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Success of research projects. Prediction and assessment from the point of view of project stakeholders thereby taking into account a sustainability approach

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Abstract

The aim of the article is to present the results of research on the success of research projects. Based on the conducted quantitative research, the importance of individual success factors and success criteria of research projects were determined, taking into account the opinions of various stakeholders thereby a sustainable approach. The research results indicate the high importance of most of the success factors and the success criteria of research projects pointed out in the literature and those in turn are important for project management and supports decision-making.

Keywords: *project success, success factors, success criteria, research projects, project stakeholders, sustainable approach*

1. Introduction

Information on which project success factors to consider when predicting project success or which success criteria to consider when assessing project success is valid for project management, as emphasized by theoreticians and practitioners. This type of information is important for project management and supports decisions such as: Should I start the project? Should I quit the project? What are my chances of successfully completing the project? Was my project successful?

Some authors emphasize the importance of the influence of different stakeholders on a project [37] and the need to manage them to increase the project's potential for success, e.g., [12, 20, 21, 55, 56]. The approach to project management, taking into account the views of different stakeholders, is in line with the Association for Project Management (APM) definition of sustainability: sustainability in the project profession is an approach to business that balances the environmental, social, and economic aspects of project-based working to meet the current needs of stakeholders without compromising or overburdening future generations [54]. The authors of this article assume that the use of the opinions

of different stakeholders in project management, including predicting the project's potential for success or assessing the success of a project is an application of a sustainable approach to project management. This assumption is consistent with what can be found in the literature: [2, 3, 6, 31, 75, 76].

The topic of the success of research projects, their success factors or success criteria are not very extensive. Although a few items on this topic can be found, they either do not deal with the distinctions from the perspective of the stakeholders in this type of project or were conducted as qualitative rather than quantitative studies.

The aim of the article is to present the results of research on the success of research projects. Based on the conducted quantitative research, the importance of individual success factors and success criteria of research projects was determined, taking into account the opinions of various stakeholders thereby a sustainable approach. This is essential for project management and supports decision-making.

The research results presented in the article are a part of an extensive research on success factors and success criteria of research projects, taking into account the phases of the project life cycle defined in the surveyed organizations. The respondents (different project stakeholders) assessed the importance of each success factor and the project success criterion and identified the phase or phases for which this factor or project success evaluation criterion was important. This study focuses only on presenting the results of research on the importance of success factors and success criteria of projects, for different stakeholder groups, without including the results taking into account the phases of the project life cycle.

The article focuses on the success of research projects and the assessment of the importance of factors and success criteria by various stakeholders, thus emphasizing a sustainable approach. For the purposes of the research, three questions were asked (cf. Table 1).

Table 1. Research process conducted for the article needs

Research process	Questions
First part	1. Literature review. What is project success and how can we measure it, also in research projects? 2. Are project stakeholders (as the inclusion of a social aspect of the sustainability approach) taken into account in measuring the success of projects, also in research projects?
Second part	3. Quantitative research Which research project success factors and success criteria are important according to different stakeholders of this type of project?
Third part	Conclusions

This study consists of three parts. The first part of the article presents a conceptual framework based on two elements: (i) presents the concept of project success and its measurement, also in research projects, (ii) explains the role of stakeholders in measuring project success (also in research projects), which is an element of incorporating aspects of a sustainable approach. The second part explains the methodology of the empirical research undertaken, describing the research sample, the data collection process and the analysis of the results of the quantitative research. The third part ends the article with conclusions.

2. Literature review and theoretical background

The literature research conducted for this paper was a typical literature review, which covered a wide range of topics at different levels of comprehensiveness and may include analysis of research findings [11]. The authors considered those publications that were within the scope of this article and related to

research projects, including R&D projects. The authors are aware of the differences between research projects and R&D projects, and thus the differences between the assessment of the success of both types of these projects. Due to the fact that R&D projects are included in the group of research projects, these differences have not been highlighted for the purposes of this study.

2.1. The concept of project success and its measurement, also in research projects

Many definitions of project success can be found in the literature, an overview of these definitions can be seen, e.g., in [39]. In general, at the beginning (1960s), project success was linked to the iron triangle, i.e., time, cost, and quality of the project [63]. Over time, several authors distinguish the concept of project success from project management success [5, 19, 23, 28, 29, 49, 53]. Project success is equated with effectiveness in achieving project outcomes, project management success is related to efficiency in implementing the project plan (so, to the iron triangle) [13, 57, 61, 62, 68]. Many researchers [4, 36, 43] regard project success (in project management) as having two components: project success and project management success. The success of a project according to some authors should be measured over time [61, 62] Some emphasize the importance of stakeholders in project success measurement [20, 69].

To determine whether a project is likely to succeed (prediction of project success) or whether it has succeeded (assessment of the project success), it is required to identify ways of measuring it. In the case of predicting success, it is useful to use so-called project success factors (SF). For assessing a project or its phases, project success criteria (SC) are used. In the literature, many authors [19, 44, 52, 64, 73] suggest defining the two terms as follows:

- success criteria are dimensions for assessing whether a project succeeds or fails.
- success factors are factors that, if they interact with a project, increase the probability of its success. In the literature, these are also referred to as critical success factors (CSF) or determinants.

What does the concept of project success look like for research projects? Here, the literature is not extensive, but based on this literature, it is possible to present the most important information on this topic [10, 16, 25, 30, 39, 46, 48]:

- stakeholders in research projects interpret the success of a project differently, the success of research projects should be assessed from the perspective of its various stakeholders,
- the success of a research project is characterized by the success of the project management (e.g., by indicating success criteria such as closing within the budget and time allowed to achieve the objectives) and the success of the project (by indicating success criteria such as publications, doctorates, or patents).

Few publications can be found in the context of success factors for research projects: [7, 27, 33, 34, 45, 50, 58, 65–67], which (especially [8, 9]) formed the basis for the carried out quantitative studies. On the other hand, according to the literature [69], project success criteria strongly depend on the type of project, therefore they must be clearly defined for a specific type of project, including research projects. They can be divided into two groups: quantitative or qualitative [14]. For research projects, exemplary success criteria in a quantitative group can be: new scientists gained by the organization due to the project, the number of patents and copyrights gained due to the project, the number of new projects funded due to

the project, the number of papers published due to the project, the number of citations generated due to the project. And for a qualitative group: new knowledge acquired due to the project, the newness of the technology used.

2.2. Project stakeholders and their connection with project success and sustainability approach, also in research projects

Stakeholder management/analysis is treated as one of the most important aspects of project management, e.g., [59, 60, 70]. Moreover, as already mentioned, stakeholders and their opinions are important in measuring the success of projects [20, 22, 24], including research projects [10, 41]; at the same time linked to the sustainability approach. How? Sustainability in project management is about social (people), environment (planet), and financial (economic) aspects/goals [1, 72]. Stakeholders' involvement and participation in projects are significant for sustainability from the project's point of view (inclusion of a social aspect). Several authors [3, 6, 31, 47] have recognized the need for more open and proactive engagement of stakeholders as a consequence of integrating sustainability into the project management. According to [35], proactive stakeholder engagement is one of the basic principles of sustainability [18, 70]. The relationship between sustainable project management and project success has been addressed in several studies, e.g., [40], [32, 38, 51, 71, 74], and a positive correlation between sustainable project management and project success has been identified [15, 26].

3. Methodology of quantitative research

3.1. Data collection

Data were collected from organizations in Poland that run research projects. 200 organizations registered or operating in Poland from the Central Registration and Information on Businesses (CEIDG) database and the National Court Register (KRS) were selected for the study. The study was conducted in the form of a telephone interview. The estimated time of the study for one respondent was about 8 minutes. The research was conducted in December 2021 on a sample of 200 organizations in Poland that run research projects. Research in organizations implementing research projects was carried out as part of the Miniatura 4 project, financed by the National Science Center, entitled "A fuzzy model for assessing the success of research projects" (project number: 494893, 2020/04/X/HS4/01922).

The research procedure included obtaining consent from the respondent for the research and informing him about the anonymization of data processing. The respondent was also informed that the answers to the questionnaire were supposed to concern one research project that was completed in the last 5 years. In the introductory part of the survey, the respondents answered 5 preliminary (demographics) questions, i.e., providing information on the size of the organization, the sector of the organization, age, gender, and responsibility of the respondent in the selected project. In the main part of the survey, the respondents answered questions related to success factors and success criteria of research projects taking into account the surveyed organization.

The language of the questionnaire was Polish. For the purposes of this study, the questionnaire was translated into English by project management specialists. Respondents answered most of the questions in the questionnaire using a seven-point Likert scale (ranging from 1 to 7). These questions concerned

the degree of significance of the success factors and the success criteria for research projects. If a given factor or given criterion is not applicable in the respondent's organization, the respondent could answer not applicable. The questionnaire is presented in the Appendix.

3.2. General information about the research sample

In the research sample of 200 organizations, 32 (16%) were micro-enterprises (employing less than 9 employees), 84 (42%) were small enterprises (employing between 10 and 49 employees) and 84 (42%) were medium-sized enterprises (employing over 50 employees) (Demographics1).

200 respondents were invited to participate in the survey. Most of them were between 25 and 34 years old ($n = 101$; 50.5%); 25 (12.5%) respondents were up to 24 years old; 52 (26%) respondents were between 35 and 44 years old; 19 (9.5%) respondents were between 45 and 54 years old, and only 3 (1.5%) respondents were over 55 years old (Demographics2).

Among the respondents who took part in the survey, 125 (62.5%) were members of the project team, 70 (35%) were project managers, 5 (2.5%) performed other roles i (Demographics3).

81 (40,%) respondents were women, 117 (58.5%) respondents were men, 3 (1.5%) respondents did not indicate their gender/indicated the answer 3 (Demographics4). Figure 1 shows the characteristics of the research sample.

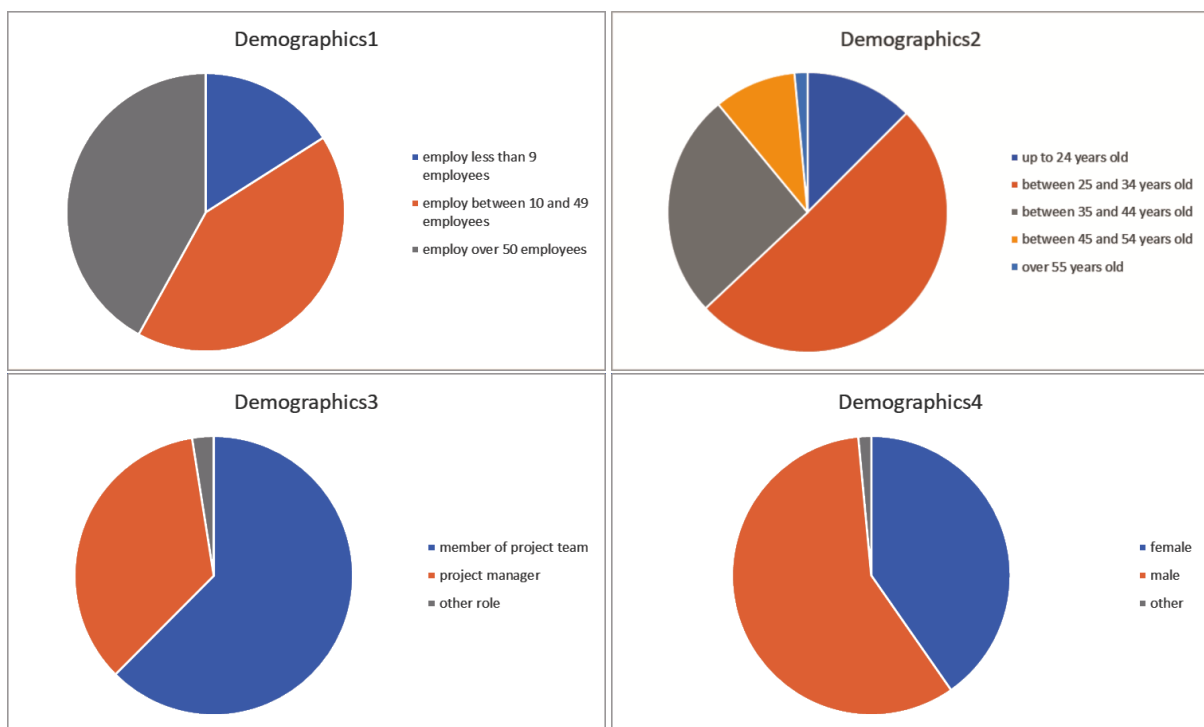


Figure 1. Characteristics of the research sample: Demographics1 (the size of the organization), Demographics2 (respondent's age), Demographics3 (respondent's responsibility of the project), Demographics4 (respondent's gender)

The organizations in which the respondents worked represented different types of sectors: 39 (19.5%) organizations operated in services, 48 (24%) in trade, 31 (15.5%) in IT, 26 (13%) in industry, 7 (3.5%) in construction, 27 (13.5%) in science, 18 (9%) in government and local government administration, 4 (2%) in other sectors than those listed in metric (Figure 2).

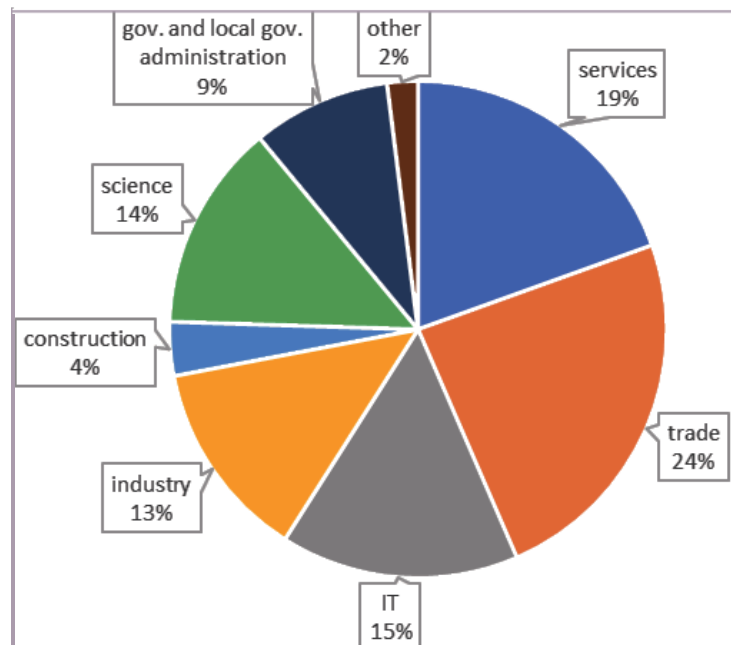


Figure 2. Type of activity/sectors of the organizations

As shown in Figure 2, in the research sample, most organizations operated in the trade, services, and IT sectors (in total 58%). Other organizations were active in the public sector (in total 23 %) and industry, construction, and production¹ sector (in total 19 %).

In the further part of the study, the results of research related to success factors and success criteria of research projects, including R&D projects, in the surveyed organizations will be presented.

4. Results

First, the stakeholders identified in the research projects (except for the project managers and project team members) will be introduced. Then the results of the research project success factors (for predicting the success of this type of project) and success criteria (for assessing the success of this type of project) will be presented.

4.1. The stakeholders of research projects

The stakeholders of research projects identified in the study (apart from the project manager and the project team members) included:

- administration supporting the service of the research project ($n = 60$; 30%),
- authorities of the organization that implements the research project ($n = 43$; 21.5%),
- sponsor/financing institution ($n = 64$; 32%)
- advisory institution (for example, a consulting company helping to prepare an application for research funding) ($n = 52$; 26%),
- expert evaluating the results of the project ($n = 73$; 36.5%),

¹In the open question concerning the organization sector, the respondents entered “production” hence the term production sector appeared here alongside industry and construction.

- partner in a consortium ($n = 37$; 18.5%),
- no one outside the project team ($n = 7$; 3.5%).

The data presented in Figure 3 shows that the respondents most often indicated expert evaluating the results of the project (36.5%), sponsor/financing institution (32%), and administration supporting the service of the research project (30%) as a stakeholder of projects implemented in their organization (apart from the project manager and the project team members). Only 3.5% of respondents indicated that their organization did not identify project stakeholders from outside the project team. It is worth emphasizing that the surveyed organizations that carry out research projects identify stakeholders in their projects. This aspect proves that the surveyed organizations incorporate a sustainable approach to project management.

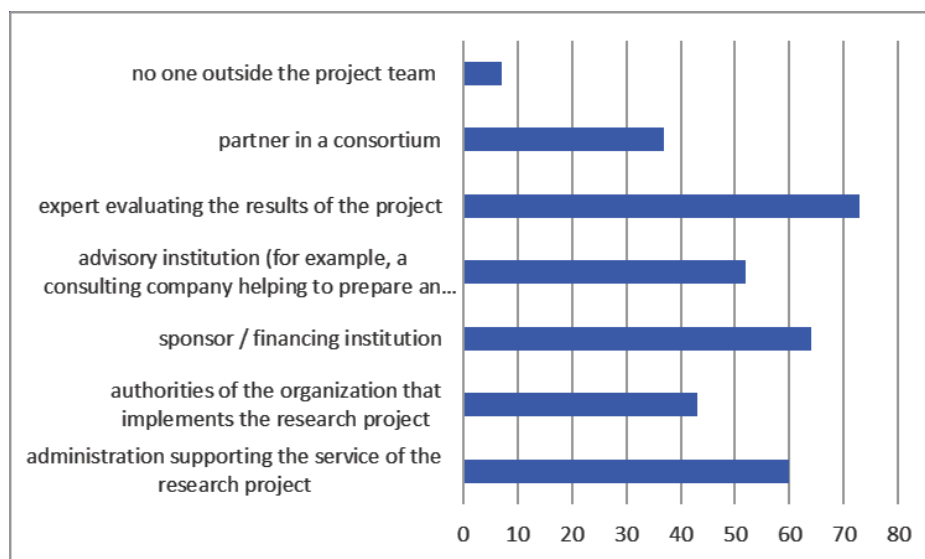


Figure 3. Stakeholders of the research projects in the study (apart from the project manager and the project team members)

In the further part of the study, the results of research related to success factors and success criteria of research projects in the surveyed organizations will be divided into various stakeholder groups, i.e., project managers and members of project teams².

4.2. Success factors of research projects for predicting success of this type of project

A questionnaire was prepared (see Appendix A) to carry out a quantitative survey on success factors for research projects based on two publications: [8, 9]. Figures 4 and 5 show how significant each of the success factors (p10.1–p10.23) were for the research projects in which the project managers and members of the project team members participated. The importance of the individual success factors was rated on

²The answers given by respondents who played other roles in the studied projects, due to the low number (only 5 people) will not be subject to further analysis

a scale of 1 to 7 (i.e., from very low to very high importance). If a given factor was not applicable in the surveyed organization, the respondent marked the answer not applicable³.

For greater clarity, the conclusions from Figures 4 and 5 along with the names and numbers of success factors of research projects are included in Table 2.

Table 2. Success factors of research projects with importance 6 or 7

Factor No.	Success factors for research projects	Percentage of respondents	
		Project managers	Members of a project team
p10.1	Efficient cooperation in the preliminary phase of the project	70	64
p10.2	Properly planned project tasks and proper allocation of resources	60	64
p10.3	Adequate financing, secured research and equipment facilities	52.9	61.6
p10.4	Involvement of scientists, their cooperation and focus on research	50	52.8
p10.5	The team and its substantive skills	51.4	56
p10.6	Achieving benefits from research conducted by consortium partners	45.7	42.4
p10.7	Proper selection and involvement of consortium partners	52.9	56.8
p10.8	Choosing the right place for the project and introducing the rules for its implementation	42.9	52
p10.9	Leadership and management	45.7	57.6
p10.10	Strong, respectful relationships within the project team	51.4	62.4
p10.11	Equal distribution of time for research conducted in individual countries	50	50.4
p10.12	Effective communication and information flow	60	64.8
p10.13	User benefits of the project deliverables	58.6	56.8
p10.14	Flexible project implementation. constant monitoring and reviews	52.9	49.6
p10.15	Invariability of partners in the consortium (no changes among partners involved)	45.7	43.2
p10.16	Properly estimated duration of the project	38.6	54.4
p10.17	The influence of sponsors on the shape of the project	37.1	42.4
p10.18	The implemented project is a subsequent research collaboration	45.7	53.6
p10.19	The implemented project is a continuation of other research	37.1	41.6
p10.20	Adjusting the subject of the project to the development strategy of a given country	42.9	48.8
p10.21	Experience of the project leader in the implementation of projects within the consortium	50	53.6
p10.22	Sufficient trust in the team	55.7	59.2
p10.23	Other factors	50	34.4

After analyzing the results of the respondents' research in the area of the importance of the success factors of research projects, the following conclusions can be drawn:

- over 50% of project managers rated 13 out of 23 success factors as important or very important,
- more than 50% members of the project team rated 16 out of 23 success factors as important or very important,
- for both project managers and members of the project team, the three most important success factors for research projects turned out to be: efficient cooperation in the preliminary phase of the project, properly planned project tasks and proper allocation of resources, effective communication and information flow,
- less than 10% of project managers rated 16 out of 23 success factors as little or very little important,

³The figure shows only the answers of the respondents, determining the importance of individual success factors of research projects on a scale from 1 to 7. That is, the higher the weight given by the respondents, the higher the importance of a given factor in the success of research projects.

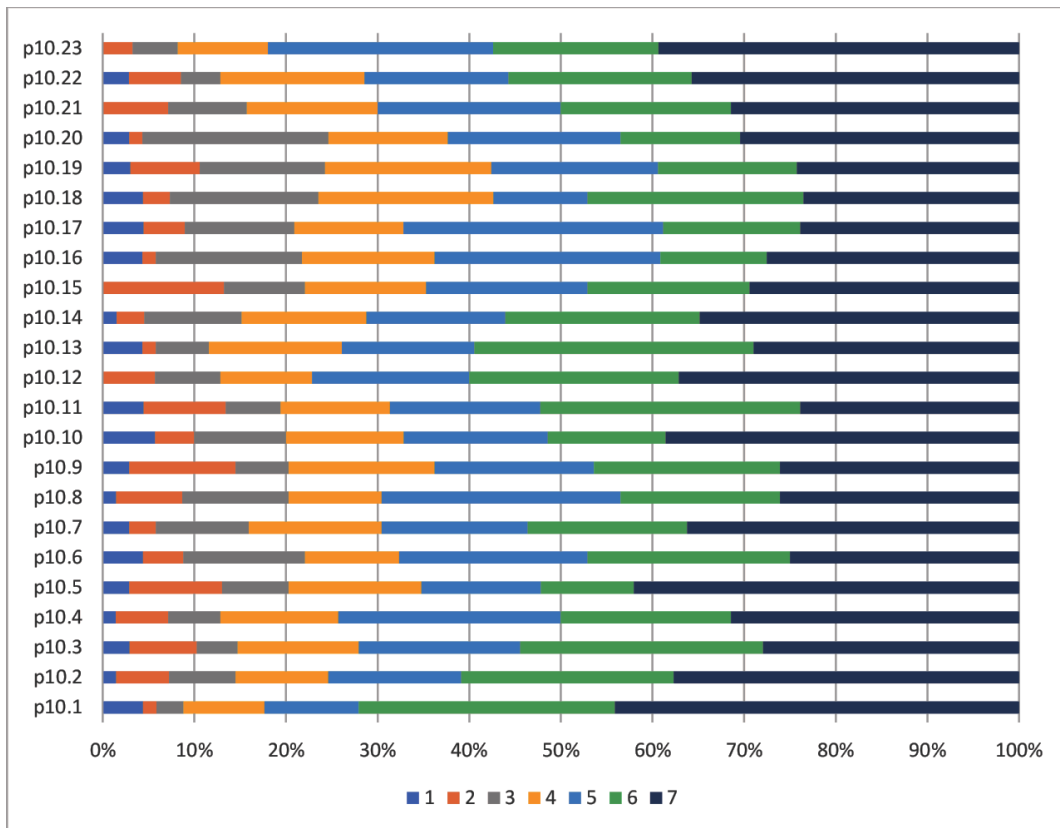


Figure 4. Importance of success factors for research projects – distribution of responses by project managers

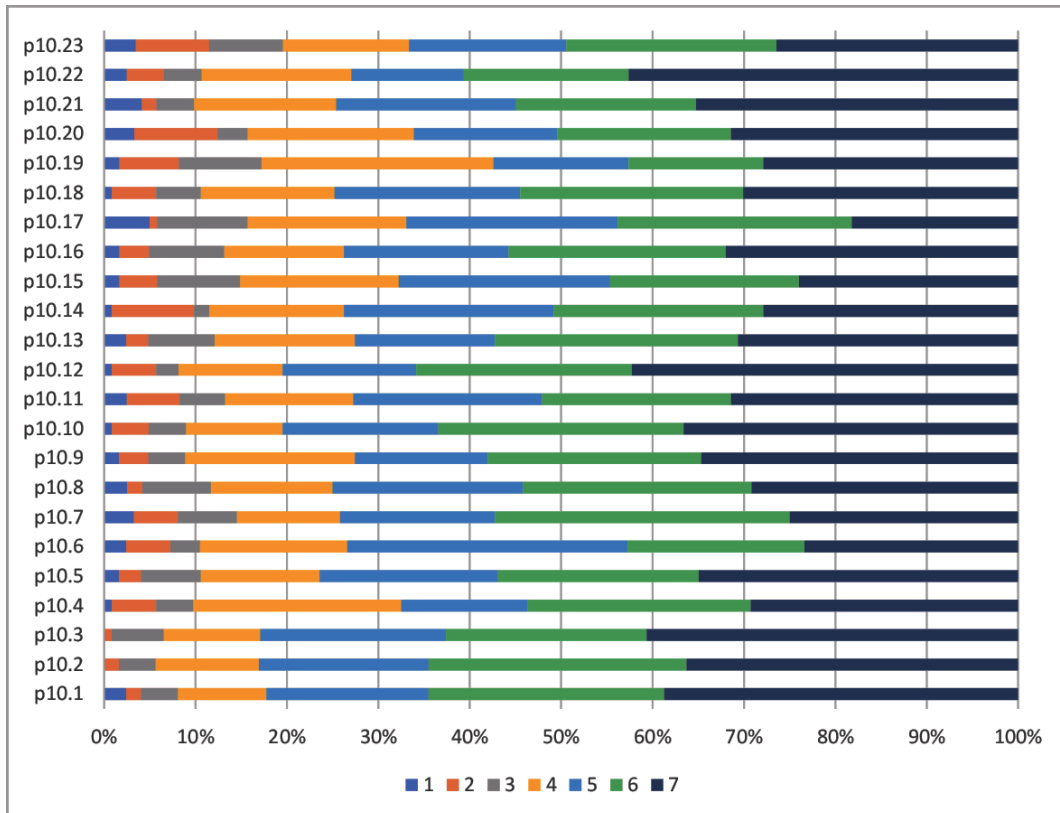


Figure 5. Importance of success factors for research projects – distribution of responses by members of the project team

- less than 10% members of the project team rated 22 of the 23 success factors as being of little or very little importance,
- only 0–5.7% of the respondents chose the answer not applicable to the success factors.

In the last question on the success factors of research projects, respondents were allowed to choose their own answers. As many as 75.5% of the respondents (project managers and members of the project team) in the group Other factors gave their own answer. Among the other factors were largely those indicative of the organization's pursuit of a sustainable approach to project management. These factors were related, inter alia, to social aspects such as the trust of colleagues, team acceptance, team cooperation, communication, interpersonal relations, atmosphere, help, support, commitment of project members, joy, pleasure, and customer trust. Some of the factors mentioned by the respondents were related to economic aspects such as money, earning a lot of money, and helpfulness. Among other success factors, there were also such factors as learning, matching the project to the client, ease of submitting applications, speed of implementation, and skillfully distributed time of each project participant.

4.3. Correlation of success factors for research projects with the size of the organization, age, and responsibility of the respondent

Correlations were analyzed with Spearman's rank correlations and shown on scatter plots with 95% confidence intervals (Figures 6, 9). A two-sided p value of <0.05 was considered statistically significant. All analyses were performed using R version 3.4.4 (R Foundation for Statistical Computing, Vienna, Austria).

The correlation of success factors was calculated for the three questions from the introductory part of the survey (Demographics): demographics1, demographics2, and demographics3. Correlation analysis was carried out for similar combinations for both the success factors (Table 3) and the criteria for assessing the success (Table 4) of research projects. The correlations regarding the success factors of research projects are shown in Figure 6.

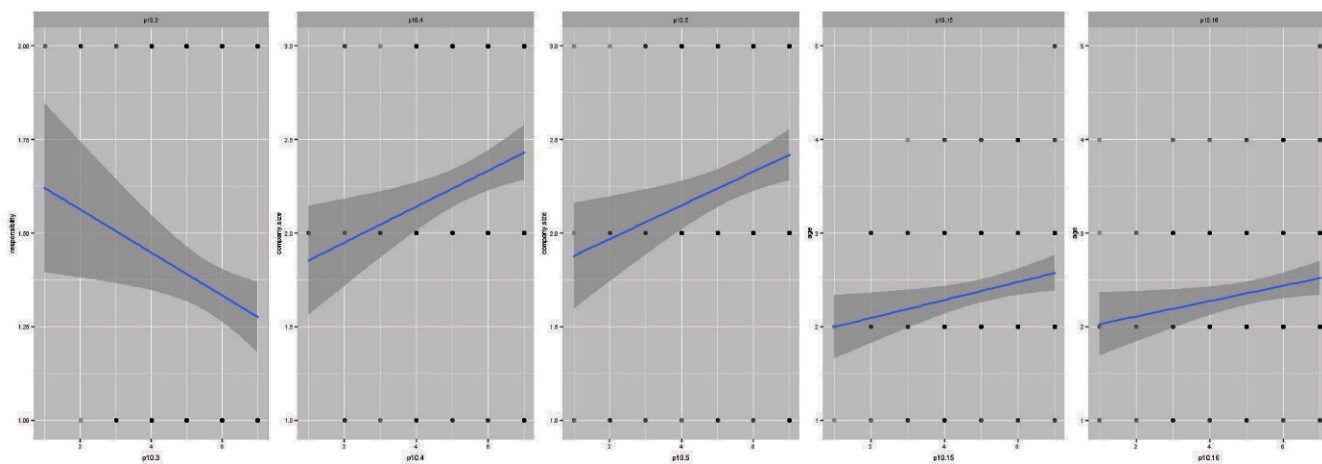


Figure 6. Correlation of success factors for research projects with the size of the organization, age, and responsibility of the respondent

Table 3 presents the results of the correlation analysis for success factors for research projects and their conclusions.

Table 3. Correlation of success factors for research projects with the size of the organization, age, and responsibility of the respondent

Factor No.	Success factors	Spearman's rank correlation	Conclusions
p10.3	Adequate financing, secured research and equipment facilities	$r = -0.14$; $p = 0.0469$	Factor p10.3 correlates significantly negatively with the respondent's responsibility in the examined project (the smaller the respondent's responsibility in the project, the greater the importance of the factor). Very low correlation.
p10.4	Involvement of scientists, their cooperation and focus on research	$r = 0.21$; $p = 0.0028$	Factor p10.4 correlates significantly positively with the size of the organization (the larger the organization, the greater the importance of the factor). Weak-to-low correlation.
p10.5	The team and its substantive skills	$r = 0.18$; $p = 0.0109$	Factor p10.5 correlates significantly positively with the size of the organization (the larger the organization, the greater the importance of the factor). Weak-to-low correlation.
p10.15	Invariability of partners in the consortium (no changes among partners involved)	$r = 0.15$; $p = 0.0430$	Factor p.10.15 correlates significantly positively with the age of the respondent (the older the respondent, the greater the importance of the factor). Very low correlation.
p10.16	Properly estimated duration of the project	$r = 0.14$; $p = 0.0446$	Factor p10.16 correlates significantly positively with age of the respondent (the older the respondent, the greater the importance of factor p10.16). Very low correlation.
p10.2	Other factors	$r = 0.16$; $p = 0.0489$	Other factors correlates significantly positively with the respondent's responsibility in the examined project (the higher the respondent's responsibility, the greater the importance of factor p10.23). Weak-to-low correlation.

After analyzing the correlation regarding the success factors of research projects, the following conclusions can be drawn:

- only 4 success factors correlated significantly positively with the age, the responsibility of the respondent, or the size of the organization, they were very low or weak to low correlations,
- only 1 success factor correlated significantly negatively with responsibility of the respondent, it was a very low correlation,
- the larger the organization, the greater the importance of Involvement of scientists, their cooperation, and focus on research and The team and its substantive skills,
- the older the respondent, the greater the importance of Invariability of partners in the consortium (no changes among partners involved) and Properly estimated the duration of the project,
- the higher the respondent's responsibility, the less importance of Adequate financing, secured research and equipment facilities and the greater the importance of Other factors.

4.4. Success criteria of research projects for assessing the success of this type of projects

A questionnaire was prepared (see Appendix) to carry out quantitative research into the success criteria of research projects based on the study described in the publications: [39, 42]. Figures 7 and 8 show to what extent each of the success criteria (p12.1–p12.18) was relevant for the research projects in which the project managers and members of the project team participated. The importance of the individual success criteria was

rated on a scale from 1 to 7 (i.e., from very low to very high importance). If a given criterion was not applied in the surveyed organization, the respondent marked the answer not applicable ⁴. That is, the higher the weight given by the respondents, the higher the importance of a given success criterion of research projects.

For greater clarity, the conclusions from Figures 8 and 9 along with the success criteria of research projects are given in Table 4.

Table 4. Success criteria of research projects with importance 6 or 7

Criterion No.	Success criteria for research project	Percentage of respondents	
		Project managers	Members of project team
p12.1	Publication	64.3	54.4
p12.2	Established cooperation	64.3	63.2
p12.3	Project deliverables	54.3	59.2
p12.4	Concept for the next project. generating ideas for the future	47.1	49.6
p12.5	Meeting the needs of end-users	48.6	51.2
p12.6	Scientific impact (recognition of the environment. prestige)	44.3	46.4
p12.7	Economic impact (as a result of the commercialization of research results)	42.9	47.2
p12.8	Social and political impact	45.7	47.2
p12.9	Completion of the project on time	54.3	56.8
p12.10	Completion of the project within the set budget	55.7	51.2
p12.11	Achieving the project goal	60	56
p12.12	Doctoral degrees	44.3	42.4
p12.13	Conference presentations	41.4	46.4
p12.14	Formation of a team thanks to a project	48.6	53.6
p12.15	Manager's satisfaction with the research carried out	51.4	54.4
p12.16	Patents	41.4	48.8
p12.17	Experience gained by scientists	44.3	48.8
p12.18	Substantive and financial settlement of the project. Acceptance of the final report	45.7	52

Source: Based on [8, 9].

After analyzing the results of the respondents' research in the area of the importance of the success criteria of research projects, the following conclusions can be drawn:

- over 50% of project managers rated 7 out of 18 success criteria as important or very important,
- more than 50% members of the project team rated 10 out of 18 success criteria as important or very important,
- for project managers, the three most important success criteria for research projects turned out to be publications, established cooperation, achieving the project goal,
- for members of the project team, the three most important success criteria for research projects turned out to be established cooperation, project deliverables, completion of the project on time,
- less than 10% of project managers rated 12 of the 18 success criteria as little or very little important,
- less than 10% of members of the project team rated 17 of the 18 success criteria as little or very little important,

⁴The figure shows only the answers of the respondents, determining the importance of individual success criteria of research projects on a scale from 1 to 7. For greater clarity, the above-mentioned drawing of respondents' answers if a given criterion was not applicable in their organization (answer not applicable).

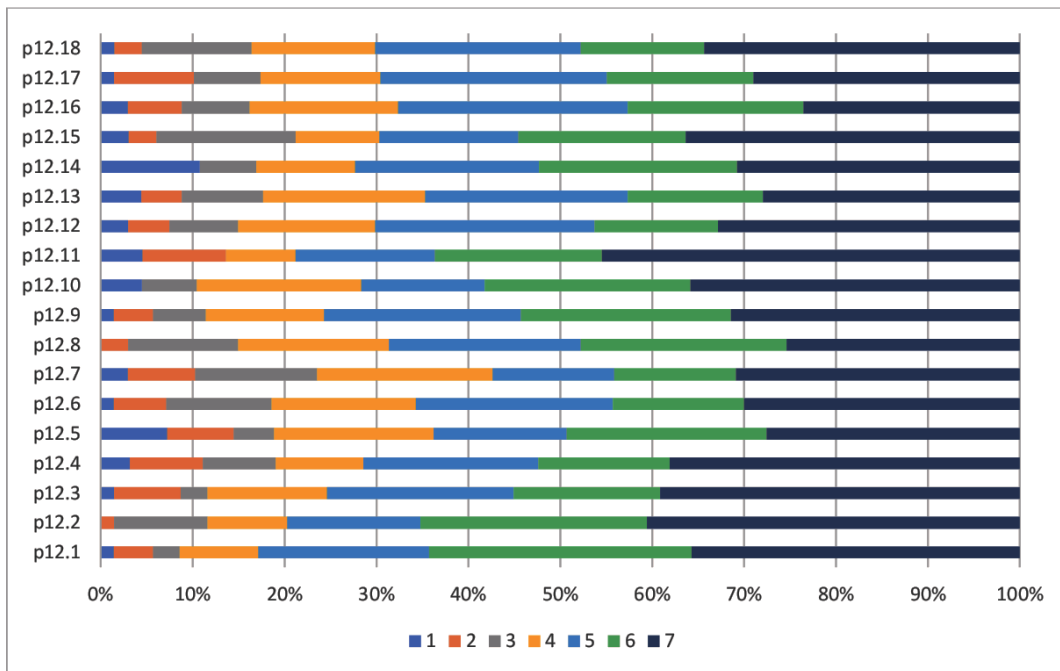


Figure 7. Importance of success criteria for research projects – distribution of responses by project managers

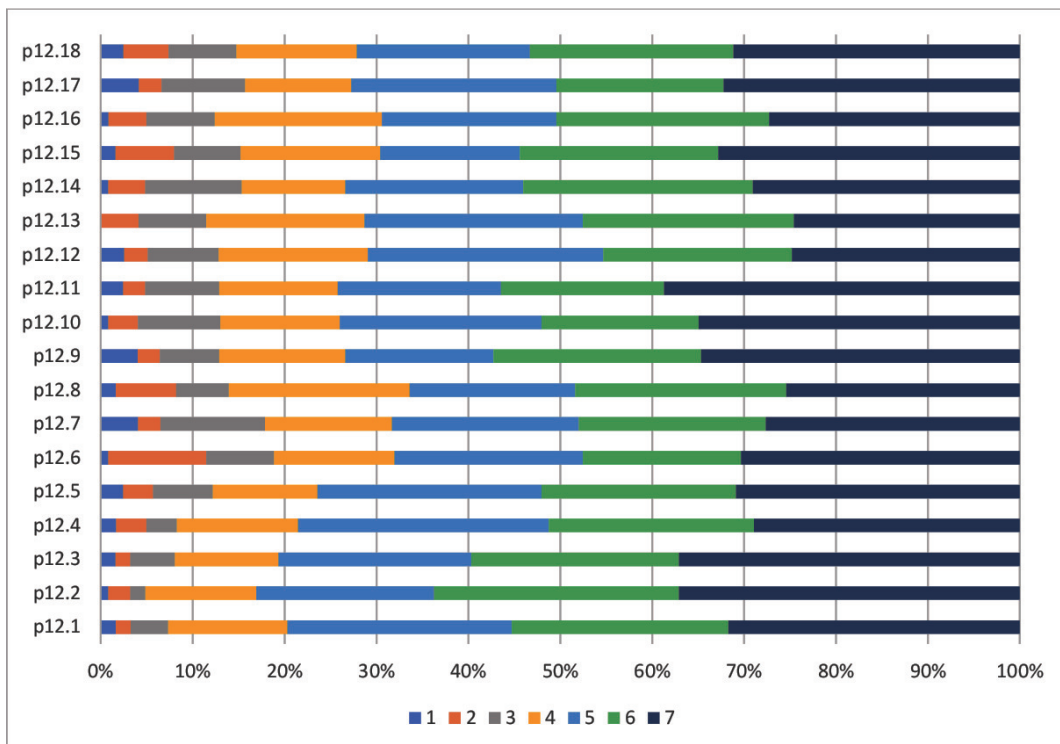


Figure 8. Importance of success criteria for research projects – distribution of responses by members of the project team

- only 0–5.7% of the respondents chose the answer not applicable to the success criteria given in the questionnaire.

4.5. Correlation of success criteria for research projects with the size of the organization, age, and responsibility of the respondent

Similar to success factors, the correlation of success criteria was calculated for the three questions from the introductory part of the survey (Demographics): demographics1 (the size of the organization), demographics2 (the age of the respondent), and demographics3 (the responsibility of the respondent). None of the success criteria correlated with the respondent's responsibility. The correlations regarding the success criteria of research projects are shown in Figure 9.

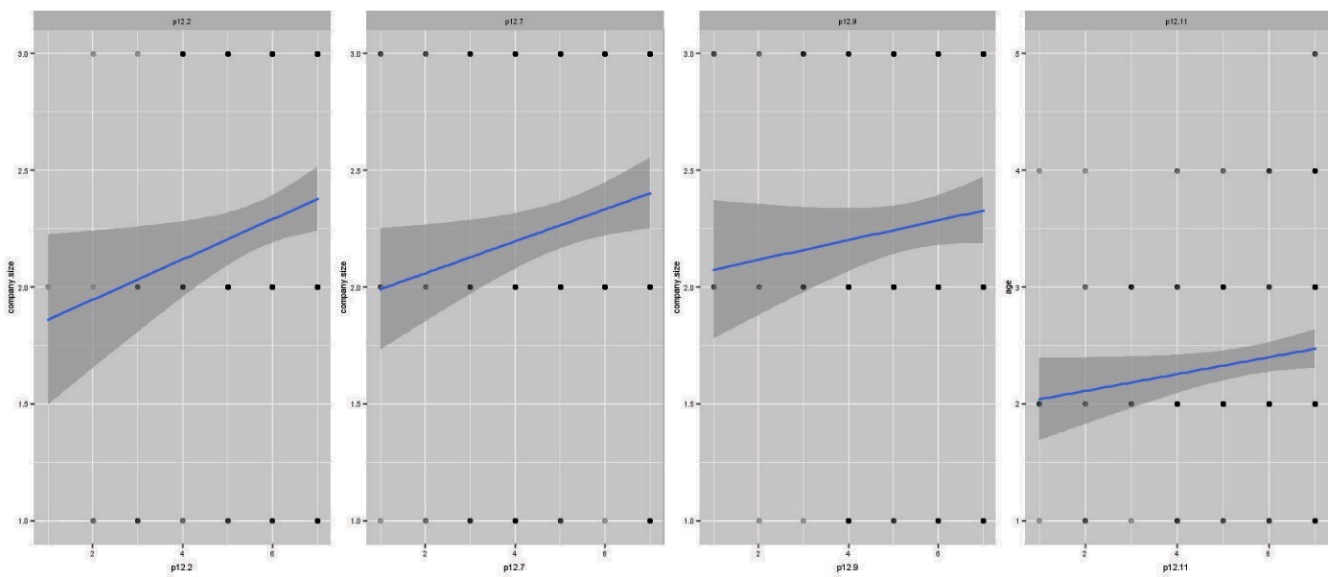


Figure 9. Correlation of success criteria for research projects with the size of the organization and the age of the respondent

Table 5. Correlation of success criteria for research projects with the size of the organization and the age of the respondent

Criterion No.	Success criteria	Spearman's rank correlation	Conclusions
p12.2	Established cooperation	$r = 0.15$; $p = 0.0410$	Criterion p12.2 correlates significantly positively with the size of the organization (the larger the organization, the greater the importance of the criterion). Very low correlation.
p12.7	Economic impact (as a result of commercialization of research results)	$r = 0.17$; $p = 0.0130$	Criterion p12.7 correlates significantly positively with the size of the organization (the larger the organization, the greater the importance of the criterion). Weak-to-low correlation.
p12.9	Completion of the project on time	$r = 0.14$; $p = 0.0470$	Criterion p12.9 correlates significantly positively with the size of the organization (the larger the organization, the greater the importance of the criterion). Very low correlation.
p12.11	Achieving the project goal	$r = 0.15$; $p = 0.0374$	Criterion 12.11 correlates significantly positively with the age of the respondent (the older the respondent, the greater the importance of the criterion). Very low correlation.

Table 5 presents the results of the correlation analysis for success criteria for research projects and their conclusions. After analysing the correlation regarding the success criteria of research projects, the following conclusions can be drawn:

- only 4 success criteria correlated significantly positively with the age of the respondents or the size of the organization, they were very low or weak-to-low correlations,
- no success criteria correlated with the responsibility of the respondent,
- the larger the organization, the greater the importance of Established cooperation, Economic impact (as a result of commercialization of research results) and Completion of the project on time,
- the older the respondent, the greater the importance of “Achieving the project goal”.

5. Discussion and conclusions

In the literature research, the authors of this manuscript found the answers to research questions (i) and (ii): What is project success and how can we measure it, also in research projects? Are project stakeholders (as the inclusion of a social aspect of sustainability approach) taken into account in measuring the success of projects, also in research projects? The main conclusions from the theoretical part include the following points:

- A project’s success will be associated with satisfying various stakeholders of the project.
- Opinions of different stakeholders in project management, including predicting the project’s potential for success or assessing the success of a project is an application of a sustainable approach to project management.
- There is a positive correlation between sustainable project management and project success.
- The topic of the success of research projects, their success factors or success criteria is not very extensive; do not deal with the distinctions from the perspective of the stakeholders in this type of project or were conducted as qualitative rather than quantitative studies.
- Success criteria (also related to the research project) can be divided into two groups: quantitative and qualitative.

Given the above, the article fills a research gap. Based on the quantitative research conducted on a sample of 200 organizations implementing research projects, the following conclusions can be drawn: a number of conclusions were drawn, which made it possible to answer the research question 3: Which research project success factors and success criteria are important according to different stakeholders of this type of project?

As mentioned earlier, for the purposes of this study, an analysis of success factors and criteria for the success of research projects was carried out, broken down by different stakeholders of this type of projects, i.e., project managers and project team members.

In the opinion of over 50% of project managers, 13 out of 23 success factors and 7 out of 18 criteria for the success of research projects were important or very important. For project managers, the three most important criteria for the success of research projects turned out to be publication, established cooperation, achieving the project goal.

In the opinion of over 50% of the project team members, 16 out of 23 success factors and 10 out of 18 research project success criteria were important or very important. For the members of the project

team, the three most important criteria for the success of research projects turned out to be: established cooperation, project deliverables, completion of the project on time.

It is worth noting that for both groups of stakeholders the three most important success factors of research projects turned out to be: efficient cooperation in the preliminary phase of the project, properly planned project tasks and proper allocation of resources, effective communication and information flow.

Among other factors of the success of research projects, which the respondents (project managers and members of the project teams) indicated in the study largely indicated the organization's pursuit of a sustainable approach to project management, what is highlighted in [15, 26].

The results obtained with regard to project success factors can easily be compared with the results described in [8, 9, 39], however, it should be emphasized that both studies presented there were qualitative and not quantitative studies (i.e. they involved a smaller number of research subjects). Our research therefore complements the existing state of knowledge on this topic.

In addition, the authors' research is a novelty due to the fact that the literature has tended to focus on identifying criteria for success of research projects [14, 39] rather than assessing their importance, especially in the opinion of different stakeholders, which is an expression of sustainable project management. At this point, it is worth adding that a significant part of the project's success criteria that have been assessed for importance in this publication coincide with those reported by the authors [14].

After conducting the correlation analysis regarding the success factors of research projects, several general conclusions can be drawn:

- The larger the organization, the greater the importance of Involvement of scientists, their cooperation and focus on research and The team and its substantive skills.
- The older the respondent, the greater the importance of Invariability of partners in the consortium (no changes among partners involved) and Properly estimated the duration of the project.
- The higher the respondent's responsibility, the less importance of Adequate financing, secured research and equipment facilities and the greater the importance of Other factors including mainly sustainable aspects.

However, after the correlation analysis of the success criteria of research projects, two general conclusions can be drawn:

- The larger the organization, the greater the importance of Established cooperation, Economic impact (as a result of commercialization of research results) and Completion of the project on time,
- The older the respondent, the greater the importance of Achieving the project goal.

It is also worth mentioning that most of the surveyed organizations (96.5%) identified stakeholders in their projects (apart from the project manager and the project team members). Due to the fact that the study concerned research projects, the organizations identified mainly: experts evaluating the results of the project, sponsors/financing institutions and administration supporting the service of the research project. This is in line with the specificity of this type of project.

The research sample was very diverse, taking into account the industry in which the surveyed organization operated. The largest number of organizations operated in the trade, services, and IT sectors, the remaining organizations operated in the public sector as well as in industry, construction, and production. The literature on the subject emphasizes a number of differences between research projects carried out

in various sectors of the economy, i.e. at universities, in industry and carried out in cooperation between universities and industry [17]. The authors are aware of these differences, but due to the thematic scope of the study, they have not been analyzed.

The research conducted by the authors shows that organizations identify and analyze stakeholders in research projects, thereby taking into account a sustainability approach. A sustainable approach is also visible in the opinions of respondents who, among other factors of the project success, including those related to social and economic aspects (from the perspective of the organization). Hence an important conclusion for the area of decision support in project management is that it is worth including the opinions of various stakeholders (from the researchers' perspective) when measuring the success of research projects.

The results of the research conducted by the authors may have a number of theoretical and practical implications.

From a theoretical point of view, our study makes two contributions to the literature. First, we found that different stakeholders assess the importance of success factors and criteria of research projects differently. In this way, we contribute to the development of literature on the success of research projects, reinforcing the need to take into account the views of various stakeholders when assessing the success of research projects. Secondly, we show that the project stakeholders proposed to include aspects related to the sustainable approach when considering the success factors of research projects. With this, we contribute to the literature that it is important to consider sustainable aspects when evaluating the success of research projects.

The results of this study also provide some managerial implications that have the potential to change the way research projects are currently managed. This study highlights the importance of different stakeholder groups in assessing the success of research projects and the need to consider sustainability aspects in this assessment. All results have cognitive value potentially useful for those who care about effective/sustainable project management. By predicting the potential of a project's success or assessing the success of a project already completed, answers to the questions formulated at the beginning of the article can be found, namely: should I start the project? should I quit the project? what are my chances of successfully completing the project? was my project successful? Persons interested in the results can be: managers of research projects, management of an organization carrying out research projects, heads of departments of such organizations including those dealing in particular with decision support, partners in a consortium or funding institutions of research projects.

However, the study conducted by the authors has a certain limitation, which is related to the size of the organization. Over 80% of the respondents who took part in the survey worked in medium and large organizations. Thus, the results of the conducted research may be used to a lesser extent by small organizations (employing less than 9 employees). In the future, it would be useful to conduct similar research in small organizations. Due to the fact that the research concerned Polish organizations, it would also be possible to carry out research on the success of research projects in other (more or less developed) countries and compare the obtained results.

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A. Appendix

A.1. Questions⁵

How important was each of the success factors listed for the research project in which you participated? Rate on a scale of 1–7. If a factor is not applicable in your organization, select NA.

Success factors	1	2	3	4	5	6	7	NA
1. Efficient cooperation in the preliminary phase of the project								
2. Properly planned project tasks and proper allocation of resources								
3. Adequate financing, secured research and equipment facilities								
4. Involvement of scientists, their cooperation and focus on research								
5. The team and its substantive skills								
6. Achieving benefits from research conducted by consortium partners								
7. Proper selection and involvement of consortium partners								
8. Choosing the right place for the project and introducing the rules for its implementation								
9. Leadership and management								
10. Strong, respectful relationships within the project team								
11. Equal distribution of time for research conducted in individual countries								
12. Effective communication and information flow								
13. User benefits of the project deliverables								
14. Flexible project implementation, constant monitoring and reviews								
15. Invariability of partners in the consortium (no changes among partners involved)								
16. Properly estimated duration of the project								
17. The influence of sponsors on the shape of the project								
18. The implemented project is a subsequent research collaboration								
19. The implemented project is a continuation of other research								
20. Adjusting the subject of the project to the development strategy of a given country								
21. Experience of the project leader in the implementation of projects within the consortium								
22. Sufficient trust in the team								
23. Other factors								

⁵The questionnaire also contained, inter alia, part on the phases of the project life cycle, because the research was part of a wider project Miniatura 4, financed by the National Science Center, entitled “A fuzzy model for assessing the success of research projects” (project number: 494893, 2020/04/X/HS4/01922).

