project's geographical coverage of and the individual characteristics of the different organizations. In this sense, the assessment "Quality of the consortium" can be used only as indirect evidence regarding the number of participants.

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Regardless of the indirect indication in figure 10 compared to figure 9, the trend is preserved, which allows us to conclude that the optimal number of participants for the drafting of a good project is between 5 and 7 with an increasing tendency, not for reduction (at this conclusion the standard deviation of the data is divided into two according to the theorem of *Nyquist* - *Shannon*).

Conclusions

From the present study we could draw the following three global conclusions:

 The normalized and the percentage success rate are quantification variables which show the success rate

of the corresponding country against the general performance rate. These measures may be extended to other high-quality spaces for quantification of qualitative hypotheses.

- From this perspective, Bulgarian position is pretty good – we display 50% local success rate and thus show a score that is among the highest. This shows that our country has significant potential and capacity to provide high-quality project proposals. According to the measure for global success, Bulgaria's score increases from 1% among the participating projects to 5% among the successful ones!
- The optimal number of participants to establish a good project proposal is between 5 and 7 with an increasing tendency and the presence of more than one organization from a country sharply worsened the chances of the project's success, except in the cases in which the duplicating organization is from the initiating country.

Future research objectives

A future task is to explore the parameters of a successful multilateral European project. The aim is to formulate the main rules that should be observed when initiating the project idea and establishment of the consortium in order to ensure maximum success of the project proposal. On this basis our goal is to develop an adequate strategy for an ex-ante of project proposals, ensuring their performance in the segment of the good projects.

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