A DETAILED ANALYSIS OF EXISTING PROJECT SUCCESS FACTORS

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The quest for knowledge about which factors influence project success has long been at the centre of attention of the project management community. This quest has produced an enormous number of success factors claimed to assist project professionals. This study is built on the results of 100[2] empirical and theoretical papers written on project success factors published since the late 1960s and aims to take them one step farther and establish their implications through categorising and statistically analysing them, in addition to explaining the underlying trends that exist for changes of success factors over time. Papers have been sorted into 4 groups: construction, IT/IS, new product development (NPD) and general. This classification will help this study to answer the following questions: What are the most repeated success factors in each category? What are the relationships between success factors from different types of projects? How has researchers' focus on project success factors changed over time? Through answering these questions, this paper identifies the fundamental differences between types of projects and warns practitioners that missing the most relevant success factors might lead to focusing on misleading areas of projects. It also reveals that general papers, constituting the majority of papers written on success factors, are not impartial and their results are biased in favour of IT/IS and NPD projects (that were identified to have more similar success factors), hence factors obtained from them are less applicable to the construction industry; something that needs to be considered by researchers in the construction management field. Furthermore, this paper highlights the change in researchers' focus on success factors from those related to the project team and management level to higher levels of the organisation and external environment. The main contribution of this paper is to identify the above hidden implications of papers written on project success factors.

Keywords: project success, statistical analysis, success factors.

INTRODUCTION

One can claim that project success is one of the most investigated subjects in the project management field, starting since results of projects were first assessed in the 1960s and continuing until the present day. Despite this, it still remains a controversial issue because of different judgments of project stakeholders on definitions of success. The definition of success is very much dependent on answers to following questions: for whom? using what criteria? and during what time period? (Morris 1983). Most of studies on project success have focused on two major areas: project success criteria and project success factors which cause a project to succeed or fail. The relationship between these two aspects and practitioners' perception of them have been scrutinised in the literature (Ghasabeh and Chabok 2009; Gunathilaka *et al* 2013; Lim and

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Mohamed 1999). Baccarini (1999) defines project success criteria to be the measures determining a project's success or failure and project success factors to work as facilitators of achieving success. He later co-authored a paper (Collins and Baccarini 2004) which showed that time, cost and quality (the iron triangle) are still the most cited success criteria by practitioners. Collins and Baccarini (2004), in addition to many more authors (McLeod *et al* 2012; Wit 1988; Bourne 2007; Rahschulte and Milhauser 2010; Woodward 2005; Atkinson 1999; Nelson 2005), have encouraged the project management community to extend their traditional definition of success criteria from the iron triangle to include other factors such as project stakeholders' requirements. As Cooke-Davis (2002) asserts, one method of doing so is to distinguish between the success of the project management process (under the control of the management team, e.g. on time completion) and the project itself (usually outside the control of the management team, e.g. products match users' business values). Jugdev and Muller (2005) accentuate the same point by raising the issue of effectiveness (considering goals and objectives of users' organisations) as well as the efficiency of the project management process in achieving success. As a consequence, there has been a shift in focus from the iron triangle to a wider spectrum of parameters, such as benefits to stakeholders and end users, illustrated by Ika (2009) through a review on papers related to project success.

The same also applies to project success factors, on which this paper is mainly focused. Morris (2013) defines success factors as those that *"need to be managed in order for project management to be successful in performing its delivery function"*. Clarke (1999) claims that benefiting from project success factors as means of focus on the main problems can considerably increase the effectiveness of project management. Similar to project success criteria, there is no consensus on project success factors among researchers. An extremely high number of factors have been mentioned in the literature during the past five decades, making it really difficult for practitioners from different industries to consider them in their projects. In order to address this issue, through reviewing and summarising existing knowledge, some researchers published a number of papers that are discussed below.

Belassi and Tukel's (1996) paper was one of the first to review previously produced success factors and categorise them into four groups of project, project manager and team members, organization and external environment in order to create a framework of success factors. Ika (2009) identified a trend for papers written on project success factors showing that for the first two decades (1960s-1970s) most factors were based on anecdotal evidence. This changed during the next two decades (1980s-1990s) when empirical evidence obtained from opinion surveys or case studies was used in creating frameworks of success factors to be deployed by practitioners. The progression continued towards more sophisticated and inclusive frameworks and more specific success factors in the 21st century. Ghasabeh and Chabok (2009) reviewed 57 papers in search for most repeated success criteria and factors regardless of type of industry and concluded that top management support is the most important factor for project success. One recent study was the one by Gunathilaka *et al*. (2013) who extracted the most repeated success factors of construction projects mentioned in previous studies.

Although the outcomes of all of the above research benefit the project management community, there is a lack of comparison of most repeated success factors obtained in various types of projects that sometimes need different project management practices. The only study that does so is the one by Pinto and Covin (1989), although their work is limited to only one set of factors. They compared success factors of two very

different types of projects (R&D and construction) and indicated that whereas they have some similar success factors, some others are completely different. This lack of research contradicts the findings of Dvir *et al*. (1998) and Shenhar *et al*. (2002) who showed a close connection between project success factors and types of project. There is also a lack of research on the possible trends in respect of changes in the identified success factors during the past five decades. This study attempts to bridge the above knowledge gaps.

METHODOLOGY

In order to address the mentioned shortcomings, 100 peer-reviewed papers, published in a variety of journals and conference proceedings, all written about the influential factors affecting project outcome, were selected. Factors cited in these papers stemmed from their authors' personal experience, case studies and opinion surveys. Each paper falls into one of the four categories of: construction projects (21), IT/IS projects (19), new product development (NPD) projects (17) and general (43) (unconcerned with the type of project). As Shenhar and Renier (1996) mention, the best way to categorise projects is to do this in accordance with their technological complexity and scope size. Regarding this, these three types of projects were chosen because of their different levels of technological complexity and uncertainty in general. The type *"general"* was also taken into account to check whether papers without any orientation towards a specific type of project produce neutral success factors or are biased towards a type of project. After extracting influential factors from chosen papers, they were combined into 35 more generic factors because of the high number and variety of original factors detected. The number of repetitions of each factor was calculated, statistically analysed and used to understand the possible implications with respect to types of projects and changes over time.

ANALYSIS AND DISCUSSION

What are the most repeated success factors in each category?

Tables 1 and 2 show all 35 success factors and their rankings based on number of repetition in each type of project and the total number of repetitions regardless of industry respectively. Note that each of these factors consists of a number of more specific factors originally mentioned in the analysed papers. For example, stakeholder management (SM) encompasses all factors related to the relationship between a project and its stakeholders from their product requirements' management to information needs. As can be noticed, there are some similarities and differences in the order of the more repeated success factors among various types of projects. For instance, while scheduling/planning (S/P) is among the top 5 for all types, procurement management (PRM) and marketing (MAR) are specifically ranked higher for construction and NPD projects respectively. The data summarised in Table 1 stress the significance of selecting the appropriate success factors in accordance with the type of project because of their fundamental differences. They demonstrate that there is no complete list of success factors to be deployed by all projects and the type of project must be taken into account when selecting the areas of focus to achieve success in managing projects.

Table 1: 35 success factors ranked from highest to lowest number of repetitions in each category

No	General		IT/IS		NPD		Construction	
1	Stakeholder Management (SM)	15	SM	16	TM	8	PRM	14
2	Top Management Support (TMS)	14	S/P	12	MAR	7	COM	13
3	Communication (COM)	13	CM	11	O/G	6	SM	13
4	Scheduling/Planning (S/P)	12	TM	11	QM	6	S/P	12
5	Project Manager/Management Role (PM)	12	BV	11	S/P	5	TM	12
6	Leadership (LEA)	12	M&C	9	PR	5	M&C	10
7	Team Members' Characteristics (TM)	11	TMS	9	SM	5	ENV	9
8	Clear Objectives/Goals (O/G)	10	O/G	9	TMS	5	PM	8
9	Change Management (CM)	8	TECH	8	CUL	5	RM	7
10	Risk Management (RM)	8	COM	7	BV	5	TECH	7
11	Monitoring & Control (M&C)	8	RM	6	TECH	4	TEM	7
12	Level of Authority (LoA)	8	PR	5	DEM	4	LEA	6
13	Organisational Culture (CUL)	8	FS	4	PM	3	TMS	6
14	Problem Solving (PS)	7	LEA	4	COM	2	FS	5
15	Project Review (PR)	7	PM	4	FS	1	LoA	5
16	Clear Business Vision (BV)	7	CUL	4	LEA	1	CCH	5
17	Quality Management (QM)	6	QM	4	LoA	1	POL	4
18	Organisational Structure (OS)	6	CONF	3	M&C	1	PS	4
19	Technology (TECH)	5	DEM	3	CM	0	O/G	4
20	Project Specifications (PSP)	5	OS	2	DM	0	PSP	4
21	Configuration Management (CONF)	5	SOF	2	ENV	0	CM	3
22	Project Trade Offs (PTOs)	4	USC	2	POL	0	QM	3
23	Feasibility Study (FS)	4	DM	1	PS	0	PR	2
24	Project Environment (ENV)	4	POL	1	PTOs	0	OS	2
25	Decision Making (DM)	4	PS	1	RM	0	DEM	2
26	Politics (POL)	3	ENV	0	CONF	0	DM	1
27	Development Method (DEM)	3	LoA	0	OS	0	PTOs	1
28	Sponsor (SPO)	1	PTOs	0	PSP	0	BV	1
29	Software Product (SOF)	1	MAR	0	SOF	0	CONF	1
30	Project Baseline (BL)	1	PSP	0	BL	0	MAR	0
31	User Characteristics (USC)	0	BL	0	SPO	0	CUL	0
32	Tendering Method (TEM)	0	SPO	0	PRM	0	SOF	0
33	Procurement Management (PRM)	0	PRM	0	TEM	0	BL	0
34	Marketing (MAR)	0	TEM	0	USC	0	SPO	0
35	Client Characteristics (CCH)	0	CCH	0	CCH	0	USC	0

Table 2: 35 success factors ranked from highest to lowest number of repetitions in all the 100 papers regardless of their categories

No	Total		No	Total		No	Total		No	Total		No	Total	
1	SM	49	8	PM	27	15	QM	19	22	DEM	12	29	DM	6
2	TM	42	9	BV	24	16	CUL	17	23	OS	10	30	PTOs	5
3	S/P	41	10	TECH	24	17	LoA	14	24	PSP	9	31	CCH	5
4	COM	35	11	LEA	23	18	FS	14	25	CONF	9	32	SOF	3
5	TMS	34	12	CM	22	19	PRM	14	26	POL	8	33	USC	2
6	O/G	29	13	RM	21	20	ENV	13	27	TEM	7	34	SPO	1
7	M&C	28	14	PR	19	21	PS	12	28	MAR	7	35	BL	1

What are the relationships between success factors from different types of projects?

A statistical analysis is conducted in order to better elaborate on the relationships between the success factors associated with the different categories under review. The rank correlation test has been chosen to better illustrate the relationships among these 4 groups of data. As explained by Levin (1984), rank correlation is *"a measure of the correlation that exists between two sets of ranks"* used for non-parametric data. The fact that this method measures the degree of association based on ranks helps this

study to remain unaffected by the different number of papers analysed for each type of projects.

In order to deploy the rank correlation method, each factor was allocated a fractional ranking value for each project type and the rank correlation coefficient (r_s) was calculated for all pairs of project types using the following formula, where n = 35:

$$r_s = 1 - \frac{6(\sum d^2)}{n(n^2 - 1)}$$

d= difference between ranks for each pair
n= number of paired observations

The results were checked using the standard error of rank correlation coefficient and conducting an upper-tailed test (Levin 1984: 628-635), as n is higher than 30 and distribution can be assumed to be normal. Assuming the level of significance to be 0.01, an upper limit of 0.4 is achieved. It can be said that there is an association between values of each analysed pair when the obtained rank correlation coefficient is higher than 0.4. This association is higher when the value of rank correlation coefficient is between 0.6 and 1. This analysis helps to determine which two types of projects have more similar or different success factors affecting them. An example of the rank correlation calculations for General and IT/IS projects and the final results for all pairs are depicted in Table 3 and Table 4 respectively.

Table 3: An example of rank correlation calculations for General and IT/IS projects

General	No of Repetitions	Ranking	IT/IS	No of Repetitions	Ranking	d	d^2
BL	1	7	BL	0	5.5	1.5	2.25
BV	7	21	BV	11	32	-11	121
CCH	0	3	CCH	0	5.5	-2.5	6.25
CM	8	25	CM	11	32	-7	49
COM	13	33	COM	7	26	7	49
CONF	5	16	CONF	3	17.5	-1.5	2.25
CUL	8	25	CUL	4	21	4	16
DEM	3	9.5	DEM	3	17.5	-8	64
DM	4	12.5	DM	1	12	0.5	0.25
ENV	4	12.5	ENV	0	5.5	7	49
FS	4	12.5	FS	4	21	-8.5	72.25
LEA	12	31	LEA	4	21	10	100
LoA	8	25	LoA	0	5.5	19.5	380.25
M&C	8	25	M&C	9	29	-4	16
MAR	0	3	MAR	0	5.5	-2.5	6.25
O/G	10	28	O/G	9	29	-1	1
OS	6	18.5	OS	2	15	3.5	12.25
PM	12	31	PM	4	21	10	100
POL	3	9.5	POL	1	12	-2.5	6.25
PR	7	21	PR	5	24	-3	9
PRM	0	3	PRM	0	5.5	-2.5	6.25
PS	7	21	PS	1	12	9	81
PSP	5	16	PSP	0	5.5	10.5	110.25
PTOs	4	12.5	PTOs	0	5.5	7	49
QM	6	18.5	QM	4	21	-2.5	6.25
RM	8	25	RM	6	25	0	0
S/P	12	31	S/P	12	34	-3	9
SM	15	35	SM	16	35	0	0
SOF	1	7	SOF	2	15	-8	64
SPO	1	7	SPO	0	5.5	1.5	2.25
TECH	5	16	TECH	8	27	-11	121
TEM	0	3	TEM	0	5.5	-2.5	6.25
TM	11	29	TM	11	32	-3	9
TMS	14	34	TMS	9	29	5	25
USC	0	3	USC	2	15	-12	144
$\sum d^2$	-	-	-	-	-	-	1695.5

Table 4: Values of rank correlation coefficient for pairs of projects

Pair of projects	Rank Correlation Coefficient (r_s)	Status
General & IT/IS	0.7625	Highly Associated
General & NPD	0.5549	Associated
General & Construction	0.4767	Associated
IT/IS & Construction	0.3582	Not Associated
IT/IS & NPD	0.6382	Highly Associated
Construction & NPD	0.2339	Not Associated

As can be seen in Table 4, although factors in the general papers are associated with those of all other types, the level of this association is considerably higher in the general and IT/IS pairing than in the other two pairings. This means that factors obtained from General papers are significantly more similar to those of IT/IS papers and relatively more similar to NPD papers than construction papers. This questions the impartiality and fairness of papers introducing success factors for all types of projects. Furthermore, the values of the rank correlation coefficient indicate a meaningful difference between factors obtained from construction papers and those from IT/IS and NPD papers while factors associated with these two later categories are highly associated.

These similarities and differences stem from different types of projects (evidence given above) and are consistent with other studies in the literature. As mentioned above, Pinto and Covin (1989) compared construction and R&D projects' success factors and concluded that while there are some common factors, there are also some significant differences. Assuming NPD to be a specific type of R&D project, results of this study confirms this by showing no association between success factors of construction and NPD projects (while not saying that they are completely opposite). Pinto and Covin (1989) also mention some of the differences of R&D and construction projects that can be traced back to the basic difference between them in terms of scope size and uncertainty and complexity of technologies they deploy, as stressed by Shenhar and Renier (1996). This can also explain the similarities between IT/IS and NPD projects and the differences between IT/IS and construction projects because of the higher technological complexity and uncertainty and more limited scope of IT/IS and NPD projects compared to construction ones.

How has researchers' focus on project success factors changed over time?

One last question this study intends to answer is how success factors extracted by researchers have changed over time. This benefits the research community by providing an opportunity to identify any possible existing trends and is analysed by dividing the papers associated with each of the 4 categories into two time zones of the 20th and 21st centuries and comparing the rankings of the top 20 success factors shown in Tables 1 and 2. Rankings have been chosen for comparison in order to avoid the effects of the different number of papers in each time zone. Results in respect of construction papers show an extensive increase in attention to tendering methods (TEM) and top management support (TMS) although change and risk management (CM and RM) attracted less attention in the 21st century (Figure 1). Regarding papers on NPD success factors, monitoring and control (M&C), technology (TECH), level of authority (LoA) and leadership (LEA) factors have all increased while attention to feasibility study (FS) plummeted in 21st century (Figure 2). In contrast to construction papers, RM were considered by more studies on IT/IS projects in 21st century (Figure 3). General studies showed that researchers considered LEA, SM, project

manager/management (PM) and quality management (QM) as success factors more often in 21st century than 20th century; nevertheless, they showed less interest in factors such as project review (PR) and technology (TECH) (Figure 4).

Figure 1: Change of top 20 factors' rankings through time in construction papers

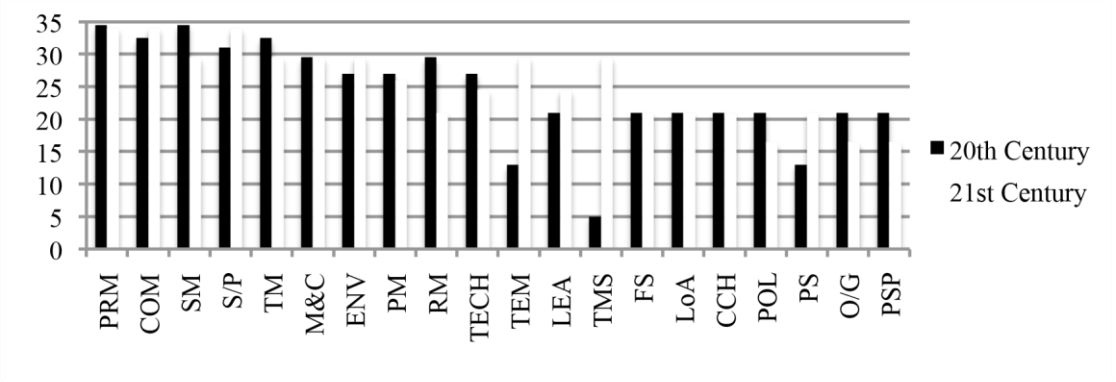


Figure 2: Change of top 20 factors' rankings through time in NPD papers

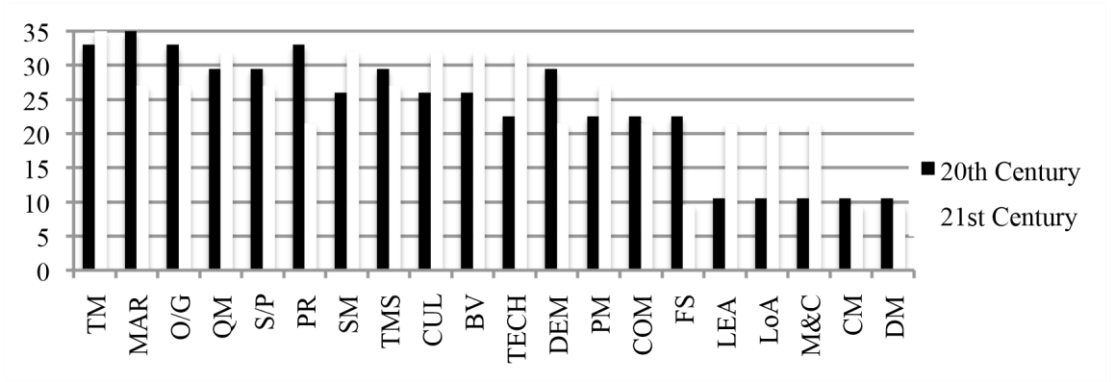


Figure 3: Change of top 20 factors' rankings through time in IT/IS papers

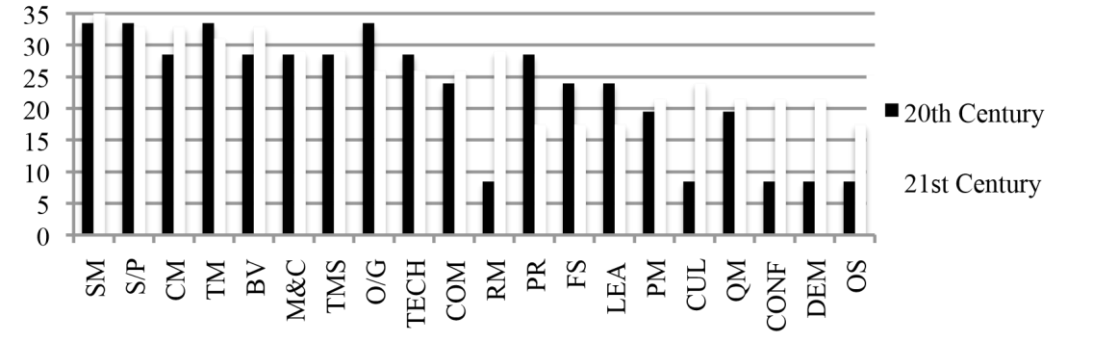
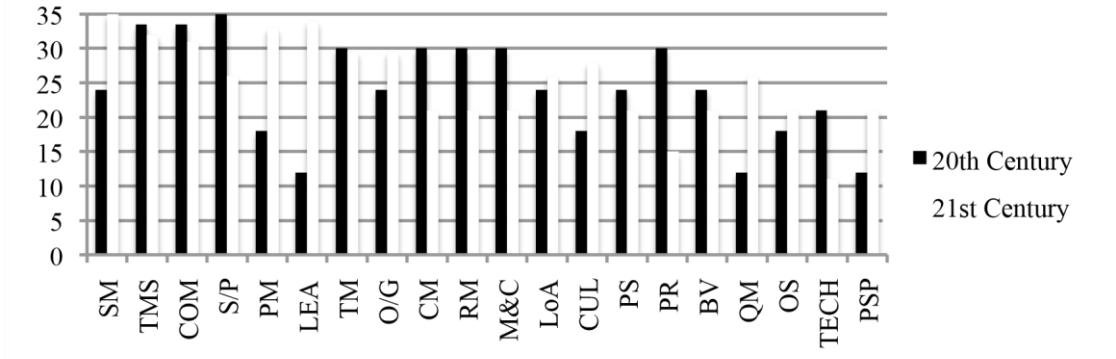


Figure 4: Change of top 20 factors' rankings through time in general papers



In order to have an overall view on the changes of success factors over the past five decades, Figure 5 depicts the information shown in Table 2 for the change of top 20 factors' rankings. In addition, a categorization of top 20 most repeated success factors illustrated in Table 2 was conducted (Table 5) using a framework for the classification of success factors based on level of relevance first introduced by Belassi and Tukel (1996). This will help to provide this study with the groundwork for comparing the level of attention of researchers to each level of relevance in the 20th and 21st centuries.

An implication of this scrutiny of changes of success factors through time is that the focus of researchers has turned from factors related to the project team and management level to factors more relevant to higher levels such as the organisation and external environment. Notice the rise of attention to factors such as organisational culture (CUL), top management support (TMS) and project environment (ENV) compared to the fall of factors such as scheduling and planning (S/P) and change management (CM) in Figure 5.

Figure 5: Change of top 20 factors' rankings through time in all 100 papers

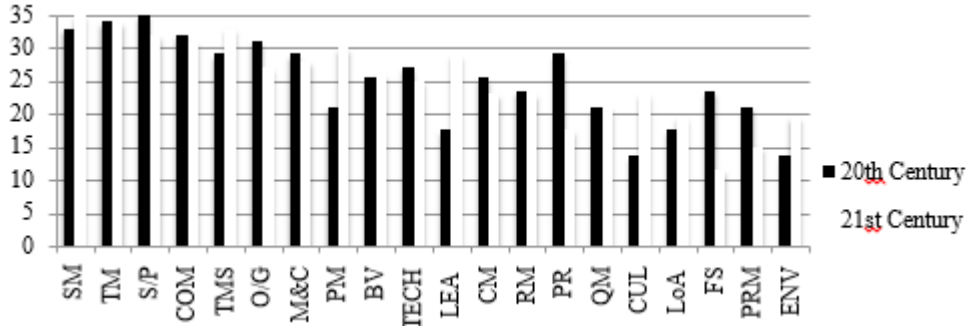


Table 5: Top 20 success factors categorised into levels of relevance as suggested by Belassi and Tukel (1996)

Level of Relevance	Top 20 Most Repeated Success Factors
Project Team	TM, COM, TECH, QM
Project Management	SM, S/P, COM, M&C, PM, LEA, CM, RM, PR, QM, FS, PRM
Organisation	TM, COM, TMS, O/G, M&C, BV, TECH, CM, PR, QM, CUL, LoA, FS, PRM
External	COM, TECH, QM, ENV

SUMMARY AND CONCLUSIONS

After decades of accumulation of project success factors, this study conducted a detailed analysis of them considering their number of repetitions, their relationships with different project types and their changes over time in order to shed light on their probable hidden implications for future research. The findings of this research contribute a number of practical and theoretical values to the existing body of knowledge. Firstly, it demonstrates the importance of selecting appropriate success factors depending on the type of project. This importance stems from differences in scope size and technological uncertainty and complexity of projects and shows that there is no universal list of success factors to be used in all project types. Secondly, It was shown through a rank correlation test that success factors of IT/IS and NPD projects are highly similar; however, they are considerably different from construction projects' success factors. In addition, papers written on success factors unconcerned about the type of projects (named *"general"* in this study) are not impartial and are

more biased towards factors of IT/IS and NPD projects. This is a warning to researchers in the field of construction management not to consider general papers' success factors as appropriate for construction projects. Thirdly, it was concluded from analysing trends of changes of success factors through time that success factors identified in 21st century are more related to organisation and external environment levels than project and team levels. This change of focus justifies more research on improving organisational and environmental tools and techniques of managing projects because of their higher influence over project success.

One limitation of this study is the high variety of papers used to extract success factors from. They have been written in different contexts and geographical locations that might make findings of this study not applicable to all situations. A similar study, considering papers with the same specifications, can be the subject of a future research.

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