

**Factors, frameworks and theory: a review of the information systems literature on success factors in project management** by Robert Irvine and Hazel Hall. Manuscript of paper accepted for publication in *Information Research*

## **FACTORS, FRAMEWORKS AND THEORY: A REVIEW OF THE INFORMATION SYSTEMS LITERATURE ON SUCCESS FACTORS IN PROJECT MANAGEMENT**

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### **ABSTRACT**

**Introduction.** We provide a critical evaluation of the literature on success factors in information systems projects, with a particular focus on organisational information systems development. This responds to recent editorial comment on the need for literature reviews that can furnish a foundation for theory building and research landscaping.

**Method.** Relevant material was found in the core fields of information management, information systems, and project management. Additional material from domains such as business management and software development were also identified.

**Analysis.** Four broad research themes emerged from the analysis of the literature: (1) the identification and exploration of project success factors and success factor lists; (2) contributions of individual/group project success factors to project success (or failure); (3) causal interactions between individual/groups of project success factors and simulations of these; and (4) project success factor frameworks.

**Results.** A high number of unique project success factors exist. Some have attracted more attention than others, there is a lack of agreement on their relative importance, and few frameworks have been proposed to model their influence. To date it has been common practice to list project success factors, whereas less attention has been paid to the question of how knowledge of the existence of these factors can be used to eliminate problems in practice. Despite the amount of research in this area, the contribution of particular success factors to project success remains unexplored, as are causal interactions between individual/groups of project success factors, and simulations of these.

**Conclusion.** Through the identification and analysis of the extant literature we identify opportunities for advancing knowledge of the practical and theoretical aspects of information systems project organisation, with particular reference to success factors and project success. Contributions from those who offer expertise in the sociotechnical analysis of systems implementations would be especially welcomed.

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## **1 INTRODUCTION**

This review article provides a critical evaluation of the literature on project success factors in information systems, with a particular focus on organisational information systems. An organisational information system can be defined as 'any of a wide combination of computer hardware, communication technology and software designed to handle

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information related to one or more [organisational] processes' (Flowers, 1996 cited by Yeo, 2002, pp. 241-242). This definition excludes 'personal' information systems such as those deployed by pilots in the cockpits of a modern fighter jets (see, for example, Kopp, 1981/2005). Systems that fall into this latter category are not subject to the issues that arise when technology is implemented in an organisational context, and are thus beyond the scope this evaluation of the literature.

Organisational information systems can vary significantly in terms of their scale, complexity and functionality, as can their host organisations and end-user populations. These are both internal, for example functional groups charged with performing organisational processes such as human resource management or production, and external to the host organisation, for example customers and suppliers. Examples of organisational information system include enterprise resource planning (ERP) systems, web-based e-commerce systems, and customer relationship management (CRM) systems.

The specific focus of this review paper falls at the intersection of two concepts (1) organisational information system development projects and (2) success factors. Defined generically, a project is 'a temporary endeavour undertaken to create a unique product or service' (Project Management Institute, 2008, p. 5). An information systems project represents a specialised form of a project. It may be conceived as a 'temporary endeavour' performed to provide an information system for a host organisation, or to significantly update or upgrade an existing implementation.

Information systems projects can be further classified as (1) implementation-only or (2) development projects. Implementation-only information systems projects do not include any significant software development (although they may still involve lesser degrees of software development for system installation, data transfer, minor customisations, etc.). They comprise the implementation of commercial packaged software products for a host organisation. In contrast, development projects involve a significant amount of software development to create the information system prior to implementation. In this paper, development projects are referred to as organisational information systems development projects to accentuate (a) the organisational aspect of the project's deliverable (the information system hosted on the hardware), and (b) the software development process used to create it.

It is acknowledged that the term project success is difficult to define and interpret (for example, Baccarini, 1999, p. 25; Cooke-Davies, 2004, p. 99; Davis, 2014, p. 189; Ika, 2009, p. 8; Standing, Guilfoyle, Lin and Love, 2006, p. 1149; Thomas and Fernández, 2008, p. 733). In addition, those who discuss project success factors often neglect to provide a detailed explanation of the concept of the broader term in their work. Ika (2009) suggests that this issue is ignored because it is presumed that 'everyone knows what is meant by project success' (p. 7), even though success in the context of project management is multi-dimensional, time-dependent, and is very much determined by the perspective of the stakeholder who is making the judgment of success (or otherwise). For example, for a business owner project success may be considered as a positive impact of the work completed on the business in question. It is also important to differentiate project success

from project management success. The former refers to the satisfaction and benefit accrued by the host organisation. The latter is concerned with management performance, typically whether the project adhered to the requirements of the schedule and budget.

Taking the above into account, for the purposes of this paper *success* is considered as an expected outcome of all projects (as identified by, for example, Hall, Beecham, Verner and Wilson, 2008, pp. 31-32; Nicholas and Hidding, 2010, p. 152; Project Management Institute, 2008, p. 5; Subramanyam, Weisstein and Krishnan, 2010, p. 137). We argue that whether or not a project is successful may be judged by assessing the extent to which the project in question meets its intended aim. At the same time we recognise that others (for example, de Wit, 1998) have argued that to objectively measure the success of a project is impossible.

Project success factors are conceived here as the conditions, circumstances and events that contribute to the success of a project. This definition is in alignment with terminology used in Ika's study (2009, p. 8), which is regularly cited alongside Jugdev and Mueller (2005) as one of two literature reviews that provide a generic analysis of project success factors. It is important that project success factors are distinguished from project success criteria (Cooke-Davies, 2004, p. 99). The latter are the principles and standards by which project success can be judged, i.e. the measures that indicate that a project has been successful (Lim and Mohamed, 1999, p. 243). In the research literature these two components of project success are sometimes deployed loosely, occasionally giving the impression of misinterpretation and/or confusion (for example: Bernroider and Ivanov, 2011, p. 326; Davis, 2014, p. 189; Gingnell, Franke, Lagerström, Ericsson and Lilliesköld, 2014; Lim and Mohamed, 1999, p. 244; Turner, Ledwith and Kelly, 2009, p. 292).

In the domain of information systems, the burgeoning interest in project success factors has created a major research stream with findings generated mainly from quantitative studies (Larsen and Myers, 1999, p. 397). Project success factors have attracted the attention of many researchers over the years, as noted by a number of authors (for example, Bryde, 2008, p. 800; Cooke-Davies, 2002, p. 185; Christensen and Walker, 2004, p. 39; Söderlund, 2004a, p. 186; Söderlund, 2011, p. 159; Thi and Swierczek, 2010, p. 570) and their study holds a prominent position in the field (Lu, Huang and Heng, 2006, p. 295). Articles on project success factors feature in project management journals such as the *Project Management Journal* and the *International Journal of Project Management* (Ika, 2009, p. 11; Söderlund, 2004a, p. 189). Practitioners have also felt the influence of the project success factor research. This is evident in the way that its output has been codified into standards, for example in project management bodies of knowledge (Papke-Shields, Beise and Quan, 2010, p. 660).

Although other researchers have previously addressed the question of project success factors in their work, their contributions have typically been at a generic level and, to date, a literature review with a specific focus on organisational information systems development has not been published in any established peer-reviewed journal. In addition, although they are valuable to information systems research from a broad perspective, the two most recent generic analyses of project success factors (Jugdev and Mueller, 2005, and Ika, 2009) are now somewhat dated. Much has changed in the working environment in the past few years,

especially in the domain of organisational information systems development with, for example, the uptake of mobile technologies, the proliferation of new breeds of software, and the move towards agile information systems development methods. Our contribution is thus a timely analysis that responds to the question of how project success factors are treated in the organisational information systems development literature, and where future research endeavours should be directed to enhance theoretical development in the domain.

As well as presenting an up-to-date and novel articulation of the treatment of success factors in an area of information systems project management practice that has previously been unexplored in detail, this paper also has practical value to information management, information systems, and project management researchers and practitioners. Since there is a paucity of literature reviews in the domain (despite the proliferation of articles that discuss project success factors per se), it is perhaps unsurprising that members of the first of these audiences – those who research information systems project management - have been accused of lacking a grasp of the literature (for example, Morris, 2010, p. 140). Our work addresses this issue by presenting a much-needed evaluative summary that can be accessed by the information systems project management research community at large. In addition, given that organisational information systems development projects are also renowned for high failure rates (as noted, for example, by: Gingnell et al., 2014, p. 21; Glass, 2006, p.15; Walsh and Schneider, 2002), the content of a paper such as this can help improve understanding amongst a wider practitioner audience.

The main contribution of this work is found in the identification of the four broad research themes that have emerged from the detailed analysis of the body of literature on the topic of project success factors in information systems development. These themes, and the main findings as related to them, are summarised in Table 1.

**Table 1: Overview of themes and findings identified from the analysis**

Theme	Overview of findings
1. Identification and exploration of project success factors and success factor lists	A large number of factors are identified and listed in the information systems literature – for example, 488 individual factors evident in 56 organisational information systems development papers in the period 1979-2012 sampled for this study– yet there is little agreement from one published list to the next.
2. Contributions of individual/group project success factors to project success (or failure)	There has been much research on the contribution of project success factors to project success, but a lack of agreement in the findings of such studies, and very little coverage of this question with specific reference to organisational information systems development.

<p>3. Causal interactions between individual/groups of project success factors and simulations of these</p>	<p>Although the theme of causal interactions is considered in the literature, the treatment is incomplete, and untested causal models are presented. Attempts to trace the dynamics of the interactions between success factors are under-explored, with no evidence of this having been researched to date with reference to organisational information systems development projects.</p>
<p>4. Project success factor frameworks</p>	<p>While there is some evidence of published frameworks of relevance to information systems projects in general, they are lacking for organisational information systems development projects in particular.</p>

Our articulation highlights where further opportunity lies to build on extant knowledge, and to enhance understanding, in this area of information systems research, as is presented in the account below.

The paper responds to recent calls for more literature reviews in the information systems literature. For example, in 2014 the editor of the *European Journal of Information Systems* Rowe appealed for ‘literature reviews that offer the most solid foundations for theory building and research landscaping’ (Rowe, 2014, p. 242). By summarising the prior research and critically examining its various contributions, we identify some thematic gaps and possible future research directions.

## **2 METHODS AND PRESENTATION OF FINDINGS**

Our main findings as related specifically to organisational information systems development derive from an analysis of 56 papers of core relevance published between 1979 and 2012. These are listed in Table 2: Organisational information systems development project success factor studies 1979-2012. They include papers from the leading, peer-reviewed conferences and journals in the fields of information systems, information management, and project management. This core set of papers represents just over a third of the material cited in this paper (56 out of 163 publications in total).

**Table 2: Organisational information systems development project success factor studies 1979-2012**

ID	Paper	Project System/ Process type	Factor type	C	D	P	Context	DS	Methods (or data sources)
1	Averweg and Erwin (1999)	Decision support systems	Critical success factors	D	I	I	Decision support systems in South Africa.	I	Analysis based on unspecified number of structured interviews with business managers, end users, IT personnel and academics in 18 non-government organisations.
2	Bannerman (2008)	Software projects	Major risk factors	B	B	I/C	Software projects in government agencies in an Australian state.	I	Quantitative analysis of 23 structured interviews with project, IT and business managers.
3	Berntsson-Svensson and Aurum (2006)	Software projects	Success factors	B	B	I/C	Financial services, consulting and telecommunication s industries in Swedish and Australian companies.	S	Analysis of survey questions completed by unspecified number of software practitioners and managers.
4	British Computer Society (2004)	Complex software and IT projects	Key players, key success factors	B	S	C	UK public and private sector, software and IT projects.	U	Analysis of written and oral 'evidence' of 70 directors, managers, project managers and software engineers from the private and public sectors, as well as academic experts. Detail of methods not specified.

ID	Paper	Project System/ Process type	Factor type	C	D	P	Context	DS	Methods (or data sources)
5	Brocke, Uebernickel, and Brenner (2009)	IT projects	Success factors	B	B	I/C	European telecommunication s firm.	C	Five case studies (two development projects). Details of methods not specified.
6	Bussen and Myers (1997)	Executive information systems	Risk factors	D	I	I	Large organisation in New Zealand.	C	Case study.
7	Butler and Fitzgerald (1999)	information systems development process	Critical success factors	D	I	I	Large Irish telecommunication s company.	I	Qualitative, case-based research based on an analysis of four development projects. 38 interviews with participants in development process.
8	Cash and Fox (1999)	Computer systems	Elements (of success)	U	U	I/C	Generic.	A	Not specified, although findings appear to be based on anecdotal evidence.
9	Cerpa and Verner (2009)	Software development	Failure factors	D	B	B	Software developers from the USA, Australia, and Chile.	S	Analysis of survey of software practitioners. Covers 70 failed projects.
10	Charette (2005)	Software projects	Failure factors	U	U	U	Unspecified.	U	Unspecified.
11	Chow and Cao (2008)	Agile software projects	Critical success factors	D	U	U	Agile software projects.	S	Quantitative analysis of a survey of agile professionals working on 109 projects in 25 countries.

ID	Paper	Project System/ Process type	Factor type	C	D	P	Context	DS	Methods (or data sources)
12	Evans, Abela, and Beltz (2002)	Software projects	Risk characteristics	B	U	U	Focus appears to be US-based projects, including development projects providing data processing applications.	O	Analysis based on risk assessment of company database of 12 years' worth of project assessments.
13	Ewusi-Mensah (1997)	Information systems development projects	Critical issues	D	U	U	Project abandonment	U	Unspecified, other than it is noted that the report is based on previous research by author.
14	Gaitros (2004)	Large software development projects	Common errors	D	U	U	Generic software development.	A	Anecdotal account based on author experience.
15	Han and Huang (2007)	Software projects	Software risks	D	U	U	Generic software projects.	S	Analysis of data generated from web-based survey of 115 project managers.
16	Hartman and Ashrafi (2002)	Information systems & information technology projects	Critical success factors	B	B	B	Canadian software projects.	I	Findings derive from 36 structured interviews. Cover 12 projects.



ID	Paper	Project System/ Process type	Factor type	C	D	P	Context	DS	Methods (or data sources)
17	Jiang and Klein (1999)	Information systems development	Risks	D	U	U	Information systems development in the USA.	S	Findings derive from 86 survey returns from information systems project managers. Includes statistical analysis.
18	Jiang and Klein (2001)	Software projects	Risks	D	U	U	Information systems software development in the USA.	S	Findings derive from 152 survey returns from information systems project managers, project leaders and professionals. Includes statistical analysis.
19	Jiang, Klein, and Ellis (2002)	Software development	Risks	D	U	U	Information systems development in the USA.	S	Findings derive from 152 survey returns from information systems project managers. Includes statistical analysis.
20	Jones (2004)	Software project management practices	(Opposing) major factors	D	B	U	Large software projects including information systems, corporations and government agencies. Appears to be US-based study.	U	Analysis of 250 projects, the full details of which are not included in the paper.

ID	Paper	Project System/ Process type	Factor type	C	D	P	Context	DS	Methods (or data sources)
21	Kanter and Walsh (2004)	Software development project	Major problem areas	D	I	I	IT organisation in a large, unidentified, decentralised company in USA.	C	Case study.
22	Keil, Cule, Lyytinen, and Schmidt (1998)	Software projects	Risk factors	D	U	U	Software development projects in Finland, Hong Kong, and the USA.	P	Delphi method with input of three panels of experienced software project managers from Finland, Hong Kong, and the USA.
23	Kim and Peterson (2001)	Information systems	Success factors	D	I	I	Internal information systems development in the USA.	S	Statistical analysis of 79 questionnaires completed by software developers working for large conglomerate companies in the USA.
24	Klein, Jiang, and Tesch (2002)	System development projects	Leading indicators	D	U	I/C	Information systems development in companies in the USA.	S	Findings derive from survey of 239 experienced information systems professionals, including information systems department managers, information systems project leaders, information systems analysts and others, from six large private organisations in the USA.
25	Leishman and Cook (2004)	Software projects	Risk factors	B	U	U	Software projects.	A	Findings based on anecdotal evidence.

ID	Paper	Project System/ Process type	Factor type	C	D	P	Context	DS	Methods (or data sources)
26	Magal, Carr, and Watson (1988)	Information centres	Critical success factors	U	U	I/C	Information centres in the USA.	S	Findings derive from survey of 311 information centre managers, directors and analysts. Includes statistical analysis.
27	Mahaney and Lederer (2003)	Information systems development projects	Reasons for failure and risk factors	D	B	I/C	Information systems development in the USA.	I	Analysis derives from structured interviews with 12 information systems project managers in a variety of industries in the USA.
28	May (1998)	Software projects	Failure causes	U	U	U	Software development projects (probably in the USA).	I	Analysis of data from interviews conducted with practitioners and consultants.
29	Merla (2005)	IT projects	Key success factors	U	U	U	'Addresses the typical problems encountered in Information Technology projects' (p.1).	O	Findings drawn from post-implementation project reviews in an unspecified organisation.
30	Milis and Mercken (2002)	Information and Communication Technology (ICT) investment projects	Success factors	U	U	I/C	ICT investment projects.	I	Qualitative analysis of four ICT projects in Belgian banks based on 16 in-depth interviews and document analysis. Grounded approach.

ID	Paper	Project System/ Process type	Factor type	C	D	P	Context	DS	Methods (or data sources)
31	Moore (1979)	Management Information Systems (MIS) software development projects	Characteristics	D	B	U	MIS software development projects.	S	Statistical analysis derived from survey of 24 department (project) managers in various organisations.
32	Moynihan (1996)	Information systems projects	Factors/themes	D	S	S	Information systems projects in Ireland.	I	Analysis based on 14 personal construct elicitation sessions with experienced application systems developers involved in the management of bespoke software-intensive application development projects for external clients.
33	Nakatsu and Iacovou (2009)	Software development projects	Key risk factors	D	S	C	Offshore and domestic outsourcing.	P	Analysis derives Delphi study that comprised 32 experienced IT project managers in two panels (one domestic and one offshore).
34	Procaccino, Verner, and Lorenzet (2006)	Software development	Process success drivers	D	B	U	Software development in USA.	S	Analysis derives from findings of online survey of 30 developers at 20 US based software development organisations/departments.
35	Reel (1999)	Software projects	Critical success factors	U	U	U	Software projects.	A	Unspecified, but evidence appears to be anecdotal.

ID	Paper	Project System/ Process type	Factor type	C	D	P	Context	DS	Methods (or data sources)
36	Richardson and Ives (2004)	Software development processes	Reasons for project failure	D	U	U	Software development projects.	O	Analysis is based on findings of previous, unspecified, studies.
37	Ropponen and Lyytinen (2000)	Software development	Risk components	D	B	U	Software development in Finland.	S	Statistical analysis of survey data collected from Finnish project managers.
38	Salmeron and Herrero (2005)	Executive information systems	Critical success factors	D	U	I/C	Executive information systems (EIS).	O	Analytic hierarchy process based research based on 18 users.
39	Sauer and Cuthbertson (2003)	IT project management in the UK	Risk factors	B	B	U	IT project management in the UK.	S	Analysis based on online survey of 1,456 IT project managers.
40	Sharma, Sengupta, and Gupta (2011)	Software projects	Risk factors (dimensions)	D	S	B	Software projects in India.	S	Analysis based on findings derived from 300 questionnaires completed by IT professionals.
41	Standish Group (1995)	IT application development	Success factors	U	U	U	US companies with an MIS that operate in a range of industries, and vary in size.	S	Analysis based on: surveys completed by 365 respondents; focus groups; and personal interviews with IT executive managers.

ID	Paper	Project System/ Process type	Factor type	C	D	P	Context	DS	Methods (or data sources)
42	Standish Group (2001)	IT application development	Success factors	U	U	U	Unspecified, although domain details likely to be similar to Standish Group (1995).	S	Unspecified, although methodology details likely to be similar to Standish Group (1995).
43	Standish Group (2009)	IT application development	Success factors	U	U	U	Unspecified, although domain details likely to be similar to Standish Group (1995).	S	Unspecified, although methodology details likely to be similar to Standish Group (1995). (This report featured in electronic newsletter <i>CHAOS activity news</i> was received in a personal communication.)
44	Taylor (2000)	IT projects	Critical success factors	U	U	U	IT projects in the UK.	I	Analysis derives from detailed questioning of 38 members of the British Computer Society, the Association for Project Management and the Institute of Management.
45	Tesch, Kloppenborg, and Frolick (2007)	Software development projects	Risks	D	U	U	Software development projects in the USA.	S	Analysis based on findings derived from survey of 23 project management professionals and group (panel) work.
46	Tiwana and Keil (2004)	Software development	Key risk drivers	D	U	C	Software development projects.	S	Analysis based on findings of survey of 61 information systems/IT directors in a variety of companies. Includes statistical analysis.
47	Ugwu and Kumaraswamy (2007)	ICT projects	Critical success factors	B	U	C	ICT projects in the construction industry.	S	Analysis based on findings of a survey of 40 client-based stakeholder groups.

ID	Paper	Project System/ Process type	Factor type	C	D	P	Context	DS	Methods (or data sources)
48	Verner and Evanco (2005)	In-house software development	Project management practices	D	I	I	In-house software development, apparently in Australia and the USA.	S	Analysis based on findings derived from survey of 101 in-house development practitioners. Includes statistical analysis.
49	Verner, Overmyer, and McCain (1999)	Software development projects	Success and failure factors	D	U	U	Software development projects in the USA.	I	Analysis based on findings derived from interviews with 20 software developers.
50	Wallace and Keil (2004)	Software development projects	Risk factors	D	U	U	Software development projects.	S	Analysis based on findings from web-based survey of 507 software project managers. Includes statistical analysis.
51	Wallace, Keil, and Rai (2004)	Software projects	Risks	D	U	U	Software projects.	S	Analysis based largely on findings from a survey of 507 software project managers. Includes statistical analysis.
52	Walsh and Kanter (1988)	Application development	Major problem areas	D	I	I	Application development.	C	Case study.
53	Warkentin, Moore, Bekkering, and Johnston (2009)	Information systems development projects	Risks	D	U	I/C	Information systems development projects.	S	Analysis based on findings derived from two different open-ended questionnaires administered in two stages to eight IT professionals.

ID	Paper	Project System/ Process type	Factor type	C	D	P	Context	DS	Methods (or data sources)
54	Wateridge (1995)	IT projects	Success factors	U	U	U	IT projects.	U	Analysis of prior research.
55	Wohlin and Andrews (2002)	Software projects	Success drivers	D	I	I	Software projects.	C	Case study of 12 software projects from various divisions of a single company.
56	Yeo (2002)	Information system projects	Critical failure factors	U	U	U	Information system projects.	S	Analysis based on findings derived from a survey of 92 participants associated with a failed IT project. Includes statistical analysis.

**Key**

C: Classification (D: development only, B: both development and packaged system implementation, U: unspecified, but development verified in or inferred by article content).

D: Development (B: both, I: in-house, S: supplier-based, U: unspecified).

P: Perspective (B: both, C: client, I: in-house, S: supplier, U: unspecified).

DS: Methods or data source (A: anecdotal; C: case study; I: interviews; O: other; P: panels; S: survey, U: unspecified).



The papers analysed in our review were identified through extensive literature searches using commercial online databases such as *ABI/Information Complete (ProQuest)*, *ACM Digital Library (ACM)*, *Emerald Journals (Emerald)*, *Expanded Academic ASAP (Gale)* and *IngentaConnect (Ingenta)*. *Google Scholar* was also used to identify a number of articles. The initial searches were conducted using combinations of the terms shown in Table 3.

**Table 3: Literature search term combinations**

Term 1		Term 2
Information systems	AND	Success factors
Information technology		Failure factors
Software projects		Risk factors
Software development		Success criteria

Many of the papers are published in information systems, project management, and information management titles including the *European Journal of Information Systems*, *Information Research*, *Information and Management*, the *International Journal of Information Management*, the *Journal of Strategic Information Systems International Journal of Project Management*, and the *Project Management Journal*. Since many phenomena in information systems research are interdisciplinary, titles from other related fields such as business management and software development were accessed to provide relevant material, as is established practice in the domain (Rowe, 2014, p. 247).

In recognition that software development has been described as a practitioner-led discipline (Glass, 2003, p. 21), and that important advances in project management research have also been made in publications outwith the realm of academic journal articles (Jugdev and Müller, 2005, p.25), various other sources such as books and commercial articles, written by academics and practitioners alike, were deemed appropriate for the analysis presented in this paper and are thus also cited in the analysis below.

The literature search also involved citation pearling to identify further material from reference lists found in the papers identified. This proved to be particularly important as a number of papers that are key to the theme under discussion, such as Moynihan (1996), would not have been identified simply by using the search terms shown in Table 3.

The content of the material accessed was then classified according to:

- The project type under discussion, for example: decision support system; executive information system; software development project.
- The description of factors listed, for example: success, failure, risk.
- The classification of the information systems project(s) examined: development, both development and packaged system implementation, or unspecified.

- The perspective from which the account of the project(s) is(are) presented: client, in-house, supplier (or unspecified)
- The context of the work described: to include details of geographic location and industry sector where specified.
- The data source on which the analysis presented is based: for example, survey data, anecdotal evidence.

An overview of the classifications as applied to the papers is provided in Table 2. The classification process contributed to a broader analysis that led to the identification of the four main research themes in the extant literature, as explored in further detail below.

The structure of our paper allows for the broad context of success factor research to be presented first. It is against this that the specifics of project success factor research as related to information systems in general, and to organisational information systems development as a particular sub-category of information systems, are then set. We then present the detail to support the articulation of the four themes summarised, exposing where there are overlaps between the general and specific literatures, and gaps particular to organisational information systems development. We conclude by arguing that there are many opportunities to develop theoretical insight in an area that is ripe for research, and that such endeavours will be of value to both information systems research and practice in general, as well as organisational information systems development project management in particular.

### **3 THE DEVELOPMENT OF PROJECT SUCCESS FACTOR RESEARCH IN THE DOMAIN OF PROJECT MANAGEMENT**

With its focus on organisational information systems development as a sub-category of information systems, this paper contributes to a larger body of literature on project success factor research. Interest in this area in general (i.e. independent of fields such as information systems and project management) grew in the middle of the twentieth century. The popularity of an article in *Harvard Business Review* (Daniel, 1961) on the development of executive information systems spawned initial interest. This work argued that companies are typically subject to between three and six industry-specific success factors (Daniel, 1961, p. 116). Almost two decades later, in 1979, a further article was published in *Harvard Business Review* on the same theme (Rockart, 1979). This later contribution became regarded as seminal in the study of success factors (Fortune and White, 2006, p. 53). It describes an interview method to assist chief executive officers in establishing the information needs of organisations. The method was later extended to include (amongst other developments) success factor classification constructs (Bullen and Rockart, 1981). These ideas were subsequently popularised in the project management literature, thus seeding the stream of research on project success factors.

In the period up until the mid-1980s empirical research on success factors in the field of project management was largely based on limited data sets and/or anecdotal evidence from single case studies, and derived from small samples (Cooke-Davies, 2004, p. 101; Jugdev and Müller, 2005, p. 24; Söderlund, 2011, p. 160). Although thought-provoking, the output of these studies cannot be considered as generalisable. Over time more rigorous studies were undertaken, drawing on data from larger samples (Söderlund, 2011, p. 160). The aim here was to identify generic project success factors applicable to all types of project, as opposed to a specific context or domain of application (Fortune and White, 2006, p. 53; Söderlund, 2004b, p. 659). While the majority of the findings from these later studies were generated from quantitative surveys (Ika, 2009, p. 12; Larsen and Myers, 1999, p. 397), a few in-depth case studies were also published (Söderlund, 2011, p. 160).

The work on project success factors described above is noted as belonging to a tradition labelled the 'factor school' (Söderlund, 2011, p. 158). Typically such studies identify ten or more items in the format of project success factor lists (i.e. a larger number than the three to six of Daniel's 1961 work on general success factors noted above). Added to this empirical research are other studies relevant to success factor research which have been labelled as *theoretical*. These either derive their findings from secondary data, or make suggestions about project success factors that have yet to be tested empirically (Fortune and White, 2006, p. 56).

A reading of the more recent project management literature as related to project success factors points to the long-held belief (or at least the assumption) that the identification and subsequent use of project success factors will lead to improved project performance (Papke-Shields et al., 2010, p. 660; Pinto and Prescott, 1999 cited by Söderlund, 2004a, p. 189). It is therefore unsurprising that efforts continue to be directed to explaining which conditions, circumstances and events contribute to the success of a project. Recent studies reported in the information systems literature cover, for example:

- the impact of political behaviours and game-playing in information systems project development (Chang, 2013)
- the role of management support in multiple project environments (Elbanna, 2013)
- means of quantifying success factors through deployment of an expert-based Bayesian model (Gingnell et al., 2014)
- the influence of cultural and external pressures on IT project performance (Gu, Hoffman, Cao and Schniederjans, 2014)
- the relationship between management styles and control in a financial services information systems implementation (Gregory and Keil, 2014)
- the part that organisational change plays on project success (Hornstein, 2015)
- critical skills for managing information technology projects (Keil, Lee and Deng, 2013)
- risk in information technology project performance (Liu and Wang, 2014)
- uses of management control systems in information systems projects (Sakka, Barki and Côté, 2013).

Further incentive for such research is the common practice of attempting to achieve organisational goals through project work (Dvir, Lipovetsky, Shenhar and Tishler, 1998, p.

**Factors, frameworks and theory: a review of the information systems literature on success factors in project management** by Robert Irvine and Hazel Hall. Manuscript of paper accepted for publication in *Information Research*

915; Söderlund, 2004a, p. 186). Another driver of these efforts is to understand why organisations that adopt this way of working continue to suffer poor project performance (Mir and Pinnington, 2014, p. 202; Söderlund, 2011, p. 159).

The general view is that with enhanced knowledge of project success factors, managers can focus their energies on those that matter most, then - it is hoped - watch as project performance improves (Andersen, Birchall, Jessen and Money, 2006, p.129). The desire to pin down the most important project success factors perhaps explains the steady stream of research publications on this theme (as noted by, for example: Bryde, 2008, p. 800; Cooke-Davies, 2002, p. 185; Christensen and Walker, 2004, p. 39; Söderlund, 2004a, p. 186; Söderlund, 2011, p. 159; and Thi and Swierczek, 2010, p. 570). This also accounts for the calls for more research into generic project success factors (for example, Bryde, 2008, p. 800; Davis, 2014).

#### **4 PROJECT SUCCESS FACTORS IN THE INFORMATION SYSTEMS AND ORGANISATIONAL INFORMATION SYSTEMS DEVELOPMENT LITERATURE**

The focus of the evaluation presented in this paper is previously published research on success factors in a particular area of information systems project management, i.e. projects related to organisational information systems development. Having set the general context of current priorities in success factor research in project management, the remainder of this review article considers the coverage of project success factors in this area by characterising its main themes, and by highlighting gaps in knowledge to be addressed in future research.

The 56 papers of core relevance to software development, competences, activities or artefacts published in the past four decades (Table 2) (henceforth referred to as the 'core papers') are authored by academics, practitioners, commercial organisations and, in one case, a professional body. The majority derive from the US. The body of work under review was published across a wide range of journals. The scattering of the literature, which is also evident in closely related areas such as enterprise resource planning projects (Ngai, Law and Wat, 2008, p. 549), may be considered an indicator of the disparate nature of research in this domain. Such disparity impedes knowledge development (Savolainen, Ahonen and Richardson, 2012, p. 10) and perhaps explains in part why there are still many differing opinions on project success factors (Andersen et al., 2006, p. 130), as will be elaborated below.

Despite the difficulties associated with researching an extant literature that is located across many titles, some authors have clearly made efforts to access and use it as a starting point for the identification of candidate success factors to explore in their own studies. In contrast, a number give the impression that their research has been carried out in near isolation. As a consequence, the core papers, when taken as a collection, indicate that there been little opportunity for learning from previously published studies. This issue has been identified as a shortcoming of project management publications in general and often highlighted at project management conferences and in project management journals (Reich et al., 2013, p. 938). A further reason why the more recent authors appear not to have

benefited from prior research is the lack of detail on research methods made available in the earlier work. For example, many accounts fail to discuss: the limitations of the work presented (for example, there is regular use of localised convenience samples); the validity and reliability of findings; and the lessons learned from the studies reported. Nor do these authors offer recommendations for further research. In some cases, the research methodology is not made clear at all. This is a criticism that has been levelled at project management research as a whole (Smyth and Morris, 2007 cited by Morris, 2010, p. 143).

The content of the core papers covers both in-house and supplier software development projects. Even so, in over half the cases (33), this distinction is not always clear from the written accounts of the studies. The most common perspective presented is that of the host organisation. Again, however, this detail is not always made explicit in the text of 30 papers. Three papers (Cerpa and Verna, 2009; Hartman and Ashrafi, 2002; Sharma, Sengupta and Gupta, 2011) consider the client and supplier perspectives together, and one focuses exclusively on the supplier perspective (Moynihan, 1996). The project settings comprise both public sector and commercial organisations. The findings from the studies derive predominantly from the analysis of quantitative data collected by survey. Some qualitative research is also presented, based mainly on structured interviews.

The detailed evaluation of previously published research on success factors related to organisational information systems development projects presented below considers the characteristics of the literature according to the four themes presented **Error! Reference source not found.** in Table 1.

#### ***4.1 The identification and exploration of project success factors and the generation of project success factor lists: quantity of factors and lack of agreement***

##### **4.1.1 Consideration of individual project success factors in information systems research**

It has been established that general research efforts related to project success factors stretch back several decades. Even so, the identification of individual factors is still highlighted as a priority area. For instance, there is a need to explore in greater detail the meaning of brief, high-level abstract ideals of factors that frequently feature in factor lists. As illustration, executive support is often named as a project success factor, but simply learning that this is important does not tell a project manager how to support a project more effectively (Zwikael, 2008a, p. 387). Another area that requires attention is the inappropriate grouping of factors. In some cases, project success factors are abstracted to such a level that they become composites (or groups) of two or more individual factors. Although it has been argued that there can be merit in grouping success factors together (Clarke, 1999, p. 140; Gingnell et al., 2014, p. 25), this can also present problems. For example, the monitoring and control process has often been noted as significant (for example, Taylor, 2000, p. 25; Walsh and Kanter, 1988, p. 19), yet these are actually two distinguishable elements, and should be considered as such (Gardiner and Stewart, 2000, p. 252). Separating them out helps identify the effects of each individual factor, and the possible interactions between them. A third limitation of previous research is that it has not

identified which factors can (and cannot) be transferred from one type of project to another. Part of the problem is that the extant studies have contributed to a project management literature that, in general, is predominantly normative (Ahlemann, El Arbi, Kaiser and Hexk, 2013, p. 43): it describes how projects *should* be managed, rather than how they are actually managed (Nicholas and Hidding, 2010).

Over the past decade a number of studies have considered in detail individual success factors for information systems projects. Unlike the remainder of organisational information systems project success factor research, such studies often employ qualitative methods, and concentrate on factors related to particular actors, namely:

1. Project manager competences (for example, Bloom, 1996; Müller and Turner, 2007; Skulmoski and Hartman, 2010; Seiler, Lent, Pinkowska and Pinazza, 2012; Thite, 2000)
2. Executive management support (for example, Beckley and Gaines, 1991a; Beckley and Gaines, 1991b; Wight, 1983; Young and Jordan, 2008; Zwikael, 2008a; Zwikael, 2008b)
3. End user involvement (for example, Hsu, Lin, Zheng and Hung, 2012; Petter, 2008; Subramanyam et al., 2010).

Ample opportunity remains to enhance understanding here (see, for example, Petter, 2008, p. 708; Hsu et al., 2012, p. 9). For example, with the exception of the three areas listed above, few other actor-based success factor studies exist. Research into other project actors, such as the project team, is merited.

A few published studies of project success factors in the extant literature consider processes, such as, for example, project success factors for the software development life-cycle (for example, Jones, 1996; Smuts van der Merwe, Kotzé, and Loock, 2010). As well as those who highlight the dearth of the coverage of processes (for example, Hofmann and Lehner, 2001, p. 58), there are others who point out the difficulties of examining them when it is often the case that the processes prescribed are routinely not followed in practice (de Bakker, 2009, p. 3; Fortune and White, 2009, p. 37). Thus there is merit in investigating how alternative behaviours and activities of individuals impact organisational information systems development project processes (Kutsch and Hall, 2005, p. 595).

#### **4.1.2 The deployment of project success factor lists in information systems research**

The broader literature shows that since the 1960s project success factors have typically been presented in lists (Fortune and White, 2006, p. 53). Many lists have been produced. Indeed, the literature of project management is replete with them (Alojairi and Safayeni, 2012, p. 17). Furthermore, existing lists readily spawn others. For example, Gingnell et al. (2014) have recently summarised and consolidated nine lists from the information systems literature into a new one that features 21 factors (pp. 23-25). Most of these lists are named as project success factor lists. Other labels have also been applied, for example: check lists (Alojairi and Safayeni, 2012, p. 17), top ten lists (Klakegg, 2009, p. 500) and hit lists (Gingnell et al., 2014, p. 23). A continued lack of agreement across these published project success

factor lists demonstrates that it has not yet been possible to generate a comprehensive list of the factors that are applicable to all projects (Altuwaijri and Khorsheed, 2012, p. 38; Fortune and White, 2006, p. 54; Söderlund, 2004a, p. 186). It should also be noted that project success factor lists often do not distinguish between the most commonly cited project success factors, and the most influential project success factors. Those that attract more attention may not be the most important (Klakegg, 2009, p. 500). A further issue is that the lists that resemble the top ten format negate the possibility of the influence of a far wider range of factors on any particular piece of work. Belassi and Tukel (1996, p. 142) and Jugdev and Müller (2005, p. 24) note another concern related to the sheer quantity of candidate project success factors in the information systems literature. The factors listed are not grouped or classified in any coherent manner in the published studies: an exception to this in the organisational information systems development literature is the work of Chow and Cao (2008, p. 964).

#### **4.1.3 Individual project success factors and lists in the organisational information systems literature**

Our analysis of the core papers reveals that, on average, each identifies twelve project success factors, thus reflecting the pattern in the wider literature as noted above. In contrast two previous studies that form part of the set present a high number of factors: Moynihan (1996) derived 113 risk constructs for project success (or failure) and Bannerman (2008) refers to (although does not elaborate upon) over 300 artefacts that ‘appeared to be relevant or important in enabling or inhibiting the performance and/or outcome’ of organisational information systems development projects (p. 2123).

Our audit revealed 488 unique project success factors related to organisational information systems development. Although further consolidation might be possible (for example, by additional effort to resolve near-synonymous terms), this number does not reflect the critical nature of a small number success factors as originally defined by Daniel (1961, p. 116), nor the spirit of a top ten list or similar as noted above. This indicates that the success of organisational information systems development projects is the function of a very large range of factors.

This also points to a possible reason for the failure of project success factor research to provide a deep understanding of real-world projects, as highlighted above: the majority of success factor studies do not acknowledge, let alone address, the large number of factors relevant to organisational information systems development projects. This does not, however, imply that individual factors are not commonly shared, nor that individual projects are so dissimilar that nothing from one case could be applied to another. Indeed, our means of describing project success factors as entity-characteristic pairs as shown in Table 4 demonstrates that there is sufficient commonality to support the transfer of certain factors between projects of different types.

**Table 4: Project entities and characteristics**

Entity types	Entity examples	Characteristic examples	Example pairing
Actors	End users Project board members Project manager Project team	Clarity Effectiveness Fitness for purpose Involvement Maturity Stability Supportivness	End users - involvement
Processes	Change control Communication Monitoring Risk management		Communication – clarity
Artefacts	Project deliverable Project estimates Project plan Project requirements		Project plan - stability

In some instances the relative rankings of the importance of project success factors identified is presented in the lists published in the information systems literature (Kwon and Zmud, 1987, cited by Larsen and Myers, 1999, p. 397). In keeping with the presentation style employed by the majority of such studies,

Two findings from this analysis are of particular interest. First, Table 5 highlights differences in the level of detail that can be found in success factor lists. Project requirements, for example, has four detailed entries in the list, each with different characteristics: (1) stability; (2) clarity; (3) completeness; and, (4) fitness for purpose. In contrast end users' involvement can be considered a much vaguer term. It does not distinguish, for example (1) the project activities in which the end users are to be involved, nor (2) the form that this involvement is to take (for example, full or part-time). This is likely to be indicative of a literature that has tended to focus on processes rather than sociotechnical issues (as also noted by Hornstein, 2015, p. 291), and the relative maturity of the consideration of these two perspectives. Here we highlight an opportunity for contributions from information systems researchers working in areas such as sociotechnical studies and social informatics to make a contribution to widening the scope of studies of information systems project success factors.

Table 5 shows the top 24 project success factors in the core papers. It is worth highlighting that none of these factors is exclusively restricted to organisational information systems development. Indeed, most are applicable to generic projects and their management. The exceptions are end users' involvement and the maturity of the project deliverable's technology.



**Table 5: 24 most-cited organisational information systems development success factors**

Rank	Entity type	Entity	Characteristic	Citations
1	Actor	End users	Involvement	18
2	Actor	Project board	Supportiveness	14
	Actor	Project team	Competence	14
	Process	Project planning	Effectiveness	14
5	Artefact	Requirements	Stability	11
	Process	Project management	Effectiveness	11
7	Artefact	Requirements	Fitness for purpose	10
8	Artefact	Estimates	Fitness for purpose	7
	Artefact	Project deliverable\technology	Maturity	7
	Artefact	Requirements	Clarity	7
	Process	Communication	Effectiveness	7
12	Actor	Client/host organisation	Staff turnover	6
	Actor	Project team	Competence/fit with project	6
	Process	Change control	Effectiveness	6
	Process	Project control	Effectiveness	6
	Process	Project monitoring	Effectiveness	6
	Process	Project	Size	6
	Process	Risk management	Effectiveness	6
19	Actor	Project manager	Experience	5
	Actor	Project team	Competence/technical	5
	Actor	Project team	Experience	5
	Artefact	Requirements	Completeness	5
	Process	Estimating	Effectiveness	5
	Process	Project	Complexity	5

A second observation is the low level of agreement on the ranking of project success factors across the papers, reflecting the case in the broader literature noted above:

- the top two factors appear together in only eight of the papers
- the top three factors appear together in only three papers
- the top four factors only appear together in one paper
- the top five factors do not appear together in any single paper.

We argue that this may be accounted for by the different contexts of the studies reported in the core papers (although it should be noted that the provision of details of context is often poor in the core papers, as can be seen in Table 2). Others have previously called for research into context-specific project success factors, for example by specific project type, geography or culture (Söderlund, 2011, p. 159) where significant differences have previously been identified (Pinto and Covin, 1989, p. 49). Equally it has been argued that the influence of organisational dynamics - particularly associated with information systems and information technology projects – are often ignored (Gauld, 2007, cited by Altuwaijri and Khorsheed, 2012, p. 38), yet merit particular attention as an important contextual factor. Since it is rare that a particular set of success factors holds the same importance across multiple studies (Kwon and Zmud, 1987, cited by Larsen and Myers, 1999, p. 398), investigations into the relative value of project success factors in similar environments is likely to furnish more meaningful comparisons and assessments of the generalisability of conclusions from research reported. For example, Smuts et al. (2010) identified almost 50 individual success factors related to the outsourcing of software development work. However, their findings derive from a single, South African, case study, and this is highly unlikely to be representative of project success factors in the development life-cycle of other contexts. This work would also address, to an extent, the question of applicability of top project success factors in particular contexts, yet also recognise that a single unified list is unlikely ever to be established (Ika, 2009, p. 9) due to the unique nature of each project.

Time should also be regarded as part of the context. This is because the influence of any project success factor is temporal: it varies at different points across the life-cycle of a project (Larsen and Myers, 1999, p. 398; Pinto and Covin, 1989, p. 49 cited by Jugdev and Müller, 2005, p. 26; Pinto and Covin, 1989, p. 59; Pinto and Prescott, 1988, p. 5; Pinto and Slevin, 1988 cited by Söderlund, 2004a, p.189). In addition, the project life-cycle itself is not static, but a dynamic phenomenon (Altuwaijri and Khorsheed, 2012, p. 38; Ginzberg, 1981 cited by Larsen and Myers, 1999, p. 398; Paré and Elam, 1997 cited by El Sawah, Tharwat and Rasmy, 2008, p. 260; Söderlund, 2004a, p. 189; Söderlund, 2011, pp. 159-160). A further element of time extraneous to the studies under review, but important to the methods deployed in our study, is the period over which the core papers were published: much has changed in information systems in the 33 years that the collection spans. Therefore it is perhaps inevitable that the attention paid to individual factors over the years is varied.

**4.2 Contributions of individual/group project success factors to project success (or failure): much research, little agreement, weak coverage in the organisational information systems development literature**

Some have claimed that there has been limited research into the influence of project success factors on project success (or failure) per se (for example, Andersen et al., 2006, p. 128; Thi and Swierczek, 2010, p. 572). However, this review of the literature demonstrates that several papers on this theme have been published in the information systems literature since 2000, as noted in the examples listed in Table 6.

**Table 6: Examples of research papers that discuss the influence of project success factors on project success (or failure) per se**

Influence	Factor	Paper
Positive	Common knowledge (end users & project team)	*Tesch, Sobol, Klein and Jiang (2009)
		Hsu et al. (2012)
	End user involvement	*Jiang, Chen and Klein (2002)
	Executive management support	Young and Jordan (2008)
	Organisational support	Gelbard and Carmeli (2009)
	Project commitment	Andersen et al. (2006)
	Project communications	Andersen et al. (2006)
	Project manager's leadership style	Müller and Turner (2007)
		Sumner, Bock and Giamartino (2006)
	Project manager's use of vision	Christensen and Walker (2004)
	Project planning practices	Kearns (2007)
	Project sponsorship	Bryde (2008)
	Project team dynamics	Gelbard and Carmeli (2009)
	Project team motivation	Verner, Beecham and Cerpa (2010)
	Project vision	Christensen and Walker (2004)
	Quality of planning	Dvir and Lechler (2004)
	Requirements engineering	Hofman and Lehner (2001)
		Hsu et al. (2012)
Risk management	De Bakker Boonstra and Wortmann (2012)	
Supportive organisational environment	Gray (2001)	
Negative	Goal changes	Dvir and Lechler (2004)
	Incremental organisational change	Winklhofer (2001)
	Project size	Sauer, Gemino and Reich (2007)
	Project volatility	Sauer et al. (2007)
	Staff turnover	Hall et al. (2008)

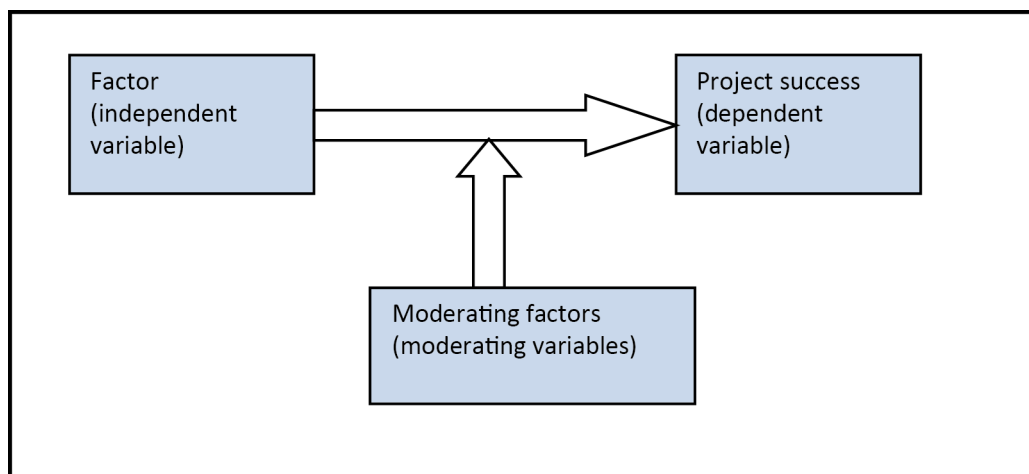
Neutral	Developer input to project estimates	Verner, Evanco and Cerpa (2007)
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Key: \*core papers

With the exception of a few qualitative studies (for example, Christensen and Walker, 2008; de Bakker et al., 2012), research into the influence of project success factors on project success per se is predominantly quantitative, as is the case for success factor lists as discussed above. Typically the results derive from surveys coupled with descriptive statistical analysis. The studies tend to focus on just one factor, or occasionally two, where the factor under investigation is considered as an independent variable that directly influences the dependent variable of project success, as illustrated in Figure 1.

. Notably, project success is not normally considered in terms of specific success criteria, i.e. measures that indicate that a project has been successful. Some of the studies also give consideration to moderating variables, i.e. those factors that might have a bearing on the influence of the factor under investigation.

**Figure 1: Research model for the influence of an individual factor on project success (or failure)**



The vast majority of studies listed in Table 6 conclude that the factor under investigation is indeed a factor of project success, i.e. it has an influence. This suggests that future studies of the impact of other factors will demonstrate that project success is a function of a far wider range of factors than previously believed. This finding calls into question once more the validity of the top 10 checklists highlighted above.

Although a detailed discussion of each of the papers listed in Table 6 is beyond the scope of this paper, the study published by Sauer et al. (2007), which conforms to the research model presented in Figure 1, merits further discussion. The authors raise an issue that is largely ignored in the published research on project success factors. They argue that if a project success factor is to be treated as an independent variable to be measured or assessed in some way, then there should be some agreement of the units of measurement to achieve this. Taking project size as an example, Sauer et al. (2007) recommend that project budget is an inappropriate unit of measurement. Instead, project size is better

measured in terms of effort. This can be viewed as the product of project team size and project duration, and expressed, for instance, as person-months (Sauer et al., 2007, p. 82).

A further issue identified by Sauer et al. (2007), but not taken into account by the majority of reported studies, is the degree or magnitude of any factor that influences project success. Without this information, the logical assumption is that the magnitude of a specific factor is directly proportional to its influence on project success. Thus it might be assumed that the more success factors in the mix, the better. However, Sauer et al's (2007) study shows this is not necessarily the case. This demonstrates, for example, that the influence of project size on project success is not linear. Instead, it rises slowly from 25 person-months until 1000 person-months, at which point it starts to rise far more steeply (Sauer et al., 2007, p. 81).

A third issue related by Sauer et al. (2007, p. 87), and noted by others (for example, Andersen et al., 2006; de Bakker et al., 2012; Hsu et al., 2012; Tesch et al., 2009) is that the relationship between a specific factor and project success 'is [typically] not as simple or direct as many think'. In many cases, specific factors are found to comprise a number of other sub-factors (as noted, for example, by de Bakker et al., 2012; Gelbard and Carmeli, 2009; Verner et al., 2007).

It is also relatively common for studies of project success factors and their contribution to project success to acknowledge that the interaction between factors is relevant, and that these interactions merit further investigation (for example, Bryde, 2008; Hall et al., 2008; Tesch et al., 2009). A number of studies (for example, Gelbard and Carmeli, 2009; Hsu et al., 2012; Tesch et al., 2009) also identify the moderating effects of intermediate factors. In addition these studies reveal small, localised causal chains associated with the specific project success factor under investigation (for example, Hofmann and Lehner, 2001; Hsu et al., 2012; Jiang et al., 2002; Wallace et al., 2004). Any claim for a specific project factor to have a direct and distinct influence on project success is therefore difficult to justify. As Hall et al. (2008) put it: 'the impact of individual factors is complex' (p. 33).

The analysis of the literature thus reveals that despite the number of papers published on the influence of success factors on project success, and given the high number of project success factors that can be identified from sampling the literature (488 from the core papers), there is clear opportunity for further investigations into the influence of success factors on project success. This is especially the case in terms of endeavours to identify the full range of factors at work, and how groups of factors have an impact.

#### **4.3 *Causal interactions between individual/groups of project success factors and simulations of these: incomplete and untested causal models***

The relationships between factors is a priority area for project management research. Indeed, it has long been argued that project success factors should not be considered on an independent basis (Clarke, 1999, p. 141). This is because 'the inter-relationships between factors are at least as important as the individual factors' (Fortune and White, 2006, p. 54). Knowledge of these relationships is of particular benefit to practitioners engaged in information systems development (Nandhakumar, 1996 cited by Fortune and White, 2006,

p. 54). However, the success factor list approach tends to treat each factor as an independent variable, and overlooks the interactions between the factors identified (Nandhakumar, 1996 cited by Myers, 1999, p. 398). As a result relationships are left unexplained (El Sawah et al., 2008, p. 260; Ginzberg, 1981 cited by Larsen and Myers, 1999, p. 398).

The published research discussed in the previous section supports the contention that numerous factors have an impact on project success. A closer analysis of this literature on project success in information systems also reveals a low understanding of how these factors interact. The need to enhance the extant knowledge was identified almost two decades ago by Belassi and Tukel (1996, p. 150), and has been expressed by others since (for example, Kim and Pan, 2006, p. 73). The earlier work noted that a combination of a large number of factors along the project life-cycle leads to project success (Belassi and Tukel, 1996, p. 142). Equally, the means by which these factors promulgate their influence in practice is significant: the factors do not typically affect a project's outcome in a direct manner (Belassi and Tukel, 1996, p. 142). It is therefore necessary to recognise that the influence of any given factor, or combination of factors, differs at points along the project life-cycle (because time influences context, as noted above), and this artefact of factor behaviour needs to be considered when assessing the overall impact of any factor on the final project outcome.

In some respects it is not surprising that there is low understanding of how success factors interact in information systems projects. Such projects are multifarious (British Computer Society, 2004, p. 15; Williams, Blakeegg, Walker, Andersen and Magnussen, 2012, p. 44; Xia and Lee, 2004, p. 69), and their management is 'a very complex undertaking in which a complex network of interrelationships and interactions exists' (Abdel and Madnick, 1983, p. 346). Indeed, complexity itself has been cited as a factor that influences project outcome, and normally one of failure, as noted in three of the core papers (Charette, 2005; Tiwana and Keil, 2004; Wohlin and Andrews, 2002).

As far back as the 1980s it was noted that an integrative model is necessary to make sense of the complex network as identified above, and this model should be flexible enough to represent the large number of factors in the complex network of interrelationships. In addition the model should be able to determine the dynamic behaviour of interactions between factors (Abdel-Hamid and Madnick, 1983, p. 346). Such a model would thus enhance understanding of information systems project success factors in two stages: first, by identifying the relationships between factors and, second, by making visible the dynamics of these relationships over the life-cycle of the project. The majority of research papers that have attempted to model project success factors address only the first issue. It should also be noted that most of these studies deal with a range of information systems projects, and not organisational information systems development projects specifically. Nonetheless, the factors considered in these studies are the same as those that feature in the success factor lists for organisational information systems development projects, for example executive management support and end user involvement. It is therefore likely that their findings are relevant to organisational information systems development projects.

Table 7 summarises the characteristics of studies that have modelled the interactions of project success factors.

**Table 7: Studies that model project success factors**

Date	Authors	Characteristics of the studies and the models proposed
2002	Akkermans and Van Helden (2002)	<p>This exploratory study of an ERP implementation attempts to understand the interrelationships between factors.</p> <p>It builds a relationship model by incorporating the relationships between 10 success factors identified in an earlier study (Somers and Nelson, 2001).</p> <p>The model identifies a reinforcing loop of causal interactions that can act as both a vicious, or virtuous, feedback loop (p. 42).</p> <p>The model demonstrates how a change in a success factor can lead to a self-perpetuating cycle of good or poor performance that eventually leads to project success (or failure).</p>
1999	Butler and Fitzgerald (1999)	<p>This case study of an information systems development process presents a network analysis of 20 project success factors.</p> <p>It demonstrates that information systems development success factors, such as a committed project sponsor and adequate documentation, are closely related.</p> <p>It concludes that these success factors influence each other, and that the strength of these influences can vary.</p>
2006	Fortune and White (2006)	<p>This theoretical study framed 27 success factors in a formal system model that considers the relationships between success factors.</p> <p>The model was then used to ‘distinguish’ between two information systems projects, one of which was successful, the other not (p. 63).</p>
2004 2006	Kim (2004); Kim and Pan (2006)	<p>The authors develop relationship models for information systems projects comprising ‘essential’ factors (12 in the 2004 publication, and 10 in 2006).</p> <p>The models derive from data collected in case studies of customer relationship management (CRM) system implementations.</p> <p>The models help explain how and why success factors affect one another, and how their interaction leads to project success (or failure) (Kim, 2004, p. 28; Kim and Pan, 2006, p. 72).</p>

2006 2008	King and Burgess (2006; 2008)	Influenced by work of Akkermans and Van Helden, the authors propose conceptual models that comprise a limited number success factors linked in causal chains (King and Burgess, 2006, p. 66; King and Burgess, 2008, p. 426).
2005	Procaccino, Verner, Darter and Amadio (2005)	The study proposes a model for organisational information systems development project success. Data for the model were collected from software practitioners. The model identifies a number of relationships between factors. The authors argue that there is a chronological critical path of success factors. Here the existence of a project champion influences the amount of time that end users make for requirements gathering. In turn, this leads to a high level of end user involvement in the development process, and results in better agreement on requirements between end users and the project team (p. 196).
2006	Sabherwal, Jeyaraj and Chowa (2006)	This study presents a theoretical information systems model that comprises 6 factors (and 4 criteria). It classifies the factors as either context-related (top management support and facilitating conditions) or user related (user experience, training, attitude and participation). A number of relationships between factors are revealed. Some relationships were unanticipated by the researchers, e.g. not all of which were 'expected' by the authors: for example, the influence of user attitudes on information systems quality (p. 1858).
2000	Yetton, Martin, Sharma and Johnston (2000)	This study presents a causal model of project performance with references to 12 project success factors. The model highlights the significance of executive management support, risk management, project team dynamics for strategic projects, and end user involvement to successful project performance (p. 263)

While these studies have enhanced understanding of the interaction of project success factors, they have limitations, and these may go some way to explain the low understanding in this area noted above. Most striking perhaps is that even though our detailed study of the core papers identifies 488 unique project success factors, the studies summarised in

Table above consider just a few key success factors each. A further issue is that only three sets of researchers (Akkermans and Van Helden, 2002; King and Burgess (2006 and 2008);



and Yetton et al., 2000) investigate and report upon (simple) causal loops in their work. A related issue is that the treatment of success criteria across the studies as a whole is superficial. As such, the papers present rather simple scenarios. A stronger portrayal of the complexity of the causal interactions between success factors in information systems projects in general, and organisational information systems development projects in particular, would result from the inclusion of a wider range of factors, relationships, and discuss of project success criteria, in future work.

A number of researchers have noted that in cases where project success factors have been modelled, the models presented are somewhat static (for example, Altuwaijri and Khorsheed, 2012, p. 38; King and Burgess, 2006, p. 67). It is thus interesting to consider the extent to which attempts have been made to simulate the dynamics of success factor relationships.

It has been argued that 'simulation is a useful tool for tactical management in software engineering. It provides a means to study complex phenomena in project development that cannot be carried out easily with actual cases' (Lee and Miller, 2004, p. 80). Added to this, the use of modelling techniques for projects in general has proved extremely useful in uncovering how complex projects behave, enhancing understanding of the actuality of projects (Cicmil, Williams, Thomas and Hodgson, 2006, pp. 682-684).

Despite this, simulation remains an under-explored technique for understanding success factors in information systems projects including those related to organisational information systems development (King and Burgess, 2008, p. 430). Some earlier publications point to computerised simulation modelling techniques as a means to extend knowledge of success factor dynamics (for example, Abdel-Hamid and Madnick, 1983, p. 346; King and Burgess, 2006, p. 62; King and Burgess, 2008, p. 430; Lee and Miller, 2004, p. 80). However, much of this work is tentative (for example, King and Burgess, 2008). The use of simulation models to enhance understanding of the dynamic relationships between success factors in organisational information systems development projects is thus another area ripe for research. There is thus significant scope for researchers to generate more comprehensive causal models to better explain factor influence in real-world organisational information systems development projects. In addition, it would be useful if the conceptual models already developed were validated, complemented, modified, and/or extended through the work of others in the future.

#### **4.4 Project success factor frameworks: dearth of frameworks for organisational information systems development projects**

A variety of generic project success factor frameworks, in a range of shapes and forms, have been proposed to address the issues such as how project success factor may be grouped. These are considered below.

Discussion of frameworks is commonplace in the mainstream general project success factor literature (Ika, 2009, p. 11; Jugdev and Müller, 2005, p. 25), and some of the frameworks described have been tested empirically (Jugdev and Müller, 2005, p. 29). However, it has

been noted that there remains a need for more inclusive project success factor frameworks (Ika, 2009, p. 11).

Early examples of general project success factor frameworks include Kerzner's model for project excellence (Kerzner, 1987, p. 33) and Slevin and Pinto's project implementation framework (Slevin and Pinto, 1987, p. 35). By the mid-1990s, Belassi and Tukul (1996, p. 144) had developed a more holistic framework. This encouraged the consideration of project success factors in terms of their classification and relationships. It also highlighted the implications of not taking particular project success factors into account (Jugdev and Müller, 2005, p. 25). The value of Belassi and Tukul's framework was that it was assessed by a range of study participants, some of whom were information systems practitioners (Belassi and Tukul, 1996, p. 149). Another general framework that was tested for its usefulness amongst information systems practitioners was that of Westerveld (2003, p. 415). This framework linked project success factors to project success criteria (i.e. the measures that indicate that a project has been successful). Evidence of the value of Westerveld's framework is shown in the assessment of an enterprise resource planning implementation (Westerveld, 2003, p. 417).

More recently, a number of success factor frameworks directly related to information systems (as opposed to general) projects have been published. For example, Vithanage and Wijayanayake (2007, p. 37) developed a framework for large-scale information systems implementations. Similarly, in 2010 Hawari and Heeks proposed a design-reality gap model for enterprise resource planning projects (p. 151). Although both of these studies are concerned with implementation-based projects, the factors that they encompass suggest that the frameworks in question may be relevant to the implementation aspects of organisational information systems development projects. Indeed Hawari and Heeks (2010, p, 155) state explicitly that there is no reason why their framework cannot be exported to other information systems applications. Fortune and White (2006) have also shown how a generic framing device can be applied to information systems projects (including one organisational information systems development project). The evidence provided in these studies thus suggests that generic project success factor frameworks can be applied to information systems projects in general, and possibly also to organisational information systems development projects.

The literature search conducted for the analysis presented in this article, however, uncovered just one framework that addresses factors for organisational information systems development projects in particular (Keil et al., 1998, p. 80). This framework focuses on risk, with particular attention paid to two of its dimensions: (1) perceived relative importance; and (2) perceived level of control. The general content of Keil et al's 1998 paper, including the framework described, is clearly useful in itself. However, its greater value in the context of a review of the literature such as this lies in its identification of the need for further development of project success factor frameworks for organisational information systems development projects. Despite the length of time since the publication of Keil et al's study in 1998, the analysis of the literature presented in this article supports the currency of this view.

## 5 CONCLUSION

Our goal when preparing this review was to generate a critical evaluation of the literature pertinent to success factors in organisational information systems development projects within the broader context of the information systems literature. It was anticipated that the our output would highlight where future research endeavour could extend the existing knowledge base on project success factors in organisational information systems development projects. This goal has been met by considering four broad research themes that emerged from an analysis of extant literature as summarised in Table 1. Although we cannot claim comprehensive coverage of all literature belonging to the domain – this is often impossible in this kind of work (Rowe, 2014, p. 246) - the collection of work reviewed is comprehensive enough for identifying (1) where previous research effort has been invested and (2) possible future research directions.

Perhaps the most prominent finding here is just how much opportunity there is to enhance the understanding of project success factors in organisational information systems development so that better decisions can be made in practice, and those decisions can be translated into actions that are properly resourced. Indeed, it is striking how a research stream that has been in existence for several decades, and has produced plenty of output in this time (despite claims to the contrary, for example, Belout and Gauvreau, 2004) has failed to generate any convincing theoretical models. What is found here is an abundance of factors, and a paucity of frameworks. This apparent immaturity of the domain is also reflected in the superficial treatment of some topics in studies that lack rigour. This is exhibited, for example, in the reluctance in some studies to acknowledge that project success factors cannot be considered as independent variables. This superficiality is also demonstrated in cases where there appears to be general ignorance of certain topics, such as the question of causal loops.

While it is useful for practitioners to have an awareness of a set of project success factors (many of which are presented in the literature), it does not follow that such knowledge can directly improve project performance. Practitioners need to understand, for example: which of the factors are most important to project success (Altuwaijei and Khorsheed, 2012, p. 38; Fortune and White, 2006, p. 54; Söderlund, 2004, p. 186); how these factors can be used to alleviate problems faced in practice (Clarke, 1999, p. 139; Nakatsu and Iacovou, 2009, p. 64); and the potential consequences of actions taken (King and Burgess, 2006, p. 59; King and Burgess, 2008, p. 421). In short, a literature that gives evidence of the existence of project success factors in the form of lists, but does not give advice on how they can be used to help eliminate problems in practice, is inadequate. There is a need for an additional narrative that describes what these real-world factors represent, and also for advice and guidance on the practical application of these factors so that practitioners can predict the consequences of their actions. Stronger theoretical models would be beneficial to those who wish to understand the primary causes of success and failure (King and Burgess, 2008, p. 421). However, with very few exceptions (for example, Rodriguez-Repiso, Setchib and Salmeron, 2007), the literature is almost completely silent on the subject of project success factor management.

There are several possible explanations for the criticisms levelled above. First, the lack of strong research tradition in project management can be cited. The main impact of this deficiency is that this domain lacks research direction, both in terms of the identification of priorities areas for research, and in promoting appropriate approaches for the execution of empirical work. Equally a literature that is scattered makes it difficult for researchers to access, to critically evaluate, and to draw upon established work in the course of their own research. It is also the case that the question of context - for example in terms of the timing, culture, governance, geographic location, strategic intent - as related to the organisational information systems development projects under scrutiny has a strong influence on project success factor behaviour. The complexity of organisational information systems development projects is also acknowledged as an inhibiting factor here. Thus it may be unreasonable to expect the findings from any particular study to necessarily match with others.

That said, this review makes clear that there are several areas related to project success factors in organisational information systems development projects that are ripe for research, and extending the knowledge in the context of the project management of organisational information systems development projects would also be welcomed by the broader information systems community. Some of the opportunity lies in addressing straightforward gaps in knowledge. For example, it is not possible to say with certainty which are the key project success factors in organisational information systems development projects. Others have made comments such as this in the context of information systems projects in general (for example, Fortune and White, 2006, p. 54). However, none have gone as far to say that the notion of the existence of 'critical' success factors may be illusory, and the search for them is not worth continuing. Our own view is that that the word 'complex' may be a better epithet than 'critical' to apply to the phrase 'success factors'. Further gaps in knowledge may be filled by exploring artefacts and actors as success factors for organisational information systems development project, and by examining the use of simulation models to enhance understanding of dynamic relationships between success factors in organisational information systems development projects.

Further research could address the contradictory nature of earlier studies in the domain. For example, there is little agreement as to the relative importance of particular project success factors. Even if agreement cannot be reached, the reasons as to why it is lacking would be a starting point of interest to the wider research community. Future research contributions that explore these issues and address others highlighted in this review will help build an evidence base that would engage both the academic and practitioner communities. This, it is hoped, will lead to the generation of theoretical insight to enhance the understanding of real-world organisational information systems development projects, as well as improve the general theoretical underpinning of project management in the domain of information systems as a valuable, and valued, domain of research.

Some of these questions may be addressed by engaging a broader community of researchers in studies that have traditionally been dominated by in project management and/or general information systems research. Such individuals may be found working in

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particular areas of information systems research, such as sociotechnical studies, social informatics, and other related disciplines. Much more may be achieved by drawing on such research domains that (1) have a tradition of in-depth qualitative analyses of systems implementations; and (2) use a range of approaches that go beyond a focus on processes to include consideration of actors and artefacts in the context of the wider macrostructure of systems implementation. Thus there is the potential for the discussion in this domain to move on from lists of factors to the presentation of frameworks, detailed simulation models, and the possible development of theory.

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