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Information systems project management success

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Abstract:
This paper aims to provide new insights into information systems (IS) project management success. Even though many studies found in the literature show results of software development projects, few studies address the success of IS (socio-technical) projects. Responses to an international survey, regarding 472 projects in total, showed that IS project management is achieving high levels of success; yet, only a minority of projects end without changes in scope, schedule or cost. Furthermore, the results show that changes in scope, schedule or cost are frequent in this kind of project and do not significantly affect the perception of success. These results provide researchers and practitioners with a better understanding of IS project management success evaluation.

Keywords:
information systems; information technology; project; project management; success; criteria; evaluation.

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1. Introduction

Project management success has been a hot topic in the scientific and practitioner literature for a long time [1-4]. However, it has been frequently reported and assumed that Information Systems (IS) projects show low levels of success [5-7]; some of the causes underlying such underachievement are [8]: project underestimation of resources; inadequate definition of requirements; changes in scope; failure to assess, control or manage risks throughout project execution; unrealistic expectations; inappropriate methodology, etc.

Even though there are well-known studies — for instance, the Standish Group's Chaos Reports [9, 10] — that show low levels of success, they typically focus on software development (technical) projects rather than on organizational IS (socio-technical) projects. Although these projects are often treated indiscriminately in the literature, it is important to differentiate them due to the specificities of organizational IS projects' activities, outputs, and outcomes (e.g., changes in business processes), which need to be considered in project management.

A primary goal of software development projects is to create Information Technology (IT) artefacts (e.g., software applications), which are typically mainly technical endeavors. Organizational IS have a different scope. An IS is a combination of intelligent agents (human and/or artificial), processes, and IT (hardware, software, and infrastructure) related to the dissemination and use of data, information, and knowledge in an organization. Accordingly, an IS project can be defined as a temporary endeavor undertaken to improve an organizational IS. In this sense, additionally to projects focused on software development (e.g., a project focused on developing a new digital game), in our study we assume that IS projects have implicit organizational interventions (such as the deployment of a commercial off-the-shelf application), which include placing IT artefacts in organizations — considering both social and technological aspects — where change management has a crucial role.

Even though many studies in the literature report on software development projects' results, few studies specifically address organizational IS (socio-technical) projects. In light of this, some interesting questions can be posed: Is the success achieved in IS project management similar to the success of software development projects? Is project management success of IS projects rigidly tied to fulfilling its scope, schedule, and cost baselines? Do changes in scope, schedule, and cost influence the overall perception on IS project management success?

This research addresses these questions by examining the project management success of IS projects, based on data from an international survey delivered to experienced IS project managers. Our study complements existing research by providing practitioners and researchers with new insights on project management success.

The paper is organized as follows. The following section summarizes the relevant literature on IS projects and project management success. The research design and methodology are described next. Then, the key findings and results are presented and discussed. Finally, we conclude with implications from this study for practice and research, limitations, and some highlights for further research.

2. Background

2.1 Information Systems Projects

Modern organizations face increasing complexity due to their business environment's higher volatility, uncertainty, and ambiguity [9]. In this context, IS play a central role in organizations and are present in almost every aspect of the business [10], being a business core asset essential to improve productivity, reduce operational costs, or gain competitive advantages.

In a rapidly changing business and technological environment, the ability to improve IS is an important aspect that can differentiate organizations from each other. Moreover, organizations must continuously innovate, and an organization's sustainable success is inextricably associated with the success of its IS projects [11].

Companies currently use IS to support their activities at all management levels, and few of them try to conduct their businesses without seeking to exploit the advantages provided by IS. With the increasing complexity of organizations, projects are also becoming more complex [12]. Currently, an IS project can assume many sizes and forms, including implementation of ERP (Enterprise Resource Planning system), CRM (Customer Relationship Management system), SCM (Supply Chain Management system), BI (Business Intelligence system), and ERP modules. IS projects also include custom systems development, systems improvement, process improvement using IT, systems migration, infrastructure enhancement, consultancy, and others [13]. The development/implementation type can vary from customized development to COTS (commercial off-the-shelf)/packaged software implementation.

Even though an IS project can include software development, our study makes a primary distinction by positing that organizational IS projects have implicit organizational interventions thus requiring a socio-technical approach [14].

2.2 Project Success and Project Management Success

The complexity and ambiguity surrounding the definition and measurement of project success [15, 16] have been recognized as a problem since awareness of success has evolved [17]. This is due, for instance, to potentially different perspectives on success by project stakeholders [18].

Two distinct components of project success can be considered [19]: Project Management (PM) success; and the success of project deliverables. The two components are differentiated as follows. PM success focuses on the management process and mainly on the project's successful realization regarding scope, schedule, and cost. These three dimensions indicate the degree of efficiency and effectiveness of project execution. The success of deliverables focuses mainly on the effects of the project's resulting products and services in the post-project stage.

Even though success of PM and success of deliverables are not mutually dependent, unsuccessful PM may jeopardize the success of deliverables. Therefore, the project and its resulting outputs cannot be viewed isolated [20]. Typically, reports on success found in the literature are mainly focused on PM success.

In the case of software development, the projects have not been synonymous with "success" in the last decades [21]. In fact, the software development area often seems to be captive of its failures [22], and this perception is widespread [16]. The Standish Group reports are a landmark in the development of this vision of "failure." This entity has published the first "Chaos Report" in 1994 [23] and, despite the study focused on software development projects, the truth is that the reported results were extrapolated to IS projects in general. Over time, with the periodic publication of the reports, the idea has persisted that projects are problematic and that the levels of failure continue practically unchanged, leading to the conclusion that this critical situation is still unravelling [20]. For instance, the Chaos Report 2020 [24] shows that only 31% of projects are successful, 50% are challenged (e.g., fail in scope, schedule, or results), and 19% fail.

Although these studies are often cited [25], several researchers have questioned them [26-28], due, for instance, to misconceptions about the definition of success and failure. Albeit this criticism of the Standish Group, other authors have reported evidence on high levels of project failure — e.g., Jørgensen and Moløkken-Østvold [28], Cuthbertson [29], Yong, et al. [30], and Iriarte and Bayona [7]. Considering that most studies found are related to software development projects, our research addresses the gap in the literature by focusing on the success of IS (socio-technical) project management.

3. Method

Our method involved administering an online survey to IS project managers. The data were analyzed using descriptive and inferential statistics.

3.1 Measurement Instrument

We used a survey instrument (questionnaire) to measure several aspects of IS Project Management success. We asked participants to consider the last three to five projects they had been involved in and to indicate the characteristics, level of success achieved, and compliance with the scope, schedule, and cost verified in each of those selected projects.

All items used a Likert scale. For "scope", "schedule", and "cost" we used a similar scale. For instance, the scale regarding scope was as follows: "Scope not fulfilled;" "Scope fulfilled WITH changes to the original plan;" "Scope fulfilled WITHOUT changes to the original plan." The "level of success" was measured using a bipolar semantic differential continuous line scale. For analysis purposes, the line was divided into eleven equal sections and coded from 0 ("project abandoned") to 10 ("complete success").

The context validity of the questionnaire was examined before starting the survey. Two professors of IS and PM, and nine IS project managers pilot-tested the surveys. The results indicated a few minor refinements, which were then made to the final questionnaire.

3.2 Data Collection

Our sample of IS project managers was primarily drawn from the worldwide community of LinkedIn users. A discussion topic with a link to the online survey was posted in several groups of PM and IS. Additionally, follow-up emails were sent to project managers and chief information officers (holding project management duties), with information about the survey and a link. A total of 111 responses were obtained. Since four of the responses were incomplete and unusable, in our analysis we used a final number of 107 complete responses, representing a total of 472 IS projects (each respondent reported three to five projects).

Table 1 summarizes the demographics of the respondents, who consisted mainly of project managers (52.3%) and chief information officers (19.7%), all of them with experience in PM. The majority of respondents are over 40 years old (71.1%) and have more than ten years of experience (58%), whereas 18.7% have more than 20 years of experience. Finally, 93.5% of the respondents indicated that they held graduate or postgraduate degrees.

Table 1. Profile of project manager respondents

	Frequency	**Percent**
Gender		
Male	85	79.4
Female	22	20.6
Age		
27 – 40	32	29.9
41 – 50	48	44.9
> 50	27	25.2
Education		
Undergraduate	7	6.5
Graduate	40	37.4
Postgraduate	60	56.1
Education area		
Informatics	20	18.7
Information Systems	39	36.5
Business Management	27	25.2
Other	21	19.6
Training or certification in project management		
Yes	70	65.4
No	37	34.6

	Frequency	Percent
Current position		
Project manager	56	52.3
Chief Information Officer / IT Director	21	19.7
Director / Manager	15	14.0
Other	15	14.0
Average years in the position		
1 – 10	23	21.5
11 – 20	45	42.1
> 20	39	36.4
Average years in project management		
1 – 5	13	12.1
6 – 10	32	29.9
11 – 20	42	39.3
> 20	20	18.7
Number of projects as project manager		
< 11	25	23.4
11 – 30	42	39.2
> 30	40	37.4

Table 2 summarizes the characteristics of the respondents' companies. The respondents came from organizations of different sizes (small, medium, and large). Many of those companies align their PM methodology with PMBOK (37.4%), while only 12.1% use a PM maturity model to improve their PM practices. The sample is split evenly in several contextual variables (e.g., total employees and turnover), rendering the analysis more reliable. The majority of those companies have headquarters in Europe (62.6%) and North America (23.4%), and an international presence (60.7%). To sum up, the respondents are experienced project managers representing various company sizes and PM approaches.

Table 2. Profile of respondents' companies

	Frequency	Percent
Total employees		
1 – 200	33	30.8
201 – 500	20	18.7
501 – 2000	22	20.6
> 2000	30	28.0
Did not know / Did not answer	2	1.9
Turnover		
< 1.000.000	15	14.0
1.000.000 – 10.000.000	19	17.8
10.000.001 – 250.000.000	24	22.4
> 250.000.000	23	21.5
Did not know / Did not answer	26	24.3
Headquarters		
North America	25	23.4
Europe	67	62.6
Other	15	14.0
Number of countries where it is present		
1	42	39.3
2 – 10	36	33.6
> 10	29	27.1
Certifications		
Yes	50	46.7
No	57	53.3

	Frequency	Percent
Project management approach/methodology		
PMBOK or Custom (based on PMBOK)	40	37.4
Custom (based on various methodologies)	26	24.3
It is not used a formal methodology	22	20.5
Other	19	17.8
Uses a project management maturity model		
Yes	13	12.1
No	94	87.9
Main software used in project management		
MS Project	55	51.4
MS Excel	20	18.7
Custom	13	12.1
Other	19	17.8

3.3 Data Analysis

The data collected through the questionnaire survey were analyzed using the Statistical Package for the Social Sciences (SPSS) software package.

The statistical tests included One-way ANOVA (and Levene's *F* test), Kruskal-Wallis, and Mann-Whitney. These tests were selected considering the number of variables, the type of measurement and number of levels of variables (of the dependent and independent variables), and compliance with statistical assumptions.

One-way ANOVA should be used when the dependent variable is normal/scale data, and the independent variable has three or more levels or groups. The assumptions of the test are: observations are independent; variances on the dependent variable are equal across groups; the dependent variable is normally distributed for each group. Levene's *F* test for the assumption that the variances of the groups are equal.

As nonparametric tests, Kruskal-Wallis and Mann-Whitney were selected when the assumptions for using parametric tests were violated (e.g., normal distribution of variables).

The Kruskal-Wallis test should be used when the dependent variable is clearly ordinal or parametric assumptions are markedly violated, and the independent variable has three or more levels or categories/groups/samples.

The Mann-Whitney test should be used when the dependent variable is clearly ordinal or parametric assumptions are markedly violated, and the independent variable has two levels or categories/groups/samples.

4. Results and discussion

4.1 Information Systems Projects

We asked project managers to characterize the last projects they had participated in. Each of them reported three to five projects, which are summarized in Table 3. They were involved in projects of varying types, costs, and durations. Almost 42% of the projects were related to implementing ERP/CRM systems, 19.3% to the implementation of custom systems, and the remaining to BI implementation, process improvement, and others (e.g., system maintenance). The development/implementation type was mainly customized development (41.9%) and implementation of packaged software/commercial off-the-shelf (COTS) together with customized development (31.6%). Regarding project duration, slightly more than half of the projects (54.1%) lasted up to nine months, and the mode duration of a project was six months. Concerning budget, the reported projects present a wide range of project sizes, including projects with a budget less than 25K EUR to projects with budgets of more than 2M EUR (the majority of projects had a budget of fewer than 250K EUR).

Table 3. Project characteristics

	Frequency	Percent
Project type		
ERP implementation	83	17.6
CRM implementation	37	7.8
BI implementation	44	9.3
ERP module implementation	78	16.5
Custom system implementation	91	19.3
Process improvement	41	8.7
Other	98	20.8
Development/implementation type		
Customized development	198	41.9
Packaged software / COTS	82	17.4
Customized development and packaged software / COTS	149	31.6
Other	43	9.1
Project Duration (in months)		
1 - 3	82	17.4
4 – 6	118	25.0
7 – 9	55	11.7
10 – 12	94	19.9
13 – 24	89	18.9
> 24	34	7.2
Project Budget (in EUR)		
< 25.001	71	15.0
25.001 – 50.000	61	12.9
50.001 – 100.000	63	13.3
100.001 – 250. 000	62	13.1
250.001 – 500.000	57	12.1
500.001 – 2.000.000	70	14.8
> 2.000.000	57	12.1
Did not know / Did not answer	31	6.6

4.2 Information Systems Project Management Success

As shown in Figure 1, IS Project Management is achieving high levels of success, with the majority of projects at the top levels (52.1% of the projects are in the ninth and tenth levels, meaning that the ten is a complete success), and only 16.1% are below level 7. Concerning the projects below the middle point (5), the percentage drops to 7.4%.

These results contradict the general idea regarding IS projects' success. The differences may be due to several reasons. They may be related to the types of projects implemented, or to evaluation criteria and evaluation models used. For instance, the classic definition of success contained in the well-known Standish Group's Chaos Reports is [23]: "The project is completed on-time and on-budget, with all features and functions as initially specified." More recently, project success was redefined by the Standish Group to "on time, on budget, with a satisfactory result" [31] and a project is considered "challenged" if it fails just one criterion.

Figure 2 shows the obtained results regarding accomplishment of scope, cost, and schedule in IS projects. Overall, IS projects are being completed according to the defined scope, schedule, and cost of the surveyed cases, respectively at 94.1% (39.8%+54.3%), 87.5% (37.9%+49.6%), and 89.8% (50%+39.8%). However, in most cases, such accomplishment is not related to the original plan. When considering the initial plan, the results drop to 39.8% in the case of scope, 37.9% in the case of schedule, and 50.0% in the case of cost.

Putting these criteria together, the total number of 123 projects (26.1%), i.e., about one-quarter of the projects, simultaneously fulfilled scope, schedule, and cost without changes to the original plan. This shows that in IS Project Management, fulfillment of scope, schedule, and cost is not rigidly tied to the initial plans.

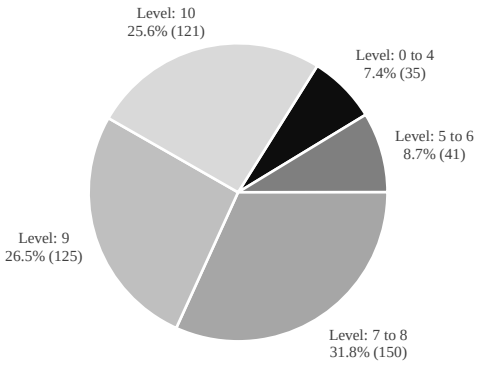

Figure 1. Level of success achieved in IS project management

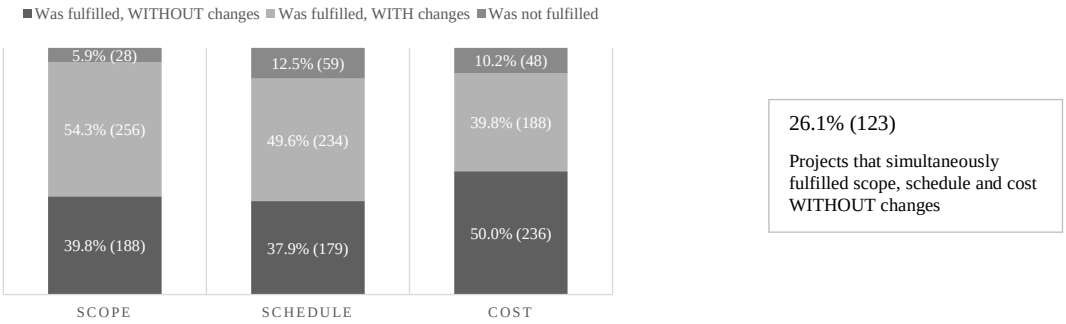

Figure 2. Compliance with Scope, Schedule, and Cost in IS project management

4.3 Information Systems Project Management Success and Fulfillment of Scope, Schedule, and Cost

We tested scope management, time management, and cost management independent variables with the dependent variable project success to analyze if differences in the level of success are related to fulfillment of scope, schedule, and cost (WITH and WITHOUT changes).

We used one-way ANOVA to compare the three levels of *scope management* on the dependent variable *project success*. Levene's *F* test result was p=0.206 (not significant), so the assumption was not violated. Since the assumptions were not violated, the ANOVA test could be used. A statistically significant difference was found among the three levels of *scope management* on *project success*, F (2, 469) = 92.658, p<0.001. The mean *success* is 4.1011 for projects where "the scope was fulfilled WITHOUT changes to the original plan", 3.3555 for projects where "the scope was fulfilled WITH changes to the original plan", and 1.5 for projects where "the scope was not fulfilled".

We used the nonparametric Kruskal-Wallis test to compare the three levels of *schedule management* on the dependent variable *project success* since Levene's *F* test (p=0.004) was significant (so the homogeneity of variance assumption was violated). The results (*Chi-Square*=1.754, p=0.416) show that there is no overall difference among the three groups of *schedule management*. Nevertheless, the mean rank for projects where "the schedule was fulfilled WITHOUT changes to the original plan" is greater than for projects where "the schedule was fulfilled WITH changes to the original plan" or "the schedule was not fulfilled" (respectively, 8.00, 5.33, and 5.00).

We used one-way ANOVA to compare the three levels of *cost management* on the dependent variable *project success*. Levene's *F* test (p=0.851) was not significant, so the assumption was not violated. A statistically significant difference was found among the three levels of *cost management* on *project success*, F (2, 469) = 83.534, p<0.001. The mean

success is 3.9746 for projects where "the cost was fulfilled WITHOUT changes to the original plan", 3.4096 for projects where "the cost was fulfilled WITH changes to the original plan", and 1.9375 for projects where "the cost was not fulfilled."

A Mann-Whitney test was used to investigate whether projects where "scope, schedule, and cost were fulfilled WITHOUT changes to the original plan" differ from the other projects regarding achieved success. This nonparametric test was selected since Levene's *F* test (p=0.009) was significant (so the homogeneity of variance assumption was violated). The results obtained (Mann-Whiney U = 10126, Wilcoxon W = 71201, Z = -9.031, p<0.001) indicate that there is a significant difference between groups. The mean rank for the group "scope, schedule, and cost were fulfilled WITHOUT changes to the original plan" is 328.67 (N=123), and the mean rank for the other group is 204.01 (N=349).

Table 4 presents a summary of the statistical tests' results.

Table 4. Level of success and fulfillment of scope, schedule, and cost

Variables	**Scope**	**Schedule**	**Cost**	**Scope, Schedule, and Cost**
Statistical test	One-way ANOVA	Kruskal-Wallis	One-way ANOVA	Mann-Whitney
Fulfilled WITHOUT changes	4.1011	8.00	3.9746	328.67 (N=123)
Fulfilled WITH changes	3.3555	5.33	3.4096	204.01 (N=349)
Not fulfilled	1.5	5.00	1.9375	
Results	Difference found	Difference not found	Difference found	Difference found
	F (2,469)= 92.658, p<0.001	Chi-Square= 1.754, p=0.416	F (2,469)= 83.534, p<0.001	Mann-Whitney U=10126, Wilcoxon W=71201, Z=-9.031, p<0.001

Additionally, we used one-way ANOVA to compare the levels of *project type* on the dependent variable *project success*. Levene's *F* test (p=0.298) was not significant, so the assumption was not violated. A statistically significant difference was found among the levels of *project type* on *project success*, F (6, 465) = 2.892, p<0.009. The project types showing a higher mean are "Business Intelligence implementation" (3.7955), "ERP module implementation" (3.6667), and "Other projects" (3.8367). This may be due to the fact that these projects usually have a smaller scope than "ERP implementation" or "CRM implementation". However, further studies are required to explore this result.

4.4 Summary and Discussion of Main Results

Figure 3 presents a summary of the achieved results, answering the underlying research questions. On the one hand, the results show that IS projects are achieving high levels of success, a finding that counters the taken-for-granted assumptions that many IS projects fail. It should be noted that in our study we address organizational IS (socio-technical) projects.

On the other hand, only a small percentage of projects (26.1%) end up fulfilling scope, schedule, and cost without changes to the original plan. It is normal in IS projects to have changes in scope, schedule or cost, so those changes, if justified, do not hinder project management success [4]. This is understandable, since these changes are often due to business vicissitudes during project implementation (i.e., beyond the control of the project) or to the characteristics of projects, which are increasingly organized in an agile way.

Notwithstanding, the projects with higher levels of success are those where scope, schedule or cost is fulfilled without changes to the original plan. Thus, changes in scope or cost may have implications in the levels of success achieved. For instance, even changes well justified and beyond the project manager's responsibility may have negative consequences on program or portfolio management, impacting other projects or business initiatives and ultimately affecting the results.

Comparing these results with the Standish Group's Chaos Report 2020 [24], there are obvious differences, but also similarities. First of all, the idea of success is quite different, since our study shows higher levels of success. However, when taking the Standish Group's definition of success strictly, the results are quite similar (26.1% in our study vs. 29% of successful projects in the Chaos Report 2020).

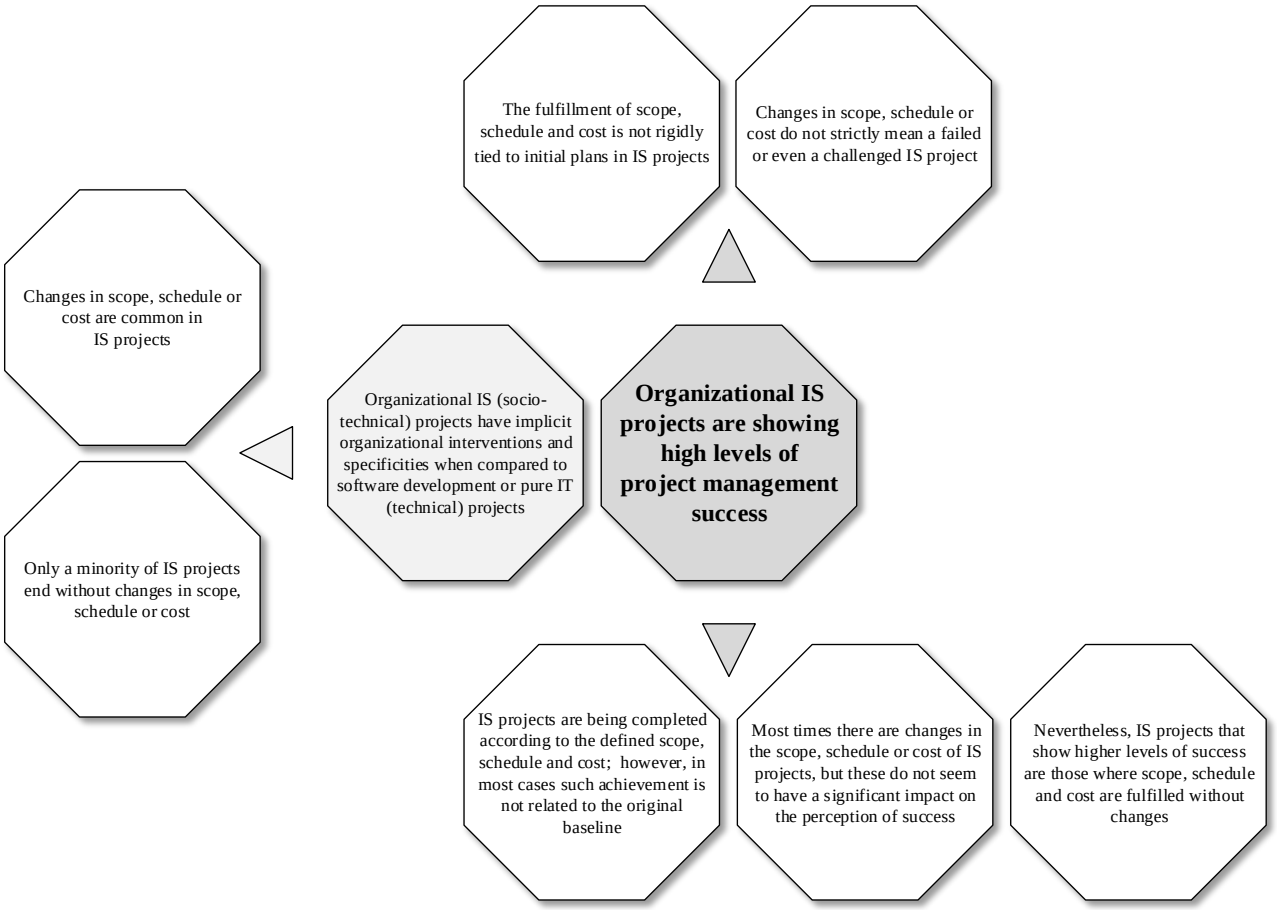

Figure 3. Summary of results

5. Conclusion

This study has significant implications for practice, research, and education, providing new insights into IS Project Management success. The obtained results challenge the general idea that IS projects are "problematic endeavors". On the contrary, organizational IS Project Management is showing high levels of success, and changes in scope, schedule, and cost do not entail a failed or even a *challenged* project, i.e., fulfillment of scope, schedule or cost is not rigidly tied to the original baseline, since the project's targets evolve along the life cycle. Since changes are common and normal in IS projects, project management methodologies should be designed and adopted by taking this into account.

Before discussing directions for future research, it is necessary to point out the limitations of this study. It represents an advance regarding earlier work, but still has some limitations. Similarly to other studies, one such limitation is that it relies on self-reported evidence of recent experiences of project managers. This means that each project that is included

in this study relies on the memory of one project manager responsible for the project. It would be interesting to contrast the various stakeholders perceptions (e.g., senior management), since they may have different perspectives on the reported success. Regarding the sample, most participants are from Europe (62.6%) and North America (23.4%). Consequently, the obtained results are relevant in the case of the surveyed companies at the moment of data gathering. Only through further research can the results be generalized (concerning other/all similar projects executed around the world).

One avenue for future research would be to examine in detail the results of IS projects, aiming to answer several new questions that arose from this research: What criteria are being used in IS projects practice to evaluate success besides the traditional "Iron Triangle"? Do these criteria differ from project to project? Since changes in scope, schedule, and cost do not seem to compromise the project's overall success, how are these changes justified and negotiated with stakeholders? Do some types of projects (e.g., BI projects) show higher levels of success? It would also be an interesting avenue to study the perspectives of several stakeholders regarding success — for instance, to analyze whether the impact of changes on success is perceived similarly by all of them.

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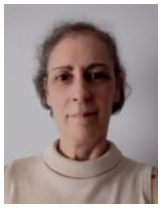

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