

Success Factors for Organisational Information Systems Development Projects: A Scottish Suppliers' Perspective

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Abstract

Organisational information systems development (OISD) projects have long been associated with failure. Not surprisingly, the cost of these failures is enormous. Yet, despite numerous studies, understanding of real-world projects is limited. In particular, little is known about the way in which various factors affect the success of OISD projects. Prior research has focussed on OISD projects from an in-house or client perspective, and the views of the supplier have largely been ignored. By investigating OISD project success factors from the supplier perspective, this doctoral study helps address this gap.

Based on an empirical investigation drawn from data collected from Scottish IS/IT solution suppliers, this research identifies and analyses 20 success factors for supplier-based OISD projects, and a range of more detailed, inter-related sub-factors related to each of the twenty. The work confirms the importance of many factors identified in the extant literature. A number of additional factors not previously identified are also exposed. Important differences between supplier and client perspectives are revealed. The findings also develop a variety of factors that have merited scant treatment in the OISD project success factor literature.

The means by which OISD project success factors propagate their influences to affect project success was also investigated. This is revealed to be a complex phenomenon comprising billions of causal chains interacting with a few million causal loops. The propagation process is performed by a sizeable network of factors, the topology of which seems to reflect the complexities of real-world OISD projects. Hence, the network is used to propose a new theory for success factors that contributes new insight into the behaviour of these projects.

The research also reveals that supplier-based OISD projects are oriented more towards project success than project management success and that OISD project success criteria are far more than simply measures of success. Indeed, the overall conclusion of this thesis is that the concept of OISD project success factors is far more complicated than has been previously articulated.

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For my mother and father.

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1. Introduction to the thesis

1.1 Introduction

This thesis presents a doctoral research project that investigated success factors for organisational information systems development (OISD) projects. The investigation addressed OISD projects from the perspective of Scottish suppliers engaged in the development of information systems¹ (IS) solutions for client organisations. The research project employed both qualitative and quantitative methods to produce findings that constitute an original contribution to knowledge in the field of IS project management. The findings also contribute to the development of theory in the field.

This chapter provides an introduction to the thesis. In the next section, the allure of project success factors is discussed. Then, the motivations for the research are presented, as are the research aims and objectives. These are followed by the definition of the project's key terms: (1) organisational information systems, (2) OISD projects, and (3) OISD project success factors. Prior to the chapter's conclusion, the structure of the thesis is described.

1.2 The allure of project success factors

A little over 50 years ago, an article entitled "Management information crisis" appeared in the *Harvard Business Review*. In the article, *success factors* were defined as the "key jobs [that] must be done exceedingly well for a company to be successful" (Daniel, 1961, p. 116). The article also stated that companies would generally have between three and six industry specific success factors (Daniel, 1961, p. 116). Around 20 years later, Daniel's work was popularised by Rockart (for example, Rockart, 1979; Bullen & Rockart, 1981), who used the term *critical success factors* to refer to "the few key areas of activity in which

¹ The terms *information systems* (IS), *information technology* (IT), and *information and communications technology* (ICT) are considered to be synonymous and, hence, are used interchangeably throughout this thesis.

favourable results [were] absolutely necessary for a particular manager to reach his goals” (Bullen & Rockart, 1981, p. 3).

Since then, the concept of success factors (i.e. that the success of a given endeavour could be determined by a few key areas of activity), has appealed to a large number of researchers, not least those conducting studies in the field of project management. Indeed, since Rockart, the allure of success factors has led many researchers to investigate the factors that affect project success (Milosevic & Patanakul, 2005, p. 181). Thus, success factor research became a major research stream in project management (Söderlund, 2004b, p. 659; Söderlund, 2011, p. 158) and information systems (Larsen & Myers, 1999, p. 397; Lu, Huang, & Heng, 2006, p. 295). That said, there is a lack of theoretical grounding in the work that has been produced. Also, despite numerous studies, a coherent set of factors for the IS/IT development process has yet to be found (Altuwaijri & Khorsheed, 2012, p. 38; Butler & Fitzgerald, 1999, p. 355). Hence, the question remains: can IS/IT project success be determined by a few, key factors? Or, despite this alluringly simple concept, is IS/IT project success a far more complex phenomenon?

1.3 Motivations for this research

The motivations for the research discussed in this thesis were three-fold:

- (1) The researcher’s experience as a professional IS consultant

The study was initially motivated by the researcher’s experience as a professional IT consultant specialising in enterprise resource planning (ERP) and “advanced” planning and scheduling applications. From 1992 to 2001, the researcher was involved in the delivery of 21 successful IS/IT projects for a diverse range of customers in a variety of countries (for example, in the UK, USA, Ireland, Germany and China) and industry sectors (for example, communications infrastructure, personal communication devices, whisky production, medical supplies and public transport services). To provide a better understanding of the researcher’s

experiences and beliefs (in relation to project management), a profile of the researcher is presented in Appendix 1.1.

(2) The widespread adoption of IT

During the 1990s, the widespread adoption of IT by organisations was profound (Lycett & Paul, 1999, p. 127). Indeed, by the beginning of the 21st Century, the very idea that a modern day organisation might operate effectively without computerised information systems seemed almost absurd. As a consequence, organisations accrued significant operational and strategic benefits from their IT investments (Chiang & Mookerjee, 2004, p. 89).

(3) The poor performance of IS projects

Yet, these benefits came at a price. In particular, the projects that delivered IS solutions had acquired a reputation for high failure rates (Wright & Capps, 2011, p. 88). In addition, although there had been successful projects in a large number of organisations (Wateridge, 1995, p. 169), many OISD projects were delivered late and/or over budget, while others failed to deliver the required functionality (Standish Group, 2009a, p. 1).

Hence, this research was conceived from the consensus of research articles that identified the poor performance of OISD projects to be a serious and recurrent problem (see, for example, Lee, 2003; Tarbet, 2012; Wallace & Keil, 2004; Wright & Capps, 2010). In other words, too many OISD projects failed to meet the required success criteria determined at their outset. Subsequently, an investigation into the reasons why contemporary OISD projects succeed or fail was deemed appropriate for a doctoral research project. This was regarded as especially important due to the regularity with which the theme has been researched and the severity of the problem area.

1.4 Research aims and objectives

Thus, the aim of this research project was to provide a better understanding of the reasons why OISD projects succeed or fail. To develop this aim further, a comprehensive review of literature in the field was performed. The literature review (presented in the next chapter) revealed a number of gaps in the literature and, in particular, identified the need for research into:

- (1) OISD project success factors from the suppliers' perspective;
- (2) The numerous success factor relationships/interactions that might (or might not) exist in real-world OISD projects.

Consequently, the research objectives for this study were defined as follows:

- (1) To provide a better understanding of OISD project success factors from a suppliers' perspective;
- (2) To provide a better understanding of the way in which these factors interact to influence project success.

These objectives were considered appropriate for providing an original contribution to knowledge and also for developing theory in the field.

1.5 Key terms and definitions

There are three key terms in this thesis: (1) organisational information systems, (2) OISD projects, and (3) OISD project success factors. These terms are defined as follows.

1.5.1 Organisational information systems

An organisational information system is "any of a wide combination of computer hardware, communication technology and software designed to handle information related to one or more [organisational] processes" (Flowers, 1996 cited by Yeo, 2002, pp. 241-242). Organisational information systems can vary significantly in terms of their scale, complexity and functionality, as can their host organisations and end user populations. End user populations can be internal and external to their host organisations. Internal end user populations

include various levels of management, specific individuals and specific functional groups. Functional groups (and individuals) are typically responsible for performing organisational functions such as sales and marketing, human resource management, engineering and product development, quality management, financial accounting, along with service and manufacturing functions (and specialised sub-functions thereof; for example, purchasing, production planning, etc.). External populations include customers, suppliers and other stakeholder groups such as investors. Examples of organisational information systems (or applications) include enterprise resource planning (ERP) systems (and sub systems thereof), web-based e-commerce systems and customer relationship management (CRM) systems.

1.5.2 OISD projects

In its generic sense, a project is “a temporary endeavour undertaken to create a unique product or service” (Project Management Institute, 2008, p. 5). A specialised form of a “project” is the IS/IT project: a temporary endeavour performed to provide² an information system for a host organisation. IS/IT projects can be further classified as (1) implementation only or (2) development projects. Implementation only IS projects do not comprise any significant software development³. Instead, these projects are used to implement commercial packaged software products for a host organisation (for example, an ERP implementation project). On the other hand, development projects involve a significant amount of software development to create the information system prior to implementation. In this thesis, development projects are referred to as organisational information systems development (OISD) projects to accentuate the organisational aspect of the project’s deliverable (the information system) and the software development process used to create it.

² Or perform a significant update or upgrade.

³ Although they may still involve lesser degrees of software development for system installation, data transfer, minor customisations, etc.

OISD projects can be further classified as (1) in-house development or (2) supplier-based development projects. In an in-house development project, the supplier organisation and the host organisation are one in the same. In a supplier-based development project, the host organisation subcontracts the development project to an external supplier. Hence, the organisations involved in the project are the supplier organisation and the client (host) organisation. The OISD projects investigated in this thesis are supplier-based and, hence, the discussion differentiates between the supplier and client organisations.

1.5.3 OISD project success factors

Prior to defining the meaning of project success factors, it is necessary to discuss what is meant by *project success*; a term that can be defined in two different ways. The first of these refers to the way in which *project success* is typically used in the literature; that is, to refer to the intended outcome of a project (see, for example, Nicholas & Hidding, 2010, p. 152; Subramanyam, Weisstein, & Krishnan, 2010, p. 137). Yet, *project success* can also be expressed as having two aspects: project success factors and project success criteria (Cooke-Davies, 2004, p. 99; Müller & Turner, 2007a, p. 299) In this context, project success factors contribute to the success (intended outcome) of the project (Ika, 2009, p. 8), whereas project success criteria are “the set of principles or standards by which project success is or can be judged” (Lim & Mohamed, 1999, p. 243). Examples of project success criteria include budget adherence, benefit to the client organisation, etc.

The project management literature provides a variety of definitions for project success factors; for example, conditions, circumstances and events (Ika, 2009, p. 8), characteristics, conditions and variables (Milosevic & Patanakul, 2005, p. 183) or circumstances, facts and influences (Lim & Mohamed, 1999, p. 245) that, when present (Cooke-Davies, 2004, p. 101), contribute to the success (Ika, 2009, p. 8) or intended outcome, of a project. Although these definitions are quite acceptable (discussed further in the next chapter), project success factors are better defined in simpler terms. As project success factors contribute to the success of a project, a project success factor is *anything* that contributes to the

success, or intended outcome, of a project. Equally, (1) a project failure factor is anything that detracts from the success of a project (or, put another way, contributes to the failure of a project), and (2) a project risk factor is a potential project failure factor that has still to be realised as such. Hence:

- (1) An OISD project success factor is *anything* that contributes to the success (intended outcome) of an OISD project;
- (2) An OISD project failure factor is *anything* that detracts from the success (intended outcome) of an OISD project;
- (3) An OISD project risk factor is a potential OISD project failure factor that has still to be realised as such.

The definition of an OISD project success factor can be further clarified by way of examples. As Chapter 2 will demonstrate (see p. 42), OISD projects encompass a wide range of success factors, the 11 most cited of which are listed in Table 1.1.

Rank	Success factor
1	End user involvement
2	Project board supportiveness
	Project team competence
	Effectiveness of the project planning process
5	Stability of the project's requirements
	Effectiveness of the project management process
7	Fitness for purpose of the project's requirements
8	Fitness for purpose of the project's estimates
	Maturity of the project deliverable's technology
	Clarity of the project's requirements
	Effectiveness of the communication process

Table 1.1. The 11 most cited OISD project success factors

The success factors in Table 1.1 are related to three project entity types: the (1) actors (for example, end users, the project board, etc.), (2) artefacts (for example, the project's requirements, the project's estimates, etc.) and (3)

processes (for example, project planning, communication, etc.) associated with an OISD project. These entity types⁴ are described further in Table 1.2.

Entity type	Definition	Entity examples
Actor	People: individuals and groups found in organisations associated with the project.	Project manager, end users, project team, executive management, project sponsor.
Artefact	Things that are typically produced, consumed, utilised or referred to by a project's processes.	Project budget, hardware, training facilities, design specifications, project metrics.
External	Entities found outwith the client/host organisation (excluding those in external organisations e.g. suppliers and partner organisations).	Financial climate, labour market, government legislation.
Process	Activities associated with the project.	Project management, software development, training.

Table 1.2. Project entity types

Unfortunately, Table 1.1 is open to a degree of misinterpretation. In particular, it might be construed that the 11 factors listed in Table 1.1 might represent those critical or key factors⁵ factors (i.e. those that should be considered to be more significant than other factors in terms of their influence on project success) for OISD projects as a whole (see Section 1.2 above). However, as the literature review will show, such an interpretation is erroneous. On the contrary, there is little agreement between researchers as to the success factors that are applicable to OISD projects in general. Indeed, the evidence suggests that OISD project success is a function of a wide range of project success factors.

Thus, in summary, an OISD project success factor (as distinct from a success criterion) is *anything* that contributes to the success (intended outcome) of an OISD project. Typically, there will be a wide range of these factors, the majority

⁴ And a fourth, less applicable entity type: externalities.

⁵ Or any similar term (for example, crucial success factors) that infers significance in relation to other factors.

of which are related to the various actors, artefacts and processes associated with the OISD project.

1.6 Thesis structure

This thesis comprises an opening section (abstract, acknowledgements, etc.), seven chapters, a reference list and a series of appendices. The contents of the six remaining chapters are summarised below.

Chapter 2 presents a critical review of the OISD project success factor literature. With numerous studies covering a number of research directions, OISD project success factors⁶ is shown to be a vibrant research area with significant research opportunities. In particular, as prior research has explored OISD project success factors predominantly from an in-house/client viewpoint, there is a need for qualitative studies that examine the supplier's perspective (first research objective) and, in so doing, describe the actuality of real-world OISD projects. Research that explains the way in which success factors propagate their influences to affect project success is also merited (second research objective).

Chapter 3 discusses the methodology employed by this research project. The first two sections provide an overview of the research approach followed by a discussion of its philosophical foundations. Next, the literature review and pilot interviews are described. The main part of the chapter presents the main fieldwork process: (1) company selection, (2) interview arrangement, (3) data collection (semi-structured interviews), followed by (4) qualitative and (5) quantitative (relationship) analyses of supplier-based OISD project success factors. The problems and limitations encountered by the research are then presented as are the measures taken to ensure the validity and reliability of the research findings.

⁶ Including risk and failure factors.

Chapter 4 addresses the first research objective by presenting the findings of a qualitative analysis that identifies and describes 20 high-level success factors for supplier-based OISD projects. These factors include effective requirements management, an effective project team and fit for purpose technology. The thick, rich descriptions provided for each factor serve to enhance understanding of the actuality of real-world OISD projects. The descriptions also reveal that the high-level success factors comprise a range of more detailed factors and relationships between them. The findings also identify a range of success criteria for project management success and organisational success.

Chapter 5 addresses the second research objective. The findings of a quantitative relationship analysis reveal that the propagation process by which success factors affect OISD project success is a complex phenomenon. The process is shown to rely upon a sizeable network of factors and criteria comprising 114 billion casual chains and three million causal loops. The most active factors in the network are shown to be significant in that they can be used to determine project performance over the lifecycle of the project. The network can also be used to identify the most significant success criteria for supplier-based OISD projects.

Chapter 6 identifies and discusses the contributions to knowledge and theory made by the research project. The primary contributions are shown to be (1) the identification and description of 20 high-level success factors (see “Chapter 4” above), and (2) the complex, active network of factors and criteria by which success factors propagate their influences to affect project success⁷ (see “Chapter 5” above). Additional contributions relating to success criteria include (1) the differentiation between client and supplier organisational success, and (2) examples of success criteria influencing other factors and criteria. A number of lesser contributions are also described.

⁷ The active network is also used to propose a new theory for the behaviour of success factors in OISD projects.

Chapter 7 provides the conclusions for the thesis. The research project is shown to have met its research aims and objectives, and that it has made original contributions to knowledge and theory. The project's research methodology is shown to be fit for purpose when assessed in terms of its strengths and weaknesses. A number of recommendations for further research are also presented. Finally, it is argued that the findings of the project show that the concept of OISD project success factors is far more complex than portrayed in the research literature.

1.7 Conclusion

This chapter has provided an introduction to the thesis. The allure of project success factors was discussed; in particular, the notion that the success of an IS/IT project can be determined, neatly and succinctly, by the influence of a few key factors. The motivations for the research; namely, the researcher's career in IT consultancy, the proliferation of IS/IT solutions and the poor performance of IS/IT projects, were also presented, as were the research aims and objectives. In summary, the research aimed to provide a better understanding of (1) OISD project success factors from a suppliers' perspective, and (2) the way in which these factors interact to influence project success. Definitions for the project's key terms were also provided: (1) organisational information systems, (2) OISD projects, and (3) OISD project success factors. Finally, the structure of the thesis was described.

Having provided an introduction to the thesis, the next chapter will present the findings of first substantial activity carried out in the research project: a critical review of the literature pertaining to OISD project success factors and closely related topics.

2. Literature review

2.1 Introduction

This chapter provides a critical review of the literature that analyses and evaluates previous research into success factors for organisational information systems development (OISD) projects. The review is essential to an understanding of how earlier research has explained OISD project success and failure. In this context, the main objectives of the chapter are twofold: (1) to provide a critical review of research previously carried out in the field, and (2) to identify the state-of-the-art for OISD project success factor research. The literature discussed here draws on a range of sources, the derivation of which is given in Chapter 3.

This chapter is structured as follows. The next section describes the background to the research. This is followed by a discussion of project success factor research:

- (1) The subject matter is introduced and discussed in the context of project success;
- (2) Project success factor definitions and terms are provided;
- (3) The origins of success factor research are identified and developed in terms of project success factors;
- (4) General criticisms of the research area are presented.

Next, the literature review turns its attention to OISD project success factors and considers the five prominent research directions in the field:

- (1) Success factor lists (including an analysis of their findings);
- (2) Specific success factors;
- (3) Success factor frameworks;
- (4) The direct influence of success factors on project success;
- (5) Causal interactions between success factors.

Having discussed the five prominent research directions in the field, three dimensions of OISD project success factor research are then explored: culture, perspective, and approach. Next, the temporality and theoretical basis of OISD project success factors are discussed. The chapter concludes by identifying the state-of-the-art for the research area and outlining the content of the subsequent chapters.

2.2 Background to the research

Project success has attracted the attention of many researchers. Although a great deal has been written about the subject, understanding of project success is far from complete (Ika, 2009, p. 7). Indeed, a certain amount of contemporary research into IS/IT project success is still being described by its authors as “exploratory” (for example, Agarwal & Rathod, 2006, p. 358; Andersen, Birchall, Jessen, & Money 2006, p. 128; Chow & Cao, 2008, p. 964; Fowler & Horan, 2007, p. 1; Procaccino & Verner, 2006, p. 1541; Thomas & Fernández, 2008, p.733; Wright & Capps, 2010, p. 2; Wright & Capps, 2011, p. 89). Others note it is “conceptual” (for example, Yu, Flett, & Bowers, 2005, p. 428) or even at a “starting point” (for example, Agourram & Robson, 2006, p. 308). These descriptions, in conjunction with the increasing trend of investment in IT (Lin, 2009, p. 865) and the poor performance of IS projects (see, for example, Standish Group, 2009a, p. 1; Wright & Capps, 2010, pp. 1-2), indicates that IS project success is an active, relevant and ongoing research area.

2.2.1 Contemporary organisational information systems

Since the mid-1950s, the widespread adoption of IT by organisations has been profound (Lycett & Paul, 1999, p. 127); a trend that has persisted and will continue to do so (Lin, 2009, p. 865). As a consequence, organisations have accrued significant operational and strategic benefits (Chiang & Mookerjee, 2004, p. 89). Yet the contribution of IT to business performance remains ambiguous (Szanto, 2005 cited by Lin, 2007, p. 93) and many companies have been considerably disappointed by their IT investments (Tiernan & Peppard, 2004, p. 609). Even so, executive management seems to have become reliant on IT to run their organisations more efficiently (Rigby & Bilodeau, 2005, p. 5).

Most organisations are now dependent on IT and would quickly cease to function should the technology underpinning their activities ever come to a halt (Peppard & Ward, 2004, p. 168).

Advances in IT have given rise to a broad range of organisational information systems. Examples of these systems include applications for financial accounting, commercial transactions, customer relationship management (CRM), supply chain management, human resources management (HRM) and production scheduling (to name but a few). Although some of these applications can be provided through the deployment of packaged software products, others require the development of bespoke software. In many cases, the bespoke software may constitute a complete application in its own right. In others, the bespoke software may be required to provide functionality not provided by the packaged solution. Where bespoke software is required, the effort required to develop these applications can be substantial (Warkentin, Moore, Bekkering, & Johnston, 2009, p. 9), sometimes involving the engagement of large teams in development cycles that take years to complete (Bechtold, 2003, p. 25).

2.2.2 Organisational information systems development

Organisational information systems development (OISD) involves the “analysis, design and implementation of applications and systems to support business operations in an organisational context” (Xia & Lee, 2004, p. 70). It is a unique, complex and unpredictable process (Han & Huang, 2007, p. 42; Na, Li, Simpson, & Kim, 2004, p. 155), often involving significant organisational change (British Computer Society, 2004, p. 17; Cicmil, Hodgson, Lindgren, & Packendorff, 2009, p. 82; Lorenzi & Riley, 2000, p. 117). Consequently, OISD requires effective management to be successful (Wateridge, 1997, p. 283). As conventional management has long been considered ineffective in such conditions (see, for example, Avots, 1969, p. 77; Gaddis, 1959, p. 89), OISD relies on *project* management to provide the requisite theory and practice. Thus, the *project* has become the basic unit used by contemporary organisations to manage their OISD activities (Lee, 2003, p. 1; Xia & Lee, 2004, p. 70).

However, the projects that deliver these systems have acquired a reputation for high failure rates (Lee, 2003, p. 1; Tarbet, 2012, p. 26; Wallace & Keil, 2004, p. 68; Wright & Capps, 2010, pp. 1-2; Wright & Capps, 2011, p. 88). Although there have been successful projects in a large number of organisations (Wateridge, 1995, p. 169), many OISD projects are delivered late and/or over budget, while others fail to deliver the required functionality (Standish Group, 2009a, p. 1). Indeed, some deliver nothing at all (Reel, 1999, p. 18). Not surprisingly, in cases where projects do not accomplish their anticipated business outcomes (Shenhar & Dvir, 2005, p. 2), the cost of these failures can be enormous (Bharadwaj, Keil, & Mähring, 2009, p. 74; Tiwana & Mclean, 2003, p. 345). There is also considerable evidence, outwith the findings of academic research, regarding the poor performance of OISD projects. Catastrophic failures often make headline news (for example, Mostrous & Elliot, 2009, p. 1). Non-academic research (for example, Sauer & Cuthbertson, 2003) and various books (for example, Glass, 1998; Yourdon, 1997) also make important contributions. Of particular note is the commercial research conducted by the Standish Group (for example, Standish Group, 1995; 1999; 2004; 2009a). This body's research findings are the "most widely quoted statistics in the IT industry" (Jørgensen & Moløkken-Østfold, 2006, p. 297) and are often cited by researchers as a driver for their studies (Glass, 2006, p. 15) (for example, British Computer Society, 2004, p. 8; Kendra & Taplin, 2004, p. 30; Rodriguez-Repisoa, Setchib, & Salmeron, 2007, p. 582; Tesch, Kloppenborg, & Frolick, 2007, p. 61). This is despite criticisms of the Standish Group's research results and methods (see, for example, Eveleens & Verhoef, 2010, p. 36; Glass, 2004, p. 103; Jørgensen & Moløkken-Østfold, 2006, p. 300).

Previous research, such as that published by Brooks (1975), shows that OISD project performance is not a new problem. Despite evidence of some improvement (Sauer & Cuthbertson, 2003, p. 1), the failure rate is not only high (Xia & Lee, 2004, p. 70), but unnecessarily so (Tiwana & Keil, 2004, p. 73). These findings, coupled with high investment figures, have led to serious concerns regarding the successful implementation of OISD projects (Saleh & Alshawi, 2005, p. 47). That said, there is evidence to suggest that of all the

project management application areas (for example, construction, utilities and pharmaceuticals), IS/IT projects perform better than the rest (Müller & Turner, 2007a, p. 306). However, the overwhelming view of many academic studies is that OISD project performance is a major problem (Glass, 2006, p. 15).

2.2.3 Challenges faced by OISD projects

OISD projects face a host of difficulties, a number of which can be considered to characterise this type of project. It is argued, for example, that the IS/IT project environment tends to exhibit a higher level of uncertainty than other project management application areas (Wirth, 1996, pp. 8-9). OISD projects also face difficulties in terms of high levels of risk and design changeability (Milosevic, 2004, pp. 1289-1291). End user involvement is also considered critical (Morris, 2004, p. 10). When discussing these, and other issues, it is useful to frame OISD project challenges as (1) technological, (2) process, (3) people and (4) organisational (Chow & Cao, 2008, p. 962). Each of these is elaborated below.

2.2.3.1 Technological challenges

There is evidence to suggest that relatively few OISD projects fail due to technical problems (DeMarco & Lister, 1999, p. 4; Kappelman, McKeeman, & Zhang, 2006, p. 32). That is not to say that OISD projects do not face technological challenges: these certainly exist and always will (Lorenzi & Riley, 2000, p. 116). Technological challenges can refer to characteristics of the end product i.e. the information system. These include software complexity (British Computer Society, 2004, p. 15; Chiang & Mookerjee, 2004, p. 89), ease of use and system performance (Procaccino & Verner, 2006, pp. 115-116). Another characteristic is software intangibility (Sommerville, 2007, p. 93). This has been cited as a barrier to accurate progress measurement (Chiang & Mookerjee, 2004, p. 89; Morris, 2004, p. 12). Technological challenges can also refer to the development tools favoured by the project team (for example, compilers, debuggers, source code libraries, etc.). These tools might prove to be unreliable or difficult to integrate with existing technologies (Yourdon, 1997, p. 185). However, technical challenges are far easier to deal with than those related to

people and the organisation as a whole (Lorenzi & Riley, 2000, p. 117). Indeed, it has even been claimed that many technically-sound information systems have failed due to sabotage by the end users (Lorenzi & Riley, 2000, p. 123).

2.2.3.2 Process challenges

OISD projects consist of a number of interrelated processes, some of which can pose significant challenges. Development processes have generally been considered to be one of the primary contributing factors to the success (or failure) of OISD projects (Saleh & Alshawi, 2005, p. 48). These processes have been described as undisciplined and incomplete (Lyytinen, 1987, p. 9). Practitioners have also been criticised for rarely following software engineering best practices (British Computer Society, 2004, p. 17). It has also been argued that there are no standard development processes and that is often impossible to reliably predict when software processes will cause development problems (Sommerville, 2007, p. 93).

OISD projects are genuinely difficult to manage (Morris, 1994, p. 187). They require effective project management to be successful. Failure to do so can result in an information system that is never completed or finished poorly (Weinberg, 2003, p. 4). Unfortunately, planning and control has been found to be lacking (Wateridge, 1997, p. 283), as has scope management (Rehman, Ullah, Rauf, & Shahid, 2010, p. 10:1), risk management (Thomsett, 2002, p. 157), value management (Morris, 2004, p. 13) and milestone tracking (Jones, 2004, p. 7). Difficulties in estimating (Jones, 2006, p. 8) and specifying system requirements are also relevant (Morris, 2004, p. 11). Indeed, management in general is a major challenge. Management issues can be the main impediments to software development and many technology based projects fail due to poor managerial approaches to organisational and human factors (Jaafari, 2003, pp. 52-53).

2.2.3.3 People challenges

It has been noted that it is "people who deliver projects, not processes and systems" (Cooke-Davies, 2002, p. 189). Thus, people "are the single most

important part of successful projects” (Hartman, 2000, p. 28 cited by Jugdev & Müller, 2005, p. 26). In this respect, obtaining involvement and support from executive management (Thomsett, 1993, p. 6) and end users is vital (Morris, 1994, p. 188). Since it is “people who do the work” (Zielinski, 2005, p. 19), the majority of project problems can be traced back to people i.e. those who design, manage and work in organisations, by engaging in processes (again designed and managed by people) which consume, utilise, produce or maintain technological and other artefacts. Slevin and Pinto (2004) frame the significance of people from the project managers’ perspective, focussing on one key challenge: “All people problems are problems of communication. And all (at least most) project [manager] problems are people problems – the team, the line manager, upper management, the customer, suppliers, etc. ... or involve people that have to be convinced, persuaded, stroked or put on the right path” (Slevin & Pinto, 2004, p. 75).

The literature also notes several examples of how human characteristics can influence the success (or otherwise) of a project. For example, project managers need be suitably experienced (British Computer Society, 2004, p. 22), particularly as they exert a substantial influence on the success or otherwise of a OISD project (Wateridge, 1997, p. 285). Indeed, it has even been shown that a project manager’s personality has an influence on the success of a project (Wang & Li, 2009, p. 872). Similarly, the project team should possess adequate technical and communication skills (British Computer Society, 2004, p. 22). They also require knowledge of the business domain in which they are working (Institute of Electrical and Electronics Engineers, 2004, p. 8:7). Demotivated project team members can be detrimental to the success of an OISD project (Cerpa & Verner, 2009, p. 132) as can end users with unrealistic expectations (Cerpa & Verner, 2009, p. 131).

2.2.3.4 Organisational challenges

People should also be considered in terms of the organisations in which they work. For example, in an OISD project, people working on the project are part of

the project organisation. In a wider context, people are also part of their host organisation. Thus, the “organisation” is key to OISD projects.

Organisational issues can have a significant impact on OISD projects (Gorla & Lin, 2010, p. 62; Lorenzi & Riley, 2000, p. 117). For example, project team performance is influenced by organisational culture (Thamhain, 2004, p. 533). Political pressures, organisational hostility (Yeo, 2002, p. 243) and high staff turnover (Verner, Overmyer, & McCain, 1999, p. 1025) are also failure factors. The size of the organisation is known to be an issue, with communication challenges increasing with organisational size (Hyvari, 2006, p. 36). Even an organisation’s commitment to measurement processes is essential to the success of a project (Institute of Electrical and Electronics Engineers, 2004, p. 8:7).

2.2.4 Cobb’s paradox

All of these issues are plausible reasons for OISD failure and, it is reasonable to suggest that the literature proposes a range of valid reasons why OISD projects fail. With published “best practice” available to address the majority of these problems since 2004 (British Computer Society, 2004, p. 4), an improvement in OISD performance should already be evident since this date. However, there is evidence to suggest that this is not the case (for example, Standish Group, 2009a, p. 1). This scenario has been referred to as Cobb’s Paradox: “We know why projects fail, we know how to prevent their failure – so why do they still fail?” (Cobb, 2004, p. 1).

One possible explanation for the perception of poor OISD project performance is that it is being measured using inappropriate success criteria. For example, in conducting comparatively recent studies, the British Computer Society (2004) and the Standish Group (2004; 2009a) have elected to measure the success of OISD projects based on the application of the traditional golden (or iron) triangle (depicted in Figure 2.1). That is, against (1) schedule, (2) cost and (3) scope metrics. These success criteria can be traced back to one of the first project management articles ever published (see Gaddis, 1959, p. 89). The golden triangle focuses project management activity on delivering a project’s

predetermined requirements (specification, scope, quality), on time (schedule) and to cost (budget) (Westerveld, 2003, p. 412). It also represents the relationships between these success criteria and hence the trade-offs that can be made between them. For example, reducing the cost of a project might only be achievable at the expense of reduced scope (or quality) of the project's deliverable.

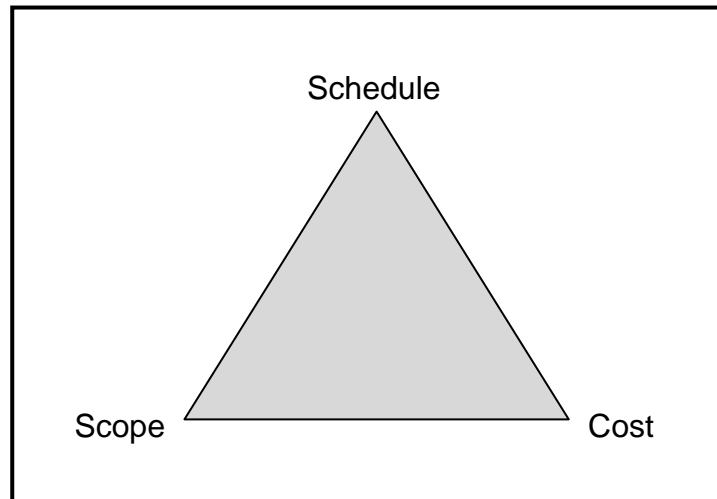


Figure 2.1. The golden (or iron) triangle

There has been some debate as to whether the golden triangle is appropriate for measuring the success of a project and, if so, in which circumstances (Munns & Bjeirmi, 1996, p. 81; Wateridge, 1998, p. 59; Westerveld, 2003, p. 142). Indeed, since project success has been described as complex, ambiguous (Jugdev & Müller, 2005, p. 29) and multidimensional (Shenhar, Levy, & Dvir, 1997, p. 5), a simple triangle, based on three main criteria, as explained here, might be inadequate as a tool to measure OISD project performance (Wateridge, 1998, p. 59). For example, it has been argued that the dimensions of project success should be extended to encompass stakeholder perceptions (Fowler & Walsh, 1999, p. 8; Wateridge, 1995, p. 171) and to differentiate between short term objectives (such as project efficiency) and longer term goals; in particular the impact on the customer and business success (Shenhar, Levy, & Dvir, 1997, p. 12).

Another possible explanation for poor project performance is that it *is* actually improving (Sauer & Cuthbertson, 2003, p. 1), perhaps even dramatically. However, the modern day business environment is becoming increasingly turbulent (Andersen, Birchall, Jessen, & Money, 2006, p. 127). This, coupled with tighter deadlines, lower budgets and larger scopes, might mean that improvements in project performance are being eclipsed or nullified by factors such as competitive pressures and national imperatives that “keep driving a stunning growth in projects’ size, speed and complexity” (Pyster & Thayer, 2005, p. 24).

However, these explanations do not necessarily fully justify the high failure rate of OISD projects. Therefore, another possible explanation is that projects are simply not being managed properly. In other words, OISD project personnel are not implementing known best practice (if, indeed, there is such a thing).

2.2.5 Known best practice for OISD project management

In 2004, the British Computer Society, in conjunction with The Royal Academy of Engineering, reported that a disproportionate number of problems in IS projects stem from a failure to implement known best practices (British Computer Society, 2004, p. 17). The report also stated that many IT managers and practitioners lack project skills and recommended the use of established project management procedures (British Computer Society, 2004, p. 4). IT personnel may lack such skills because they tend to rise through the ranks of the organisations more quickly than in other industries (Wirth, 1996, p. 9) and are often assigned project management responsibilities beyond their level of expertise (Sauer & Cuthbertson, 2003, p. 17). Thus, best practices and established project management procedures will not be implemented if OISD project personnel lack the requisite project management skills. A key to resolving this issue could be to provide education for project managers that is better than that currently undertaken. Although improved education should almost certainly yield benefits, the underlying assumption is that current understanding of project management best practice is relevant to present day OISD projects. However, there is evidence to suggest that this is not the case.

The project management literature is dominated by normative studies (Cicmil & Hodgson, 2006 cited by Alojairi & Safayeni, 2012, p. 16). The goal of these studies is to discover an ideal model or standard for project management (Alojairi & Safayeni, 2012, p. 16). Consequently, a huge amount of published material is “devoted to prescribing how projects should be managed” (Nicholas & Hidding, 2010, p. 148), as opposed to how they are actually managed. Unfortunately, little of this “theoretical” material has been empirically tested (Nicholas & Hidding, 2010, p. 148) and it has even been suggested that, at present, there is “not yet a theory of project management” (Turner, 2006a, p. 1). Although there is some merit in this argument, the real issue seems to be four-fold. First, project management theory, as found in textbooks written for practitioners (such as, Turner, 1999), is not overt; “it is there” but not presented explicitly as being theoretical (Turner, 2006a, p. 1). It is also embryonic and in need of further development (Turner, 2006a, p. 1). Second, a single theory of project management is unlikely to suffice. Instead, multiple approaches are necessary; at the very least, normative theory and descriptive theory (Sauer & Reich, 2007, p. 2). Third, all too much project management research is “theory free” or, at best, “not sufficiently embedded in theory” (Morris, 2010, p. 143). Fourth, project management research is a relatively young discipline having existed for only 50 years or so.

Suffice to say that developing a project management theory remains a “hugely important challenge for the research community” (Sauer & Reich, 2007, p. 1). To this end, Rodney Turner⁸ “decided to write a series of [four] editorials ... outlining what [he thought] the theory of project management [was] and its current stage of development” (Turner, 2006a, p. 1). Turner’s theory of project management (see, Turner, 2006a; 2006b; 2006c; 2006d) reflects the normative material prevalent in the literature and includes 17 corollaries (typically processes); for example, risk management, requirements management, etc.,

⁸ J. Rodney Turner is an established editor and author of 16 project management text books. In addition to being Professor of Project Management at the SKEMA Business School, in Lille France, he is also editor of the *International Journal of Project Management* (Elsevier, 2012). He is also an active researcher in the field of project management.

and seven roles; for example, the project sponsor and project manager (refer to Appendix 2.1 for a full listing of corollaries and roles). Unfortunately, since Turner's editorials, there is little evidence of further development of a theory of project management in the literature.

Thus, the topic of project management has attracted considerable criticism (Winter & Smith, 2006, p. 13) and has been described as simply missing the mark (Thomsett, 2002, p. xxiii). There is mounting concern regarding the value and relevance of "traditional project management theory" (such as it is) and the way in which it relates to project management in practice (Winter & Smith, 2006, p. 13). In particular, the research literature has failed to explain why projects deviate from plans, incur cost overruns and suffer internal conflicts (Packendorff, 1995 cited by Alojairi & Safayeni, 2012, p. 16).

Project management lacks a strong theoretical base and a set of guiding concepts (Shenhar & Dvir, 2005, p. 2). Indeed, "there is no sound theory of project management" (Turner, 2005, p. 573) and gaps have been found between theory and practice (Hallgren & Maaninen-Olsson, 2005, p. 17; Yeo, 2002, p. 246). In addition, there has been an "extraordinary silence on the theoretical advancement" of project management in over 40 years of research (Koskela & Howell, 2002, p. 293). In fact, much a project management research has been accused of being "theory free" (Morris, 2010, p. 143) with the same author compelled to describe project management theory as being stuck in a 1960s time-warp (Morris, 1994, p. 217). Yet, real-world projects have moved on from the 1960s: they have changed, rarely unfolding according to plan and hence have become inherently messy, ambiguous and confusing (Bredillet, 2005, p. 3). OISD projects, in particular, have seen significant changes since the 1990s. These changes have led to new organisational challenges related to people, processes and the working environment (Saleh & Alshawi, 2005, p. 47). Many OISD projects also involve significant organisational change (British Computer Society, 2004, p. 17; Cicmil, Hodgson, Lindgren, & Packendorff, 2009, p. 82; Lorenzi & Riley, 2000, p. 117). Jaafari (2003, p. 53), finding no evidence to suggest that project management supports such change, concludes

that it is “a manifestation of the failure of the contemporary project management model to respond to the challenges faced by ... [IS/IT] ... projects.”

Of particular interest are the project management bodies of knowledge, maintained and published by professional organisations such as the Project Management Institute (PMI) and the Association for Project Management (APM). These bodies of knowledge reflect the current knowledge base for modern project management (Crawford, Morris, Thomas, & Winter, 2006, p. 726; Turner, 2005, p. 573) and are highly relevant to OISD projects (Institute of Electrical and Electronics Engineers, 2004, p. 8:2). Not only are the bodies of knowledge enormously influential, but they are used by practitioners as best practice guides (Morris, 1999, p. 1). Although these bodies of knowledge are widely accepted, many practitioners and academics believe they have serious shortcomings (Morris, 2004, p. 6). For example, practitioners have questioned whether the bodies of knowledge reflect the actuality of managing projects (Crawford, Morris, Thomas, & Winter, 2006, p. 724). Researchers have voiced similar concerns (for example, de Bakker, 2009, p. 3; Fortune & White, 2009, p. 37). The bodies of knowledge have also been described as inadequate (Morris, 2004, p. 10) and narrow (Crawford, Morris, Thomas, & Winter, 2006, p. 724). Indeed, it has even been argued that the bodies of knowledge may even be counter-productive for present day projects (Koskela & Howell, 2002, p. 303).

There are a number of reasons for these criticisms. First, the bodies of knowledge “are based on unrealistic views of how companies and individuals behave” (Winter & Smith, 2006, p. 15). Their methods and techniques are unable to deal with project complexity, uncertainty and environmental influences (Fortune & White, 2009, p. 37) and hence their use might be “inappropriate and potentially disadvantageous” (Cicmil, Williams, Thomas, & Hodgson, 2006, p. 687). As a result, there are cases where these methods and techniques are simply not used (Fortune & White, 2009, p. 37). Furthermore, the bodies of knowledge do not describe how project management can be applied to all projects (Turner, 2005, p. 573), tending instead to “treat all projects as if they were the same” (Winter, Smith, Morris, & Cicmil, 2006, p. 640). The bodies of knowledge also fail to account sufficiently for human issues, which are often

identified as the most significant (Winter, Smith, Morris, & Cicmil, 2006, p. 640). Finally, the bodies of knowledge fall short of reality, particularly in terms of larger, more complex projects (Crawford, Morris, Thomas, & Winter, 2006, p. 724). Specifically, they fail to explain how complex projects behave in terms of inter-related causal effects and the existence of feedback loops (Winter & Smith, 2006, p. 13). For these reasons, the bodies of knowledge fail to satisfactorily describe the richness of what really happens in project environments (Cicmil, Williams, Thomas, & Hodgson, 2006, p. 684).

These arguments suggest that many projects, and OISD projects in particular, no longer have an effective project management paradigm (Morris, 2004, p. 10). However, the existing project management bodies of knowledge are still considered to be rich and helpful (Shenhar & Dvir, 2005, p. 3) and certainly should not be abandoned (Cicmil, Williams, Thomas, & Hodgson, 2006, pp. 683-684; Winter & Smith, 2006, p. 13). This implies that the bodies of knowledge might be described as necessary but not sufficient. In other words, there is a gap between “what we need to know and what we actually know about project management” (Shenhar & Dvir, 2005, p. 2). Clearly, this gap needs to be closed.

2.2.6 Closing the gap in project management knowledge

Closing this gap represents a considerable challenge. Not only is there a gap in knowledge, but it has been suggested that research is still grappling with basic questions such as “what works and what doesn’t?” (Cooke-Davies, 2003, p. 77). For example, risk management is often prescribed as an essential project management process. Yet the evidence regarding its actual influence on project success is still inconclusive (de Bakker, 2009, p. 4). Similarly, the relevance of quantitative tools and techniques for project planning and control is questionable given the complexity and uncertainty of contemporary projects (Alojairi & Safayeni, 2012, p. 16). In addition, despite many years of research, understanding of the actuality of projects i.e. “how practitioners actually manage projects” (Winter & Smith, 2006, p. 6) is limited (Cicmil, Williams, Thomas, & Hodgson, 2006, p. 675). Again, taking risk management as an example,

understanding of the risk management process is still based on how it is assumed to work, not how it is really used in practice (de Bakker, 2009, p. 4); a criticism that can be extended to the normative research as a whole that dominates the literature. But most importantly, there is still a “general lack of agreement amongst authors regarding the factors that influence project success or failure” (Fortune & White, 2006, p. 54). Within this context, the remainder of this chapter will discuss prior research into project success factors and that concentrating on OISD projects.

2.3 Project success factors

Although just one of many proposed definitions, project success factors can be defined as conditions, circumstances and events that contribute to the success of a project (Ika, 2009, p. 8). Since the 1960s, many authors have published lists of these factors (Fortune & White, 2006, p. 53), popularly referred to as critical success factors (CSFs). Indeed, the project management research literature is replete with these lists (Alojairi & Safayeni, 2012, p. 17). In the field of information systems, the success factor approach became a major research stream (Larsen & Myers, 1999, p. 397) and continues to occupy a prominent position in the field (Lu, Huang, & Heng, 2006, p. 295). The approach attempts to identify the factors that contribute to project success (Larsen & Myers, 1999, p. 397) by collecting quantitative data regarding project implementations and then determining the relative importance of the various factors that influence project success (Kwon & Zmud, 1987 cited by Larsen & Myers, 1999, p. 397). The primary output from these studies is typically lists of project success factors (Sauser, Reilly, & Shenhar, 2009, p. 666), sometimes referred to as top ten lists (Klakegg, 2009, p. 500), check lists (Alojairi & Safayeni, 2012, p. 17) or laundry lists; the latter term being attributed to Richmond (1993, p. 117) by Akkermans and van Helden (2002, p. 35). These lists are referred to as “descriptive” lists, not because they are supported with any form of descriptive narrative, but because they are derived from descriptive empirical studies that seek to identify actual success factors (Alojairi & Safayeni, 2012, p. 17). This approach differs significantly from the success factor *method* developed by Rockart (1979) (discussed below) and is better described as the success factor *approach* or,

quite simply, factor research (Bussen & Myers, 1997, p. 145; El Sawah, Tharwat, & Rasmy, 2008, p. 290).

2.3.1 Project success factors in the context of project success

Project success factors should not be discussed out of context; that is, without reference to project success. Project success has been described as a rather “slippery subject” (Cooke-Davies, 2004, p. 99) that is both vague and ambiguous (Ika, 2009, p. 8) and complex to define (Standing, Guilfoyle, Lin, & Love, 2006, p. 1149). It is a somewhat difficult and elusive concept (Thomas & Fernández, 2008, p. 733) with no consistent interpretation (Baccarini, 1999, p. 25) or commonly agreed definition (Thomas & Fernández, 2008, p. 733). IS/IT project success is also difficult to define in terms of its conceptualisation and operation (Basten, Joosten, & Mellis, 2011, p. 12). But, unfortunately, it is not unusual for authors to “simply presume that everyone knows what is meant by project success” (Ika, 2009, p. 7).

Project success is intrinsic to all projects. From the point of their inception, projects are intended to be successful. In this context, project success is a term that, more often than not, is used to refer to the intended, successful outcome of a project (see, for example, Hall, Beecham, Verner, & Wilson, 2008, pp. 31-32; Nicholas & Hidding, 2010, p. 152; Project Management Institute, 2008, p. 5; Subramanyam, Weisstein, & Krishnan, 2010, p. 137).

Project success can also be expressed as having two aspects: project success criteria and project success factors (Cooke-Davies, 2004, p. 99; Müller & Turner, 2007a, p. 299). Both of these aspects are important and should not be confused (Cooke-Davies, 2004, p. 99). Yet, in the research literature, they occasionally are (for example, Bernroider & Ivanov, 2011, p. 326; Lim & Mohamed, 1999, p. 244; Turner, Ledwith, & Kelly, 2009, p. 292). Project success criteria can be considered to be “the set of principles or standards by which project success is or can be judged” (Lim & Mohamed, 1999, p. 243). As previously defined, project success factors are conditions, circumstances and events that contribute to the success of a project (Ika, 2009, p. 8). Indeed, anything that contributes to the success of a project is a project success factor.

Although project success factors contribute to the success or failure of a project, they do not provide the basis for judging the success of a project (Lim & Mohamed, 1999, p. 243). That is the purpose of project success criteria.

2.3.1.1 Project success criteria

Project success criteria have attracted the attention of many researchers. Although an in-depth discussion of project success criteria research is beyond the scope of this chapter, a review of the central issues in this area is useful. As Turner points out: “How can you say what the correct success factors are until you have identified the criteria?” (Turner, 1996 cited by Ika, 2009, p. 9).

As discussed briefly above (see p. 19), the primary argument regarding success criteria centres around the use of the golden triangle to measure a project’s performance in terms of delivering predetermined requirements (specification, scope, quality), on time (schedule) and to cost (budget) (Andersen, Birchall, Jessen, & Money, 2006, p. 128; Jugdev & Müller, 2005, p. 20; Procaccino & Verner, 2006, p. 1541; Westerveld, 2003, p. 412) and its relevance to contemporary project management (see, Munns & Bjeirmi, 1996, p. 81; Wateridge, 1998, p. 59; Westerveld, 2003, p. 142). Criticisms of the golden triangle have led to a consensus amongst authors that (1) success criteria need to be extended beyond that of the golden triangle, and (2) success should be measured from two different viewpoints. As Cleland (1986) states, “Project success is meaningful only if considered from two vantage points: (1) the degree to which the project’s technical performance objective was attained on time and within budget, [and] (2) the contribution that the project made to the strategic mission of the enterprise” (Cleland, 1986, p. 6). The first vantage point reflects the criteria of the golden triangle and is thus concerned with the efficiency of the project *process* and its management. The second vantage point extends beyond the completion of the project *process* and addresses the effectiveness of the project’s deliverable, or *product*, to provide value to the host organisation. Although different authors use different terminology to delineate *process* and *product* success, there is general agreement that this distinction is both necessary and valid for IS/IT projects (for example, Agarwal & Rathod,

2006, p. 359; Saleh & Alshawi, 2005, p. 48; Thomas & Fernández, 2008, p. 737) and for projects in general (for example, Andersen, Birchall, Jessen, & Money, 2006, p. 142; Cooke-Davies, 2002, p. 185; Ika, 2009, p. 13). For the purposes of this thesis, the first vantage point (*process* success) is referred to as project management success and the second (*product* success) as organisational (or business) success (as defined by Thomas & Fernández, 2008, p. 737).

Admittedly, a number of authors have suggested that there is a certain amount of disagreement on the “new success criteria” that should be used to determine project success (for example, Basten, Joosten, & Mellis, 2011, p. 12; Rai, Lang, & Welker, 2002 cited by Thomas & Fernández, 2008, p. 734; Wateridge, 1995, p. 171). However, on the whole, the literature shows that, for IS/IT projects, this is not the case. First, the golden triangle would seem to be appropriate for determining project management success (see above). Secondly, organisational success requires two additional criteria: (1) organisational (commercial and/or strategic) benefits (Andersen, Birchall, Jessen, & Money, 2006, p. 143; Saleh & Alshawi, 2005, p. 48; Thomas & Fernández, 2008, p. 734; Wateridge, 1995, p. 170; Wateridge, 1998, p. 63) and (2) stakeholder (client and/or end user) satisfaction (Agarwal & Rathod, 2006, p. 369; Basten, Joosten, & Mellis, 2011, p. 12; Saleh & Alshawi, 2005, p. 48; Thomas & Fernández, 2008, p. 734; Wateridge, 1995, p. 170; Wateridge, 1998, p. 63).

Yet it would be erroneous to suggest that the debate over OISD project success is complete. On the contrary, a number of important issues remain. For example, research has indicated that perceptions of OISD project success vary by stakeholder group (Wateridge, 1995, p. 170; Wateridge, 1998, p. 63) and geographical location (cultural background) (Pereira, Cerpa, Verner, Rivas, & Procaccino, 2008, p. 906). There are also difficulties in defining success measures at the beginning of an OISD project. Requirements will almost certainly change over the course of the project (de Bakker, Boonstra, & Wortmann, 2010, p. 500), thus making the definition of realistic success measures, at project start-up, near impossible (Savolainen, Ahonen, &

Richardson, 2012, p. 1). Stakeholders also have tendency to be overly optimistic in terms of their expectations and to underestimate potential challenges (Glass, 1999, p. 19; Thomas & Fernández, 2008, p. 733), thus detracting further from the validity of success measures. Finally, and perhaps most importantly, there has been an apparent reluctance by the OISD project research community to adopt the “new success criteria” described above; instead adhering to the traditional measures defined by the golden triangle (Savolainen, Ahonen, & Richardson, 2012, p. 2).

2.3.2 Project success factor definitions

There is no single, agreed definition of a project success factor. Instead, as the research area has developed, different authors have offered differing definitions. In general, differences in wording do not seem to be significant. However, there is one aspect of these definitions: the sphere of influence exerted by project management, that requires discussion. For example, success factors can be defined as “those elements within the project that can be influenced directly by project management so as to increase the chance of achieving success” (Andersen, Birchall, Jessen, & Money, 2006, p. 128). Similar definitions are provided by a number of authors (for example, Ika, 2009, p. 8; Milosevic & Patanakul, 2005, p. 18; Westerveld, 2003, p. 412). These definitions are too narrow as they exclude factors outwith the project life cycle; that is, factors that exist before the project starts (Ahonen & Savolainen, 2010, p. 2185; Klakegg, 2009, p. 500) and therefore cannot be influenced directly by project management (Belassi & Tukel, 1996, p. 141). The same can be said for external factors outwith the project boundary; for example, changes in the business environment (Mahaney & Lederer, 2003, p. 8), over which project management has little or no control (Belassi & Tukel, 1996 cited by Westerveld, 2003, p. 412; Bussen & Myers, 1997, p. 146; Verner, Overmyer, & McCain, 1999, p. 1026). Hence, wider definitions that address this failing are more appropriate. For example, Cooke-Davies (2004, p. 101) defines success factors as those elements that, when present, tend to “improve perceived success, while their absence contributes to failure” (Cooke-Davies, 2004, p. 101). Again, similar definitions are available (for example, Andersen, Birchall, Jessen, &

Money, 2006, p. 129; Lim & Mohamed, 1999, p. 243). These definitions recognise that external factors, outwith the project can contribute to the success (or failure) of a project.

2.3.3 Project success factor nomenclature

The literature lacks consistent terminology for project success factors. Instead, research studies into OISD project success factors use a variety of synonyms. In addition to *success* factors (for example, Berntsson-Svensson & Aurum, 2006; Standish Group, 2009b), these include *critical success* factors (for example, Chow & Cao, 2008; Thi & Swierczek, 2010), *key success* factors (for example, British Computer Society, 2004; Merla, 2005), *success drivers* (for example, Procaccino, Verner, & Lorenzet, 2006; Wohlin & Andrews, 2003) and *key project* factors (for example, Thi & Swierczek, 2010). Early success factor research focussed on the reasons for project failure (Belassi & Tukel, 1996, p. 141; Thi & Swierczek, 2010, p. 570). Thus, antonymic references to failure (as opposed to success) are also relevant. These include studies on *failure* factors (for example, Cerpa & Verner, 2009; Charette, 2005), *critical failure* factors (for example, Yeo, 2002) and *failure* causes (for example, May, 1998). Potential failure factors are also expressed in terms of project risk. These include articles on risks (for example, Jiang & Klein, 1999; Jiang, Klein, & Ellis, 2002), *risk* factors (for example, Leishman & Cook, 2004; Taylor, 2007), *key risk* factors (for example, Nakatsu & Iacovou, 2009), *major risk* factors (for example, Bannerman, 2008) and *risk characteristics* (for example, Evans, Abela, & Beltz, 2002). Indeed, it can be argued that any research study that identifies a list of reasons why projects succeed or fail is a valid source of success or failure factors (for example, Gaitros, 2004; Kanter & Walsh, 2004; Moynihan, 1996). After all, as explained in Chapter 1 (see p. 6), a project success factor is *anything* that contributes to the success of a project.

2.3.4 The origins of success factor research

The concept of success factors is not new and can be traced back decades, if not centuries (Forster & Rockart, 1989, p. 1). Traditionally, project managers attended to these in an “intuitive manner” (Jugdev & Müller, 2005, p. 24).

Although contemporary discussions of success factors can be found in earlier management publications (for example, Drucker, 1955, pp. 347-351), their origin is typically attributed to Daniel (1961) for his discussion of the issues associated with the development of executive information systems. Daniel defined success factors as the “key jobs [that] must be done exceedingly well for a company to be successful” (Daniel, 1961, p. 116). Companies would generally have between three and six industry specific success factors (Daniel, 1961, p. 116). Over a decade later, Anthony, Dearden and Vancil (1972, pp. 155-158) seem to have been the first to introduce the *critical* prefix, thus forming the term used by many contemporary studies: critical success factors (CSFs).

Rockart (1979) represents the seminal work on success factors (Fortune & White, 2006, p. 53). Rockart was primarily concerned with developing the CSF *method*; a structured interview technique designed to assist chief executive officers in defining the information needs for their organisations. Bullen and Rockart (1981) developed Rockart’s work by presenting various success factor classification constructs and extensive details of the interview process. Having been popularised by Rockart, success factors began to appear as the subject of studies into project management and various other research areas. The primary output from these studies are lists of success factors, similar to that depicted in Table 2.1.

Rank	Success factor
1	User involvement
2	Executive management support
3	Clear business objectives
4	Emotional maturity
5	Optimising scope
6	Agile process
7	Project management expertise
8	Skilled resources
9	Execution
10	Tools and infrastructure

Table 2.1. An example of a success factor listing
(Source: Standish Group, 2009b)

As previously discussed, these lists have appeared regularly since, with many researcher investigating the factors that affect project success (Milosevic & Patanakul, 2005, p. 181). Thus, success factor research became a major research stream in project management (Söderlund, 2004b, p. 659; Söderlund, 2011, p. 158) and information systems (Larsen & Myers, 1999, p. 397; Lu, Huang, & Heng, 2006, p. 295).

2.3.5 Project success factor research

Early research, that is studies conducted up until the mid-1980s, tended to be based on limited data sets, in particular, single case studies and anecdotal evidence (Cooke-Davies, 2004, p. 101, Jugdev & Müller, 2005, p. 24; Söderlund, 2011, p. 160). Over time, these studies were replaced by more rigorous survey research with large sample sizes (Söderlund, 2011, p. 160). In addition, a few in-depth case studies have been carried out (Söderlund, 2011, p. 160). There have also been a number of theoretical studies⁹ (Fortune & White, 2006, p. 56). Research techniques are predominantly quantitative; for example, surveys coupled with quantitative data analysis techniques (Ika, 2009, p. 12; Larsen, 2001, p. 2; Söderlund, 2011, p. 167). Hence, much of success factor research differs from Daniel's and Rockart's original works. First, it often seeks to identify generic project success factors (Söderlund, 2004b, p. 659); that is, those applicable to all types of projects (Fortune & White, 2006, p. 53) rather than specific application areas. Second, many of the studies utilise quantitative approaches (Ika, 2009, p. 12; Larsen & Myers, 1999, p. 397) without recourse to the interview techniques used by Rockart's CSF method. Third, on average, factor lists typically contain more than ten success factors, thus exceeding "between three and six" success factors as identified in Daniel's studies (Daniel, 1961, p. 116). These studies have collectively been referred to

⁹ The definition of a theoretical study varies between authors. For example, Fortune and White define a theoretical study as one in which the "data [is] often based on [the] work of others" (Fortune & White, 2006, p. 56). On the other hand, Belassi and Tukul consider a theoretical study to be any study that is not empirically proven (Belassi & Tukul, 1996, p. 142). Unfortunately, neither of these definitions explicitly state that a theoretical study should make a contribution to project success factor theory.

as belonging to the factor school: “empirical research relying on descriptive statistics on the criteria and factors of project success and failure” (Söderlund, 2011, p. 158).

The need for research that identifies project success factors is based on a number of driving forces. The first of these is the widespread use of projects in organisations (Dvir, Lipovetsky, Shenhar, & Tishler, 1998, p. 915; Söderlund, 2004a, p. 186), an aspect that is pertinent to OISD projects (Lee, 2003, p. 1; Xia & Lee, 2004, p. 70). The second is poor project performance (Pinto & Prescott, 1990 cited by Söderlund, 2004a, p. 189; Söderlund, 2011, p. 159); again, relevant to OISD projects (see, for example Standish Group, 2009a, p. 1; Wright & Capps, 2010, pp. 1-2). The third is the belief (or assumption) that the identification and use of success factors will lead to better project performance (Papke-Shields, Beise, & Quan, 2010, p. 660; Pinto & Prescott, 1999 cited by Söderlund, 2004a, p. 189) by focusing project management attention on such factors (Andersen, Birchall, Jessen, & Money, 2006, p. 129). As a result, project success factors have received significant attention from researchers over the past years, as noted by a number of authors (for example, Bryde, 2008, p. 800; Cooke-Davies, 2002, p. 185; Christensen & Walker, 2004, p. 39; Söderlund, 2004a, p. 186; Söderlund, 2011, p. 159; Thi & Swierczek, 2010, p. 570) with a number of articles appearing in prominent project management journals such as the *Project Management Journal* and the *International Journal of Project Management* (Ika, 2009, p 11; Söderlund, 2004a, p. 189).

Research into success factors is considered important (Papke-Shields, Beise, & Quan, 2010, p. 651; Thi & Swierczek, 2010, p. 567). In particular, success factor listings “represent a useful compilation and transfer of experience from a large number of projects” (Klakegg, 2009, p. 500). A number of useful factors have been identified (Jugdev & Müller, 2005, p. 24), some of which have been found to be generic to all projects, regardless of project type (Pinto & Covin, 1989, p. 49 cited by Jugdev & Müller, 2005, p. 26). A potential candidate for this is executive management (or project board) support, “the most cited [success factor] in the project management literature” (Fortune and White, 2006, p. 54

cited by Zwikael, 2008, p. 387). Yet, the most commonly cited factors are not necessarily the most important (Klakegg, 2009, p. 500).

Research has also found that there are significant differences between project types (Pinto & Covin, 1989, p. 49). It has also been claimed by Papke-Shields, Beise, and Quan (2010) that success factor research findings have been codified in standards such as the project management bodies of knowledge (Papke-Shields, Beise, & Quan, 2010, p. 660); although these authors do not provide specific examples. Some factors have been shown to be more important than others (Dvir, Lipovetsky, Shenhar, & Tishler, 1998, p. 932). The research has also shown that the significance of success factors varies across the project life cycle (Pinto & Covin, 1989, p. 49 cited by Jugdev & Müller, 2005, p. 26; Pinto & Prescott, 1988, p. 5; Pinto & Slevin, 1988 cited by Söderlund, 2004a, p.189). In other words, success factors can be considered as being temporal across the project lifecycle.

Research into project success factors has allowed project management to evolve over recent decades (Papke-Shields, Beise, & Quan, 2010, p. 660). Despite being a major research stream for many years, reference to, and the use of, success factors has yet to diminish (Fortune & White, 2006, p. 54) and further work is still required. Some authors (for example, Bryde, 2008, p. 800) cite the need for research into generic project success factors. Others (for example, Söderlund, 2011, p. 159) suggest that research into context-specific success factors would seem to be more appropriate (Ika, 2009, p. 15). For example, success factors for specific project types and/or geographical/cultural areas (Söderlund, 2011, p. 159). Although various factors influencing IS/IT project success have been identified (de Bakker, 2009, p. 5), further success factor research into IS/IT projects is still required (Rodriguez-Repiso, Setchib, & Salmeron, 2007, p. 582).

2.3.6 Criticisms of project success factor research

Despite their widespread use, project success factor studies have been criticised in the research literature, including those concerned with IS implementations (Larsen & Myers, 1999, p. 307). These criticisms are generally

directed at studies that produce descriptive lists of project success factors (discussed below), not the other research directions in the field (also discussed below). Although these lists have identified a number of useful success factors (Jugdev & Müller, 2005, p. 24), little agreement has been reached on the factors for project success (Altuwaijri & Khorsheed, 2012, p. 38; Fortune & White, 2006, p. 54; Söderlund, 2004, p. 186). Indeed, what the success factor lists do seem to demonstrate is that it is not possible to develop a comprehensive list of factors appropriate to all projects (Ika, 2009, p. 9). Similarly, a coherent set of factors for the IS/IT development process has yet to be found (Altuwaijri & Khorsheed, 2012, p. 38; Butler & Fitzgerald, 1999, p. 355). Indeed, “very few factors have been shown to be important across multiple studies” (Kwon & Zmud, 1987 cited by Larsen & Myers, 1999, p. 398).

According to Alojairi and Safayeni (2012), this might be due to a flaw in one of the research area’s basic assumptions: that “a single theory of project management exists” (Alojairi & Safayeni, 2012, p. 17). This assumption has been questioned (as discussed above) because it contradicts the unique nature of projects. Thus, as all projects are inherently unique, how can success factors be transferred from one project and applied to others of different types (Alojairi & Safayeni, 2012, p. 17)? However, the reason that success factors *can* be transferred between projects is that projects *do* have similarities. They have (1) common actors (for example, a project manager, a project team, etc.), (2) common processes (for example, project planning, risk management, etc.) and (3) common artefacts (for example, a project plan, a project deliverable, etc.), all of which can be described using common characteristics (for example, their effectiveness or fitness for purpose). Therefore, although a unified theory of project management may or may not exist, sufficient commonality exists to support the transfer of certain success factors between projects of various types. Of course, the question still remains: which factors can be transferred and which cannot?

Another reason why a comprehensive list of factors has yet to be found might be due to the limited number of factors contained in the lists. As most lists

resemble top ten lists (Klakegg, 2009, p. 500), they negate the possibility that project success is influenced by a far wider range of factors.

Belout and Gauvreau (2004) point to the lack of empirical data on success factors (Belout & Gauvreau, 2004, p. 2). However, this criticism is questionable given the large number of empirical studies. As above, it has also been observed that early success factor literature is based on single case studies (Jugdev & Müller, 2005, p. 24), anecdotal evidence or surveys with very small sample sizes (Cooke-Davies, 2004, p. 101). Although anecdotal evidence might be considered thought-provoking, it is dangerous to suggest that it purports to be generically applicable to a large target population of real-world projects. Similar criticisms regarding the generalisation of limited findings can also be applied to research based on small sample sizes or single case studies (Arber, 2001, p. 59; Pickard, 2007, p. 59).

Although there are exceptions (for example, Bannerman, 2008), project success factor research is compromised due to the way in which it presents its results. Success factor lists are considered to be descriptive because they “describe” real-world projects by way of empirical studies (Alojairi & Safayeni, 2012, p. 17). However, by presenting their results as a list of brief, highly abstract labels, the reader is left unclear as to their meaning (Fortune & White, 2006, p. 54). For example, the term “executive support” (refer to Table 2.1) does not provide sufficient information on how to better support a project (Zwikael, 2008a, p. 387). This constitutes a serious criticism of project success factor research as it has done little to define its basic terms; that is, what do these factors actually mean? More so, without adequate supportive information, the reader is left with little choice but to refer back to the project management literature to find these meanings. But the project management literature is predominantly normative (Cicmil & Hodgson, 2006 cited by Alojairi & Safayeni, 2012, p. 16); that is, it describes how projects should be managed (Nicholas & Hidding, 2010, p. 148), not how they actually are managed. Thus, “descriptive” project success factor research is severely compromised as it requires the reader to refer back to normative, not descriptive, material. To address this issue, descriptive lists of

project success factors should be supported by additional narrative to describe the real-world factors that they present.

The success factor list approach assumes that OISD projects are more likely to be successful as long as practitioners are aware of the various factors and understand how to address them during the course of the project (Larsen & Myers, 1999, p. 397). However, few studies have attempted to analyse, assess or clarify the various factors (Belassi & Tukel, 1996, p. 141). The literature also provides little in the way of advice and guidance regarding the practical application of success factors (Clarke, 1999 cited by Jugdev & Müller, 2005, p. 24). Similarly, practitioners are provided with little in the way of assistance to understand the consequences of their actions (King & Burgess, 2006, p. 59; King & Burgess, 2008, p. 421). Although the literature provides evidence to support the existence of project success factors, there is little advice on how these factors can be used to help alleviate the problems faced by project managers in practice (Clarke, 1999, p. 139; Nakatsu & Iacovou, 2009, p. 64). In this respect, stronger theoretical models would be beneficial to project managers in better understanding the primary causes of success and failure (King & Burgess, 2008, p. 421). However, with very few exceptions (for example, Rodriguez-Repiso, Setchib, & Salmeron, 2007), the literature is almost completely silent on the subject of project success factor management.

Success factor studies have also been criticised for treating the project life cycle as a static process rather than a dynamic phenomenon (Altuwaijri & Khorsheed, 2012, p. 38; Ginzberg, 1981 cited by Larsen & Myers, 1999, p. 398; Paré & Elam, 1997 cited by El Sawah, Tharwat, & Rasmy, 2008, p. 260; Söderlund, 2004a, p. 189; Söderlund, 2011, pp. 159-160). Thus, the studies ignore the social and organisational dynamics associated with IS/IT projects (Gauld, 2007 cited by Altuwaijri & Khorsheed, 2012, p. 38). The majority of studies also ignore the potential for factors to have varying degrees of significance over the different stages of the project life cycle (Larsen & Myers, 1999, p. 398). This is a view supported by the earlier work of Pinto and Covin (1989, p. 59). Thus, it can be difficult for practitioners to determine the actual importance of a particular factor at various points over the project life cycle. Not only do the majority of

studies fail to recognise variations in the significance of success factors across the project life cycle but they fail to take into account the dynamic nature of their interactions over time (discussed below). Thus, success factor research fails to provide a meaningful depiction of real-world projects (Söderlund, 2004a, p. 189).

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), this can also present significant problems. Consider, for example, the “monitoring and control” process. This process has been identified as a potential failure factor (see, for example, Taylor, 2000, p. 25; Walsh & Kanter, 1988, p. 19). Yet, monitoring and control are not the same thing and should not be stated as such (Gardiner & Stewart, 2000, p. 252). Separating the two helps identify the effects of each individual factor, and the possible interaction between them. Indeed, “the inter-relationships between factors are at least as important as the individual factors” (Fortune & White, 2006, p. 54). Therefore, success factors should not be considered on an independent basis (Clarke, 1999, p. 141). However, the success factor list approach treats each factor as an independent variable, thus overlooking the interactions between them (Nandhakumar, 1996 cited by Myers, 1999, p. 398). Thus, the literature fails to explain the relationship between various factors (El Sawah, Tharwat, & Rasmy, 2008, p. 260; Ginzberg, 1981 cited by Larsen & Myers, 1999, p. 398). However, “a better understanding of the relationship between key success factors and the [IS/IT development process] is required if success factors are to be of any guidance to the practitioners to develop effective information systems” (Nandhakumar, 1996 cited by Fortune & White, 2006, p. 54).

2.4 Research into OISD project success factors

Having considered project success factors and general criticisms of the research area, the discussion will now turn to project success factors as applicable to OISD projects in particular. Research into OISD project success factors comprises five research directions. Articles reviewing the chronological

development of project success factor research (for example, Ika, 2009; Jugdev & Muller, 2005) recognise the first two: (1) success factor lists and (2) success factor frameworks, but pay little or no attention to the others: (3) individual success factors, (4) the influence of success factors on project success, and (5) the causal interactions between success factors. This section discusses all five research directions.

2.4.1 OISD project success factor lists

Over the past 50 years, a great many researchers have published articles containing lists of project success and/or failure factors (Fortune & White, 2006, p. 53). These descriptive lists, ranked or otherwise, represent the primary output of project success factor research. Some of the lists are generic while others attempt to identify success factors for specific project types (Fortune & White, 2006, p. 53). One such type is information systems (IS/IT) projects, with many studies providing success factors lists for projects with, or without, software development. Despite claims that research in this area has slowed (Fortune & White, 2006, p. 54), lists of OISD project success/failure factors still appear regularly in the literature (for example, Cerpa & Verner, 2009; Sharma, Sengupta, & Gupta, 2011).

The following discussion provides an analysis of the main text of research articles containing descriptive lists of OISD project success, failure or risk factors. Studies that perform an analysis of success factor list research (for example, Fortune & White, 2006; Nasir & Sahibuddin, 2011) typically seek to identify the most commonly cited success factors. Although this analysis identifies these factors, it also seeks to provide a better understanding of the nature of success factors presented in prior literature with a view to determining appropriate conclusions. Unlike Fortune and White (2006) (IS/IT and generic project success factors) and Nasir and Sahibuddin (2011) (IS/IT project success factors), this analysis deals exclusively with articles that contain OISD project success, failure or risk factors.

2.4.1.1 OISD project success factor research studies

The literature search on which this analysis is based identified 56 suitable research articles, all published between 1979 and 2011 (refer to Appendix 2.2 for further details). A number of the authors do not explicitly state that their work is concerned with OISD projects, as opposed to IS/IT projects in general (for example, Charette, 2005; Merla, 2005). However, in the analysis, if their content was found to make specific reference to software development competences, activities or artefacts, they were deemed suitable. The studies were conducted by academics, practitioners, commercial organisations and one professional society. They provide descriptive lists of success, failure and risk factors, using a variety of synonyms. On average (mean), each list contains 12 factors. The articles cover both in-house and supplier based software development although, in the majority of cases (33 articles), this distinction is not clear. Whilst the studies reflect the views of practitioners in varying roles, the most common perspective provided is that of the host (in-house/client) organisation (although, again, this is not made clear for 30 of the articles). Indeed, only one article focuses exclusively on the suppliers' perspective with another three investigating that of both the supplier and client. A wide range of countries are represented with the USA being the most popular. There are only three UK-based studies. The organisations targeted by the studies include commercial companies of various sizes in a range of industry sectors. The public sector is also represented. Research methods are varied but questionnaire based surveys with quantitative analytical techniques are the most popular. Qualitative research is also evident, in particular structured interviews. Five case studies were also found.

Although part of a major research stream (Larsen & Myers, 1999, p. 397), the studies are quite disparate in character. Other than reviewing prior research (to identify candidate success factors for use in their surveys), a number of studies seem to have been carried out in near isolation. Until recently, there has been little opportunity for "learning" from prior studies, with many articles failing to provide limitations, lessons learned or recommendations for further research. Similarly, discussions of validity and reliability were also found to be rare and, in

some cases, the research methodology was not made clear; a criticism that has been levelled at project management research as a whole (Smyth & Morris, 2007 cited by Morris, 2010, p. 143). Research focus (for example, geographical location) also seems to be almost at random, with researchers utilising localised, convenience samples. The studies are also published in a wide range of journals, hence contributing to the disparity of the research. Interestingly, this “scattering” of results is also evident in closely related areas such as enterprise resource planning (ERP) projects (Ngai, Law, & Wat, 2008, p. 549). Such disparity impedes knowledge development (Savolainen, Ahonen, & Richardson, 2012, p. 10) and perhaps explains why there are still many differing opinions on the factors for project success (Andersen, Birchall, Jessen, & Money, 2006, p. 130).

2.4.1.2 OISD project success factor analysis

The analysis process is described further in Chapter 3 (p. 88). It is concerned with OISD project success factor studies only¹⁰. Articles providing generic success factors are not included as there is little agreement on factors that are relevant to all project types (Fortune & White, 2006, p. 54; Söderlund, 2004a, p. 186; Wateridge, 1995, p. 171). Similarly, articles concerned with IS projects that involve only a small degree of software development effort (that is, those that are primarily concerned with the implementation of packaged software) are also excluded. A good example of this type of project is ERP implementations. Although ERP projects often involve software development for integration purposes (Nah, Lau, & Kuang, 2001, p. 294; Ngai, Law, & Wat, 2008, p. 556), this is typically on a relatively small scale. As these do not qualify as “bespoke software-intensive application development projects” (Moynihan, 1996, p. 359), ERP implementations (and other IS implementation projects) are excluded, despite their similarity to OISD projects (Rothenberger, Srite, & Jones-Graham, 2010, p. 81). All of the studies focus on the OISD project at the *project* level. Articles dealing with specific areas of the project (for example IS project

¹⁰ Although a number of studies deal with OISD projects *and* “implementation only” projects.

manager competences) are also excluded (for example, Bloom, 1996; Skulmoski & Hartman, 2010). Studies of this type are discussed later in the literature review.

The analysis found that success factors can be expressed as characteristics of entities associated with OISD projects (examples of which are provided below). The use of characteristics in success factor studies is not unusual, although they usually describe the project as a whole rather than entities associated with the project (for example, McLain, 2009; Rodriguez-Repisoa, Setchib, & Salmeron, 2007; Sharma, Sengupta, & Gupta, 2011; Thi & Swierczek, 2010, p. 572). However, Milosevic and Patanakul (2005, p. 183) do refer to characteristics in their definition of success factors. The analysis also found that project entities can be classified using four entity types: actors, processes, artefacts and externalities¹¹ (external). These are described in Table 2.2. Again, similar classifications can be found in “frameworks” provided by prior factor research (for example, Chow & Cao, 2008; Moynihan, 1996; Nakatsu & Iacovou, 2009).

¹¹ The definition of *external* entities (refer to Table 2.2) has been extended from entities beyond the project boundary to those beyond the host/client organisation’s boundary. This is due to the importance of the host/client organisation in OISD projects.

Entity type	Definition	Entity examples
Actor	People: individuals and groups found in organisations associated with the project.	Project manager, end users, project team, executive management, project sponsor.
Artefact	Things that are typically consumed, produced, utilised or referred to by a project's processes.	Project budget, hardware, training facilities, design specifications, project metrics.
External ¹²	Entities found outwith the client/host organisation (excluding those in external organisations e.g. suppliers and partner organisations).	Financial climate, labour market, government legislation.
Process	Activities associated with the project.	Project management, software development, training.

Table 2.2. Project entity types
(replicated from Table 1.2)

The entities contained within these entity types tend to be hierarchical (as do some of the characteristics used to describe them). For example, domain experts might be considered to be part of the project team which, in turn, is part of the host organisation (assuming in-house development).

The analysis process for this chapter has six basic steps:

- (1) Success/failure factors were retrieved (verbatim) from the research articles;
- (2) Composite factors (those containing two or more factors) were deconstructed into unique factors
- (3) Each factor was then expressed as a characteristic of an appropriate entity;
- (4) Where appropriate, failure factors were restated as success factors;
- (5) Synonymous terms were resolved;
- (6) Each factor was assigned a code to denote its project type (refer to Table 2.3).

¹² Also (occasionally) referred to as *externalities*.

Project type	Definition
OISD	Projects that involve bespoke software development to deliver an information system for end users in a host organisation.
Information system (IS/IT)	Projects that deliver an information system for end users in a host organisation e.g. an enterprise resource planning (ERP) implementation project.
Organisational technology	Projects that deliver a technology product for end users in a host organisation e.g. a project to introduce a new manufacturing technology to production operatives.
Organisational	Projects not involving the delivery of a technology product in a host organisation (most likely some kind of organisational change) e.g. a business process re-engineering (BPR) project.
Generic	Projects that require the use of generic project management principles e.g. a new product development (NPD) project.

Table 2.3. Project types

This resulted in a list of unique success factors. However, step four requires further clarification. Restating a failure factor as a success factor (and vice versa) requires that success and failure factors are related. Although research in this area is inconclusive, the work of Jones (2004), Bannerman (2008) and, most importantly, Fowler and Horan (2007) suggests that this is the case i.e. there might be a considerable relationship between specific success and failure factors. In other words, the same factor can be “extremely influential” to both successful and unsuccessful OISD projects (Fowler & Horan, 2007, p. 17). Indeed, Verner, Overmyer and McCain (1999) state that certain factors can be expressed as “bipolar descriptor pairs” and suggest that successful OISD projects place emphasis on these factors whereas unsuccessful projects do not (Nicholas & Hidding, 2010, p. 154; Verner, Overmyer, & McCain, 1999, p. 1025).

Entity type	Entity	Characteristic
Actor	Project manager	Competence\social skills
	End users	Involvement
	Host organisation	Staff turnover (low)
Artefact	Project requirements	Detail
	Success criteria	Agreement of
	Project schedule	Realism
External	Business environment	Benevolence
Process	Project	Complexity (low)
	Risk analysis	Effectiveness
	Software development	Evolutionary

Table 2.4. Examples of success factors expressed as characteristics of entities

2.4.1.3 OISD project success factors

Although it is conceded that a few factors (for example, the supportiveness of the project board) would be better represented using two (or more) entities, OISD project success factors can be expressed as characteristics of entities associated with the project. Examples of these are provided in Table 2.4. Thus, an OISD project success factor can be defined as: a characteristic and associated actor, artefact, process or externality (external factor) that contributes to the success (or otherwise) of an OISD project. Put another way, entities can be said to play “host” to a number of success factors via their characteristics.

The literature surveyed identifies 488 unique factors (listed in Appendix 2.3). Although further consolidation might be possible (for example, by further resolving synonymous terms), this number does not reflect the critical nature of success factors originally defined by Daniel (1961, p. 116); that is, between three and six factors. On the contrary, this suggests that the success of an OISD project might be the function of a far wider range of factors. Research by Moynihan (1996) and Bannerman (2008) supports this view. Moynihan derived 113 risk constructs from his study while Bannerman identified over 300 artefacts that “appeared to be relevant or important in enabling or inhibiting the

performance and/or outcome” of OISD projects (Bannerman, 2008, p. 2123). Unfortunately, Bannerman does not elaborate any further. Perhaps then, a major reason why success factor research does not provide a deeper understanding of real-world projects (Söderlund, 2004a, p. 189) is that the majority of success factor studies do not acknowledge, let alone address, the large number of factors relevant to OISD projects.

In keeping with the presentation style employed by the majority of success factor studies (refer to Table 2.1), Table 2.5 shows the 24 most cited OISD project success factors from the 56 articles analysed (with a more comprehensive listing presented in Appendix 2.4). Interestingly, none of these factors are exclusively restricted to software development, with most (all but end users’ involvement and the maturity of the project deliverable’s technology) being applicable to generic projects and their management (discussed further below). The low level of agreement between articles is also significant. For example, the “top two” factors (end users’ involvement and project board supportiveness) appear together in only eight articles whereas the “top three” factors (end users’ involvement, project board supportiveness and project team competence) appear together in only three articles. Similarly, the top four factors only appear together in one article and the top five factors do not appear together in any single article. Table 2.5 also contrasts the level of detail that can be found in success factor lists. On the one hand, project requirements has four detailed entries in the list, each with different characteristics i.e. stability, clarity, completeness and, at a more general level, fitness for purpose. Conversely, end users’ involvement can be considered to be vague as it does not identify (1) the project activities in which the end users are to be involved, or (2) the form that this involvement is to take (for example, full or part time).

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

Table 2.5. The 24 most cited OISD project success factors
(success factors with five or more citations)

There are a number of other points of interest regarding OISD project success factors. Factors are more commonly expressed in terms of failure (61%) than success (39%); although this ratio is heavily influenced by the number of risk factor studies (35%)¹³. As such, the “early” interest in project failure (Thi &

¹³ Success factors (38%), failure factors (28%) and risk factors (34%).

Swierczek, 2010, p. 570) has persisted in factor research. In relation to the criticisms discussed above, a mere 1.7 percent of factors describe any kind of relationship with other factors. Also, 19 percent of factors are composite; that is they contain two or more unique factors.

As discussed above (see p. 41), there are a number of studies in which it not possible to determine whether the research is addressing in-house or supplier based software development. However, the results of the analysis contain far fewer references to clients and suppliers than to the host organisation. There are also no references to any form of sales process or contract. This suggests that (1) the bulk of the projects represented by these studies are actually concerned with in-house development projects, and (2) success factors are being perceived from the host organisation’s perspective; not that of the supplier. Second, other than project size, there is little evidence to suggest that studies are concerned with large scale OISD projects. For example, there is no mention of the project organisation’s management structure including the need for multiple development teams led by their own team leaders. Thus, it is not unreasonable to suggest that OISD success factor research deals with smaller rather than larger projects.

Entity type	Percentage
Actor	44%
Artefact	30%
External	1%
Process	25%

Table 2.6. OISD success factor proportions by entity type

Based on the literature reviewed, the proportion of OISD project success factors by entity type is shown in Table 2.6.

The low number of external factors seems to support the view of Bussen and Myers that success factor research fails to identify issues outwith the project (Bussen & Myers, 1997, p. 149). However, this might be due to external factors being defined as those that lie beyond the organisational boundary, not the

project boundary. The other three entity types, in particular actors (44%), are better represented. However, given the significance of people in projects (Cooke-Davies, 2002, p. 189; Hartman, 2000, p. 28 cited by Jugdev & Müller, 2005, p. 26; Slevin & Pinto, 2004, p. 75; Zielinski, 2005, p. 19), perhaps the proportion of success factors associated with actors should be even higher. The same argument can be applied to processes. Project artefacts are typically produced or maintained by project processes (in particular, the project deliverable). Therefore, by concentrating on process success factors, the fitness for purpose of project artefacts should, as a consequence, improve.

Actors		Artefacts		Processes	
Entity	No.	Entity	No.	Entity	No.
Project team	60	Project deliverable	24	Project	14
Client/host organisation	43	Requirements	22	Communication	8
End users	40	Project objectives	13	Software development	8
Project board	17	Project plan	9	Project\processes	6
Project manager	14	Project deliverable\technology	6	Target business processes	5
Project sponsor	13	Estimates	4	Change management	4
Project stakeholders	8	Project deliverable\hardware	4	Requirements definition	4
Supplier organisation	8	Project resources	4	Change control	3
Domain experts	2	Change requests	3	Project management	3
Partner organisations	2	Methodologies\development	3	Project monitoring	3

Table 2.7. Entities ranked by number of unique characteristics

Table 2.7 shows examples of actor, artefact and process entities ranked by their number of characteristics. For example, the project manager has 14 unique success factors as shown in Table 2.8. This implies that the overall effectiveness of an OISD project entity, in this case the project manager, is a function of a variety of success factors. However, there is considerable variation in the number of characteristics between entities (refer to Table 2.7), with many having very few other than the need to be effective or fit for purpose. Table 2.7 also shows that actors are better represented by characteristics than artefacts

which, in turn have more characteristics than processes; proportions that are consistent with those shown in Table 2.6.

Success factor (characteristic)	Source(s)
Characteristics (overall)	Kim & Peterson, 2001
Competence (overall)	Milis & Mercken, 2002
Competence\leadership skills	Kanter & Walsh, 1988; Walsh & Kanter, 2004
Competence\managerial skills	Klein, Jiang & Tesch, 2002
Competence\people skills	Wallace & Keil, 2004
Competence\project management	Merla, 2005; Standish Group, 2009
Competence\social skills	Milis & Mercken, 2002
Conflict with other project managers (low level of)	Jiang, Klein & Ellis, 2002
Effectiveness	BCS, 2004; Wallace & Keil, 2004
Experience	Merla, 2005; Milis & Mercken, 2002; Standish Group, 2001; Verner, Overmyer & McCain, 1999; Wallace & Keil, 2004
Power	Milis & Mercken, 2002
Supportiveness\adding extra personnel to meet an aggressive schedule late in the project (low level of)	Berntsson-Svensson & Aurum, 2006; Cerpa & Verner, 2009
Supportiveness\long working hours (low level of)	Berntsson-Svensson & Aurum, 2006
Understanding\end users' needs	Reel, 1999

Table 2.8. Project manager success factors (characteristics)

Project type	Percentage
OISD	5%
IS/IT	4%
Organisational technology	9%
Organisational	21%
Generic	61%

Table 2.9. OISD project success factors by project type

The composition of an OISD project based on success factors by project type (refer to Table 2.3) is depicted in Table 2.9; that is, the proportions of unique factors that are specific to different project types.

A mere five percent of the success factors are unique to OISD projects, the other 95% being shared with organisational IS projects. This supports the high degree of similarity between OISD and IS implementation projects (such as ERP projects) noted by Rothenberger, Srite and Jones-Graham (2010, p. 81). More importantly, the success of an OISD project is largely determined by generic factors (61%) and the number of organisational factors (21%) exceeds by far those related to IS/IT and OISD projects combined (9%). Overall, these figures show that there is a high level of commonality between OISD projects and projects of other types, thus facilitating the transfer and application of success factors between projects of said types.

2.4.1.4 OISD project success factor studies containing the suppliers' perspective.

As previously discussed (see p. 49), the perspective provided by the success factor analysis is predominantly that of the host (in-house/client) organisation. However, the sample of articles analysed did contain four studies containing a suppliers' perspective (as listed in Table 2.10).

Study	Perspective(s)	Factor type	Geographical area(s)
Cerpa & Verner (2009)	Supplier and client	Success	USA, Chile & Australia
Hartman & Ashrafi (2002)	Supplier and client	Success	Canada
Moynihan (1996)	Supplier only	Risk	Ireland
Sharma, Sengupta & Gupta (2011)	Supplier and client	Risk	India

Table 2.10. Studies examining OISD project success, failure or risk factors containing the suppliers' perspective

In terms of the contributions to knowledge made by these studies, Sharma, Sengupta and Gupta (2011) can be discounted because, although they seem to have collected data from both client and supplier organisations, their findings do not differentiate between the two. Of the remaining three studies, Hartman and

Ashrafi (2002) and Cerpa and Verner (2009) reported only slight differences in perspective between the supplier and client. This leaves Moynihan (1996) which, as the only study to focus exclusively on the suppliers' perspective, is more representative of this research project. Moynihan reported that most of the risk factors identified in his study had already been mentioned in the OISD project risk literature¹⁴. That said, Moynihan's study did reveal some "subtle elaborations of these factors" (Moynihan, 1996, p. 364).

Hence, a realistic expectation for future studies of OISD project success factors from a suppliers' perspective is that many of the newly identified factors will already have been reported in the OISD project success, failure and risk factor literature (as listed in Appendix 2.3). However, a number of new factors should also be expected, particularly at a detailed level and through the development of factors previously reported in the literature. It might also be possible to provide a comparison between success factors as perceived by supplier vis-à-vis client organisations. This is because the perspective presented by the OISD project success factor studies identified by the literature review is predominantly that of host (in-house/client) organisation (see p. 49). In fact, performing the success factor analysis described above (see p. 42), with the exclusion of the four articles listed in Table 2.10, produces remarkably similar results in terms of the most cited factors; refer to Appendix 2.5 in comparison to Appendix 2.4.

2.4.1.5 Conclusions for OISD project success factor lists

The observations provided above can be summarised in terms of the competences required for successful OISD project management. In addition to the 14 success factors listed in Table 2.8, the analysis suggests that client and supplier-based OISD project managers, need to be people focussed, with a firm grasp of generic and organisational project management practices and their application to real-world projects. Due to the large number of potential success

¹⁴ Based solely on the literature reviewed in previous study conducted by Barki, Rivard and Talbot (1993).

factors, they should have an eye for detail and be able to deal with complicated, if not complex, situations; particularly those relating to the host organisation. They should also be aware that the entities that they manage (particularly actors and artefacts) are in themselves host to multiple success factors (in the form of their various characteristics). Experience of IS/IT projects, with, or without, software development is certainly important but not, it would seem, quite as relevant as the other competences previously mentioned. In other words, the analysis suggests that research into generic, organisational, organisational technology, and IS/IT projects is relevant to OISD projects, as are studies concerned with project actors and, to a slightly lesser extent, artefacts and processes.

Although success factor lists have identified a number of useful factors (Jugdev & Müller, 2005, p. 24), the limitations of these lists have given rise to a number of other research directions. First, factors are typically not grouped or classified in any coherent manner (Jugdev & Müller, 2005, p. 24). Hence, a number of frameworks have emerged. These frameworks seek to organise factors in such a way that they might be more useful to readers (Jugdev & Müller, 2005, p. 25); for example, to aid understanding or possibly to stimulate discussion (Söderlund, 2011, p. 157). Second, the success factors identified in the factor listings are not usually supported by any form of descriptive text or narrative. Hence, research into individual success factors or entities has been required. Third, lists of success factors do not address the effect of factors on project success or the causal interactions between factors. Thus, researchers have carried out studies in both of these areas. The literature review will now discuss each of these areas in relation to OISD projects. Where appropriate, attention is given to studies concerned with generic, organisational, organisational technology, and IS/IT projects.

2.4.2 Research into project success factor frameworks

The use of frameworks in research is commonplace. For example, a literature search for the term will, more than likely, return thousands of articles incorporating some kind of framework. Hence, it is hardly surprising to find that

frameworks (outlines, models, schemes, etc.) have appeared regularly in project success factor literature for a number of years (Ika, 2009, p. 11; Jugdev & Muller, 2005, p. 25). These frameworks have become increasingly holistic and some are being empirically tested (Jugdev & Müller, 2005, p. 29). However, the need for more inclusive project success factor frameworks still remains (Ika, 2009, p. 11).

Although there are exceptions (for example, Chow & Cao, 2008, p. 964), the factors contained in success factor lists are typically not grouped or classified in any coherent manner (as noted by Belassi & Tukul, 1996, p. 142; Jugdev & Müller, 2005, p. 24). To address this issue, a number of authors have proposed a variety of generic project success factor frameworks (in a range of shapes and forms). Early examples include Kerzner's model for project excellence (Kerzner, 1987, p. 33) and Slevin and Pinto's project implementation framework (Slevin & Pinto, 1987, p. 35).

In the mid-1990s, Belassi and Tukul (1996, p. 144) developed a holistic framework allowing readers to consider success factors in terms of their classification, relationships and implications if factors were not addressed (Jugdev & Müller, 2005, p. 25). Belassi and Tukul provided evidence to support the usefulness of their framework based on participant responses in their study, some of which were from IS practitioners (Belassi & Tukul, 1996, p. 149). Westerveld (2003, p. 415) also developed a generic framework linking project success factors to success criteria. Like Belassi and Tukul, Westerveld provides evidence to support the usefulness of the model; in this case to assess the performance of a project organisation implementing an ERP solution (Westerveld, 2003, p. 417). Fortune and White (2006) (discussed later) have also shown how a generic framing device can be applied to IS projects (including one OISD project). Thus, the evidence provided by these studies suggests that generic project success factor frameworks can be applied to IS projects and perhaps even OISD projects.

More recently, a number of IS project success factor frameworks have appeared in the literature. For example, Vithanage and Wijayanayake (2007, p.

37) developed a framework for large scale information systems implementations. Similarly, Hawari and Heeks (2010, p. 151) propose a design-reality gap model for ERP projects. Although both studies are concerned with implementation based projects, the factors they encompass suggest that their frameworks might be relevant to the implementation aspects of OISD projects. As Hawari and Heeks state, there is no reason why their framework could not be applied to other information systems applications (Hawari & Heeks, 2010, p. 155).

Unfortunately, the literature search found only one framework that addressed factors for OISD projects. Keil, Cule, Lyytinen and Schmidt (1998, p. 80) propose a risk categorisation framework based on two dimensions: perceived relative importance of risk and perceived level of control. An interesting finding of this study was that individuals perceive risks to be higher for items over which they have little or no control (Keil, Cule, Lyytinen, & Schmidt, 1998, p. 82). However, although these findings are useful, the study is more notable in that it is indicative of the need for additional OISD project success factor frameworks.

2.4.3 Research into individual OISD project success factors

Over the past decade there have been a number of studies into individual success factors for IS and OISD projects. Unlike the remainder of OISD project success factor research, studies in this area often employ qualitative methods. The majority of studies have a people focus; that is, concentrating on actor related aspects such as project manager competences, executive management support and end user involvement. These aspects are discussed below.

2.4.3.1 Project manager competences

In their review of project success factor literature, Turner and Müller (2005, p. 49) found that, in the main, it ignored project managers, their leadership styles and competences. However, this is not to say that the studies conducted prior to 2005 had not provided insights into the IS project manager. For example, the importance of selecting a project manager with the correct qualities and skills prior to the start of an IS project had been identified (Bloom, 1996, p. 9). Thite

(2000) had also identified five essential leadership characteristics for IS project managers: (1) organisational catalyst, (2) intellectual stimulation, (3) charisma, (4) contingent reward, and (5) active monitoring of exceptions (Thite, 2000, pp. 239-240).

More recently, a few studies have advanced understanding of the IS project manager. Successful IS project managers require excellent communication skills. They also require a range of “emotional” competences including self awareness, sensitivity, influence and motivational qualities. Conversely, strategic and visionary competences in IS project managers are detrimental to their performance. Interestingly, this competence “profile” is also well suited to organisational change projects (Müller & Turner, 2007b, pp. 29-30). Project manager competence profiles have also been shown to vary across the IS project life cycle. That is, various characteristics, competences and social skills have differing levels of importance in the initiation, planning, implementation and closeout stages of an IS project (Skulmoski & Hartman, 2010, p. 73). However, a project manager’s competences are of little consequence unless he or she is sufficiently motivated. This is best served through the provision of “an interesting task, a cohesive, goal oriented team, receiving the necessary resources, and the possibility to influence important decisions” (Seiler, Lent, Pinkowska, & Pinazza, 2012, p. 71).

Despite these studies, a range of research opportunities exist. First, none of these studies focus specifically on OISD project managers. Thus, it cannot be assumed that their findings are equally relevant to OISD projects. Issues with generalisation also remain. For example, the findings of Skulmoski and Hartman (2010) are based on 21 Canadian interviewees. Thus, the extent to which the results can be generalised and applied to different cultures require additional research (Skulmoski & Hartman, 2010, pp. 74-75). Finally, there are competence areas that have not been addressed in an IS or OISD project context. For example, the skills and behaviours required for effective people management (Fisher, 2011, p. 1000). All that said, another viewpoint suggests that the role of the project manager is over-emphasised and that understanding of project reality would be better served by researching other areas; in

particular, social networks of interactions involving individuals and groups involved in the project management process (Alojairi & Safayeni, 2012, p. 17).

2.4.3.2 Executive management support

The importance of executive management (project board) support in IS projects has been recognised, at the very least, since the early 1980s (for example, Wight, 1983, pp. 39-42). The failure of executive management to accept responsibility for their IS projects has been cited as one of the main reasons why various factors become problems during implementation (for example, Beckley & Gaines, 1991a, p. 25; 1991b, p. 61). More recent research has even suggested that executive management support is the most important of all success factors in IS projects (Young & Jordan, 2008, p. 720). Zwikael (2008a, p. 387; 2008b, p. 498) supports the view that executive management support contributes highly to project success and identifies a number of high impact executive management support processes for OISD projects (Zwikael, 2008b, p. 505). However, in addition to being industry specific, these processes vary significantly by country (Zwikael, 2008b, p. 509). Thus, additional research into executive management support for OISD projects across various countries is merited (Zwikael, 2008b, p. 509). Further research is also required to explore support processes in more detail and to determine the appropriate level of executive management support (Young & Jordan, 2008, p. 721).

2.4.3.3 End user involvement

End users, in particular their involvement in project processes, have long appeared in OISD project success factor listings (for example, Fairley, 1994; Rademacher, 1989; Standish Group, 1995). The negative effects of inadequate end user involvement have also been demonstrated by numerous studies (Jiang, Chen, & Klein, 2002). Conversely, prior literature has consistently discussed the importance of end user involvement in the software development life cycle (Petter, 2008, p. 707). However, as recent studies suggest, there is substantially more to end users than simply involving them in OISD projects. For example, end user involvement is significantly affected by pre-project partnering activities designed to enhance collaboration and align expectations

among stakeholders (Jiang, Chen, & Klein, 2002, pp. 22-23). End user involvement can also be framed (along with leadership and trust) as a strategy for managing end user expectations (Petter, 2008, p. 704). However, as a measure of project success, end user satisfaction has been shown to deteriorate with increasing levels of involvement in OISD projects (Subramanyam, Weisstein, & Krishnan, 2010, p. 138). In fact, end users are often most satisfied when they have minimal involvement in an OISD project (Subramanyam, Weisstein, & Krishnan, 2010, p. 140). Thus, a balance needs to be struck when determining the optimal level of end user involvement. But the nature of the end users' involvement is also significant. Effective end user involvement in the development process has been shown to be based on shared knowledge between end users and developers or, failing that, the quality of the relationship between the parties (Hsu, Lin, Zheng, & Hung, 2012, p. 8). As these studies show, end user involvement is not as simple as it is often portrayed. More so, there are ample research opportunities to examine this area in further detail and to address issues such as the generalisability of findings (see, for example, Petter, 2008, p. 708; Hsu, Lin, Zheng, & Hung, 2012, p. 9).

2.4.3.4 Other success factor studies

Unfortunately, only a few other actor-based success factor studies exist. Thus, research into other OISD project actors, such as the project team, would seem to be merited. Similarly, only a few process related articles can be found. For example, Jones (1996) and Smuts, van der Merwe, Kotzé, and Looek (2010) both investigated success factors for the software development life cycle; the latter identifying nearly 50 individual success factors relating to outsourcing software development. However, as these findings were derived from a single, South African case study, additional research is required to address generalisation issues. Indeed, understanding of OISD processes seems to be poor. For example, in their study of requirements engineering, Hofmann and Lehner (2001) state, "We know surprisingly little about the actual process" (Hofmann & Lehner, 2001, p. 58). Research has also shown that prescribed project management processes are often not followed in practice (de Bakker, 2009, p. 3; Fortune & White, 2009, p. 37). The findings of other studies, such as

Kutsch and Hall (2005), also suggest that there is merit in investigating how the behaviours and activities of individuals impact rational OISD project processes (see Kutsch & Hall, 2005, p. 595). Clearly then, additional research into OISD processes in general is required. Finally, there would seem to be two unexplored research topics: (1) artefacts as success factors for OISD projects, and, possibly (2) external OISD project success factors.

2.4.4 Research into the influence of success factors on OISD project success

According to some, there has been limited research into the influence of success factors on project success (Andersen, Birchall, Jessen, & Money, 2006, p. 128; Thi & Swierczek, 2010, p. 572). However, a variety of success factor articles in this area have been published since 2000 (refer to Table 2.11). This suggests that, for OISD and IS projects, at least, the situation is changing. Given the wide range of success factors identified in Section 2.4.1, the opportunity for a great deal more research would seem to exist.

With the exception of a few qualitative studies (for example, Christensen & Walker, 2008; de Bakker, Boonstra, & Wortmann, 2012), research in this area is predominantly quantitative (as is the case for success factor lists discussed above on p. 41): surveys coupled with descriptive statistical analysis. Studies in this area tend to focus on one, sometimes two, factors. The factor under investigation is considered as an independent variable that directly influences project success, the dependent variable (refer to Figure 2.2). Notably, project success is not normally considered in terms of specific success criteria. Some of the studies give consideration to moderating variables; that is, those factors that might have a bearing on the influence of the factor being investigated.

Project type	Factor	Influence	Article(s)
OISD	Common knowledge (end users and project team)	Positive	Tesch, Sobol, Klein, & Jiang (2009); Hsu, Lin, Zheng, & Hung (2012)
	Requirements engineering	Positive	Hofmann & Lehner (2001); Hsu, Lin, Zheng, & Hung (2012)
	End user involvement	Positive	Jiang, Chen, & Klein (2002)
	Project team motivation	Positive	Verner, Beecham, & Cerpa (2010)
	Quality of planning	Positive	Dvir & Lechler (2004)
	Goal changes	Negative	
	Staff turnover	Negative	Hall, Beecham, Verner, & Wilson (2008)
	Developer input to project estimates	None	Verner, Evanco, & Cerpa (2007)
	Project manager's leadership style	Positive	Sumner, Bock, & Giamartino (2006)
IS	Risk management	Positive	de Bakker, Boonstra, & Wortmann (2012)
	Incremental organisational change	Negative	Winklhofer (2001)
	Project planning practices	Positive	Kearns (2007)
	Project team dynamics	Positive	Gelbard & Carmeli (2009)
	Organisational support	Positive	
	Project size	Negative	Sauer, Gemino, & Reich (2007)
	Project volatility	Negative	
	Human resource management	Marginal	Belout & Gauvreau (2004)
	Project manager's use of vision	Positive	Christensen & Walker (2004)
	Project vision	Positive	Christensen & Walker (2008)
	Executive management support	Positive	Young & Jordan (2008)
	Project manager's leadership style	Positive	Müller & Turner (2007b)
Generic	Project sponsorship	Positive	Bryde (2008)
	Supportive organisational environment	Positive	Gray (2001)
	Project commitment	Positive	Andersen, Birchall, Jessen, & Money (2006)
	Project communications	Positive	

Table 2.11. Research articles investigating the influence of factors on project success

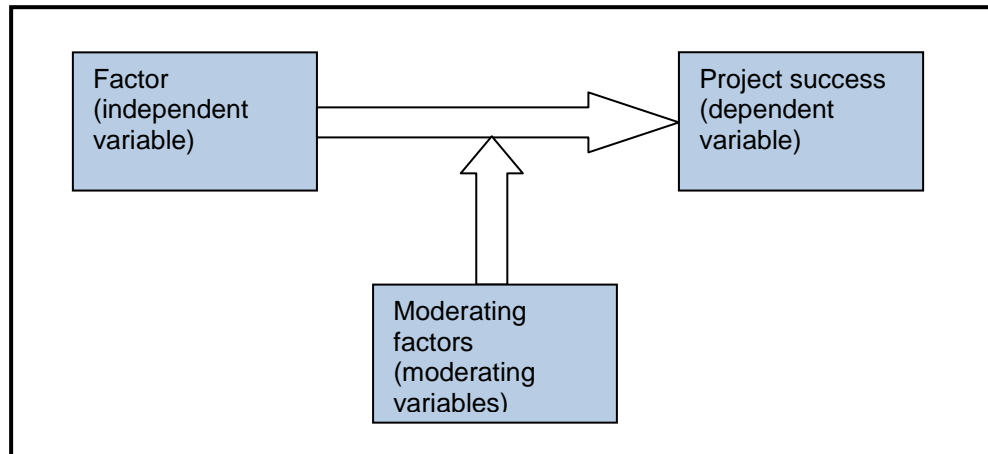


Figure 2.2. Research model for the influence of factors on project success

Interestingly, 92% of the studies in Table 2.11 found that the factor under investigation has an influence on project success. This seems to suggest that further studies in this area will identify additional factors that influence project success, thus supporting the view that project success is indeed a function of a wide range of success factors, not a limited few as purported by the “top 10” checklists analysed in Section 4.2.1.

Although a detailed discussion of each of the articles listed in Table 2.11 is outwith the confines of this literature review, Sauer, Gemino and Reich (2007) merits further discussion. This study conforms to the research model presented in Figure 2.2. Yet, it raises an issue that the majority of success factor research ignores, let alone addresses. Treating a success or failure factor as an independent variable implies that the factor can be measured or assessed in some way. Thus, some form of unit of measure might be required. For project size, the study recommends that project budget (stated, for example, in US dollars) is an inappropriate measure. Instead, project size is better measured by effort: the product of project team size and project duration (expressed, perhaps, as person-months) (Sauer, Gemino, & Reich, 2007, p. 82). The study also identifies another issue: the degree or magnitude of a factor that influences project success. Again, the majority of studies give no guidance on this point. Without further information, the logical assumption is that the magnitude of a specific factor is directly proportional to its influence on project success. In other words, for success factors, the more the better (and vice versa). However, as

this study shows, this is not always the case: 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, Gemino, & Reich, 2007, p. 81).

Sauer, Gemino and Reich (2007) also allude to another issue: the relationship between a specific factor and project success “is [typically] not as simple or direct as many think” (Sauer, Gemino, & Reich, 2007, p. 80). In general, researchers investigating this area agree (for example, Andersen, Birchall, Jessen, & Money, 2006; de Bakker, Boonstra, & Wortmann, 2012; Hsu, Lin, Zheng, & Hung, 2012; Tesch, Sobol, Klein, & Jiang, 2009). In many cases, specific factors are found comprise a number of other “sub” factors (see, for example, de Bakker, Boonstra, & Wortmann, 2012; Gelbard & Carmeli, 2009; Verner, Evanco, & Cerpa, 2007). It is also relatively common for studies to acknowledge that the interaction between factors is relevant and therefore requires further investigation (for example, Bryde, 2008; Hall, Beecham, Verner, & Wilson, 2008; Tesch, Sobol, Klein, & Jiang, 2009). A number of studies (for example, Gelbard & Carmeli, 2009; Hsu, Lin, Zheng, & Hung, 2012; Tesch, Sobol, Klein, & Jiang, 2009) also identify the moderating effects of intermediate factors. Finally, it is not uncommon for studies to reveal small, localised causal chains related to the factor being investigated (for example, Hofmann & Lehner, 2001; Hsu, Lin, Zheng, & Hung, 2012; Jiang, Chen, & Klein, 2002; Wallace, Keil, & Rai, 2004). In summary, these studies suggest that the concept of a factor directly influencing project success is somewhat of a misnomer. Instead, “the impact of individual factors is complex” (Hall, Beecham, Verner, & Wilson, 2008, p. 33) requiring further research to provide a better understanding of why and how success factors contribute to project success or failure.

2.4.5 Research into causal interactions between OISD project success factors

The research described in the previous section has provided support for the influence of various factors on project success or failure. Yet, it has done little to enhance understanding of how these factors interact and promulgate their influence in practice. This is a need identified by, amongst others, Belassi and

Tukel (1996, p. 150). In general, the studies in the previous section have two primary limitations. First, it is typically the combination of a large number of factors, throughout the project life cycle, that results in project success or failure (Belassi & Tukel, 1996, p. 142). However, by treating success factors as independent variables, the studies do not address combinations of factors or their interactions. Second, factors do not typically affect a project's outcome in a direct manner (Belassi & Tukel, 1996, p. 142). Again, by attempting to assess the direct influence of a success factor on project success, the studies do not identify the intermediate paths that the initial effects of given factor may actually take over a project's life cycle to influence a project's outcome. Thus, in the mid-1990s, Belassi and Tukel (1996) expressed their expectation for future research into the causal relationships between success factors (Belassi & Tukel, 1996, p. 150). Unfortunately, research in this area is still limited, particularly so for OISD projects. Thus, there still exists little to explain how success factors are related, and how and why they lead to IS success or failure (Kim & Pan, 2006, p. 73).

OISD projects, have been referred to as being complex (British Computer Society, 2004, p. 15; Williams, Klakegg, Walker, Andersen, & Magnussen, 2012, p. 44; Xia & Lee, 2004, p. 69) and complexity cited as a failure factor in a number of studies (for example, Charette, 2005; Tiwana & Keil, 2004; Wohlin & Andrews, 2002). This view can be traced back, at the very least, to the early 1980s, in that the management of OISD projects "is a very complex undertaking in which a complex network of interrelationships and interactions exists" (Abdel-Hamid & Madnick, 1983, p. 346). Making sense of such a network requires an integrative model containing a large number of components or factors in a complex network of interrelationships. Over and above this, an effective means is required to accurately determine the dynamic behaviour of the interactions between factors in the model (Abdel-Hamid & Madnick, 1983, p. 346). Hence, enhancing understanding of OISD project success factors has two stages. First, the relationships between success factors need to be identified. Second, the dynamics of these relationships over the life cycle of the project requires investigation.

2.4.5.1 Identifying relationships between success factors

The majority of research articles in this area address the first stage i.e. identifying the causal interactions between success factors. Unfortunately, most of these studies only deal with IS projects, not OISD projects. However, as the factors encompassed by these studies also appear in success factor lists for OISD projects (for example, executive management support and end user involvement), their findings would seem to have some relevance for OISD projects.

Akkermans and van Helden's (2002) exploratory ERP case study has been cited as a study that has moved the success factor debate on from "simply listing factors to trying to understand the interrelationships between factors" (King & Burgess, 2006, p. 61). This is because the study presents a causal model incorporating the relationships between 10 success factors previously identified by Somers and Nelsen (2001). More importantly, their relationship model identifies a reinforcing loop of causal interactions that can act as both a vicious or virtuous feedback loop (Akkermans & van Helden, 2002, p. 42). Simply put, vicious loops detract from project success while virtuous loops do the opposite. Thus, the study shows how a change in a success factor can lead to a "self-perpetuating cycle of good or poor performance" (Akkermans & van Helden, 2002, p. 45) that eventually leads to the success or failure of a project (King & Burgess, 2006, p. 61).

Subsequent studies, have built upon Akkermans and van Helden's work for IS project success factors. Kim (2004) and Kim and Pan (2006) use customer relationship management (CRM) case studies to develop a relationship model for IS projects comprising 12 and 10 "essential" factors respectively. The models help explain how and why success factors affect one another and how their interaction leads to project success (Kim, 2004, p. 28; Kim & Pan, 2006, p. 72). King and Burgess (2006; 2008) also propose conceptual models containing a limited number success factors linked in causal chains (King & Burgess, 2006, p. 66; King & Burgess, 2008, p. 426).

Similar studies have also been undertaken by a number of researchers. For example, Fortune and White's (2006) theoretical study framed 27 success factors in a formal system model that considers the relationships between success factors. The model was then used to "distinguish" between two IS projects, one of which was successful, the other not¹⁵ (Fortune & White, 2006, p. 63). Butler and Fitzgerald's (1999) case study of an IS development process was presented as a network analysis of 20 factors; thus illustrating that IS development success factors (for example, a committed project sponsor and adequate documentation) are closely related. Not only do these success factors influence each other, but the strength of these influences can vary (Butler & Fitzgerald, 1999, p. 368). Similarly, Sabherwal, Jeyaraj and Chowa (2006) provided a theoretical IS model containing a mere six factors (and four criteria), described as either context related (top management support and facilitating conditions) or user related (user experience, training, attitude and participation). The study identifies a number of relationships between factors, not all of which were "expected" by the authors: for example, the influence of user attitudes on IS quality (Sabherwal, Jeyaraj, & Chowa, 2006, p. 1858). Yetton, Martin, Sharma, and Johnston (2000) also provided a causal model of OISD project performance containing 12 factors. The model helps highlight the significance of executive management support, risk management and project team dynamics for strategic projects and end user involvement to ensure successful OISD project performance (Yetton, Martin, Sharma, & Johnston, 2000, p. 263). Finally, Procaccino, Verner, Darter and Amadio (2005) proposed an model for OISD project success containing 10 factors. The model, based on data collected from software practitioners, identifies a number of relationships between factors. More so, the model identifies a chronological critical path of success factors in which having a project champion influences the amount of time that end users make for requirements gathering. This, in turn, leads to a high level of end user involvement in the development process which results in

¹⁵ An OISD project and an IS implementation project.

better agreement on requirements between end users and the project team (Procaccino, Verner, Darter, & Amadio, 2005, p. 196).

Although these studies have enhanced understanding of the interaction of IS and OISD project success factors, they have a number of limitations. First, all of the studies address only a small number of key success factors. Similarly, only three of the studies include (simple) causal loops and the treatment of success criteria across the studies as a whole is best described as limited. Thus, they represent relatively simple scenarios, requiring the addition of more success factors, relationships and criteria to provide a better representation of complex OISD projects (Kim, 2004, p. 28; King & Burgess, 2008, p. 430). Thus, there is a significant opportunity for researchers to provide more comprehensive causal models that provide a better explanation of the behaviour of real-world OISD projects. Second, further research is required to validate, complement and extend the conceptual models presented by the studies. Finally, and most importantly, because all the models are still static in nature, they do not address the dynamic nature of real-world IS and OISD projects.

2.4.5.2 Investigating the dynamics of success factor relationships

Altuwaijri and Khorsheed (2012) note the static nature of success factors identified in prior research (Altuwaijri & Khorsheed, 2012, p. 38). King and Burgess (2006) cite similar concerns (King & Burgess, 2006, p. 67) and hence the need to develop dynamic success factor models for OISD projects. A number of authors have identified computerised simulation modelling techniques as a means to accomplish this (for example, Abdel-Hamid & Madnick, 1983, p. 346; King & Burgess, 2006, p. 62; King & Burgess, 2008, p. 430; Lee & Miller, 2004, p. 80). As Lee and Miller (2004) state, "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 & Miller, 2004, p. 80). Indeed, the use of modelling techniques for other project types (other than OISD projects) has shown to be extremely useful in developing understanding of how complex projects behave (Cicmil, Williams, Thomas, & Hodgson, 2006, pp. 682-683) and

has made a significant contribution to understanding the actuality of projects (Cicmil, Williams, Thomas, & Hodgson, 2006, p. 684). Yet, despite such promise, simulation remains an under-explored technique for understanding success factors in IS projects (King & Burgess, 2008, p. 430) and OISD projects. Thus, although tentative steps have been carried out in this area (for example, King & Burgess, 2008), the use of simulation models, to enhance understanding of the dynamic relationships between success factors in OISD projects, represents a significant opportunity for further research.

2.5 Dimensions of OISD project success factor research

Having discussed the five OISD project success factor research directions, the discussion will now turn to the state-of-the-art of empirical research in the area. This can be described using three dimensions: culture, perspective and approach.

Empirical research into OISD project success factors relies almost entirely on the views of practitioners associated with this type of project. The same is true for factor research investigating other project types. In this respect, project success factor research is very much practice-led (based on empirical data) as opposed to being theoretically-derived (normative). Prior research (for example Peterson, Kim, Kim, & Tamura, 2002, p. 434) has shown that perceptions of OISD project success factors varies by geographical location. More accurately, success factors are viewed differently depending on a practitioner's cultural environment. Because of this, a number of authors have identified an opportunity for their findings to be explored in other cultural settings (for example, Moynihan, 1996, p. 365; Procaccino, Verner, & Lorenzet, 2006, p. 83; Skulmoski & Hartman, 2010, pp. 74-7; Taylor, 2007, p. 22; Zwikael, 2008b, p. 509). Hence, there is ample opportunity for research into OISD project success factors in different countries and/or cultures.

Many organisations outsource their OISD process to external suppliers (Elitzur, Gaviious, & Wensley, 2012, p. 379; Heiskanen, Newman, & Eklin, 2008, p. 268). Although a number of studies include supplier based OISD projects (for example, Mahaney & Lederer, 2003; Procaccino, Verner, & Lorenzet, 2006), the

perspective investigated is almost entirely that of the client, not the supplier (Savolainen, Ahonen, & Richardson, 2012, p. 2; Taylor, 2007, p. 22). Indeed, a recent review of IT outsourcing literature (refer to Lacity, Khan, & Willcocks, 2009) identifies 191 outsourcing articles, all of which present the clients' perspective. Unfortunately, limiting research to the client perspective does not reflect the reality of OISD projects (Savolainen, Ahonen, & Richardson, 2012, pp. 9-10). This is because, for subcontracted projects, the supplier and client may have differing viewpoints on the factors that contribute to project success or failure (Cerpa & Verner, 2009, p. 132; Savolainen, Ahonen, & Richardson, 2012, p. 2; Taylor, 2007, p. 22) and that the suppliers' perspective can be different from that espoused in mainstream literature (Moynihan, 1996, p. 364). As a consequence, understanding of OISD projects, from a suppliers' perspective, is poor (Savolainen, Ahonen, & Richardson, 2012, p. 2). Hence, there is a need for empirical studies that examine OISD projects from the suppliers' perspective (Savolainen, Ahonen, & Richardson, 2012, p. 10).

Empirical research into OISD project success factors is predominantly quantitative (Ika, 2009, p. 12). As a result, a number of success factors have been identified. A number of studies have also supported the existence of various success factors by attempting to qualify their direct influence on project success. However, understanding of OISD projects is still far from complete. In particular, understanding of real-world projects is poor (Cicmil, Williams, Thomas, & Hodgson, 2006, p. 675) as is the matter of how and why OISD success factors influence project success in practice. Although the reasons for this are not clear, there seems to be sufficient argument that qualitative research methods are more appropriate to addressing these issues. For example, the only OISD project success factor list studies to acknowledge the large number of potential factors (that is, Bannerman, 2008; Moynihan, 1996), utilise qualitative methods. From a more general standpoint, qualitative methods are considered to be particularly effective when understanding of a particular phenomenon is modest (Eriksson & Kovalainen, 2008, p. 5). Hence, it would seem that developing a better understanding of OISD project success factors would benefit from qualitative as opposed to quantitative methods.

2.6 Temporality of OISD project success factors

The penultimate topic to be discussed is that of temporality; not only because it is relevant to the success of OISD projects, but because it has implications for research in the field. Project success factors have been described as temporal (Khandelwal & Ferguson, 1999, p. 2); that is, they vary over a project's life cycle (Pinto & Covin, 1989, p. 49). But, as previously discussed, factors can also exist prior to the project life cycle (Ahonen & Savolainen, 2010, p. 2185; Klakegg, 2009, p. 500). Furthermore, project success factors can also be temporal in terms of the host organisation and beyond (Khandelwal & Ferguson, 1999, pp. 2-3). For example, as organisations mature, the factors pertinent to their OISD projects are also subject to change. Yet wider still, as the environment changes (for example, the introduction of new technologies), project managers will be constantly faced with a set of new problems and challenges (Belassi & Tukel, 1996, p. 150; Verner, Overmyer, & McCain, 1999, pp. 1025-1026).

Rank	1995	2001	2009
1	User involvement	Executive support	User involvement
2	Executive management support	User involvement	Executive support
3	Clear statement of requirements	Experienced project manager	Clear business objectives
4	Proper planning	Clear business objectives	Emotional security
5	Realistic expectations	Minimised scope	Optimising scope
6	Smaller project milestones	Standard software infrastructure	Agile process
7	Competent staff	Firm basic requirements	Project management expertise
8	Ownership	Formal methodology	Skilled resources
9	Clear vision and objectives	Reliable estimates	Execution
10	Hard working, focussed staff	Other	Tools and infrastructure

Table 2.12: Standish Group success factor listings (1995, 2001, 2009)
(Source: Standish Group, 1995; 2001; 2009b)

Consider, for example, some of the success factor research conducted by the Standish Group (1995; 2001; 2009b). This is shown in Table 2.12 and illustrates

the temporal nature of 17 OISD project success factors between 1995 and 2009. Although end user involvement and executive management occupy the two most highly ranked positions over the three studies, the other factors demonstrate greater degrees of temporality. For example, the relative importance of project “objectives” rises with each subsequent study. Yet, none of the other factors (14) appear in all three lists and nearly half (eight) only once. Indeed, even those that appear in two of lists (six) show important changes. For example, project “scope” evolves from being minimised to optimised between 2001 and 2009, despite retaining its rank. Similarly, a formal methodology for software development is replaced by an agile approach over the same period.

In summary, OISD project success factors represent a “moving target”, based upon which, two conclusions can be drawn. First, the temporal nature of factors, is another possible reason for the general lack of agreement on success factors for OISD projects. Second, temporality also serves as a driving force for continuous research into OISD project success factors, thus keeping research in line with the reality of contemporary OISD projects.

2.7 Theoretical basis of OISD project success factors

Having provided a critical analysis of the OISD project success factor and related literature, the final area of discussion is the theoretical basis for said factors, which it borrows, for the main part, from generic project success factor theory. Unfortunately, much like project management theory as a whole (see p. 22), success factor theory is seldom expressed explicitly in the literature. Indeed, even where theory is stated clearly as such (for example, in project success factor frameworks and, to a lesser extent, research into causal interactions between project success factors), the theory espoused in these studies receives little or no support beyond the limited evidence provided by the original articles’ authors. However, the main problem is that the majority of project success factor research comprises empirical studies that fail to use their findings to build theory. Consequently, project success factor research has

provided very little in terms of theory development (Söderlund, 2004a, p. 187; Söderlund, 2004b, p. 659).

All that said, this does not mean that a theory of OISD project success factors does not exist. On the contrary, it is quite possible to determine what may be construed as OISD project success factor theory by examining the research literature discussed in this chapter and identifying the “theoretical” elements that seem to have gained general (or, at least, partial) acceptance by the research community. The remainder of this section “builds” such a theory.

The starting point for OISD project success factor theory is that project success contains two mutually exclusive aspects: (1) success criteria and (2) success factors (see p. 27). In relation to success criteria (the measurements of project success), project success is, again, considered to have two aspects: (1) project management success and (2) organisational success, each with their respective success criteria (see p. 28).

Turning now to success factors, Rockart’s definition of CSFs for project management still has merit: “the few key areas of activity in which favourable results [are] absolutely necessary for a particular manager to reach his goals” (Bullen & Rockart, 1981, p. 3). More recent definitions (for example, Ika, 2009, p. 8; Milosevic & Patanakul, 2005, p.183) are also valid but, when considered as a whole, suggest that a project success factor is *anything* that contributes to the success of a project (see p. 6).

Despite the identification of nearly 500 unique OISD project success factors, success factor theory retains the “critical” nature of success factors. That is, project success is dependent on a few, rather than a large number of factors. For the main part, this is due to the large number of empirical studies that produce “top 10” factor lists (see p. 40). The same is true for research into causal interactions between project success factors (see p. 63) that produces simplistic networks comprising limited numbers of success factors, linear causal chains and causal loops in an attempt to explain the manner in which success factors affect project success.

In summary, OISD project success factor theory constitutes a simplistic model of success factors, their relationships and the way in which success factors affect project success. As this simplicity does not reflect the complex nature of contemporary projects (Bredillet, 2005, p. 3; Crawford, Morris, Thomas, & Winter, 2006, p. 724; Fortune & White, 2009, p. 37; Winter & Smith, 2006, p. 13), project success factor theory can only be described as weak in its ability to provide credible explanations of the behaviour of real-world OISD projects.

2.8 Conclusion

The literature review shows that OISD project success factors, incorporating failure and risk factors, is a vibrant research area. Driven by the poor performance of OISD projects, the research area has number of active research directions, all of which can be further justified by the temporal nature of project success factors, poor understanding of the “actuality” of real-world projects (Cicmil, Williams, Thomas, & Hodgson, 2006, p. 675) and the weak theoretical basis for the research area.

Studies providing descriptive lists of OISD project success factors remain popular and are beginning to enhance understanding of specific perspectives, such as that of the supplier, and various cultural settings (see, for example, Sharma, Sengupta, & Gupta, 2011). Yet, specialised studies of this type are rare and significant research opportunities still exist. In particular, there is a need for more empirical studies that examine OISD projects from the suppliers’ perspective (Savolainen, Ahonen, & Richardson, 2012, pp. 10) and in different cultural contexts (see, for example, Moynihan, 1996, p. 365; Procaccino, Verner, & Lorenzet, 2006, p. 83; Skulmoski & Hartman, 2010, pp. 74-7; Taylor, 2007, p. 22; Zwikael, 2008b, p. 509). The success factor analysis described in Section 2.4.1 (see p. 40) also suggests that OISD projects comprise a large number of relevant success factors (see also Bannerman, 2008; Moynihan, 1996). Thus, approaches such as overly-simplistic “top 10” or laundry lists of success factors, produced by predominantly quantitative techniques, are not sufficient to describe the richness of what really happens in a project environment (Cicmil, Williams, Thomas, & Hodgson, 2006, p. 684). Instead,

qualitative approaches would seem far better suited to enhancing understanding of real-world OISD projects and the reasons why these projects succeed or fail.

The literature review identified a lack of frameworks for OISD project success factors. There is also scope for additional studies into the influence of individual factors on OISD project success. However, the contributions made by both of these research directions are at an abstract rather than detailed level. They are also relatively simplistic and receive little or no support other than the limited evidence provided by the original authors. Frameworks, for example, tend to be high level outlines as opposed to in-depth explanations. Similarly, research into the influence of individual factors on OISD project success does not explain how these factors actually interact and promulgate their influence in practice. Indeed, the concept of a factor directly influencing project success is somewhat of a misnomer. Hence, in terms of enhancing understanding of complex, real-world OISD projects, the potential contributions made by these research directions would seem to be somewhat limited.

Understanding of the dynamic relationships between OISD project success factors is poor; so much so, that this research direction is probably best described as being in its infancy. There is certainly a need to develop dynamic success factor models for OISD projects. However, a precursor to achieving this is the identification of the numerous success factor relationships/interactions that might exist in real-world OISD projects. Therefore, research that seeks to identify and describe such relationships is certainly needed. In particular, research that explains the way in which success factors interact and hence propagate their influences to affect project success would seem to be of particular value.

The remainder of this thesis describes an empirical study that contributes to two of the areas discussed above. Specifically, the research investigates OISD project success factors as viewed by information system supplier organisations in Scotland; the first time that such a perspective has been studied. The study extends beyond the identification of individual success factors and provides

detailed explanations of factors as perceived by OISD project professionals. The study also examines the way in which success factors interact and hence propagate their influences to affect OISD project success.

3. Methodology

3.1 Introduction

This chapter presents the methodology employed to conduct this research project. In so doing, the research approach and methods are clearly described. This is particularly important in the field of project management as the majority of researchers in this area (over 90%) do not make their research methodology explicit (Morris, 2010, p. 143).

This chapter is structured as follows. Over the next two sections an overview of the research approach is provided followed by a discussion of its philosophical foundations. The subsequent sections of the chapter describe various aspects of the research in more detail. First, the literature review is discussed in terms of the literature search and a quantitative analysis of OISD project success studies. Next, the use of pilot interviews is described. The main part of the chapter then presents the main fieldwork process. This process comprised five stages:

- (1) Company selection;
- (2) Interview arrangement;
- (3) Data collection;
- (4) Qualitative analysis;
- (5) Relationship analysis.

Following the main fieldwork process, the problems experienced during the research are described. Prior to the chapter's conclusion, the quality of the research process is discussed in terms of its validity and reliability.

3.2 Overview of the research approach

This research was conceived from the consensus of research articles that identified the poor performance of organisational information systems development (OISD) projects to be a serious and recurrent problem. In other words, too many OISD projects failed to meet the required success criteria

determined at their outset. Subsequently, an investigation into the reasons why contemporary OISD projects succeed or fail was deemed worthy of a doctoral research project. Thus, the aim of the project was to provide a better understanding of the reasons why OISD projects succeed or fail.

To develop this aim further, a comprehensive review of literature in the field was required (discussed in Section 3.4). The review revealed a number of gaps in the literature and, in particular, identified the need for research into:

- (1) OISD project success factors from the suppliers' perspective;
- (2) The numerous success factor relationships/interactions that might (or might not) exist in real-world OISD projects.

Thus, the research objectives for this study were defined as follows:

- (1) To provide a better understanding of OISD project success factors from the suppliers' perspective;
- (2) To provide a better understanding of the way in which these factors interact to influence project success.

Satisfying these objectives would require various "instruments" to collect and analyse data (see, for example, Denscombe, 1998, p. 240; Merriam, 1995, p. 51; Pyett, 2003, p. 1170). Appropriate data sources also needed to be identified. All in all, these instruments and data sources would need to be combined in a coherent research approach. Broadly speaking, the choices available were that of a quantitative or qualitative approach, or perhaps a hybrid of the two.

The literature review suggested that future research should adopt a qualitative approach. A review of the literature discussing qualitative research theory also supported this view (see, for example, Denscombe, 1998; Fielding & Thomas, 2001; Labuschagne, 2003; Patton, 2002); in particular, that providing a better understanding of OISD project success factors would benefit from a qualitative study. The primary reason for this was that "understanding" would be best served by providing in-depth descriptions of success factors in real-world OISD

projects. In so doing, this would allow the research to contribute to understanding the actuality of projects. This is a gap in the literature identified by various researchers (for example, Cicmil, Williams, Thomas, & Hodgson, 2006, p. 675; de Bakker, 2009, p. 3; Fortune & White, 2009, p. 37).

For qualitative research, the instruments utilised for data collection are typically interviews, observation or the review of pertinent documents. Having concluded that observation and document review were not practical options, qualitative interviews were identified as the instrument for data collection.

Qualitative interviews can take numerous forms in terms of the structure they employ. An interview can be highly structured (similar to a quantitative survey), comprising a number of specific, closed questions. Conversely, an interview may exhibit no structure other than a single, open-ended question. Clearly, an interview can also be structured anywhere between these two extremes; that is, containing varying degrees of specific and open-ended questions. Given that research into OISD project success factors from the suppliers' perspective was, at best, in its infancy, a relatively unstructured interview was deemed appropriate for this project. This would allow the interviewees to identify and discuss success factors as they saw fit and with minimal bias from the researcher and his knowledge of prior research. However, it was also recognised that the interviews needed to collect a small amount of quantitative data regarding the interviewees' roles and experiences. Thus, the interview structure was defined as follows:

- (1) Eight short, closed questions to solicit/confirm interviewee details;
- (2) A single open-ended research question in the form of a statement: "In my experience as a [project role], [a particular factor] is significant to the success or failure of an OISD project because ... [discussion]" affording the interviewees the opportunity to identify and discuss factors as they saw fit.

Having defined the data collection approach, interview structure and specific questions, attention turned to the data analysis approach. It was decided that the interviews should be transcribed verbatim. Although this would be a very time consuming exercise, it would provide an important opportunity for the researcher to familiarise himself with the interview data. Verbatim transcripts would also serve as a basis for both broad and detailed coding.

To satisfy the first research objective (providing a better understanding of OISD project success factors from the suppliers' perspective) a qualitative approach would be employed. This would involve a broad, entity-based coding approach to identify themes from the transcripts. These themes, in themselves high-level success factors, would be based on a coding structure derived from the success factor analysis performed as part of the literature review (discussed below). However, it was also anticipated that a degree of open-coding would be required. If necessary, these themes would then amalgamated and the text for each reviewed to produce informative narratives for each factor.

Satisfying the second research objective (providing a better understanding of the way in which OISD project success factors interact to influence project success) would require a more quantitative coding approach. In this instance, the transcripts would be analysed in more depth to identify detailed success factors (represented as entities and characteristics) and relationships (influences) between them.

Having determined the basic approaches for data collection and analysis, a series of six pilot interviews were carried out (described in Section 3.5). The primary objective of these interviews was to test the research processes and hence determine their "quality" prior to the main fieldwork process (described in Section 3.6). The pilot interviews suggested that the processes were, indeed, fit for purpose. However, it was deemed necessary to add another open-ended interview question: "How do you define project success?" This question would act as a precursor to the main interview question (discussed further in Section 3.6).

Next, the main fieldwork process commenced with the identification of appropriate data sources. Scotland has a strong IT sector comprising numerous IT departments and, more so, a variety of supplier organisations. These supplier organisations range from small, highly specialised companies to large, global players. The sector employs in excess of 40,000 personnel which, compared with the whisky industry (11,200), textiles (27,000) and the electronics sector (41,000), makes it a significant asset to the Scottish economy (ScotlandIS, 2012). Hence, a priori sampling was used to identify candidate supplier organisations for the research project. As opposed to random sampling, this form of purposeful sampling helped ensure that the interview participants were knowledgeable in terms of the research project's subject matter. During the subsequent interviews, additional participants were secured using snowballing (another form of purposeful sampling). In all, 33 participants were interviewed and, as all but one of the interviews were recorded, the recordings transcribed as described above.

Broad, entity-based coding and subsequent analysis (as described above) were then used to satisfy the first research objective (providing a better understanding of OISD project success factors from the suppliers' perspective). This resulted in various definitions of OISD project success and the identification of 20 OISD project success factors. These findings, presented in Chapter 4, also confirmed that the success factors comprised of more detailed factors and that relationships existed between the factors. Consequently, the interview transcripts were coded in detail as described above.

At this stage, the second research objective (providing a better understanding of the way in which OISD project success factors interact to influence project success) was expanded. That is, to provide a better understanding of:

- (1) The number of detailed success factors (and success criteria) that are involved;
- (2) The relationships that exist between the factors;

- (3) The causal chains by which success factors propagate their influence to affect project success;
- (4) The key factors and relationships involved in the propagation process.

The detailed coding process had identified a large number of detailed factors and relationships between them. Hence, a small software application was developed to identify causal chains (and loops) and the key factors and relationships involved in the propagation process. This software was then used to help analyse the detailed factors and their relationships, the findings of which are presented in Chapter 5.

3.3 Philosophical foundations of the research approach

This section discusses the philosophical foundations of the research approach. The way in which these foundations, or assumptions, have informed the research approach is explained, as is their influence on the use of quantitative and qualitative methods. The limitations of the approach and the ensuing knowledge claims are also discussed.

The philosophical foundations of social research are “messy” (Crotty, 1998, p. 216). The “language-in-use” is often daunting (Johnson & Duberley, 2000, p. 2) and no discussion can be considered complete (Creswell, 2012, p. 23). There are no set standards (Creswell & Clark, 2007, p. 22) or firm guidelines (Creswell, 2012, p. 65). The terminology is inconsistent and even contradictory (Crotty, 1998, p. 1); for example, one author’s epistemology¹⁶ can be another’s interpretive framework (compare, for example, Crotty, 1998, p. 5 and Creswell, 2012, pp. 36-37). Further still, a given epistemology might exist in an array of bewildering varieties (see, for example, Crotty, 1998, p. 20; Halfpenny, 2003, p. 372). Viewpoints are still evolving (Creswell & Clark, 2007, p. 22) and authors often disagree over the tenets associated with a certain research approach (see, for example, Creswell, 2012, pp. 226-228). Perhaps because of this

¹⁶ The author’s viewpoint regarding the nature of *knowledge* (Stainton-Rogers, 2006, p. 79).

“mess”, the philosophical foundations of social research are often ignored (Easterby-Smith, Thorpe, & Jackson, 2008, p. 56), hidden (Myers, 2009, p. 35), overlooked (Creswell, 2012, p. 18) or, at best, seldom clearly presented (Johnson & Duberley, 2000, p. 8).

Although it can be argued that researchers should refrain from debating philosophical issues (Pickard, 2007, p. 5; p. 22) and that this is best left to “those who care about it” (Miles & Huberman, 1988, p. 223 cited by Pickard, 2007, p. 22), to do so disadvantages the researcher. In particular, the philosophical foundations of a research approach¹⁷ exert considerable influence on what can and cannot be achieved. They also place limits on any ensuing knowledge claims (Myers, 2009, pp. 35-36). Hence, researchers would do well to understand these foundations (Creswell, 2012, p. 83; Pickard, 2007, p. 5; Lee & Lings, 2008, pp. 50-51; Myers, 2009, pp. 35-36) and the way in which they inform and guide their research (Creswell & Clark, 2007, p.20; Guba & Lincoln, 1998, p. 218 cited by Pickard, 2007, p. 5).

The primary philosophical stance adopted within this thesis is based upon an interpretive¹⁸ epistemology¹⁹. Hence, the research approach is rejecting the positivist²⁰ worldview of the nature of knowledge i.e. that it may be attained by way of detached, value-free observation that seeks to identify universal features of its subject matter to offer explanation, control and predictability (Crotty, 1998, p. 67). Although positivism has been shown to have merit for research into the natural sciences, this is not necessarily the case for social and cultural issues;

¹⁷ This section uses the term *research approach* instead of *research paradigm* due to the numerous meanings afforded to the word *paradigm* in the research literature (Creswell & Clark, 2007, p. 21).

¹⁸ Also referred to in the literature as *interpretivist* (see, for example, Crotty, 1998, p. 67) and *interpretivism* (see, for example, Creswell, 2012, p. 24).

¹⁹ Although epistemology (i.e. understanding *what it means to know*) is discussed in this section, ontology (i.e. understanding *what is*) is not. This is because ontology need not be expressly addressed when discussing a research approach (Crotty, 1998, pp. 10-12).

²⁰ Also referred to in the literature as *positivism* (see, for example, Pickard, 2007, p. 6).

such as those related to OISD projects. Instead, an interpretive epistemology, through its acceptance of multiple realities (Lee & Lings, 2008, p. 60) and culturally devised interpretations of the world, seems better suited to describe and understand social and cultural reality (Crotty, 1998, pp. 66-67).

An interpretive epistemology provides access to various interpretive frameworks (Creswell, 2012, pp. 35-38). Of relevance to this research project is the social-constructivism²¹ framework in which reality is neither objective nor exterior, but is “socially constructed and given meaning by people” (Easterby-Smith, Thorpe, & Jackson, 2008, p. 58). It is important to note that all of the data collected by this research project can be considered to be socially constructed. Thus, in terms of its data collection, this research project can be considered epistemologically pure. However, a pragmatic framework i.e. one by which reality is made known through the use of methods that are considered both practical and workable (Creswell, 2012, p. 37), is also relevant. Given that researchers are responsible for devising a research process that serves their purposes best (Creswell, 2012, p. 28; Crotty, 1998, p. 216), a pragmatic framework is not only justified, but essential.

An interpretive epistemology can be realised through a number of research methodologies, of which the phenomenological study is best suited to this research project. Phenomenology is the study of lived, human experiences (Lee & Lings, 2008, p. 59) and phenomenological studies report how their participants “view their experiences” (Moustakas, 1994 cited by Creswell, 2012, p. 20). This type of research lends itself well to qualitative methods (Denzin & Lincoln, 2011, p. 3 cited by Creswell, 2012, p. 44; Lee & Lings, 2008, p. 65). These include open-ended interviews; “the more open-ended the questioning, the better” (Creswell, 2012, p. 25). Also relevant are coding, analysis and presentation techniques, all designed to explore their subject matter in extreme

²¹ Also referred to in the research literature as *constructivist* (see, for example, Pickard, 2007, p. 6) and *constructionism* (see, for example, Easterby-Smith, Thorpe, & Jackson, 2008, p. 58); although it is acknowledged that certain authors distinguish between words such as *constructivism* and *constructionism* (see, for example, Crotty, 1998, p. 79).

depth and detail (Creswell, 2012, p. 79; Pickard, 2007, p. 240). However, as quantitative data is useful to interpretive research (Lee & Lings, 2008, p. 65), a mixed method approach can also be of merit (Creswell & Clark, 2007, p. 34; Crotty, 1998, p. 15). Thus, a quantitative relationship analysis was performed (refer to Section 3.6.5) to complement the initial qualitative analysis (refer to Section 3.6.4).

The adoption of a phenomenological methodology founded on an interpretive epistemology with pragmatic and social constructionist frameworks brings with it a number of potential limitations. First, constructionist truth is neither absolute or appropriate for generalisation (Crotty, 1998, p. 16). Simply put, in interpretive, socially constructed research, the generalisation of findings is impossible (Dervin, 1997, p. 14 cited by Pickard, 2007, p.13; Lee & Lings; 2008, p. 67). Thus, all such claims should be avoided. That said, interpretive, socially constructed research is still suited to theory generation (Easterby-Smith, Thorpe, & Jackson, 2008, p. 72) and the development of practice and policy (Creswell, 2012, p. 81); albeit subject to appropriate consideration of its suitability for transferability (Erlandson, Harris, Skipper, & Allen, 1993, p. 33 cited by Pickard, 2007, p.13).

Second, knowledge that is both constructed and interpreted is intrinsically altered, modified and contaminated by these processes, their context and their actors. For example, due to their unavoidable personal involvement, researchers might be unable to separate individual experience from its holistic, socio-historical context (Lee & Lings, 2008, p. 60). In other words, bracketing²² personal experiences might prove impossible for researchers and, hence, their assumptions will always be incorporated in their findings in some way (Creswell, 2012, p. 83). Thus, meaning is always modified by the interpretive process (Blumer, 1969, p. 2 cited by Crotty, p. 72). Although this is a central tenet of interpretive research, it should also be recognised as a potential limitation;

²² The process by which a researcher excludes his or her experiences from the research (Creswell, 2012, p. 78).

especially if the intended audience of the research do not share comparable ontological and epistemological beliefs (Easterby-Smith, Thorpe, & Jackson, 2008, p. 73). Put another way, the subjective nature of the findings (Easterby-Smith, Thorpe, & Jackson, 2008, p. 73), being culturally and historically affected (Crotty, 1998, p. 64), can be problematic for audiences of a differing culture and/or of a positivist viewpoint (Halfpenny, 2003, p. 379).

Finally, socially constructed, interpretive approaches seek to provide complex, detailed understanding (Creswell, 2012, p. 65). However, there are limitations regarding the completeness of such an understanding. For example, phenomenology treats culture as both enabling but, paradoxically, crippling; “while it offers us entrée to a comprehensive set of meanings, it shuts us off from an abundant font of untapped significance” (Crotty, 1998, p. 71). Similarly, socially constructed reality is always “unstable, constantly changing, and unavoidably subjective” (Lee & Lings, 2008, p. 60). Thus, interpretation and knowledge are never final (Lee & Lings, 2008, p. 60) and interpretive findings can sometimes be construed as being tentative and inconclusive (Creswell, 2012, p. 187), as opposed to being complete.

In conclusion and, all of the above said, it is best remembered that limitations are inevitable for the majority of research projects (Pickard, 2007, p. 55) and the ensuing knowledge claims. Thus, it is important that these limitations are clearly identified and explained (Pickard, 2007, p. 55). The difficulties and limitations encountered by this research project are discussed below in Section 3.7.

3.4 Literature review

Having provided an overview of the research approach and discussed its philosophical foundations, the remaining sections of this chapter will provide details of five aspects of the research methodology. These are (1) the literature review (this section), followed by (2) the pilot interviews, (3) the main fieldwork process, (4) the difficulties encountered during the project and (5) the quality of the research process.

The literature search and review processes initiated at the start of this research continued throughout the study. The final update to the content of the literature review was performed in June 2012. Interestingly, the frequency by which project success factors are discussed in the literature grew over the course of the study, indicating increased interest in the topic. These articles have served to reinforce the need for the research described in this thesis.

3.4.1 Literature search

The literature review, as provided in Chapter 2, makes use of a diverse collection of research material. For the main part, the discussion makes reference to significant articles from leading, peer-reviewed journals in the fields of project management and information systems, as well as other related fields such as business management and software development respectively. These publications include the *International Journal of Project Management*, the *Project Management Journal*, the *European Journal of Information Systems* and the *Journal of Strategic Information Systems*. Reference is also made to a limited number of conference papers.

Software development has been described as a practitioner led discipline (Glass, 2003, p. 21). Important advances in project management research have also been made in publications outwith the realm of academic journal articles (Jugdev & Müller, 2005, p. 25). Consequently, various other sources such as books and commercial articles, written by academics and practitioners alike, are cited as deemed appropriate.

It is important to define the scope of material covered in the literature review. Project success is intrinsic to all OISD projects. That is, *all* projects are intended to be successful in terms of meeting their initial objectives. Thus, it can be argued that each and every research article that describes an aspect of an OISD project is, in some way or another, related to project success. This is particularly true for success factors. There are also studies outside the field that should be examined and integrated into project management (Alojairi & Safayeni, 2012, p. 16). However, it would be impossible for this research project to review *all* of the literature that addresses *all* aspects of OISD projects and

their management. Therefore the discussion is limited, for the main part, to those publications that deal directly with OISD project success in terms of success criteria and success, failure and risk factors.

On the whole, publications were sourced from online databases to which Edinburgh Napier University provides access. These resources were used to gain access to scholarly journals (and other materials) relating to project management, information systems and software development. The databases included *ABI/INFORM 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 literature search was conducted using combinations of the terms shown in Table 3.1 (16 combinations in all). The combinations were used to identify articles containing the terms in their titles, abstracts and key words (or similar depending on the search options provided by each database). Literature searches were carried out periodically throughout the research project (approximately once every six months).

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

Table 3.1. Literature search term combinations

The literature search also involved a significant amount of “snowballing” to identify further material from citations found in articles. This proved to be particularly important as a number of articles that are key to this research (for example, Moynihan, 1996) could not be identified using the terms shown in Table 3.1. The end product of the literature search was a selection of 325 articles, books, book chapters, etc., that, although not complete in terms of

every article written on OISD project success, was deemed sufficient to conduct a satisfactory review of said literature. Again, this is particularly important in the field of project management as, all too often, researchers “seem to have only a partial knowledge of the literature” (Morris, 2010, p. 140).

As part of the research, a literature search was also conducted on qualitative research methods. In this case, material was drawn from various text books, supplemented by research articles that discuss generic aspects of qualitative research. These articles, culled from the same databases as listed above, were not restricted to the project management and information systems research areas. This is because qualitative research is a cross disciplinary subject and many of its key tenets are transferrable between research areas. For example, the concepts of validity and reliability are as relevant to educational research as they are to OISD project success factor research.

3.4.2 OISD project success factor analysis

A quantitative analysis of OISD project success factor lists (as contained in the 56 studies listed in Appendix 2.2) was conducted as part of the literature review. The purpose of the analysis was fourfold:

- (1) To identify all of the unique factors in said lists;
- (2) To identify the most cited factors in the lists;
- (3) To construct a coding book (structure) that may be used as a basis for qualitative analysis purposes during subsequent stages of this research;
- (4) To produce various descriptive statistics from the lists and hence provide a better understanding of OISD project success factors.

The literature search on which the analysis was based identified 56 suitable research articles, all published between 1979 and 2011 (refer to Appendix 2.2). A number of the authors did not explicitly state that their work is concerned with OISD projects, as opposed to IS/IT projects in general (for example, Charette, 2005; Merla, 2005). However, in the analysis, if their content was found to make specific reference to software development competences, processes or artefacts, they were deemed suitable. Note also that the perspective provided

by the analysis is predominantly that of the host (in-house/client) organisation. The analysis process had six basic steps:

- (1) Success/failure factors were retrieved (verbatim) from the research articles;
- (2) Each factor was then checked to ensure that it described a unique factor (as opposed to two or more factors). For example, Milis and Mercken (2002) listed “powerful project manager with sufficient social skills” as a success factor. However, this is, in fact, two separate factors. In such cases, the original factor was deconstructed into the relevant number of unique factors; in this instance “powerful project manager” and “project manager with sufficient social skills”;
- (3) Each factor was assigned an entity type (*actor*, *artefact*, *process* or *externality*, as previously described in Table 2.2), an entity name, and a characteristic that described the entity in some way. In the above example, “powerful project manager” would have been designated as an *actor* named “project manager” characterised as being “powerful.” Similarly, “monitoring is ineffective,” (a failure factor cited by Mahaney and Lederer (2003)), would have been designated as a *process* named “monitoring” with a characteristic of “ineffective.” For factors in which no characteristic was provided (for example, “project manager”), a default values were assigned (in general, “effectiveness” for *actors*, *externalities* and *processes*, and “fitness for purpose” for *artefacts*);
- (4) In most cases, failure factors were restated as success factors. For example, “ineffective monitoring” would be restated as being “effective.” However, certain factors were left as failure factors where this was not really possible (for example, project duration) or where the factor was better expressed as a failure factor (for example, client arrogance);
- (5) Synonymous terms were resolved at both entity and characteristic level;
- (6) Each factor was assigned a code to denote its project type (as previously described in Table 2.3).

The result of this process was a list of unique OISD project success factors as reported by prior research in the field (refer to Appendix 2.3). The list was then

used to identify the most cited factors (refer to Appendix 2.4), an entity based coding book (refer to Appendix 3.1) and a range of descriptive statistics (as presented in Chapter 2; see p. 46).

Finally, as discussed in the literature review, the success factor analysis described above was performed for a second time with the exclusion of four studies containing a supplier's perspective. The results of this secondary analysis (presented in Appendix 2.5) were remarkably similar to the original analysis suggesting that there is little difference between client/in-house and supplier perspectives regarding OISD project success factors.

3.5 Pilot interviews

Prior to the main fieldwork process (described in the next section), six pilot interviews were conducted. The main objective of the pilot interviews was to demonstrate the effectiveness (or not) of using an open-ended interview technique to gather information for the research. Another reason for conducting pilot interviews prior to the main body of interviews was to build the researcher's experience in conducting such interviews. This is significant because it has been shown that more experienced interviewers obtain better responses in terms of their volume and detail (Fielding & Thomas, 2001, p. 134). The pilot interviews also provided an opportunity to iron out any unforeseen problems with the researcher's interviewing style, audio recording equipment and presentation materials.

For the pilot interviews, the interviewees included two professional IT project managers, a retired company director (with IS/IT project board experience), a research student (with professional software development experience) and two professional software engineers. The interviews with the two professional software engineers were also used in conjunction with the 31 interviews conducted during the main fieldwork process.

The format for each pilot interview was similar to that used for the main fieldwork process. The format consisted of an outline of the research, recording of participant characteristics, an introduction to the interview process, a

discussion section and a conclusion. However, the pilot interviews showed that two modifications to the format were required.

First, the discussion section for the pilot interviews comprised a single question (or discussion point): “In my experience as a [project role], [a particular factor] is significant to the success or failure of an organisational IS development project because ... [discussion].” The difficulty with this as a single question is twofold:

- (1) Interviews often require an initial icebreaker question that will almost guarantee a response so as to allow the participant to talk freely thereafter (Sharp, Peters, & Howard, 2002, p. 158) i.e. prior to the main research question;
- (2) More importantly, the main research question lacks context i.e. the participants were being asked to discuss project success factors without the opportunity to define what they actually meant by project success.

Consequently, an initial question: “How do you define project success?”, was added as a precursor to the main research question.

Second, a number of slides were presented to the participants in an attempt to facilitate their discussion. These slides offered alternate views (or models) of project success factors. However, the pilot interview participants made little or no use of these slides during the interview. Moreover, appropriate intervention by the interviewer (in terms of prompts, probes and checks) was found to be a more effective means of facilitating discussion. Therefore, these slides were removed from the presentation used for the main body of the interviews.

Informal feedback from the participants indicated that they were comfortable with the interview process. They also stated that they considered it worthwhile and even enjoyable, welcoming the opportunity to discuss their project experiences.

Each interviewee consented to their interview being recorded. Therefore, after each interview, these recordings were transcribed, verbatim. Although a relatively lengthy process, the resultant transcripts proved suitable for analysis

proposes. In particular, it was found that the entity-based coding book derived from the first success factor analysis (as discussed above) could be applied, in part, to the transcripts to identify high level success factors and supporting information. However, the need for open coding was also recognised. It was also found that the transcripts could be analysed at a more detailed level to identify detailed success factors (in the form of entities and characteristics) and the relationships between them.

Two of the interviewees kindly agreed to participate in follow-up sessions. During these sessions, the interviewees were presented with a series of statements containing the detailed factors and relationships identified from the transcripts by the researcher. The interviewees were then asked if they agreed with these statements. Both interviewees indicated that they agreed with all of the statements and thus the factors and relationships derived from their transcripts. The follow-up sessions were also used to ensure that the researcher had correctly identified the high level factors covered in the interviews. Again, it was found that these had been identified correctly.

In summary, the pilot interviews and subsequent analysis demonstrated that an interview process utilising open-ended questions would be an effective means for gathering and, thereafter, analysing data for the research.

3.6 Fieldwork process

Once the pilot interviews had been successfully completed, the main fieldwork process commenced. The fieldwork process comprised five stages (as depicted in Figure 3.1), each containing a number of steps. The initial objective of the fieldwork process was to obtain, collect and analyse appropriate data from approximately 40 interviews (minimum and maximum of 30 and 50 respectively), each with a participant who was working as a project manager, consultant or software developer for a company engaged in the development of information systems solutions for client organisations. The target interview figures were based on the number of interviewees involved in similar studies. In particular, Moynihan (1996): 14 participants, and Taylor (2007): 22 participants.

The first stage of the fieldwork dealt with identifying potential companies to take part in the research while the second attempted to secure interviews with suitable participants. The third stage concentrated on data collection in the form of semi-structured interviews while the fourth and fifth dealt with qualitative and quantitative analysis respectively. Each stage contained a number of steps, some of which are decision points. Each of the steps are described in the next five sections.

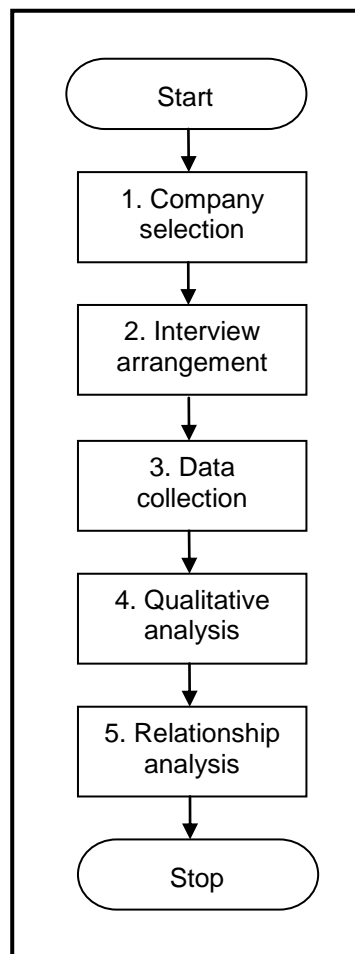


Figure 3.1. Fieldwork process stages

3.6.1 Stage 1: Company selection

The first stage of the fieldwork process (company selection) took place during September 2008. The objective of the company selection stage was to identify potential organisations to take part in the research. It had four steps (refer to Figure 3.2).

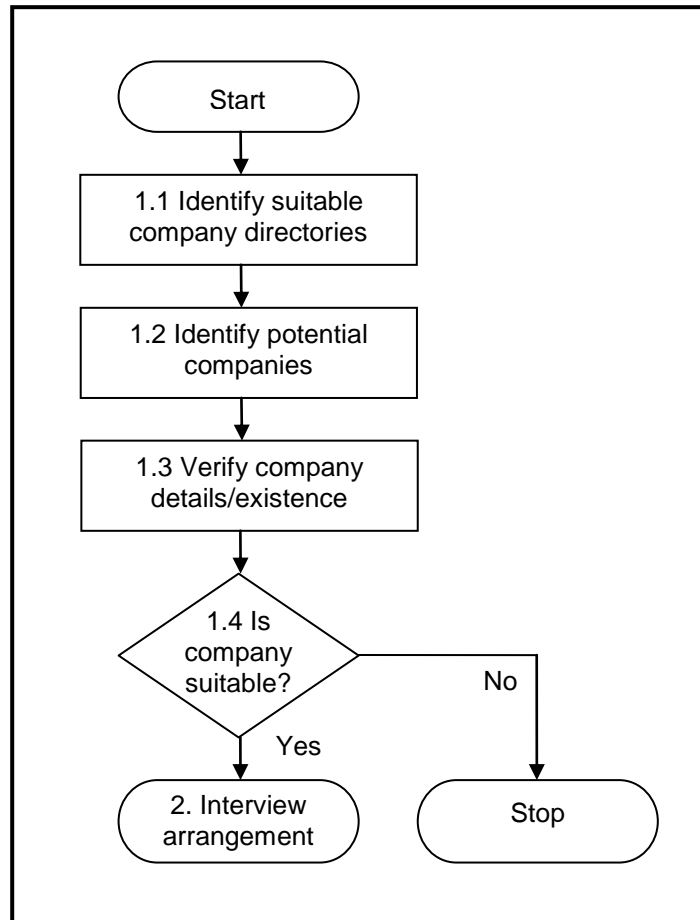


Figure 3.2. Stage 1: Company selection

Step 1.1 – Identify suitable company directories

The first step in the process was to identify suitable lists of companies that were in the business of supplying information systems to client organisations. Initially, a number of lists were obtained from directories to which Edinburgh Napier University²³ subscribed. However, as none of these provided contact names within the companies, the lists were rejected as not having a named contact might seriously detract from the success rate of the next stage (interview arrangement). To remedy this problem, attempts were made to identify internet-based directory listings that provided contact names. Two web-based business

²³ In this thesis, all references to the researcher's university are cited as Edinburgh Napier University, despite the fact that the university was known as Napier University prior to 25th February 2009.

directories, complete with contact names and business descriptions, were identified i.e. ScotlandIS (2008) and the Edinburgh Business Directory (2008). These directories contained over 200 potential companies.

Step 1.2 - Identify potential companies

All of the companies contained in these directories were screened to identify those that were engaged in the development of information systems for client organisations. This was achieved by reviewing the brief description of each company's business activity provided in the directories (the Edinburgh Business Directory being particularly limiting). This step identified in excess of 250 potential companies.

Step 1.3 – Verify company details/existence

As the business description provided by the on-line directories was unacceptably brief, further screening was performed using each company's web presence; mainly their web pages but also on-line articles relating to the company, if they were found to exist.

Step 1.4 – Is company suitable? (decision point)

From the information obtained from Steps 1.2 and 1.3, a decision was made as to the suitability of the company to participate in the research i.e. was the company engaged in the development of information systems for client organisations? If the answer was "no" the overall process was terminated for that company. If the answer was "yes" the company was admitted to the next stage. This step provided a set of 137 suitable companies.

3.6.2 Stage 2: Interview arrangement

The second stage of the fieldwork process was interview arrangement (depicted in Figure 3.3). This took place between September 2008 and January 2009. The objective of the process was to arrange interviews (participant, date, time and location) and had seven steps. This particular stage, as noted by Noy (2009, p. 462), proved to be a particularly time consuming aspect of the

fieldwork process. It was also a vital stage as “until you convince someone to spend the time to talk to you, you will not obtain any data to analyse at all” (Noy, 2009, p. 455).

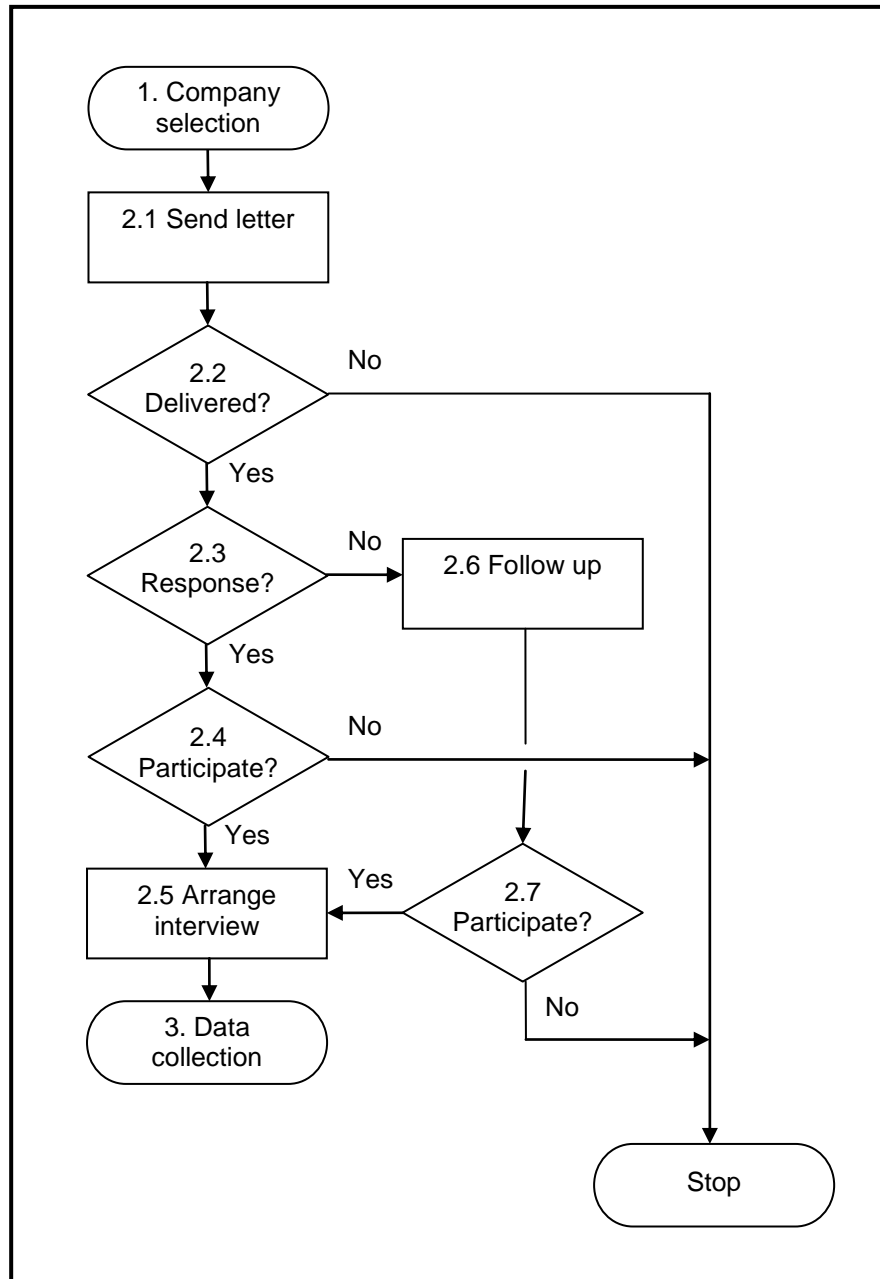


Figure 3.3. Stage 2. Interview arrangement

Step 2.1 – Send letter

A letter, on Edinburgh Napier University headed paper, was sent to the named contact in each company. These letters (an example of which is provided in

Appendix 3.2) were sent out in two batches (during October and November 2009). Enclosed with each letter were a response form (refer to Appendix 3.3) and a prepaid envelope. The response form was printed on green paper to attract the attention of the recipient. Copies of each letter were also held on file with an accompanying log sheet to track the subsequent dialogue with each company.

Step 2.2 – Delivered? (decision point)

Of the 58 letters sent, five were returned as being incorrectly addressed, despite the addresses being checked against the original business directory and the company's web site. In such cases, the overall process was terminated for that company.

Step 2.3 – Response? (decision point)

29 reply forms were not returned. In such cases follow up action was carried out as described in Step 2.6.

Step 2.4 – Participate? (decision point)

Of the 24 reply forms returned, 14 companies agreed to participate in the research whilst 10 declined. A few of the respondents provided reasons for not wishing to take part in the research (for example, as one stated: "Due to the current economic climate we can only allocate resource to work that will raise money"). For those that declined to participate the overall process was terminated for that company.

Step 2.5 – Arrange interview

The 14 companies that agreed to participate in the research were then contacted via telephone. During the telephone call, the potential participants were provided with a summary of the research objectives and the interview process. In particular, the participants were provided with foresight of the two questions that would be asked during the interview i.e.

- (1) “How do you define project success?”;
- (2) “In [your] experience as a [project role], [a particular factor] is significant to the success or failure of an organisational IS development project because ... [discussion].”

In some cases, participants requested additional information about the research prior to consenting to be interviewed. This information was then forwarded to them by email.

Step 2.6 – Follow up

For the 29 companies that did not reply, a great deal of effort was expended in attempts to make contact via telephone. 22 potential participants were eventually contacted whereas, despite repeated telephone calls, no contact was made with the remaining seven.

Step 2.7 – Participate? (decision point)

Of the 22 named contacts that were successfully contacted, 12 agreed to participate in the research whilst ten declined. These respondents provided reasons various for not wishing to take part in the research (for example, that they had already participated in a number of student research projects). For those that declined to participate the overall process was terminated for that company.

In summary, the process described thus far provided 26 potential interviews (14 via reply forms and 12 from follow up activities). During data collection stage, another 12 interviews were obtained via “snowballing.” However, of these 38 interviews, only 31 actually took place with the other seven being lost, possibly due to the downturn in the economic climate which was prevalent at the time.

3.6.3 Stage 3: Data collection

The third stage of the fieldwork process was data collection (depicted in Figure 3.4). Its objective was to conduct 31 interviews in a manner appropriate to the

research and to transcribe the results into a form suitable for analysis (stage four). The stage has four steps.

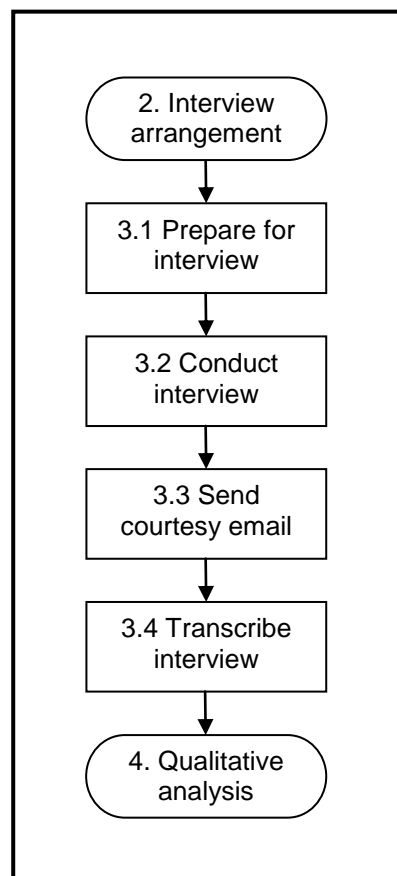


Figure 3.4. Stage 3: Data collection

All 31 interviews were conducted at a date, time and location of each participant's choice. Interviews were conducted at various locations across central Scotland between October 2008 and January 2009. Most of the interviews were conducted on the participants' business premises (18) although others were conducted in coffee houses (5), participants' homes (5), Edinburgh Napier University (1), a private club (1) and a motorway service station (1).

Each interview was conducted using a process consisting of five steps (refer to Figure 3.4), each of which is described below.

Step 3.1 – Prepare for interview

Before each interview a number of preparatory activities were carried out. These included double checking the date, time and location of the interview and that all required kit (interview presentation, digital recorder, spare batteries, etc.) were present and correct (for example, that the digital recorder had sufficient storage space and battery charge). In most cases, a route map to the interview location was produced and used to ensure that the researcher arrived in ample time for the interview. The company's web presence was also reviewed to gain basic information that might aid the interview process. Finally, an appropriate dress code was chosen for the interview (for example, suit and tie for interviews on company sites and more casual attire for home-based interviews).

Step 3.2 – Conduct interview

Following the appropriate introductions and pleasantries, the participant was provided with an outline for the interview. The researcher explained that he would first ask for some basic details about the participant:

- (1) Name;
- (2) Current role;
- (3) Company name;
- (4) Experience in current role (years);
- (5) Total OISD project experience (years);
- (6) Application domains (experience of);
- (7) Client domains (experience of);
- (8) Typical project size (person-months).

This data provides a description of the participant sample. If practicable, it would also enable the subsequent analysis to identify similarities and differences between various characteristics. For example, between different roles, experience levels and application domains.

Next, the participant was given a brief presentation²⁴ (see Appendix 3.4) to describe the research objectives and the interview process. The first slide (depicted in Figure 3.5) was used to describe the overall structure of the interview which would last approximately one hour. The first part consisted of the presentation mentioned above after which the main part of the interview began. At this point participants were reminded that there were only two interview questions and that they could terminate the interview at any point without explanation. Finally, it was explained that the interview would conclude by describing the next steps in the research and by providing the participants with the opportunity to ask any questions they might have.

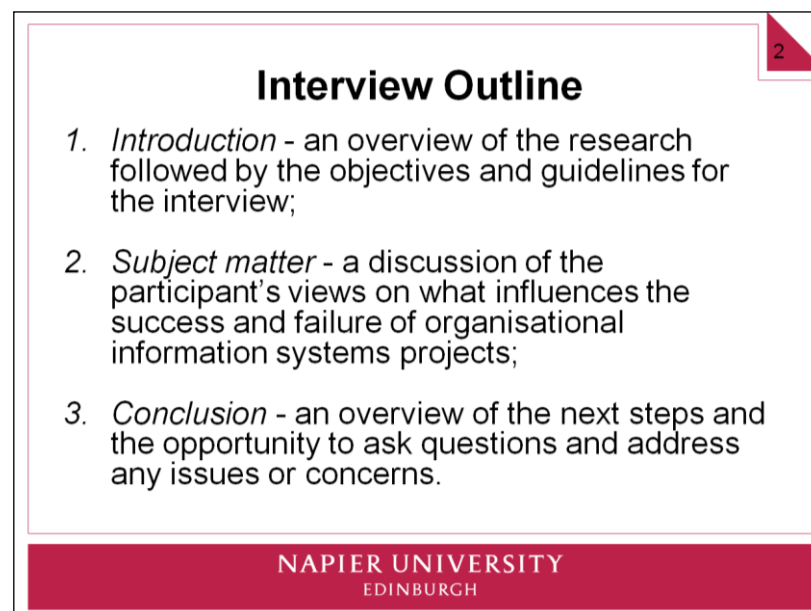


Figure 3.5. Interview outline slide

Next, the research aim and a brief overview of the interview process were presented to the participant. The slide depicted in Figure 3.6 was used to explain that the overall aim of the research was simply “to provide a better

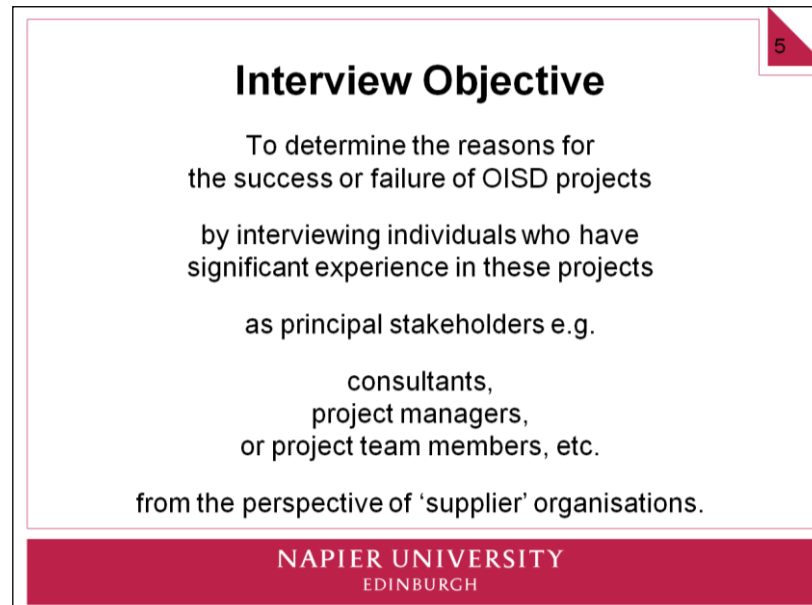
²⁴ Certain slides i.e. the main title slide and the title slides for each of the three sections (introduction, subject matter and conclusion) have been omitted from this chapter because they add no value to the discussion. However, the full version of the presentation can be found in Appendix 3.3.

understanding of why organisation information systems development (OISD) projects succeed or fail.” It was also explained that the need for such research arose from (1) a perceived lack of understanding about success factors for real-world projects on the part of academic research, and (2) that this had not been investigated from the perspective of Scottish suppliers.



Figure 3.6. Research aim slide

The next slide (depicted in Figure 3.7) was used to present the interview objective to the participant. First, it was explained that real-world practitioners, such as the interview participant, could help address this lack of understanding. Hence, the interview objective was “to determine the reasons for the success of OISD projects by interviewing individuals who have significant experience in these projects as principal stakeholders.”

The slide features a white background with a thin red border. In the top right corner, there is a red triangle containing the number '5'. The main text is centered and reads: 'Interview Objective', 'To determine the reasons for the success or failure of OISD projects by interviewing individuals who have significant experience in these projects as principal stakeholders e.g. consultants, project managers, or project team members, etc. from the perspective of 'supplier' organisations.' At the bottom, a red horizontal bar contains the text 'NAPIER UNIVERSITY EDINBURGH' in white.

Interview Objective

To determine the reasons for the success or failure of OISD projects

by interviewing individuals who have significant experience in these projects

as principal stakeholders e.g.

consultants,
project managers,
or project team members, etc.

from the perspective of 'supplier' organisations.

NAPIER UNIVERSITY
EDINBURGH

Figure 3.7. Interview objective slide

Second, the researcher explained that he was currently interviewing three main types of practitioner i.e. consultants, project managers and project team members (primarily software developers). In addition, a number of senior managers (including directors) had also offered to be interviewed, thus representing a fourth category of interviewee. The common link between these practitioners was that they were all employed by supplier organisations that developed information systems solutions for client organisations. It was also explained that an additional reason for targeting practitioners working for supplier organisations was that they were considered by the researcher to have breadth and depth of experience superior to that to professionals working for in-house IT departments. This is due to the range of applications and, more so, the range of clients with which they interact.

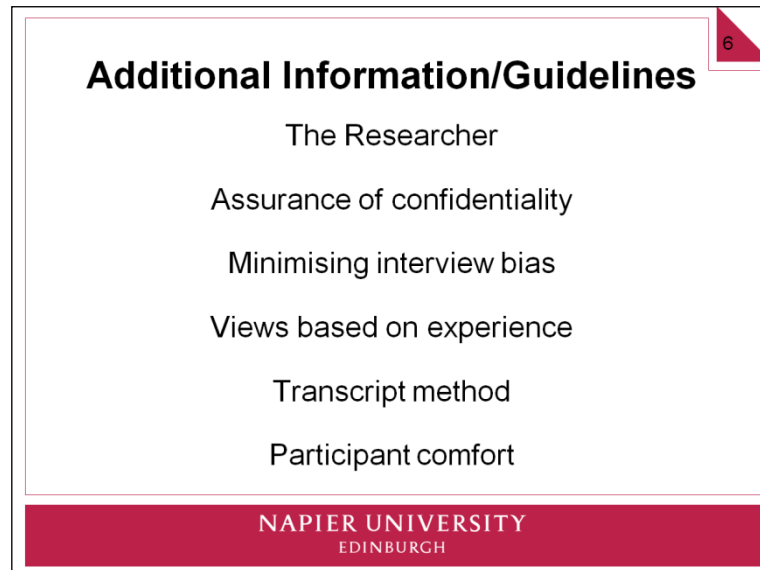


Figure 3.8. Additional information/guidelines slide

The fourth slide (depicted in Figure 3.8) was used to provide the participant with some additional information and guidelines regarding the interview i.e.

- (1) The researcher described his experience in terms of educational qualifications, professional background, and in particular 12 years as a consultant delivering information systems projects;
- (2) Assurances of confidentiality and anonymity were then provided. It was explained that if the participant mentioned a company, a name or even a scenario that might identify an individual or an organisation, this information would be anonymised in the research output. Furthermore, if this was not possible, the information would not be utilised in any way by the research;
- (3) The rationale behind “minimising interview bias” was then clarified. In summary, it was explained that a large amount of success factor research is based on a questionnaire approach. Such research leads participants to address subject matter identified by the *researchers*, as opposed to that which the participants might consider to be important. Therefore, to help address this issue, the interview would consist of two open-ended questions, within which the participants would be encouraged to concentrate on the issues that they felt were relevant;

- (4) It was then explained that, in terms of the information provided by the participant, no justification was required other than their own experience;
- (5) The researcher then explained that he would prefer to record the interviews using a digital voice recorder. It was also explained that the recordings would not be made available to anyone else other than the researcher and that they would simply be transcribed for future analysis. However, it was also explained that, if the participant was not comfortable about being recorded, the researcher would endeavour to make notes of the interview;
- (6) Finally, the issue of participant comfort was highlighted to the participant. In particular, participants were encouraged to inform the researcher if they felt uncomfortable at any point in the interview due to the nature of the questions and/or the subject matter being discussed. They were also reminded that they could terminate the interview at any point, for whatever reason, without explanation.

The next slide (depicted in Figure 3.9) was used to provide some additional information regarding the research. The entity map, depicting an athlete's involvement in training sessions and competitive races, was used to describe how this type of map can be built for an OISD project. It was further explained that various success factors could be modelled as characteristics of the various entities (classified as actors, artefacts, processes and externalities) and that relationships could be defined between the characteristics to help explain the behaviour of project. It was also explained that OISD research had a limited knowledge of how these characteristics and relationships work, hence the reason for the interviews with real-world practitioners.

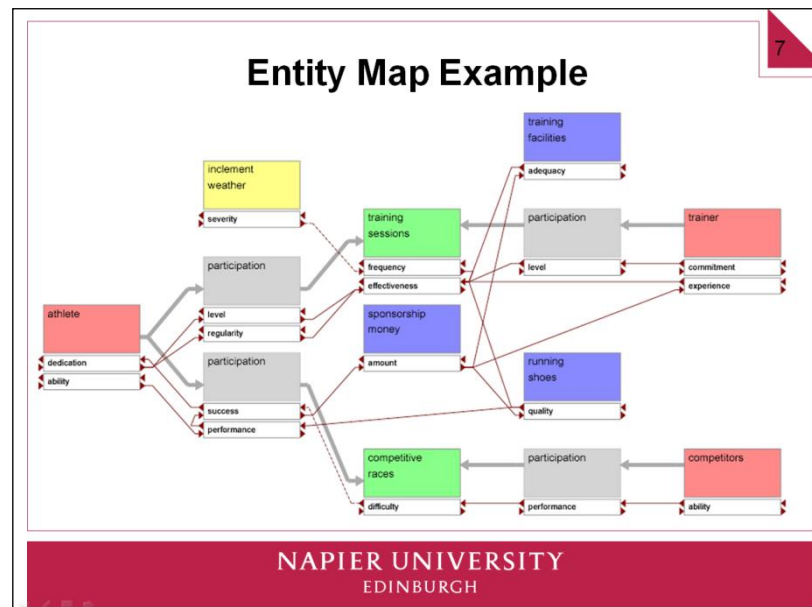


Figure 3.9. Entity map example slide

After the additional information and guidelines had been explained, the main part of the interview commenced i.e. discussion of the subject matter. This was also the point in the interview process where the researcher started to record the interview (for all but one participant who preferred that the researcher take notes). Note also that during this part of the interview the participant always had sight of the main research question (provided using the slide depicted in Figure 3.10) i.e. “in my experience as a [project role], [a particular factor] is significant to the success or failure of an organisational IS development project because ... [discussion].”



Figure 3.10. Participant perspective slide

Once recording had begun, the interviewer asked the first research question: “How do you define project success?” The participant then provided an appropriate answer, in all cases with minimal prompting from the interviewer. When the first question was concluded, the researcher introduced the second research question and allowed the participant to answer in whatever manner they deemed appropriate. However, unlike the first question, this part of the interview tended to involve a degree of interaction on the part of the researcher. Although most of the participants were able to discuss the question with relatively little assistance, interviewer interjections, in the form of prompts, probes and checks, were sometimes necessary for the following reasons:

- (1) There were occasions when the participant would “dry up.” To help overcome this situation, the researcher would endeavour to reframe the question with a prompt. For example, “What do you find has helped (or hindered) you to deliver your projects?”;
- (2) Another strategy was to ask the participant, by way of a probe, to explain more about issues they had raised earlier in the interview. For example, “You said that project start-up is key. Could you explain what that entails?”;

- (3) There were also occasions when clarification of a particular point, by way of a check, was required (usually due to misunderstanding on the part of the researcher). For example, “Am I correct in thinking then, that the requirements evolve from one increment to another?”

Finally, at the conclusion of the second question, recording of the interview was terminated.

To conclude the interview, the researcher explained the time scales required to complete the interviews and also those required to conduct the analysis. The participants were also told that they would be provided with a preliminary report of the research findings at the end of May 2009. The participants were then provided with the opportunity to ask any questions that they might have before finally being thanked again for participating in the research. In certain cases, the participants would also be asked if they could recommend another potential participants. This “snowballing” approach provided a further nine interviews.

Step 3.3 – Send courtesy email

Directly following each interview, the participant was sent a courtesy email thanking them for participating in the research. The email also restated that they would receive a preliminary report of the research findings at the end of May 2009.

Step 3.4 – Transcribe interview

Transcription took place between November 2008 and March 2009.

Of the 33 interviews (including the two pilot interviews used as part of the main body of the research), 32 were recorded using a digital voice recorder and the one other in notes form. The 32 digital recordings were transferred to a PC as waveform audio format (WAV) files. The quality of these recordings was generally very good, even those made in reasonably noisy locations, with very few sections rendered inaudible. The files were transcribed verbatim, with ellipsis to denote pauses in speech and exclamation marks to identify exclamatory remarks. However, other changes in the participants tone of voice

were not noted. Neither were any form of visual cues. Inaudible sections were also identified. Time stamps (e.g. [10:32]²⁵) were also placed at regular intervals throughout the transcripts so that, during analysis, the document content could be located easily in the corresponding WAV file (and vice versa). The participant's and researcher's dialogue were differentiated by way of normal and italic typefaces respectively. The transcripts were stored as Microsoft Word 2007 documents. A sample of the transcript from one of the pilot interviews, is provided in Figure 3.11.

[45:53]

I think, in any project that's going to be tackled, you need a good team. You need good information obviously, in the beginning – and with the information you need to make a good plan – and when you've got the plan ready, you need a good team. You present the plan to the team and give the team time to consider it – and off you go and do it.

And along the way?

Along the way you need communication – all the time.

Okay.

Good reporting back, on a regular basis, with good communication.

And if you don't have that?

You're sunk.

Figure 3.11. Transcript fragment example

For the one interview that was recorded in notes form, the process was a little different. On the same day as the interview, the notes were reviewed and the researcher's interpretation recorded using the digital voice recorder. The resultant recording was then transcribed in the same manner as the other interviews.

²⁵ The format for the time stamps is [mm:ss] e.g. [24:56] represents 24 minutes and 56 seconds of elapsed interview time.

3.6.4 Stage 4: Qualitative analysis

The fourth stage of the fieldwork process was a qualitative analysis of the interview transcripts. This stage was designed to assist in satisfying the first research objective (providing a better understanding of OISD project success factors from a Scottish suppliers' perspective). This involved identifying and describing a range of OISD project success factors and providing a definition of OISD project success. The main part of the work took place between March 2009 and May 2009 with refinements being made throughout the remainder of the project. The stage had four steps as depicted in Figure 3.12.

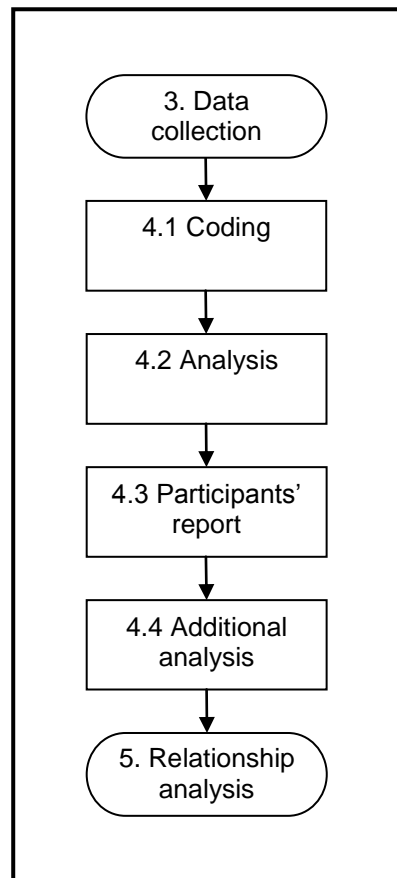


Figure 3.12. Stage 4: Qualitative analysis

Step 4.1 – Coding

The interview transcripts were coded, using QSR's NVivo software²⁶, at a broad, entity-based level to identify relevant themes (or patterns). The themes, constituting high level OISD project success factors, denoted actors (for example, project manager, project team, etc.), artefacts (for example, technology, planning tools, etc.) and processes (for example, requirements management, project planning, etc.). Additional themes were used to identify project success and also segments of the transcripts that were not relevant to the research. The coding process comprised deductive and inductive elements. Deductive coding was loosely based on the entity-based coding book (presented in Appendix 3.1) derived from the success factor analysis described in Section 3.4.2. Inductive (open) coding ensured that new themes could be identified as required. The themes were then consolidated (again using QSR's NVivo software) into 20 OISD project success factors and one other theme containing definitions of project success.

Step 4.2 – Analysis

This step constituted a qualitative analysis involving a manual review of the themes to identify similarities (and differences) between interviews. This led to the identification of various sub-themes, more detailed success factors and relationships. These findings were then written up as thick, rich descriptions for each of the 20 OISD project success factors and also a definition for OISD project success.

Step 4.3 – Participants' report

The rationale behind the participants' report was to provide companies with an incentive to take part in the research. The 25 page report, issued in May 2009, presented the preliminary findings from the research. Having described how the participants defined project success, the bulk of the report identified and

²⁶ QSR NVivo 8.0.

described the 20 OISD project success factors. Feedback on the report was favourable (indeed no negative feedback was received). Several participants stated that they considered it informative whilst others indicated that they would be circulating the report to others within their organisation. One participant requested permission to cite the report during business presentations.

Step 4.4 – Further analysis

A limited amount of additional analysis was conducted during the remainder of the project. This allowed the researcher to reflect on the preliminary findings and make appropriate modifications; in particular to the way in which the 20 success factors were to be presented in Chapter 4. The findings were also compared to the results of the detailed coding process (described below in Section 3.6.5). Again, this led to a number of minor amendments. However, despite the various refinements, the preliminary and final versions of the findings were found to be similar. The final version of the findings are presented in Chapter 4.

3.6.5 Stage 5: Relationship analysis

The fifth stage of the fieldwork process was a quantitative analysis of the interview transcripts. This stage was designed to satisfy the second research objective (providing a better understanding of the way in which OISD project success factors interact to influence project success). As the qualitative analysis had confirmed that the 20 high level success factors comprised more detailed factors and relationships between them, this objective was expanded to providing a better understanding of:

- (1) The number of detailed success factors (and success criteria) that are involved;
- (2) The relationships that exist between the success factors;
- (3) The causal chains by which success factors propagate their influence to affect project success;
- (4) The key factors and relationships involved in the propagation process.

Hence, this stage involved a detailed coding process and a computer aided quantitative analysis. The work took place between January and June 2012, and had three steps (as depicted in Figure 3.13).

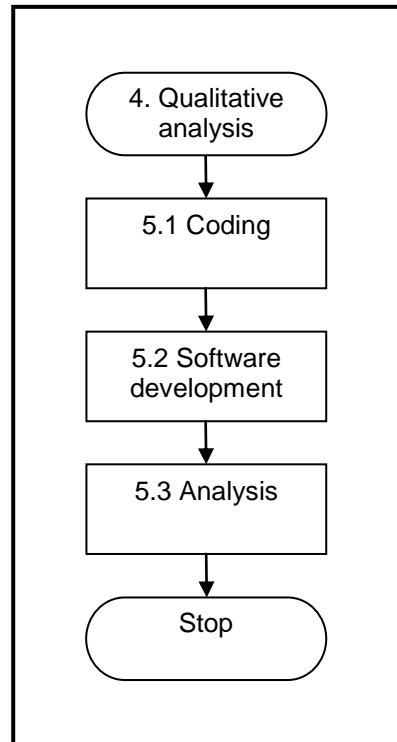


Figure 3.13. Stage 5: Relationship analysis

Step 5.1 – Coding

Analysis of the interview transcripts revealed numerous success (and failure) factors. Several definitions of project success, in the form of various success criteria, were also found. Consequently, all instances of success factors, success criteria and the term “project success” were coded in the form of entities and characteristics.

Analysis of the interview transcripts revealed numerous relationships, the majority of which were between success factors i.e. from a source factor to a target factor. However, a number of other relationship types were also identified; for example, from success factors to success criteria and from success criteria to project success. These, and other, relationship types are discussed further in Chapter 5.

Relationships were also found to have two influence types: (1) those having a *positive* effect on the target (or receiving) factor (or criterion), and (2) those having a *negative* effect. In quantitative terms, positive influences contribute (cause an *increase*) to the target factor whilst negative influences detract from (result in a *decrease*). The relationships identified by the coding process (collectively referred to as the relationship data set) were stored in a Microsoft Excel spreadsheet.

In summary, the coding process identifies entities and characteristics. A default value is assigned if no characteristic is available (“effectiveness” for actors and processes and “fitness for purpose” for artefacts). The coding process is relatively simple, on occasions subjective and time consuming. The process can be explained by way of an example (refer to Figure 3.14 and Table 3.2).

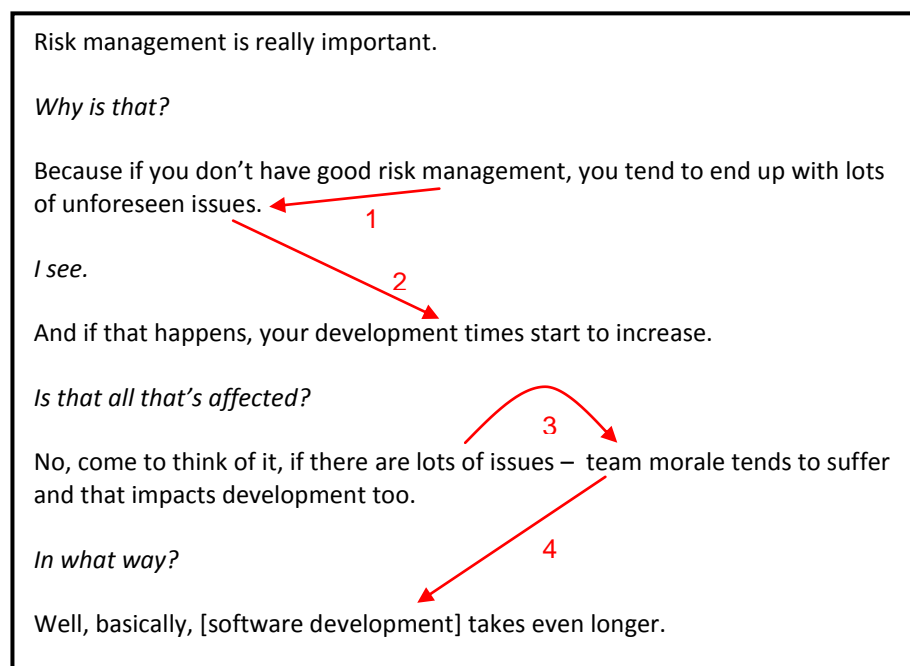


Figure 3.14. Detailed coding transcript fragment example

In this example, the coding fragment (as depicted in Figure 3.14) yields four different relations (as shown in Table 3.2, in which the factors are expressed in *entity.characteristic* notation).

Id	Source factor	Influence	Target factor
1	Risk management.effectiveness	Negative	Issues.number of
2	Issues.number of	Positive	Software development.duration
3	Issues.number of	Negative	Project team.morale
4	Project team.morale	Negative	Software development.duration

Table 3.2. Detailed coding relationship examples

Step 5.2 – Software development

The relationship data set contained a large number of relationships. These were to be constructed into a relationship network. Unfortunately, the number of relationships suggested that the network would, in all likelihood, be too large to analyse manually. Hence, a small software application was developed to assist with the analysis. The detailed requirements for the software are presented in Appendix 3.5. In summary, the software was required to:

- (1) Read the relationship data set and construct it into a relationship network;
- (2) Identify the active causal chains by which success factors propagate their influence through the relationship network to affect project success²⁷;
- (3) Identify the key success factors and relationships involved in the propagation process.

The software was written in C# using object-oriented principles. Software development (specification of requirements, software design, coding and testing) took approximately 10 days (80 hours) and was performed in three stages:

²⁷ The software was to identify two types of linear causal chain: (1) those that influenced project success and (2) those that did not. Causal chains that influence project success are referred to as being *active*. Causal chains that do not influence project success as referred to as being *inactive* or *impotent*. These terms are discussed further in Chapter 5.

- (1) Functionality to read the relationship data set, construct the relationship network, identify active chains (those that affect project success), calculate activity levels for the factors and relationships involved, and produce various output files;
- (2) Modifications required to deal with the large size of the relationship network;
- (3) Enhancements to provide further analysis of causal loops.

In summary, the software consisted of an application class and five data classes. The application class was responsible for:

- (1) Reading the relationship data set and constructing the relationship network;
- (2) Propagating factors through the network to identify causal chains (and loops) in accordance with number of user defined parameters (refer to Appendix 3.5);
- (3) Recording the activity of the factors and relationships involved in the propagation process (refer to Appendix 3.5);
- (4) Writing a variety of tab delimited output files (suitable for importing to Microsoft Excel for analysis purposes).

The data classes were used to model entities, success factors (expressed as entities and characteristics), relationships, causal chains and causal loops. A class design for the software is presented in Appendix 3.6.

Step 5.3 – Analysis

This software was then used to perform an analysis of the relationships described above (refer to Step 5.1). In essence, the software was used to read the relationship data set, construct the relationship network and hence:

- (1) Analyse success factors (and success criteria) in terms of:
 - (1) The factors they influence;
 - (2) The factors they are influenced by;
- (2) Identify and describe active causal chains;
- (3) Identify and describe causal loops;
- (4) Analyse the interaction between causal loops;
- (5) Analyse the activity of success factors, success criteria and relationships in the active causal chains;
- (6) Analyse the activity described in (5) by:
 - (1) Entity;
 - (2) Entity type;
 - (3) Project type.

To achieve the above, the propagation software was used to perform a number of propagation runs. Initially, these propagation runs attempted to propagate all of the factors contained in the relationship data set. However, this proved to be problematic due to the size of the relationship network (refer to Section 3.7.4 for a full discussion of this issue). Hence, the propagation software was used to perform a series of additional propagation runs; in particular, propagation runs to:

- (1) Propagate specific factors;
- (2) Analyse potentially active factors;
- (3) Analyse causal loops for specific factors;
- (4) Analyse the interaction of causal loops;
- (5) Analyse the propagation of factors affecting specific success criteria;
- (6) Analyse various special cases.

A full listing of the propagation runs performed during the analysis is presented in Appendix 3.7. The findings of the analysis are presented in Chapter 5.

3.7 Difficulties and limitations encountered during the research

Despite appropriate planning, design and testing, a number of difficulties and limitations were encountered during the research. Although these did not

detract significantly from the quality of the research, they should still be disclosed.

Research stage	Difficulty/limitation
2 – Interview arrangement	Actual number of interviews was fewer than planned
	Job functions of actual interview participants did not match target
	Time (and effort) required to secure interviews was greater than expected
3 – Data collection	A few of the interviews proved quite difficult to control
	Little or no control over the participants' motivation, preparation or truthfulness regarding the interviews
	Background noise during the interviews
	One interviewee's refusal to be recorded
	Interview bias (on the part of the researcher)
	Data collected was based on the perceptions of the interview participants
4 – Qualitative analysis	Subjective nature of the data coding process
5 – Relationship analysis	Extensive run times associated with the propagation software

Table 3.3. Research difficulties/limitations

The primary difficulties and limitations encountered by this research project are summarised in Table 3.3 and discussed in full in Appendix 3.8. Although some of these only affected the efficiency of the research project, a number had the potential to affect the quality of the research findings. Hence, a variety of measures were implemented to ensure the validity of the findings and the reliability of the research process. These measures are discussed in the next section.

3.8 Quality of the research findings

As presented above, this research project encountered a number of difficulties and limitations. Some of these (for example, the effort required to secure interview participants), resulted in inefficiencies and delays to the project. Fortunately, these inefficiencies and delays did not prove detrimental to the findings of the research. However, other difficulties (for example, those encountered during the field interviews, data coding and whilst using the propagation software) all had the potential to impact the effectiveness of the

research process and, hence, the quality of the research findings. Hence, an important part of the research project was to ensure that the research design (as presented in Chapter 3) was appropriately robust for delivering results of the highest quality; specifically, in terms of their validity and reliability²⁸.

The validity and reliability of a qualitative research project depend greatly on the “skill, sensitivity and training” of the researcher (Labuschagne, 2003, p. 101). In other words, “research is only as good as the investigator” (Morse, Barrett, Mayan, Olson, & Spiers, 2002, p. 17). Although this is a great strength in qualitative research, it can also be construed as a fundamental weakness (Patton, 1990 cited by Pyett, 2003, p. 1172) as the researcher’s attributes can have a significant influence on the validity of the research (Pyett, 2003, p. 1172). Fortunately, however, there are a number of measures that can be used to help ensure the validity and reliability of qualitative research findings. Some of these measures (for example, researcher triangulation and understanding the research process) enhance both validity and reliability. The measures employed by this research are described in the next two sections.

3.8.1 Validity

Validity is concerned with the accuracy of a research instrument when measuring an item (Gilbert, 2001, p. 23). Put another way, for research findings to be valid, they should accurately reflect truth, reality and cover the key issues (Denscombe, 1998, p. 241).

Key to determining the validity (and reliability) of a research process (and its findings) is understanding the process itself (Gilbert, 2001, p. 24). As Chapter 3 shows, the researcher has a firm understanding of the overall research process and the instruments employed. Another key factor is that the research process should employ instruments that are well established in qualitative investigation (Shenton, 2004, p. 64). Subsequently, this research project ensured that its

²⁸ The terminology typically used by qualitative researchers in the UK and Europe (Morse, Barrett, Mayan, Olson, & Spiers, 2002, p. 14).

instruments (for example, semi-structured interviews) met this criteria. Moreover, a variety of procedures were employed to reinforce the validity of the research findings. These included researcher triangulation (peer reviews), researcher reflexivity, member checking (participant feedback), thick, rich description, purposive sampling, and auditing (see, for example, Creswell & Miller, 2000; Johnson, 1997; Mays & Pope, 1995).

The research did not employ traditional data triangulation i.e. the use of alternate physical data sources (Creswell & Miller, 2000, pp. 126-127). Attempts were made in this area (for example, to take account of alternative data provided on the participant's company web sites) although these proved unfruitful. Similarly, it was considered inappropriate to ask each participant for access to their company's project documentation. However, the research did utilise another form of data triangulation: the use of a range of informants to triangulate between data sources (Shenton, 2004, p. 66) i.e. by including multiple job functions in the sample (for example, project managers, software developers, etc.). The research also employed researcher triangulation to enhance validity (see, for example, Denzin, 1978 cited by Creswell & Miller, 2000, p. 127; Johnson, 1997, p. 283; Mays & Pope, 1995, p. 110). Equally applicable to reliability (discussed below), this involved two individuals outwith the project performing thematic coding of an interview transcript. In both cases, the level of agreement with the researcher's coding was found to be reasonably high (80% and 85% respectively) hence supporting the validity of the research.

Research validity can also be enhanced through researcher reflexivity i.e. where a researcher discloses his or her "personal beliefs, values, and biases that may shape their inquiry" (Creswell & Miller, 2000, p. 127). Hence, a profile of the researcher disclosing his experience and beliefs (Johnson, 1997, p. 284), is provided in Appendix 1.1. The profile allows the reader to better understand the researcher's position in relation to the research findings (Creswell & Miller, 2000, p. 127). Although this does not constitute a comprehensive implementation of researcher reflexivity (see, for example, Creswell & Miller, 2000, p. 127; Johnson, 1997, p. 284), it does assist in enhancing the validity of the research findings.

Member checking (participant feedback) is “the most crucial technique for establishing credibility” and hence validity (Lincoln & Guba, 1985, p. 314). In simple terms, this involves discussing the researcher’s interpretation of the interviews with the interview participants (Johnson, 1997, p. 283; Mays & Pope, 1995, p. 111; Shenton, 2004, p. 68). However, it is important to restrict these interpretations to a relatively descriptive level; for example, data coding (as opposed to the final results), as asking participants to judge the correctness of the findings is, more often than not, a threat to validity (Guba & Lincoln, 1981 cited by Morse, Barrett, Mayan, Olson, & Spiers, 2002, p. 16). Therefore, this research confined member checking to the data coding processes (as part of the pilot interviews), the outcome of which was very satisfactory i.e. both participants involved reported that their transcripts had been coded correctly at thematic and detailed levels. However, as this was found to place a considerable burden on the participants, it was decided not to employ member checking in the main fieldwork process. Another form of participant feedback also resulted from the interim report issued to the interview participants. Although this report was not accompanied with a request for any form of feedback (which, with hindsight was a missed opportunity), a certain amount of participant feedback was received. And, although limited, all feedback was found to be very positive, thus enhancing the validity of the research findings (albeit to a limited extent, especially in light of the need to restrict interpretations to a relatively descriptive level).

The research also made use of “external auditors” (three professors; one internal to the student’s university, and two external to the university) to audit elements of the project. The purpose of these audits was to “examine both the process and product of the inquiry, and determine the trustworthiness of the findings” (Creswell & Miller, 2000, p. 128). Feedback from the audits was provided verbally and, although confirming the validity of the research process, did identify certain deficiencies; for example, that the potential for interviewer bias was somewhat higher than claimed by the researcher. However, the research could have made more extensive use of auditors. For example, the audit trails developed to support reliability (discussed in the next section) could

have, and should have been, subjected to external audit. That said, a number of other methods were employed to enhance the reliability of the research (discussed in the next section).

The validity of a qualitative study can be established by describing its findings in thick, rich detail (Creswell & Miller, 2000, p. 128; Shenton, 2004, p. 69). For this study, this is demonstrated in Chapter 4. The thick, rich descriptions provided in Chapter 4 assist the reader in understanding that the findings are, indeed, valid. Thick descriptions also help the reader to determine the applicability of the findings to similar contexts (Creswell & Miller, 2000, p. 129). Finally, an integral part of thick descriptions is the use of low-level inference descriptors; for example, verbatim quotations and descriptions that closely reflect the participant's accounts (Johnson, 1997, p. 283). Hence, particular attention was made to these descriptors during the development of Chapter 4, thus ensuring that the findings of the analysis were closely related to the narratives provided by the interviewees.

To ensure validity, the sample of interview participants should be appropriate to the research. That is, the sample should consist of "participants who best represent or have knowledge of the research topic" (Morse, Barrett, Mayan, Olson, & Spiers, 2002, p. 18). In this research project, this was accomplished using purposive sampling to identify professionals who had relevant experience of supplier-based OISD projects. This also helps ensure sampling adequacy: that sufficient data has been obtained to account for and replicate all aspects of the phenomenon under investigation (Morse, Barrett, Mayan, Olson, & Spiers, 2002, p. 18). Unfortunately, despite accounting for a wide range of OISD project success factors (and associated detail), the findings cannot be used to demonstrate that the data collected via the interviews had definitely reached saturation point. On the contrary, it is quite possible that the sample size was too small to achieve saturation. However, in defence of this point, it should be noted that the sample size of 33 is significantly higher than those for comparable studies; for example, Moynihan (1996): 14 participants, and Taylor (2007): 22 participants. Hence, it is argued that the validity of this study is more than likely to be greater than the aforementioned studies.

Finally, a few words regarding the truthfulness of the interview participants are warranted. Truth is a factor for the validity of research findings (Denscombe, 1998, p. 241). Hence, the truthfulness of the interviewees is of prime importance and tactics should be employed to help ensure their honesty (Shenton, 2004, p. 66). Although there was no apparent reason for the interview participants to provide dishonest accounts (as might have been the case in a study in which recrimination was a concern), all interviewees were still guaranteed anonymity (for themselves and their companies) relating to their views (as presented in the findings) and confidentiality regarding their interview transcripts i.e. that they would not be made available to anyone other than the researcher. Such guarantees are typical in research studies to encourage the truthfulness of the interview participants and hence the validity of the findings (see, for example, Hall, 2004, p. 202). Closely related to participant truthfulness is trust between the researcher and the participants. To an extent, this can be achieved by the researcher familiarising him or herself with a participant's organisation prior to the interview (Shenton, 2004, p. 65). Hence, prior to each interview, sufficient time was spent by the researcher to review organisational information provided by the participant's company's web site. For this research, these measures seem to have had the desired effect. In particular, participants were quite open in providing examples of OISD project failures at a personal and company level.

3.8.2 Reliability

Reliability is concerned with the consistency of a research instrument when measuring an item (Denscombe, 1998, p. 240; Gilbert, 2001, p. 23). In other words, a reliable research process (and, hence, its instruments) will produce the same data each time it is used and that any variation in the findings will be due to variations in the item being measured, not the process itself (Denscombe, 1998, p. 240).

As with validity, understanding the research process is key to determining its reliability (Gilbert, 2001, p. 24). Again, Chapter 3 demonstrates the researcher's understanding of the overall research process and the instruments employed.

As above, a range of techniques were also available to reinforce the reliability of research findings. The techniques employed by the research project included the utilisation of computer software, process documentation, the use of coding books and independent assessment (see, for example, Mays & Pope, 1995; Merriam, 1995).

The use of computer software is commonplace in qualitative research (Patton, 2002, p. 442) and can be used to enhance reliability, particularly in analysis (Mays & Pope, 1995, p. 110). Indeed, its use had a significant impact on the reliability of this research project. In particular, the software developed as part of the relationship analysis of OISD project success factors (refer to Chapter 5) guaranteed that the propagation process would generate reliable results between propagation runs (refer to Chapter 3). In other words, variations in findings (of which there were very few) were purely due to variations in the relationship data set; for example, the rectification of errors found in the data set whilst the output from the propagation process was being checked²⁹.

Computer software was also used to enhance reliability in a number of other areas. For example, the qualitative coding process was carried out using QSR's NVivo software³⁰. Additionally, a specifically designed spreadsheet and a bespoke software application were used to conduct the success factor analyses performed as part of the literature review (as discussed above). This software enhanced reliability between the results produced during the initial literature review and those produced later in the project; for example, as additional success factor articles were identified and analysed. Clearly then, future use of the same software (i.e. in subsequent studies) would aid reliability between this and later studies.

²⁹ As part the relationship analysis, checks were performed on the output of the propagation process. These checks revealed a few errors in the relationship data set (for example, the influence type was found to be incorrectly coded in a few relationships). In all such cases, the errors were corrected and the propagation process(es) re-run. Performing checks in this manner serves to enhance reliability (Morse, Barrett, Mayan, Olson, & Spiers, 2002, p. 17).

³⁰ QSR NVivo 8.0.

One of the main strategies employed by qualitative researchers to ensure reliability of their analyses is to document the analysis process in detail (Mays & Pope, 1995, p. 110). This ensures that analysis decisions are clearly visible and that individual findings can be linked back to the data from which they were derived. In this research, a detailed documentation system was implemented for data coding during the relationship analysis (refer to Chapter 5). The system provided an audit trail whereby any success factor or relationship could be linked back to the transcript(s) and paragraph(s) from which they were derived and, more importantly, to show how the original narratives had been translated into the entity-characteristic combinations used in the analysis.

The development of coding books and coding rules (prior to deductive coding and as a result of inductive coding) serves to enhance reliability through making them available to other researchers during the research project (Mays & Pope, 1995, p. 110). Similarly, these coding books can be made available to subsequent studies. For this research, an entity-based coding book, derived from the success factors identified in the literature review (refer to Appendix 3.1) was produced for the qualitative analysis (presented in Chapter 4). These success factors, expressed as entity-characteristics (refer to Appendix 2.3) also formed the basis of the coding process for the relationship analysis (presented in Chapter 5).

The reliability of a qualitative analysis can be enhanced by subjecting the interview transcripts to an independent assessment by additional, similarly-skilled researchers and comparing the level of agreement between those rating the transcripts (Mays & Pope, 1995, p. 110); referred to above (in relation to validity) as researcher triangulation. Unfortunately, this was to prove difficult for this research project, simply because the researcher was found to be the only individual in the university undertaking similar research. However, two of the researcher's family members (both of whom were educated to degree level and could be considered to be computer literate) did agree to code segments of an interview transcript at a broad entity-based level (as performed during the qualitative analysis). In both cases, the reviewers were provided with the entity-based coding book discussed above to aid their analyses. Although both

reviewers reported difficulties during the coding process, high levels of agreement were obtained (80% and 85% respectively), thus reinforcing the reliability of the research.

3.9 Conclusion

This chapter has described the methodology employed to conduct this research project. An overview of the research approach was presented, followed by detailed accounts of the primary elements of the methodology: (1) the literature review, (2) the pilot interviews, and (3) the main fieldwork process. The problems experienced during the research were also discussed as were the measures implemented to ensure the validity and reliability of the findings.

Despite the problems experienced during the research, the research methodology exhibits several strengths. The decision to utilise a predominantly qualitative approach was justified by the literature review. The use of open ended questions in the interviews was also a significant strength as it provided sufficient rich, thick descriptions to support both qualitative and quantitative analyses. However, the key strengths of the research methodology can be attributed to the measures implemented to ensure the validity and reliability of the research findings (as described above). In summary, the strengths of the research methodology more than compensated for its weaknesses and, hence, the research methodology can be considered fit for purpose in relation to achieving the project's aims and objectives.

The next two chapters present the findings of this research project. Although both chapters are based on a common data collection process, they differ significantly in terms of their analysis methods. First, Chapter 4 presents the findings of the qualitative analysis. These findings reveal 20 high level OISD project success factors and various definitions of OISD project success. Next, Chapter 5 presents the findings of the quantitative relationship analysis. These findings provide a detailed account of the way in which OISD project success factors interact via long causal chains to influence project success.

4. 20 OISD project success factors

4.1 Introduction

This chapter presents 20 success factors for organisational information systems development (OISD) projects. The factors are based on the experiences of 33 IT professionals working for Scottish supplier organisations engaged in the delivery of OISD projects to client organisations. The chapter also describes how the interview participants defined project success.

The chapter is structured as follows. The next section describes the participant sample. This is followed by the participants' definitions of project success. Next, the main part of the chapter presents 20 success factors for OISD projects, as derived from a qualitative analysis of the interview transcripts. A detailed description is provided for each factor. These descriptions are intended to leave the reader in no doubt regarding the meaning of each factor as provided by the interview participants. The chapter's findings are then discussed in terms of their contribution to knowledge and the issues that they raise. The chapter concludes by presenting further research objectives to be considered in Chapter 5.

4.2 Participant sample

The interviews were provided by a sample of 33 participants (denoted as P1 ... P33 in this and subsequent chapters)³¹. All of the participants were based in central Scotland and engaged, in a professional capacity (i.e. as sole traders or working for supplier organisations), delivering OISD projects to client organisations. This criteria qualified each participant as a suitable candidate for the interview process. Characteristics of the participant sample are presented in Appendix 4.1.

³¹ 31 participants from the main fieldwork process and two from the pilot interviews (P1 and P2).

The participants comprised nine software developers, nine consultants, six project managers and three software development managers. The remaining six worked at more senior levels of management in their organisations: five company directors and one managing director. In total, the 33 participants represented 24 individual supplier organisations.

The participants had an average (mean) of 10 years experience in their current role. More importantly, the participants had a collective experience of over 500 years, on average 16 years (mean) per participant, in the delivery of OISD projects to client organisations. Thus, the sample were considered as having a high level of experience in the field³² and, consequently, a knowledgeable data source for this study.

The majority of participants were engaged in the delivery of various application types to various types of client organisation. A number of participants delivered specialised application types; for example, customer relationship management (CRM), law, commercial and financial applications.

The average (mean) size of project delivered by the participants equates to 60 person-months: six project team members over 10 months. However, as shown in Table 4.1, there is a substantial variation in project size amongst participants.

Project size (person-months)	Number of participants
Fewer than 10	7
Between 11 and 50	11
Between 51 and 100	7
Over 100	8

Table 4.1. Number of participants by project size

³² Based on similar criteria used by Sauer, Gemino and Reich (2007, p. 80) to define the term “high levels of experience.”

4.3 Project success

This section presents the responses to the first research question³³: “How would you define project success?” Overall, the participants provided a range of responses, the majority of which incorporated success criteria relating to the intended, successful outcome of an OISD project. These responses conform to the way in which the term *project success* is often used in the literature (see p. 27).

As discussed in Chapter 2 (see p. 28), success criteria are measures of (1) *project management success* or (2) *organisational success*. This section presents the participants’ responses using these categories.

4.3.1 Project management success

As the literature review showed, project management success is concerned with the efficiency of the project process and its management (see p. 28). Project management success is measured using the criteria encompassed by the golden triangle: adherence to (1) schedule, (2) budget and (3) requirements.

10 participants cited the importance of schedule adherence (P3, P6, P7, P8, P12, P19, P20, P24, P26, P32), eight the importance of meeting budgets (P3, P6, P7, P8, P19, P20, P24, P26) and 10 the importance of satisfying requirements (P14, P20), scope (P32), quality (P3, P15), wants (P5, P9, P26), or specifications (P13), as stated at the beginning of the project (P3, P8, P29) but often subject to change (P26). The iron triangle was also considered to be less important than client side criteria such as customer satisfaction (P6) and business benefit (P10), both of which are discussed below. As one participant stated, “So what if the project was a little over budget or was delivered a month late,” when it delivered the anticipated benefit to the business (P10). It was also recognised that schedule, budget and requirements are not necessarily equally

³³ Covering participants P3 ... P33 only. The question was not part of the pilot interviews in which P1 and P2 participated (as discussed in Chapter 3).

important (P32). For example, satisfying requirements might be subordinate to meeting the project's due date.

4.3.2 Organisational success

As the literature review showed, organisational success extends beyond the completion of the project process and addresses the effectiveness of the project's deliverable to provide benefit to the organisation (see p. 28). Although the literature suggests that this should be measured in terms of organisational benefit and stakeholder satisfaction, it makes no reference to the existence of multiple organisations in its discussion of project success. As the OISD projects described in this study involve at least two organisations³⁴, participant responses are presented below in terms of (1) the client organisation and (2) the supplier organisation.

4.3.2.1 Client organisation

A number of participants described the need for projects to meet their clients' business needs or objectives (P10, P14, P15, P25). One participant stated that project success was "achieving what was *actually* asked for, not what was asked for" (P30)³⁵. In other words, the project's deliverable needs to be *actually* useful to the client organisation (P23) and to provide business benefit (P4, P10, P20); for example, increased sales (P25) or operational savings (P7, P25). As such, it is the delivery of business benefit that leads to project success (P10). This requires effective benefits realisation (P31) and measurement of success in terms of that benefit (P31).

A successful project is one in which the client can be described as satisfied (P6, P11, P23, P33) or happy (P6, P10, P13, P19, P22, P23, P24, P33). In other

³⁴ In addition to the supplier and client organisations, some of the participants made mention of client side partner organisations and multiple supplier organisations.

³⁵ The example presented by this participant was that of a project to build a factory to produce square wheels. Although the factory was "the best square wheel factory in the world", it was of no *actual* use to the client organisation.

words, client expectations (P11, P15, P21), parameters (P22), or perceptions (P14) have been met (satisfied). Satisfied clients are important, not least because they constitute the source of repeat business (P19, P22, P24) or follow on work (P6, P13) and provide the basis for long term supplier-client relationships (P13). As one participant stated, “If we don’t have customer satisfaction, then we don’t have any more work” (P23).

Client organisations have their own perceptions, or views, of a project’s success (P14, P19). These can be subjective (P11), implied (P29) or unique to each project (P14) or client (P19). They are also prone to change (P15, P16, P31); perhaps as the business changes (P31), the goals of the project change (P26), or the project evolves (P16). In this respect, a successful project can be defined in terms of the way that these perceptions, or expectations (P21), have been identified (P25, P29), managed (P19, P20, P22) and satisfied (P25) and the degree of client buy-in that has been attained, particularly from the project’s sponsor (P17). However, this “dynamic” view was not found to be universal; for example, project success was also be defined as delivering what was agreed at the outset of the project (P3, P8, P17, P20, P29). In other words, “delivering ... what you’ve defined in the first instance” (P17).

Although client organisations usually comprise a number of stakeholder groups, end users are particularly important in defining project success. The project’s deliverable has to be fit for purpose for those that will make use of it (P15). In other words, end users can engage with the information system in such a way that it makes a difference to them. Thus, the end users are actively using the system (P21) and are happy working with it (P12). Or, as one participant stated, “there’s no good in having a system that’s fully functional if it’s not useable by the people who are going to use it” (P29). Thus, a successful project is one that satisfies the client’s real needs (P16), principally the end users (P17), with the project deliverable becoming the organisation’s “book of record” (P4) for many years after implementation (P29).

4.3.2.2 Supplier organisation

As commercial organisations, suppliers need to meet certain financial (or commercial) objectives (P22, P24). In short, they need to make money to be able, or willing, to sustain their business activities (see, for example, Goldratt & Cox, 1984). And, because all of the participants' companies use OISD projects as the primary vehicle to deliver their products and services, there is normally an anticipated profit margin, or commercial objective, associated with each project (P10, P13, P14, P19, P22, P33). Therefore, getting paid is a measure of project success. As one participant pointed out, "If the customer pays for it, it's a success" (P21) and, for suppliers, getting paid is important (P5, P22). Put slightly more colourfully, "It's extremely bloody irritating if you don't get paid" (P28).

Another aspect that can help define a successful project is "what did we get out of the project that's going to help us make the next one more successful?" (P21). Successful projects can also be described as an "intellectual success" (P23) and can deliver better internal processes and technologies for use on future projects (P33). Successful projects can be enjoyable (P23, P28, P33) or provide satisfaction to those involved (P24). As one participant said, "That was a great project and I really enjoyed working on it" (P33). Such enjoyment and/or satisfaction might apply to everybody involved in the project, including the client (P24).

4.4 Success factors

This section discusses the responses to the main interview question, presented to the interview participants as a statement: "In my experience as a [project role], [a particular factor] is significant to the success or failure of an OISD project because ... [discussion]." In all, the participants identified and described 20 OISD project success factors. These factors are listed in Table 4.2.

Rank	Type	Factor	Coverage (%)
1	Process	Effective requirements management	15.5
2	Actor	Effectiveness of the project team	11.4
3	Process	Effective communication	9.7
4	Actor	Effectiveness of the project manager	6.9
5	Process	An effective development approach	6.8
6	Actor	Effectiveness of the client organisation	6.6
7	Actor	Effective client involvement	6.4
8	Process	An effective sales process	5.5
9	Artefact	A fit for purpose project governance model	5.3
10	Process	An effective project start-up	4.9
11	Process	Effective project planning	4.7
12	Artefact	Fit for purpose technology	3.7
13	Process	Effective software testing	2.4
14	Process	Effective risk management	2.2
15	Process	Effective change management	1.7
16	Process	Effective stakeholder management	1.7
17	Process	Effective post implementation support	1.5
18	Process	Effective training	1.5
19	Process	Effective expectation management	1.2
20	Process	Effective lessons learning	0.5

Table 4.2. 20 OISD project success factors

Prior to describing each of these factors, the order in which they should be presented deserves discussion.

4.4.1 Determining the relative importance of OISD project success factors

More often than not, OISD project success factor studies (as discussed in the literature review) rank their factors in terms of their relative importance (significance, criticality, etc.). Thus, the most important factor is ranked one, the second most important is ranked two, and so on (see, for example, Procaccino, Verner, & Lorenzet, 2006; Sauer & Cuthbertson, 2003; Yeo, 2002). In quantitative studies (for example, Cerpa & Verner, 2009; Chow & Cao, 2008; Han & Huang, 2007), these rankings are determined using descriptive statistics. As qualitative studies do not make use of such techniques, simpler methods are

often utilised to determine the significance of the factors they identify. For example, studies by Moynihan (1996) and Taylor (2007), both of which are comparable to this study, cite the number of interviewees that make reference to each of the factors that they identify. However, the suitability of such an approach is somewhat questionable. In particular, it takes no account of the amount of time and effort expended by the interviewees to describe a particular factor. Consider, for example, one success factor that is described at length by an interviewee and another that simply receives a brief mention. Surely, the former carries more weight in terms of its significance. For this reason, the factors listed in Table 4.2 have been ranked (initially) using the coverage each received from the interview participants³⁶.

Unfortunately, the use of coverage figures to rank factors is not without its concerns. One issue is that the coverage figures might be construed as absolute values (refer to Table 4.2); for example, that effective requirements management (ranked 1st with 15.5% coverage) is 31 times as important than effective lessons learning (ranked 20th with 0.5% coverage). At best, this is misleading but, more probably, dangerous in terms of its implications. Indeed, it can be argued, that without an effective lessons learning process, the performance of future projects is unlikely to improve. Hence, effective lessons learning should be considered as highly significant for OISD project success.

The use of coverage figures also ignores any emphasis or significance afforded to the success factors by the interviewees. However, as only eight of the interview participants identified a factor (or factors) as being key or significant (refer to Table 4.3), this does not seem to be a serious issue. On the contrary, over 75% of the interviewees did not attach any explicit significance to any

³⁶ The coverage figures presented in Table 4.2 were calculated as follows. First, the word counts for each of the factors were determined. For example, if three interviewees had described a particular factor using 300, 400 and 500 words respectively, the word count for that factor would be 1,200 words. Next, the total coverage was calculated by summing the individual word counts of all 20 factors. Finally, the coverage figures (one per factor) were calculated by dividing each factor's word count by the total coverage figure and multiplying by 100 to obtain a percentage.

factor, thus implying that no one factor is any more important than any other. Of course, if this is the case, then it can easily be argued that the success factors should not be ranked at all. Indeed, this was the conclusion reached by Bannerman (2008, p. 2125) because he deemed all of the factors in his study to be important. Therefore, as the use of coverage figures (or reference counts as discussed above) to rank success factors is somewhat flawed and also that there is evidence to suggest that all factors are important, a more suitable approach is required to present the 20 OISD project success factors listed in Table 4.2.

Participant	Key factor(s)
P2	1) Fit for purpose requirements, 2) effective communication
P3	1) A controlled project start-up
P9	1) Overselling in the sales process, 2) effective communication
P10	1) Effective requirements management, 2) management commitment (for larger projects), 3) effectiveness of the project manager
P14	1) Effective project planning, 2) effective communication, 3) fit for purpose requirements
P17	1) Usability and 2) reliability of the project deliverable
P29	1) Effective project planning
P30	1) Effective communication, 2) honesty of the project stakeholders

Table 4.3. Key success factors identified by the interview participants

As discussed in Chapter 1 (see p. 5), an OISD project is a specialised form of a generic project: a temporary endeavour (Project Management Institute, 2008, p. 5) to create an organisational information system. Thus, an OISD project is a process. As with its generic counterpart, an OISD project comprises various sub process (see, for example, Project Management Institute, 2008, p. 43). As, 14 of the 20 success factors identified by the interview participants are processes or, in the case of *an effective development approach* (Factor 5 in Table 4.2), process related, it makes sense to present these first. It also makes sense to present these factors chronologically within the context of the project life cycle and the software development life cycle (SDLC).

Another reason for presenting process related factors in chronological order is that the interviewees provided evidence to suggest that processes and events occurring earlier in the project can have a significant impact on subsequent processes. For example, an unsuccessful sales process (Factor 8 in Table 4.2) renders the remaining factors irrelevant. Similarly, a poorly executed sales process can prove extremely detrimental to the remainder of the project; as can a poorly executed project start-up (Factor 10 in Table 4.2). Indeed, in the context of software testing (Factor 13 in Table 4.2) it is always better to detect software defects earlier rather than later when they can become far more costly to rectify.

Hence, the remainder of this section will present the 20 success factors identified by the interview participants as follows. The 15 process related factors are discussed first. These are followed by the two artefact success factors identified by the study (a fit for purpose project governance model and fit for purpose technology) and last, but by no means least, the four actor related success factors: the effectiveness of (1) the project team, (2) the project manager and (3) the client organisation, and (4) effective client involvement.

4.4.2 Process related success factors

This section presents the 14 process related OISD project success factors identified by the interview participants. To aid the discussion, Figure 4.1 provides a schematic representation of an OISD project in which the 14 success factors are depicted as key processes in relation to simplified project and software development life cycles.

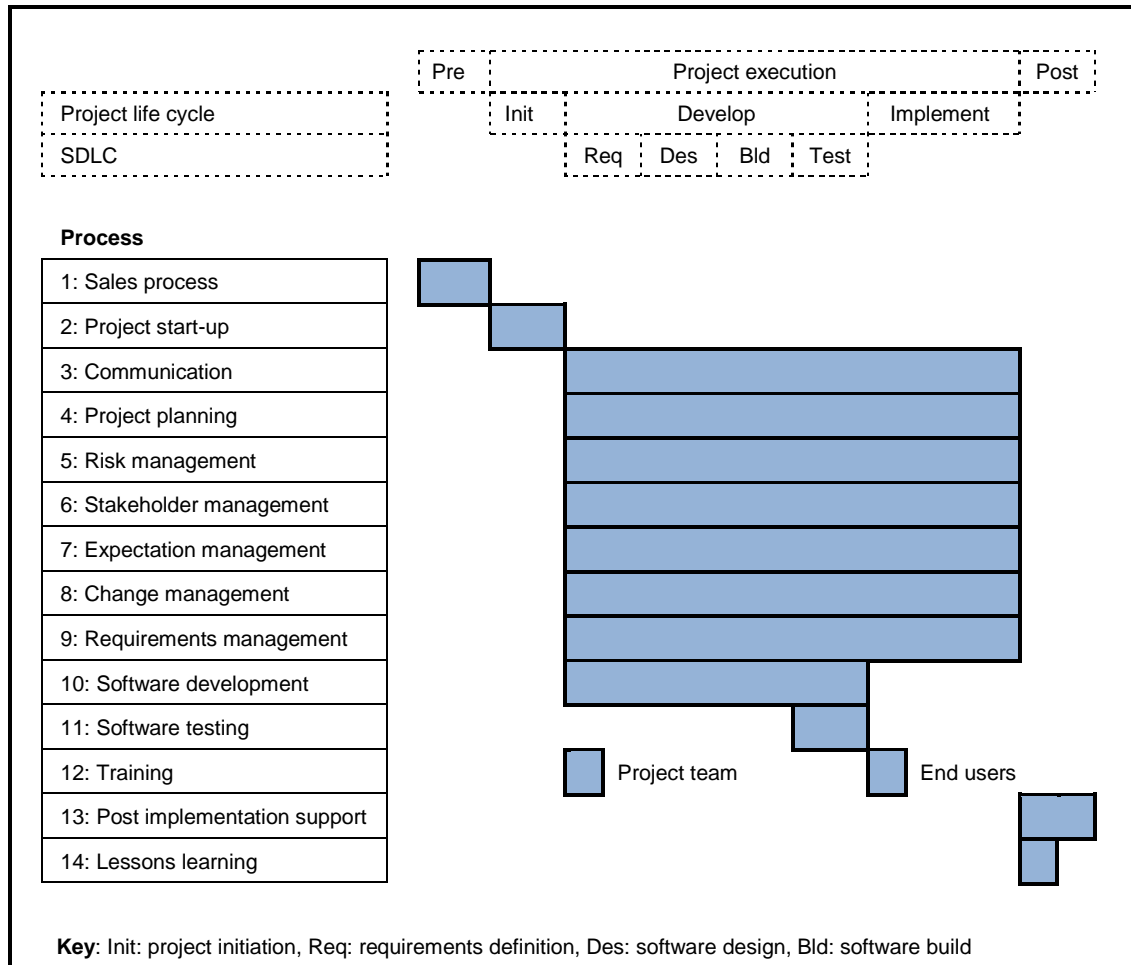


Figure 4.1. 15 key OISD project processes identified by the interview participants

As Figure 4.1 shows, the sales process precedes (denoted *pre*) project execution. Project execution comprises 11 processes with two others (post implementation support and lessons learning) occurring *post* execution. This shows that supplier organisations are well aware that project success is not simply a function of the project execution processes. Instead, the project life cycle needs to be “extended” to encompass processes that are *pre* and *post* execution. This also applies to six of the project execution processes (Factors 3 to 9, inclusive, in Figure 4.1), elements of which can be carried out earlier (and for that matter, later) in the project as integral parts of the sales process and project start-up.

Having presented the key project processes in relation to the project and software development life cycle, the remainder of this section presents the 14

process related OISD project success factors identified by the interview participants. The factors are presented in the order depicted in Figure 4.1.

4.4.2.1 An effective sales process

IS/IT supplier organisations earn their reputations by delivering successful projects. However, as a precursor to successful delivery, authorisation must be obtained from the prospective client organisation to embark upon the project. In some cases, projects are obtained directly as a follow-up to prior projects. However, in the majority cases, projects are obtained as the result of an successful sales process. Unfortunately, as a number of the participants pointed out, the sales process is not always executed in a satisfactory manner (P2, P3, P4, P7, P9, P13, P14, P19, P21, P24, P26, P31). A badly executed sales process (or cycle) has the potential to cause a project to fail straight away (P21, P31), before the development activities have even started. Indeed, a number of participants, typically working in larger organisations, provided examples of projects in which the sales process had caused significant difficulties. As one disgruntled project manager stated, “Salesmen have screwed up projects royally before” (P3), a criticism that one sales-oriented participant considered to be somewhat well deserved (P7). In addition, the view that sales personnel are notorious for selling things that are hard to deliver was expressed by several participants (P2, P3, P7, P9, P14, P21, P24, P26). It was even stated that, for some sales personnel, “ethics doesn’t matter – [they are] out to make money” (P3) and that some companies might even be dishonest with clients when trying to secure future projects (P2).

The problems caused by poor sales processes manifest themselves in a variety of ways. In some cases, project managers (and consultants) find themselves faced with unrealistic timescales (P3, P9, P24) or with allotted budgets that turn out to be insufficient (P13, P14, P21, P24). In other cases, specific requirements have been missed (P14) or the promised functionality simply not possible or available (P3, P9, P14, P21). As such, the interviews revealed various examples of project staff having to deal with the consequences of unrealistic client expectations (P2) due to sales staff overselling (P9); to quote,

“life, the universe and everything” (P21). Thus, project staff are often left to deal with significant issues (P14). In some cases, this involves having to work out how the system will function in the manner that sales personnel had promised it would (P9), sometimes by cutting corners from day one of the project (P3). This was seen by one project manager as an external factor over which they have little or no control (P3). Unfortunately, it would seem that such occurrences are all too frequent (P24).

To be fair, the sales process is not without its difficulties (P2, P3). There are often commercial pressures, particularly in the current economic climate³⁷ (P9, P26). As a consequence, projects can be underbid to secure work (P26). Similarly, bids (or tenders) might be submitted for the wrong jobs: “Bidding for a job that doesn’t fit our technology or experience as a company particularly well ... gives us a whole potential stack of problems later on” (P19). Conversely, securing projects with an appropriate fit increases the probability of success (P28). Getting this right can also be influenced by the client organisation in that they should evaluate the supplier organisation to determine “how good a fit they are” (P4). During the sales process, information can also be vague (P14, P24): “You don’t know the whole picture when you’re tendering” (P24), making it difficult to quote accurately for prospective projects (P13). Indeed, in some cases, the information provided by the client during a tendering process can turn out to be completely different from the real requirements (P11).

The client organisation can also have a significant influence by dictating the way in which their procurement process (or procurement model) is executed (P4, P28). For example, the supplier organisation might only be allowed to provide a few demonstrations to one or two managers (P4) who, perhaps, “haven’t a clue about what they’re trying to do” (P31) as opposed to involving client staff who will actually use the system (P9). Alternately, supplier organisations can be required to submit competitive tenders (closed bids) that require interpretation

³⁷ The global economic downturn of 2008 to the present day.

of supposed requirements (P13). The ability of the client organisation to judge and evaluate tenders can also be influential (P4, P31).

There are also a number of other problems, generally more applicable to larger rather than smaller organisations. The first of these is that the staff involved in (or are responsible for) the sales process often differ from those who will deliver the project (P13, P14): “Somebody will sell something ... and then just disappear” (P7). This lack of continuity can manifest itself as a lack of accountability for delivering the end solution (P3). Clearly, this situation can be alleviated by ensuring that delivery personnel are involved in the sales process (P13, P21). Secondly, it is sometimes the case that sales staff lack sufficient knowledge regarding the proposed solution. As one participant stated, “They know enough about things to be dangerous ... they know they key words ... the buzz words” (P2). Similarly, there are instances where a salesperson simply “doesn’t know enough about the product, does a demonstration, promises [the customer] the earth and then hands [the project] over” (P9) to the project manager, more often than not, with insufficient information (P9).

In general, the sales process is a more significant success factor for larger organisations. This is because, in smaller organisations, there is typically more likelihood that those who deliver the project will also have had involvement in the sales process. That said, this does not mean that smaller organisations are immune from the effects of poor sales processes. They also need to ensure that their sales process adheres to basic project governance principles; for example, that it produces a statement of work, signed by representatives of both the supplier and client, to specify exactly what is to be delivered to the customer (P27).

In summary, a well-executed sales process would seem to be an important factor for OISD project success. It should involve a great deal of up-front work to ensure that implementation planning issues are not left until project start-up (discussed in the next section). In other words, it is prudent to ensure that a measure of implementation thinking is carried out at the start of the sales cycle (P4). As one project manager stated, “It’s better for us to engage as early as

possible” and “the quicker you can get from sales mode to implementation mode the better” (P11). Indeed, engaging with clients earlier rather than later can lead to increased sales and revenues for the supplier organisation (P11). Achieving this requires lots of face-to-face communication between appropriate staff thus building the customer relationship and setting realistic expectations. Effective handovers between those involved in the sales process and implementation staff are also beneficial (P13). More so, it seems important that sales staff have an involvement in the overall business as opposed to a “go out and sell something” mandate (P13).

4.4.2.2 An effective project start-up

A project’s start-up (initiation, setup or kick-off) represents the first stage of the project’s execution process (refer to Figure 4.1). However, as described above, it will almost always have been preceded by some form of sales process (also referred to as the procurement process from the client’s perspective). Therefore, in some cases, “you’ve already done a lot of the implementation thinking” prior to the project’s formal start-up or setup (P4). As such, there can be a degree of overlap between the sales process and project start-up. Thus, suppliers have licence to address certain start-up activities during the sales process. Indeed there is evidence to suggest that engaging in start-up activities as early as possible is beneficial to project success and the supplier organisation as a whole (P12). As discussed above, suppliers can achieve higher sales revenues by engaging project staff early in the sales process (P11).

The general view provided by the interview participants was that getting a project’s start-up right was key to project success (P3, P26, P32). In fact, one participant considered it to be the most important aspect of a project, stating that, “If you invest enough time at the beginning then you’ll save time and money ... later on in the project” (P3). Put another way, “If you set [off] on the wrong foot ... the project’s a failure from the start” (P3) or, to use a cliché, “by failing to prepare, you prepare to fail” (P3). Therefore, investing time and effort

to define the project up front and to ensure that it has a controlled start will help make the project a lot easier during the remainder of its life cycle (P3).

Project start-up comprises a range of activities (or sub processes). Some of these activities are concerned with the transition (or handover) from the sales to start-up processes (P3, P8). For example, checking that the business case is sound and that the allocated budget is adequate. Similarly, that project objectives and timescale expectations are realistic and that commercial aspects reflect the reality of the project's requirements (P8). Other activities tend to concentrate more on shaping how the project is actually going to be run. For example, defining communication processes (P3, P15) and mobilising various stakeholder groups (for example, the project team).

In terms of specific activities, the most widely cited was ensuring that roles and responsibilities were properly defined and understood (P3, P8, P9, P15, P20, P22, P25, P26, P33). Participants also cited budget preparation (P3, P4, P8, P16, P26, P30) and the definition of objectives/goals/targets and success criteria (P2, P11, P20, P30). Defining a business case (P7, P8, P25) and an appropriate governance model were also considered important (for example, reporting structures, frequency of meetings, change control process, etc.) (P3, P8, P11). Other activities include requirements analysis, risk identification, resource planning, stakeholder mapping, etc. (P8, P11, P12, P26). In this respect, it is often prudent to embark upon these and other processes (refer to Processes 3 to 9 in Figure 4.1 and corresponding Sections 4.4.2.3 to 4.4.2.9 below) at the earliest opportunity.

The start-up process also needs to produce a variety of output documents. These include the project charter (terms of reference document or project initiation document) (P8, P11, P12) and other key artefacts such as the initial project plan (P3, P8, P12), with key documents requiring sign-off from the client (P3). As such, project start-up represents the starting point for key project processes such as project planning, risk management and requirements management (see below).

Another important element of project start-up is ensuring that the appropriate client and supplier side stakeholder groups understand, agree upon and, preferably, sign-off on the various aspects of the project; for example, project goals and objectives (P7, P8, P11, P26, P30). In this, communication is an important factor, quite often facilitated by way of various kick-off, start-up or project initiation meetings (P3, P8, P11, P12). Needless to say, these meetings need to be planned, prepared for and conducted in an effective manner (refer to Project Governance as discussed below).

Obviously, the amount of effort required for project start-up activities will vary significantly depending on the size and complexity of the project. For larger projects, start-up can be highly detailed (P26) whereas for smaller projects it is likely to be less so. It is therefore important that start-up processes and their deliverables are fit for purpose; for example, recognising that a project initiation document might be three or 300 pages long, depending on the nature of the project (P8).

In summary, the interviewees considered that time spent on start-up activities is an important factor for project success. And, although an effective start-up cannot guarantee success, the more time spent at the beginning tends to pay dividends later in the project (P3): “The more that they’re defined and controlled at the beginning ... makes them far more likely to succeed” (P32).

4.4.2.3 Effective communication

Many participants made reference to communication as a success (or failure) factor (P1, P2, P4, P5, P6, P7, P8, P9, P10, P13, P14, P16, P29, P30, P31). Therefore, it would seem that effective communication is also an important factor for OISD project success. Indeed, four interviewees considered communication to be key to OISD project success (P2, P9, P14, P30). As one project manager stated, “If you don’t have good communications, you just don’t have good projects” (P16).

One of the main reasons why communication is so important is that it underpins most, if not all, of the project management processes (for example,

requirements management, project planning, etc.) discussed in this section. Simply put, these processes would not be able to function without effective communication. For example, how could a business analyst elicit adequate requirements, or a project manager administer a project plan, without effective communication? Thus, communication is intrinsic to the project as a whole, acting as the glue that holds everybody (and everything) together, ensuring that “everybody understands what’s going on in the project at all times” (P13).

The significance of communication can be illustrated by discussing what happens when this glue disintegrates and projects become unstuck (or fragmented). In this respect, a number of participants (i.e. P4, P16 and P30) had experience of troubleshooting projects (by way of project interventions) when things are going seriously wrong and/or are failing. In such cases, there tends to be a great deal of friction and finger pointing between various stakeholder groups; perhaps to the extent that “everybody’s staff is blaming everybody else” (P28). Often, where there appears to be a wide range of problems and issues, in reality, these turn out to be quite trivial (P16) and are often the result of insignificant misunderstandings between stakeholders as opposed to the incompetence of personnel (P30). In short, it is invariably the case that failing projects are due to breakdowns in communication (P16, P30). Therefore, the intervention required to get these projects back on track is normally a case of bringing everybody together and getting them to understand what the problem is. This is followed by arbitration to enable communication between all those involved (P16) and ensuring that they are all moving in the same direction (P16, P30).

Clearly, modern day OISD projects have a range of communication media at their disposal. These include (in no particular order), paper based and softcopy artefacts (for example, sign-off documents, reports, diagrams, plans, registers, etc.), email, telephone and conference calls, meeting, workshops, etc. However, there seems little doubt that verbal communication is more effective than written means (P1, P6) and that face-to-face communication is the most effective approach (P10, P20, P23, P30): “The easiest way to do it is to sit down face-to-face and start work” (P30). That said, face-to-face communication is not just

about well-run project meetings. In many cases, it takes the form of an informal conversation to discuss a problem openly (P10), perhaps by having a chat over coffee (P4, P13) or even a beer (P19). That said, project meetings are still important (P12), as long as they are not being held for the sake of holding meetings (P16).

Not only does communication support all project processes, but it serves to bond together all of the project's stakeholder groups, ensuring that everyone is "on the same page" (P16). Especially for larger projects, this means that there may be a large number of communication channels between and within the various stakeholder groups. Although the interviews made reference to a number of these (for example, between the client's senior management and the end users), the communication channels between the supplier and the client organisations seem to be particularly important (P5, P6, P9, P10, P13, P14, P20, P24, P27, P29, P30). As one participant stated, "If you can't crack the communication with your customer, you're going to struggle" (P5). In general, participants considered building and keeping a good working relationship with the client to be of prime importance. Regular contact with the client is therefore essential (P12), thus "making sure that ... the client's always aware [of] what's going on" (P6).

There are, however, a number of issues regarding communication. The first is that some people are just not proficient at communicating. In particular, software developers "traditionally ... aren't the best people at talking to each other" (P19). Similarly, some people have difficulty knowing when to communicate, particularly if they are inexperienced (P18). For example, when they have problems (P6, P18), "people are sometimes reluctant to ask for help because it shows that they are not able to do something" (P6). In other cases, people can be afraid to communicate, particularly if their message contains bad news. For example, certain suppliers might not communicate effectively when they are running late (P30). However, effective communication needs to convey both good and bad news (P7). It can also be difficult to "make sure that everybody's ... talking a language that everybody else understands" (P16). This might be down to the "ambiguity [of] meaning" in the communication content

(P1). It might also be due to varying degrees of interpretation, perhaps influenced by an individual's cultural background (P1, P16). It can also be due to basic language barriers (P23) or, from a supplier's perspective, a poor understanding of the client's terminology (P5, P12) (and vice versa from the client side). As a result, the supplier is unable to converse with the client using language that the client understands; a competence that is required of contemporary supplier organisations (P5). There can also be difficulties identifying appropriate communication channels in some client organisations, particularly those with large, hierarchical management structures (P20). As one participant complained, "It's sometimes very difficult to find out [who to talk to] to resolve problems" (P20).

The interviews also identified a number of hallmarks of effective communication. It needs to be honest and truthful (P3, P4, P7, P13, P14, P29, P30). In the words of one participant, "Honesty is important – pulling the wool over the customer's eyes just doesn't work" (P14). Indeed, customers respond more favourably to honest communication (P14). Communication should also be open (P10, P13), thus ensuring that matters are presented up front (P3). It also needs to be regular (P6, P7, P9, P12, P14, P24, P29), especially when communicating progress (and issues) from the supplier to client organisation.

In conclusion, regular, open and honest communication means that issues don't get hidden, are not allowed to worsen and can be dealt with more quickly (P10). It also means that project team members are all working to the same objectives and moving in the same direction (P2, P16); as opposed to making differing assumptions that do not agree with one another (P19). Thus, effective communication is key to project success. One participant, feeling particularly passionate about this, advised, "Communicate to people, communicate to people, communicate to people" (P8).

4.4.2.4 Effective project planning

Although it seems somewhat obvious, all projects, regardless of their size, need some sort of project plan (P4, P18), as opposed to having no definitive start and finish (P8), go-live date (P20), etc. Indeed, two of the participants (P14, P29)

specifically identified planning as a key success factor: “Planning is the major, most important thing” (P29). However, the format of the plan and the techniques used to produce and manage it can vary enormously depending on the size and complexity of the project. For large, complicated projects a significant amount of detailed planning work may be required (P7) whereas, for smaller, simpler projects, a more simplistic approach is probably more appropriate. But again, the key point here is that, whatever the project, “you have to have a plan” (P8, P20); and that plan needs to be realistic (P9, P12, P16). Conversely, poor planning, coupled with poor estimating, is likely to contribute to a project missing its end date (P14).

A realistic project plan needs to be in place very early on in the project (P9). It needs to reflect an agreed timescale for an agreed implementation of an agreed deliverable (P4, P8). In particular, the project plan should identify a realistic and definitive completion date (P8, P20). Thus the project plan precludes the “it’ll be complete when its complete” mentality found in some organisations (P8). Moreover, the plan needs to be communicated to and understood by the project’s stakeholders.

Project planning requires the use of appropriate technical tools (P3), of which Microsoft Project was the only such tool cited in the interviews. These tools facilitate the production of realistic, coordinated plans that identify the necessary activities along with their priorities, time scales, resource requirements and dependencies. In particular, dependencies were identified by a number of participants as being key in terms of their identification and management (P20, P25).

A concept that seems worthy of consideration when developing the project plan is the “valley of despair” (P8). Although projects often start with unbiased optimism and enthusiasm from those involved (P8), there tends to come a point towards the middle of the project when people recognise the enormity of what they have taken on (P4/P8). It is at this time that those involved perceive the project to be more difficult and more complex than originally expected (P8). Either way, “there's going to be pain and discomfort” (P4). Moreover, it is in this

“valley of despair” (P8) (or perhaps towards the end of the project) that unforeseen issues will arise, typically resulting in project slippage (P8). It therefore seems reasonable that, if such a scenario is considered likely, the “valley of despair” should be incorporated in the project plan (P8).

A major tenet of project planning is estimating the time required for the activities that comprise the project (and also the demonstrated capacity of the project team): “If we could hit our estimates, it would make everything else a lot simpler to manage” (P32). Therefore, projects require personnel who are competent in estimating (P33). Unfortunately, there are a number of problems regarding estimates. As one participant revealed, “I don’t think I’ve been involved in any project where the initial estimates [have] been at all anything like what we actually did in terms of hours” (P26). It was also pointed out that it can be difficult to obtain commitments from project team members regarding activity end dates (P14). One of the reasons for this is that it is quite difficult to provide estimates for tasks that have not been performed before. Another is that people tend to be overly optimistic when estimating, perhaps tending to favour the perfect person-hour as opposed to realistic time estimates (P30). In summary, people can be “really bad at ... working out how long it’s going to take them” to do something (P30).

It would also seem that experience is a factor in estimating (P14, P33). For example, estimates for the durations of activities given by inexperienced personnel tend to be incorrect (P32). In general, more experienced personnel tend to be better at estimating: “From experience they start to realise how long things actually should take” (P30). Similarly, experienced project managers are aware that they need to be able to identify optimistic estimates and factor these estimates accordingly (P30, P32). Personnel also need to be provided with a culture that (1) gives them the confidence to produce (and communicate) realistic estimates, and (2) encourages them to improve their estimating skills (P30).

Finally, there is a danger that, much like risk management (discussed in the next section), project planning becomes an academic exercise (P8). “You can

have the best plan in the world” (P8) but the reality is that assumptions can be wrong and that circumstances will change, particularly for longer term projects (P8). In other words, projects rarely unfold as planned (P4) and project managers need to recognise that they operate in a “world where things will go wrong” (P8). For example, slippages need to be reported (P14) and key dependencies monitored (P16). Thus, the project plan needs to be managed i.e. not only tightly controlled and monitored, but also adapted to cope with a changing environment (P4). Indeed, in extreme cases, the project plan may have to be disregarded and a completely new plan put in place (P8).

4.4.2.5 Effective risk management

The interviews provided various examples of the issues that can arise over the course of an OISD project: A third party supplier might fail to deliver a software component to schedule (P19); an important task may not be carried out due to absenteeism (P14); or, unexpected problems may surface during software testing (P7). At a more general level, there might be the risk of missing the project’s end date or failing to satisfy key requirements. Therefore, because there is an element of risk on every project (P30), the most appropriate approach to risk management should be given consideration during every project’s start-up, regardless of the size of the project. That said, a strong, rigorous approach to risk management (P8) (as opposed to less formal approaches) is probably more appropriate to larger, rather than smaller, projects (or programmes).

Unfortunately, it would seem that projects do not always have an effective risk management process (P8, P30, P31). Some project managers do not (or are not allowed to) manage risk properly (P30) and thus are unable to prevent risks becoming real issues. As a result, unexpected issues arise (akin to those described above) which threaten the objectives of the project. There are a number of reasons for this. To a lesser extent, it can be because those involved in the project simply do not understand risk (P8). The level to which the various stakeholder groups are risk averse can also have an influence (P7). It can also be because the project’s risks have simply not been adequately identified (P15)

or because the wrong people are involved in the risk management process (P15).

The main reasons for ineffective risk management appear to be two-fold. The first is that risk management is often a one-off exercise (P8). Despite being adequately identified and documented at the start of a project, risk items are simply left to “gather dust” (P8). Consequently, the remainder of the risk management process becomes a passive (if not nonexistent) exercise, with risks not being reviewed and mitigating actions not being monitored, progressed and closed out (P30). Worse still, new risks that become apparent over the course of the project are simply ignored (P31). In summary, the biggest part of risk management is the monitoring of risk (P30) i.e. monitoring and reviewing risks (and actions) on a regular basis (P15).

The second reason for ineffective risk management is that it is sometimes viewed as the sole responsibility of the project manager. Clearly, in some cases, this is unfeasible due to limits in the volume of information an individual can cope with (P30). Therefore, a better approach is to transfer the ownership of individual risks to members of the project team (or other stakeholder groups) (P8, P30). However, adopting such an approach, does rely on a number of factors. These include trust and communication (P30) and an organisational culture in which people are encouraged and empowered to look after the aspects of the project for which they are responsible (P30).

Finally, the participants also offered several pieces of advice regarding the risk management process. These included using a consistent approach from project to project (P14), ensuring that the review process is conducted regularly and in a disciplined manner (P15), and employing an appropriate risk management methodology (P14), complete with appropriate artefacts (risk registers, etc.) (P20, P25, P31); for example, a “good, sensible level of PRINCE2 governance” (P25) (discussed in Section 4.4.3.1 below).

4.4.2.6 Effective stakeholder management

A distinguishing characteristic between small and large projects can be the number of stakeholder groups involved. For example, the development of an enterprise solution for a large client organisation might well involve multiple (third party) suppliers (P11), not forgetting the client's internal IT departments (P19). Supplier organisations might also find it necessary to hire their own third party specialists (P16) or even recommend particular service providers (P29). Similarly, the client will normally present itself at different organisational levels (for example, senior management, end users, etc.), and as a diverse range of departments or sub organisations i.e. different areas of the same business (P13). There might even be multiple client organisations (P32).

From a client perspective, multiple stakeholder groups can have different cultures and may never have worked with or shared information with each other before (P31). They might well have diverse expectations (P32) and may all have slightly different requirements from one another (P13). This can lead to political infighting within the client organisation (P13). Similar problems can exist on the supplier side (P26). Again, these can be the source of continuous difficulties (P19). In a sense, it might seem obvious that supplier organisations should act in unison on a project (P25), especially as the performance of each supplier tends to reflect on each and one another (P29). Yet, this is not always the case; for example, two suppliers competing for the implementation of their own solution (P26) or, in terms of problems, "pointing the finger at each other" (P20). In fact, it can be hard to get suppliers to talk to one another and deliver effectively (P20). On the contrary, suppliers can resort to silo building, erecting walls between each other to diminish inter-supplier communication (P25). The same might be said of the stakeholder groups within the client organisation.

In general, multiple stakeholder groups make for more complicated projects (P24, P31). And, with multiple stakeholder groups becoming the norm in many projects (P31), an appropriate amount of stakeholder management is required (P8): "You need to manage your stakeholders" (P8). Or, put slightly differently, "you can't take your eye off the ball in terms of stakeholders" (P8). However,

managing that totality is considered hard (P24) and, as one participant pointed out, “If you can manage to cope with ... these different types of stakeholders ... then you’re doing well” (P31). However, the reality is that projects can quite easily end up on the brink of failure, sometimes to the point of litigation, if stakeholders are not managed properly (P25).

4.4.2.7 Effective expectation management

To a certain extent, the process of expectation management shares a key characteristic with communication (as described above) in that it forms an integral part of a number of other processes (or factors) described in this section (for example, requirements management, the sales process, etc.). That said, communication is certainly a key element of expectation management.

Expectation management can constitute a significant element of an OISD project, perhaps because “people’s expectations of what they get for their money – or should get for their money – are really high” (P2). Part of the reason for this might be down to the excitement that has surrounded IT over the past years; for instance, the view that “software can do anything you want” (P21). Another influence could be the proliferation of high quality, mass market software that can be found on the desktops in end users’ homes (P2). It might also be because modern day organisations, particularly in the current business climate, simply demand value for money (P2). From a supplier’s perspective, expectation management is also key to retaining a bank of goodwill with the client organisation (P19).

Regardless of the reason, supplier organisations need to manage the expectations of their clients. In particular, managing the expectation of what’s possible and what’s not (P22). Realistic expectations need to be set early in the project life cycle (P11). This is particularly important in the sales process to ensure that the supplier organisation is not overselling what they are capable of delivering (P19). Expectations also need to be managed as the project progresses; for example, through the regular alignment of expectations as initial assumptions change (P19).

Suppliers are likely to encounter major challenges if they have not defined and managed the expectations of the client organisation in terms of the project deliverable (P8). In particular, supply organisations can expect “a bit of a battle” as clients attempt to secure additional functionality for their financial outlay (P2). Indeed, client organisations can expect features to be delivered regardless of whether or not they have been documented (P11). However, expectation management is not just about the project’s end deliverable. Managing the customer’s expectations regarding the implementation process is equally important (P8). Customers need to understand the reality of not only (1) their involvement in the implementation process (discussed in Section 4.4.4.4), but also (2) the timing of the deliverables that will provide a project’s benefits (P8). This can be particularly true of executive management (the project board) as they can “be a bit divorced from reality in [OISD] projects ... as to what something actually is and what something isn’t” (P8).

The final point about this factor is that it is not only about managing client expectations. For example, the supplier organisation’s project team will have their own expectations and, as such, need to be given appropriate consideration and management (P8). A similar argument can be applied to other stakeholder groups in the project (for example, other supplier organisations). Therefore, expectation management can be considered a greater challenge for larger, rather than smaller, projects.

4.4.2.8 Effective change management

Although it could be argued that the responsibility for change management lies with the client organisation, a number of participants still recognised this as a success factor.

According to the interviewees, people can be averse to change (P31), can act negatively towards it (P19) and will tend to fight against it (P31), especially if they feel it has been foisted upon them (P19). Given that people can also be very resourceful and innovative (P21), this can be a significant issue: “If [the end users] can get around a system, or make something easier for them[selves], they will” (P21). Many organisations are not used to change and

find it difficult to deal with (P31). Some simply lack the flexibility and dynamics required to change their ways of working (P31). More so, the majority of organisations do not understand business change (P31). In short, for many organisations, change is something that is incredibly difficult to achieve and is often done slowly (P31).

Yet, OISD projects can involve a significant amount of change on the part of the client organisation (P31). In some cases this might involve radically different ways in which the organisation does business i.e. as the new system enables the business to introduce new processes (P31). In others, operational efficiency changes might involve redistributing staff (P31) or perhaps even reducing headcount (P19). In such circumstances, people tend to become nervous about measures that might result in them losing their jobs (P19). Hence, organisations will typically tend to fight against these changes. However, the effects of ineffective change management can be devastating. For example, if a client organisation fails to change, “You [can] end up with a system that’s implemented, does everything that you need it to do, but nobody uses it” (P21). Hence the need for effective change management.

Effective change management is not easy, has many facets and is time consuming. It involves effective communication and active involvement with all levels of the organisation (P31). Change management requires effort to convince people of the need for change and hence obtain buy-in and acceptance of the proposed solution (P21). It involves not only an assessment of the impact on the organisation (P31) but the emotional impact on individuals (P7). For example, the project might have a profound impact on people’s attitudes to their jobs. Thus, appropriate messages need to be carefully communicated to the end user community to secure their buy-in (P19/P31). In particular, people need to understand the reasons for their own emotional investment (P19). Failing to do this can result in people feeling uncomfortable and hence fighting against the changes required for the project to be successful (P31).

Another aspect of change management involves minimising the impact of the change. “People are much more accepting ... if the change isn’t such a big one” (P17). In particular, one participant (predominantly working on smaller projects) emphasised the need to maintain familiarity where possible: “If something is familiar, you’re more likely to use it” (P17). As such, it is often wise to look at the systems that the client organisation is currently operating and not just providing a deliverable that is new but unfamiliar to them (P17).

4.4.2.9 Effective requirements management

In addition to appearing in the majority of the interviews (27 in all), the subject of requirements and their management received the greatest amount of coverage from the participants. In essence, requirements management would seem to be a key factor for project success (P2, P10, P14). Simply put: “Incorrect requirements means that you’re off building the wrong thing” (P25). However, it is also problematic, partly because the process spans the entire project life cycle, linking the project’s inception to its ultimate delivery, and thus encountering a wide range of issues in between.

Determining (or defining) requirements, although easier on smaller projects, can be difficult (P1, P24). Yet successful projects require a solid understanding of what will be delivered (P2, P5, P24, P27, P28, P33). As one participant stated, “If you’ve not got the requirements right at the beginning ... you’re on a hiding to nothing” (P24). In other words, effectively identifying a project’s requirements, or scope, is a key success factor (P2, P10, P14). Conversely, “not understanding what the customer wants in the first place” may be regarded as a failure factor (P13). Hence, one of the biggest issues for many projects is gaining a comprehensive understanding of the problem in relation to business needs and requirements, and then to convert this understanding into a requirements specification that defines exactly what needs to be developed. As one participant stated, “Once we’ve both agreed what the problem is, then we can start thinking about the solution” (P17).

Without adequately stated requirements, the final deliverable becomes an intangible entity (P11). Thus, it can be difficult to determine when the project is

actually finished (P15) and the final outcome may well be an information system that is not what the client organisation needs (P16). In the interim, inadequate requirements are often the cause of problems during a project's testing phase (P19). Yet, determining adequate requirements for OISD projects is not easy (P1, P24). Not only do requirements need to be within the bounds of earlier project documents (P10); for example, the project charter, but they need to reflect the client's expectations and goals (P20). Unfortunately, it can be difficult to understand what is required at the beginning of an OISD project (P24), as many customers "don't understand what they want in the first place" (P13).

A number of interview participants made reference to the requirements definition process (P17, P22, P23, P24, P25, P27, P29), comprising both requirements elicitation (or gathering) (P2, P3, P5, P10, P14, P27) and analysis (P3, P10, P16, P22). In terms of dependencies, the requirements definition process requires consideration early in the project; for example, to avoid resourcing issues, the required skill sets should be identified earlier in the project (P19). Similarly, "understanding the objectives of the key stakeholders on the client side is crucial" (P20). Otherwise the definition process becomes "vague and woolly" (P20), resulting in all sorts of requirements, many of which might be irrelevant.

Although it might seem obvious that "the person that wants the project needs to know what they want" (P17), it can be the case that the client's understanding of what they "think they want" differs from "what they really want" (P24). Another problem can be that the client organisation simply does not know what it wants from the project (P1, P5, P13) or does not seem to be fully aware of what its requirements are (P2, P11). Another reason is that the client's senior management, normally the initiators and sponsors of the project, do not understand their organisation's "coalface" i.e. the real business rules and workflow processes within their organisation (P5, P11, P28). In extreme cases, management "don't know anything about what their staff do" (P28) and have "all sorts of weird ideas about what they want" (P28). For example, in one client organisation, it became clear to the supplier that the client's senior managers had "never been near a loading bay in ... the last 25 years" (P16) and thus could

not articulate realistic requirements. Hence, gaining access to appropriate individuals is key to successful requirements elicitation (P5, P24, P27). Indeed, a common failure of requirements elicitation is that “nobody went and actually asked the right people” (P16). More often than not, this interaction goes beyond senior management and includes other key stakeholder groups; in particular, the business/end users i.e. the people that actually use the system (P5, P11, P14, P16, P27, P28). As one participant stated, “You need to speak to the people that are going to be using [the system]” (P27). However, due to funding and resource issues, gaining access to end users is not always easy (P16). Similarly, access to end users is sometimes denied to prevent them from requesting additional functionality (P21).

As one or two people “doesn’t provide the business perspective” (P14), a larger number of client side staff should be involved in the elicitation process (P27, P28). Thus, a significant amount of information would be collected to make it easier for the supplier over the remainder of the project (P6). However, user involvement should be balanced as “too much ... is bad because it generates requirements that aren’t actually realistic. Not enough means you’re not going to get your user acceptance” (P21). Although there are a number of methods used to elicit requirements (for example, individual interviews, reviewing existing systems, etc.), the use of requirements workshops has merit: “Getting the right number of people involved in requirements workshops at the start makes a big difference” (P14).

An important role in the elicitation process is that of the requirements (or business) analyst (P3, P10, P16, P22) i.e. analysts who can determine exactly what “the remit is of what needs to be developed” (P3), including requirements that are inferred rather than explicitly stated (P29). Analysts need experience in their field or domain (P16) i.e. a deep understanding of the industry sector and application area (P16). They need to understand how the client organisations operate (P9, P24, P29), not just at present, but in the future (P9). This is particularly important from the client’s perspective as customers can assume and expect that a supplier understands each and every issue, even if these transpire to be company specific (P16). Analysts also require a range of other

skills. They need to be able to ask the right questions (P1, P9) in an effective and appropriate manner (P10) using the customer's language/terminology (P5). To dig a little bit deeper (P16, P22), they need to be inquisitive (P5, P29) and "nosey" (P5). They also need to be "up front when [they] don't understand something" (P5) and have excellent listening skills (P10). In general, analysts need a range of soft skills in order to carry users forward, to agree upon requirements and create user buy-in (P10). That said, analysts also have to be able to stand their ground, particularly on requirements that are out of scope (P10). Finally, analysts need to be able to articulate their findings in writing in the form of a requirements specification (or statement of work) (P27). As such, analysts need to be able to structure their thoughts, structure the document, spell correctly and use appropriate grammar (P10). Unfortunately, according to one participant, these skills seem to be less common now than they were 20 years ago (P10).

The requirements specification is a key artefact in the requirements management process. Requirements documents constitute an output of the definition process and serve as a cornerstone of understanding for all stakeholders regarding the requirements for the solution that the project will deliver. In other words, a key part of requirements management is to "write them up, send them out, get them signed off – and then you've got a page to work on" (P14).

Adequate requirements documents should be accurate (P3), unambiguous (P10) and understandable (P10, P22, P27). They should be easy to read (P10) and consistent in terms of their language and level of detail (P10). Furthermore, they should employ language and artefacts (for example, use case diagrams) that are appropriate to the target audience (P22). They should also be presented at a functional, not process, level (P4) and should define exactly what is to be developed (P3) and/or what is expected (P17). That said, larger projects tend to need more prescriptive requirements documents (P1).

Without adequate requirements documents, stakeholders will be unable to understand what they have signed up for (P10). In the first instance, this lack of

understanding serves to undermine stakeholder buy-in (P10). Secondly, it prohibits project team members from having a shared understanding of requirements causing them to head off in different directions (P2) during the delivery of the project. Indeed, a common cause of projects going off track is that the technical team does not understand the requirements (P16). In summary, without adequate requirements documents, you are unlikely to produce what is expected (P18); a serious and costly mistake (P25).

However, it can be incredibly difficult to produce high-quality requirements documents (P1). Over and above the literacy skills of their authors, this might be down to insufficient time being made available for the task; for example, a sponsor who does not care about the effort put into documents (P2). It can also be difficult to utilise requirements documents. In particular, identifying omissions from specifications can be a difficult problem (P32). They will be also be interpreted and understood differently between individuals (P32), perhaps due to different cultural backgrounds (P1). Furthermore, documentation inevitably raises questions (P20). Not only do the readers have to know what questions to ask but they need access to the documents' authors (P20). Otherwise, stakeholders can really struggle to interpret the requirements (P20).

Another use of requirements documents is to obtain customer sign-off on project requirements (P3, P6, P10). However, this can also be difficult. This is partly because individuals are afraid of accountability (P10), but also because it can be difficult for them to leverage change after sign-off (P10). Yet, customer business environments and cultures tend to change (P9, P10). There are many reasons for this including competitive pressures and changing legal requirements. Businesses also tend to move forward in terms of new products (and services) and changes in management (P13). Or perhaps the business is simply experiencing growth (P29). All of these factors can cause requirements to change over the course of a project, particularly in longer projects (P13). As such, a project's initial scope is seldom correct and is itself subject to change (P10). As one participant stated, "I don't think I've ever been involved in any project ... that the requirements we start with are the requirements that we end up with at the end of the day" (P24).

Unmanaged incremental changes to a project's requirements can be referred to as "scope creep." In this respect, poor scope control, can be described as a significant factor affecting the success of a project (P10, P17, P24), particularly for fixed price projects (P19, P24) (as opposed to projects priced on a time and materials basis). Although scope creep can be caused by the factors outlined above, it can simply be due to inadequacies in the original requirements specification (P6, P14); again, perhaps because the clients do not know what they want in the first place (P26). Its source can also be political; for example, when middle management try to maximise functionality for their own departments (P10).

Scope creep can be difficult to deal with, particularly for inexperienced project personnel (P2). In some cases it can be a huge problem that causes considerable rework and thus adversely affects both timescales and budgets (P6, P14, P24). Moreover, it may lead to failure as the project can no longer deliver the required functionality within its given resources (P10). Scope creep can be alleviated by measures such as senior management involvement (P10), effective expectation management (P4), iterative development (P29), requirements sign-off (P6, P13, P17), and commercial flexibility (wiggle room) to absorb changes (P19, P29). However, controlling changes usually requires an effective change control process. Otherwise, supplier organisations can find themselves undertaking a large amount of extra work at their own cost (P14) and to the detriment of system maintainability and the project's delivery date (P17).

One of the reasons for having an effective change control process is that customers do not always understand the impact of seemingly small changes (P6). However, the basic reason for having a change control process is that many projects fail because changes to requirements are simply not managed properly (P17). Not only does an effective change control system need to be rigorous but it should be explained upfront (P6). This informs the customer that there will be an impact due to changes (P6). Effective change control also needs to be properly managed as opposed to simply being a collection of "fantastic looking artefacts" and procedures (P20).

In summary, requirements management is a key factor for OISD project success. Clearly, careful attention should be paid to the issues surrounding the definition of requirements and preparation of the initial requirements document. However, it is equally important that changes to these requirements are appropriately managed throughout the life cycle of the project.

4.4.2.10 An effective software development approach

OISD projects can be delivered using a number of different software development (and deployment) approaches. Broadly speaking, these include:

- (1) The traditional one-off waterfall approach (predetermined requirements are delivered by an one-off development process/cycle);
- (2) Incremental development (predetermined requirements are developed over two or more increments/cycles);
- (3) Iterative/evolutionary development (requirements are allowed to evolve from one development iteration/cycle to the next).

Introductory explanations of these approaches can be found in elementary texts such as Hughes and Cotterell (2006, pp. 68-92).

In general, participants did not favour the use of a pure waterfall approach. Instead, deliverables were usually split into phases, increments or iterations, especially for projects with longer life cycles. That said, the development approaches described by the participants tended to be more incremental than iterative (or evolutionary) by nature. In other words, although requirements can be modified slightly between planned increments (for example, as the “technology changes, the business changes [or] people change” (P31) or, perhaps, as the client’s understanding of the solution increases as increments are delivered (P29)), they are far less likely to evolve freely throughout the project. However, there was certainly a degree of confusion on the part of some participants as to whether or not their approaches were incremental or iterative/evolutionary.

The participants identified a number of drivers that influence the choice of development approach. The first of these is the mantra of delivering early and often (P15) to allow the business to realise benefit early (P10, P25) and with lower risk (P31). This helps explain the predominant use of incremental, phased, time boxed and iterative approaches to deliver solutions within very short periods of time (P23), as opposed to waiting nine or ten months before the system is ready (P27). There were also clients who do not know what they want from the project (P14), thus requiring a more iterative approach. Indeed, a staged approach could be required simply because “three months down the line, the customer [might want] something different” (P13).

Other advantages of delivering in stages include the ability to leverage opportunities throughout the project (P10). In addition, “if you say you’re going to deliver in a month’s time, you get much better buy-in and ... participation” from the client organisation (P13). Breaking the project down into smaller chunks can also make them more “understandable and doable” and result in lower risk developments (P31). It also negates the need for people to sign-off huge requirements documents for delivery at some distant date (P10). Furthermore, incremental delivery can build project momentum and form delivery centric behaviours in the project team as they get used to delivering in interim steps (P8).

However, there are other factors that often need to be taken into account when deciding upon the most appropriate development approach. Not least of these is the client’s preference for “the way they want you to approach it” (P22). For example, an incremental approach is probably more appropriate for risk averse organisations (P10) or where potential changes in management might lead to new project objectives and requirements (P13). Similarly, for projects in which multiple suppliers are delivering different aspects of the overall solution, each might have different ways of working (P15, P24) such that their delivery methodologies are incongruent to each other (P25). Hence, the need to ensure that development approaches are in alignment with each other. At a more fundamental level, the minimum implementation footprint i.e. the minimum

usable set of features (P15), might be so large that a pure waterfall approach is the only feasible option (P10).

Other than the use of the three development approaches described above, the interviews did not reveal the use of any specific development methodologies (such as SSADM³⁸). However, a number of participants did make reference to various elements of the development approach which they considered to be success factors. One such factor is prototyping: “We try and do as much prototyping as possible” (P22). Prototypes provide instant feedback (P19), assist in the identification of operational flaws (P16), and facilitate ideas and recommendations that add value to the project (P16/P17). They also aid communication through face-to-face contact (while reviewing the prototypes) and help set client expectations by demonstrating the software throughout the project (P19). In summary, “The earlier you can get [a prototype] back to [the client] the better” (P16).

The need for an appropriate or minimum level of documentation can also be a factor (P1, P17, P22), as opposed to documentation that “would give *War and Peace* a good run for its money” (P21). Or, in terms of process, “don’t do quality ... for quality’s sake” (P13). As one participant explained, “I think you need a minimum of technical design to get a solution well articulated and understood, but it can become very self serving in that you end up spending more time writing documents than you actually do building software. So I think there’s a practicality to what design artefacts people must do – and there actually tend to be not that many” (P25).

Finally, although there were various examples of iterative (or evolutionary) development, the interviews provided little evidence to support the use of purely agile development methods (although there were a few brief references to agile testing). As one participant stated, “I try and keep away from things like agile to be honest” (P5). Indeed, the general consensus was that agile methods are not

³⁸ Structured Systems Analysis and Design Method.

appropriate for OISD projects (although they may be more suitable for in-house development). One reason for this is that client organisations tend to be uncomfortable with the “it’s done when it’s done” approach (P25), preferring instead to specify requirements up front, if they can (P10). From a suppliers’ perspective, one participant stated that his organisation was more comfortable with a document based approach as opposed to agile development with no detailed designs, etc. (P15). Other criticisms suggested that agile development can produce sloppy projects with solutions that are not particularly strong (P16). Although it was also recognised that agile development might lead to “the absolute Savile Row perfect fit” in terms of a solution, it was felt that it would, more than likely, be a very expensive fit (P25).

4.4.2.11 Effective software testing

Eight of the interview participants discussed software testing as a success factor for OISD projects. Effective software testing helps minimise the risk to development (P24) and hence the project as a whole. Indeed, one of the interview participants made it clear that their company had recognised the value of software testing over the past few years and that they had made efforts to improve their testing processes (P24). As she said, “We’re a lot better at testing than we used to be” (P24). In summary, effective testing leads to fewer troublesome deployments i.e. if done properly, there should be very few issues during a project’s go-live stage.

However, testing is not without its problems, particularly for larger projects. As one participant explained: “It’s amazing how hard it is to get test systems and data that cover all the scenarios that you need to test for” (P20). Some of the problems can be considered to be generic (applicable to testing in general), whereas others are more specific to either:

- (1) Development testing: tests performed by the development team (unit testing, system testing, integration testing, etc.);
- (2) User acceptance testing (UAT): tests involving staff from the client organisation, typically performed after the development team have performed their own testing.

At a generic level, testing is not always perceived as important by the client organisation (P12). Thus, in situations where a project is behind schedule, testing is often one of the first activities to be squeezed in terms of the time made available for it (P24). There can also be significant difficulties, particularly for larger projects, in developing a comprehensive range of test scripts. In other words, there may well be scenarios that are difficult (if not impossible) to anticipate; for example, how an application will actually be used by a particular user (P14), or the effects of interference from a third party application (P14). A similar scenario applies to projects involving multiple suppliers in which constructing end-to-end testing environments is not only difficult but can be costly and time consuming in terms of data setup (P20).

As far as development testing is concerned, the general consensus seems to be that testing should start earlier rather than later: “If you find serious defects down the chain, they’re very expensive to fix” (P25). In this respect, embedding testers with the developers makes sense as test scenarios (even if incomplete) can be started earlier and “big expensive defects get caught quicker and therefore exercised out of the system quicker” (P25). Embedding testers also improves communication thus decreasing the time required for testing (P25).

Finally, there are a number of issues regarding user acceptance testing (UAT). Clearly, UAT should not commence until development testing is complete. Otherwise, UAT turns into a “promoted beta test” (P22). However, involving users prior to UAT can be beneficial (P24), particularly in setting their expectations. In fact, a cause of testing phases that perform poorly is that the client’s expectations have not been managed properly (P19). An ineffective requirements management process can also be to blame (P19). Yet, sometimes it is simply because end users reveal errors that the development team had not considered or had assumed would never happen (P27). Also, UAT should not be perceived purely as a validation of the project’s technical deliverable; it can also be used to validate the training of the end users (P12).

But there can be problems with the end users themselves. The first is that the right people required to perform the testing are sometimes not available (P12),

possibly delaying the project. The second, relates more to the issue of ownership. To an extent, the completion of UAT i.e. sign-off that confirms the system “does what it says on the tin” (P24), represents a shift in ownership from the supplier to client organisation (P22). However, for some client staff, “the responsibility of what they’re doing starts to weigh on them and the doubt starts to creep in” (P22). This doubt can create disputes between the supplier and client organisations and therefore elongate the time required to complete UAT (P22). Fortunately, this can be alleviated by identifying someone on the client side who can take control of end user activities in the UAT process (P24).

4.4.2.12 Effective training

The need for effective training in an OISD project seems abundantly obvious (P3, P9, P17, P29). For example, when asked why end users needed to be trained, one participant pointed out that without training they wouldn’t know “how to use the system ... simple as that” (P9). As others said, you really need to give “the users an understanding of what the system’s for” (P17) or even “how to do a degree of trouble shooting” (P29). Yet, beyond the seemingly obvious, there are other aspects of training that were described during the interviews.

Training methods (P4) and the trainees’ characteristics (for example, differing levels of IT literacy, age, etc. (P7)) need to be considered. Although some aspects seem quite clear cut (for example, training with real data “makes it easier [because] they’re training with information that they’re aware of” (P9)), others seem less so. Take, for example, the train the trainer route (P4). Although cost effective, this approach can lead to information being filtered, as it is passed through the trainers (P4). This can result in a system that is hardly used as the end users have not been provided with all of the necessary information as to how the system operates as a whole (P4).

Training also needs to be considered, not only from the client’s perspective, but in terms of the supplier’s staff too (P3, P8). For example, project teams may be required to learn about new technologies (P3) or the client’s business terminology (P9). These shortfalls in knowledge or skills should be well defined

at the beginning of the project and the project team's training requirements scheduled in the project plan (P3). Training can also be provided outwith the project in terms of an individual's personal development plan (P3). The skills required to deliver a training session also need to be considered; for example, investing time "before you run the training session to ... do some form of dress rehearsal ... in a safe environment" (P8). This is particularly true for less experienced team members in order to demonstrate that they do possess the required competences (P8).

Finally, it is important to acknowledge that the benefits that can be derived from effective training have their limits (P30). It seems reasonable to expect that personnel will learn new terminology (P30), return with new ideas (P3) and new skills that prove particularly advantageous to the project (P3). Training also enhances morale and informs staff that their organisation is making an investment in them (P3). However, it is unrealistic to expect people to change simply as a result of completing training courses (P30). In this respect, there are other factors that are required to bring about changes in people's behaviours, such as effective communication and spending one-on-one time with people (P30).

4.4.2.13 Effective post implementation support

Most of the participants that took part in the research stated that their organisations provided post implementation support for the systems they develop. In most cases this support was provided from "day one after go-live" (P13). It is therefore not too surprising that, even though support is "after the fact" (P29) in terms of a project's end date, it can be considered as a success factor. Indeed, a measure of project success can be the level of support required after deployment. As one participant observed, "Support is the easiest, dullest job in the world if the project has been a success" (P19).

Although there were exceptions, most suppliers did not have support departments *per se*. And, although this cannot practicably be a matter of choice for very small companies, even the larger suppliers chose to utilise the developers who had worked on the original project to handle support matters.

Indeed, as one participant pointed out, providing continuity from development to support in this manner is “a bit of a selling point to our customers” (P13). But the main reason that the original development teams also provide support is that they are the people who “know what [they] are talking about” (P29) and hence can provide the best possible service. The problem, of course, is that when development staff are redeployed to new projects, the burden of supporting previous projects can become problematic. As one participant stated, “If you’ve got a massive support issue in the middle of your project, it can blow a big hole in it” (P14).

As such, the issue of support requires some forward thinking at the start of a project (P13). For organisations that have support departments (or service management teams), this means having them involved from the very start of the project (P7). For those that don’t, the question of, “How do we support those systems?” still remains (P13). In other words, how will the development staff actually provide support while delivering new projects? Clearly, this whole issue can be alleviated (to a certain extent) by minimising the burden of support. In this respect maintainable (P17) and intuitive (P27) software can assist, as does properly trained end users (discussed above) and the provision of fit for purpose end user documentation (P27).

4.4.2.14 Effective lessons learning

It is perhaps appropriate that the final process related success factor covered by this section is that of lessons learning. Clearly, no one likes getting burnt when things go wrong (P17), but unfortunately, even on the best projects, mistakes occasionally (if not regularly) get made. Or, as one participant emphasised, “Things *will* go wrong” (P8). It might therefore seem a matter of common sense that organisations would learn from prior mistakes and endeavour to ensure that they are not repeated on future projects. In other words, both supplier and client organisations need to ask, “What do we need to do differently?” (P8). Unfortunately, this is not as simple as it might seem (P30, P31).

For those working on smaller projects, learning lessons does not seem to present too much of a problem (P17). As one participant explained, “I’ve made mistakes in the past and I’m learning by my mistakes” (P9). However, for larger organisations working on larger projects, the learning process can be more difficult. In some cases this is simply because organisations do not revisit the reasons why previous projects fail (P31). This is made worse by a lack of understanding of prospective projects and leads to the repetition of mistakes and errors (P31). In other cases, the reason is due to a lack of continuity of personnel between projects (P31). For example, as organisations change or, as projects teams are dispersed and allocated to new assignments: “The project’s long gone and the people have changed, so a lot of the lessons learned ... are learned by the wrong people” (P31). Finally, the reason why some organisations fail to learn from previous experience is because their culture prevents them from being open and honest and therefore unable to discuss what went wrong and publicise the findings (P31).

Although the interviews did not identify many solutions to remedy this situation, it would seem that effective governance (P31) or quality frameworks (P17) are beneficial. More so, an appropriate organisational culture is very important (P31) and, at a personal level, project based performance appraisals may well assist (P8).

4.4.3 Artefact related success factors

Given that OISD projects consume, utilise, make reference to and produce a wide range of artefacts, it was somewhat surprising to find that the interviewees identified only two artefact related success factors. That said, an examination of the factors presented in the previous section does show that process based success factors are intertwined with numerous artefacts; for example, the project plan, risk registers, requirements documents, etc., all of which might be considered as sub factors for OISD project success. However, this section is restricted to the discussion of only two success factors: (1) a fit for purpose project governance model and (2) fit for purpose technology.

4.4.3.1 A fit for purpose project governance model

The interview participants were of the opinion that OISD projects require some type of framework or governance model (P4, P7, P11, P12, P14, P15, P17, P19, P20, P24, P26, P31, P33). For small projects this might simply be the preparation of a comprehensive proposal (that forms the basis for all subsequent activities) and informal adherence to some basic ground rules (P20); for example, holding regular progress meetings with the client (P5). Indeed, participants from smaller organisations saw little need for any type of formal governance, citing it as an unnecessary and unaffordable overhead: “I cannot afford to implement them” (P5). However, for larger projects, a more formal structure or governance model is usually required (P4, P7, P19). In fact, participants from larger organisations reported benefits from the introduction of governance models as their businesses grew and they undertook larger projects. As one said, “Governance wise ... we’re generally much, much more successful than we were” (P7). In general, for larger projects, formal project governance can be completely invaluable and essential for success (P7).

As a rule, proper project governance (P24) needs to be set up, or laid out, at the beginning of the project (P19, P22, P24, P31). It also needs to be acceptable to and understood by those involved in the project (P22). Broadly speaking, its purpose is to provide a structure or framework for the project to follow in terms of its overall management and execution i.e. “how we’re going to run the project” (P22), depending on the size of the company and the way in which the company operates (P22). Clearly then, for large, complex projects, a governance model might itself be extremely large in terms of the breadth and depth of processes (and supporting roles and responsibilities) that it defines.

A key tenet of effective governance is that it should be appropriate to the needs of the supplier and client organisations and the projects being delivered. In this respect, the interviews did not provide any examples of companies that had fully adopted “heavy weight” (P11) governance models such as PRINCE2. As one participant said, “You don’t need all the ... controls and frequency of meetings and the documentation regime that goes along with PRINCE2” (P11). In fact,

the full adoption of heavy weight governance structures was even considered by some to be a failure factor; to the extent that sometimes “PRINCE2 kills projects” (P4).

On the other hand, “things such as PRINCE2 [can] help” (P25). Thus, there are instances where suppliers have gained PRINCE2 accreditation in order to attract or gain new business (P5, P26). Indeed, there are “certain factors of PRINCE2 that are essential to delivery of a successful project” (P11). However, the companies that have introduced formal governance models have tended to develop more light weight approaches (P7, P14). In many cases, these variant approaches can be described as “PRINCE alike” i.e. based loosely on PRINCE2 (P4), but employing only a subset of the elements of PRINCE2 (P11, P14). As one participant stated, “We stick kind of loosely to PRINCE2 ... but we don’t stick rigidly to the methodology – we just employ some of the practices” (P14). Some aspects of project governance can even be carried out on a less formal basis; for example, informal project reviews (P7). In this way supplier organisations are able to provide sensible levels of PRINCE2 governance (P25) while making sure that they do not “spend too much time following process and not enough time doing work” (P17).

As described above, a governance model can define a large number of processes in varying degrees of detail. Typically (according to the participants) these will include the way in which a project will be documented (P4, P11, P22), the change management process (P20, P22), the frequency and nature of meetings (P5, P10, P14, P19, P20, P22), sign-off procedures (P11), risk and issue management (P14, P15, P20, P25, P26), escalation procedures (P7, P15, P20), progress reporting (P4, P13, P14, P15, P19, P20, P26), dependency management (P15, P20), the use of check points (P10, P19, P25), and roles and responsibilities (for example, the project board, technical authorities, etc.) (P4, P7, P11, P19, P20, P24). In this respect it would seem that a fit for purpose project governance model has the potential to make an important contribution to the effectiveness of many of the process described in the previous section.

Unfortunately, the application of effective project governance is not as widespread as it might be (P31). In some cases this is because client organisations simply do not understand or appreciate the need for effective governance (P20). In others it is due to the wrong people being involved in the governance process (P20). For example, “They choose people that have got spare time – not the right people – the good people are busy” (P31). It may also be that those involved do not dedicate sufficient time. For example, “The project sponsor doesn’t spend enough time on the project” (P31). Another concern is that governance models can constitute a collection of “fantastic looking artefacts” that do not actually add any value to the project (P20). Simply put, for effective governance, “It’s not what you use – it’s how you use it” (P20). Similarly, project governance “is only good ... if it’s actually used” (P26).

4.4.3.2 Fit for purpose technology

The technology i.e. hardware and software, used to deliver OISD projects was cited as a success/failure factor by a number of the interview participants: “The IT side itself can cause a problem” (P28). That said, it was also acknowledged by a few of participants that technology in itself is almost irrelevant (P5, P19). For example, the choice of development language can be immaterial (as long as it is fit for purpose). As one developer stated, “I don’t think I’m any worse a programmer for using one language over the other” (P5). In fact, in many cases there is little difference between development languages (P5). Perhaps, more importantly, client organisations tend to have little interest in technical considerations, as long as they work (P28).

In terms of software, the development process requires the use of “the right tools for the job” (P24) i.e. integrated development environments, automated testing tools, etc. In addition, tools for other project management processes (i.e. project planning, support call tracking, etc.), are also required. In general, it would seem that these kind of tools have improved (P5) over the past years and are now considered more mature (P8). However, on occasions, there are still problems; for example, compiler bugs and inadequate documentation (P1). And, as tools usually require financial outlay, organisations are sometimes

tempted to lower costs by reducing their investment in such software, by purchasing cheaper (but often inferior) alternatives (P31) or with fewer licences (P24). Of course, the downside of this is that project teams are then required to work harder whilst performing the same activities (P24).

Participants also cited problems regarding the use of third party software products as part of the overall solution. In this respect software defects can be an issue; for instance, an application in which VAT was incorrectly calculated (P4). Or, as another participant explained, in relation to new releases of packaged software, "Sometimes you get one step forward and two steps back" due to software defects (P9). It was also suggested that some off-the-shelf products are not as flexible or simple to configure as they might be (P31) hence leading to problems during deployment. Similarly, at an operating system level, configuration issues can be a problem. As one participant had found, "There's no two PCs on the planet that are configured in the same way" (P28). A similar argument applies to different flavours of operating system and the interaction (or integration) with other software products. Difficulties therefore arise in ensuring that the software deliverable will perform adequately in an environment over which the project team have little or no control (P32).

Hardware was also a concern, particularly where a project's end deliverable is intended to run on an existing IT infrastructure (P28) or, perhaps, that procured at the client's discretion. For monetary reasons some client organisations decide to make do with existing but inadequate hardware (P9). In other cases, hardware is procured to the absolute minimum specification hence providing no opportunity for dealing with increased levels of system usage (P29). For these reasons, hardware performance can become an issue (P28). Hence, specifying fit for purpose hardware at the start of the project can be considered an important aspect of OISD project success (P29).

Finally, the project's deliverable (the information system) was identified as a success factor by 25 of the interview participants. Clearly, any information system needs to be fit for purpose but, as the participants showed, this is a function of a wide range of characteristics. The software should be based on

stable (P31) and mature (P8, P31) technology. It should be free from defects (P2, P18) and software hacks (P32). The software should also be maintainable (P2, P8, P14, P17, P32), reliable (P17, P21) and extensible (P8, P17, P21, P27, P32). And, from the end users' perspective, usability (ease of use) was the most cited characteristic (P5, P15, P17, P18, P28, P29). Yet, usability can be achieved using relatively straight forward measures. Ensuring that the software is familiar to end users helps (P17, P27) as does spending time on the software's graphical user interface (GUI) (P6, P18, P19, P27, P28). Indeed, paying attention to the software's GUI can even have a positive effect on client buy-in to the project (P19, P28).

4.4.4 Actor related success factors

As it is people who deliver projects (P8), it came as no surprise that the interview participants identified a number of specific actors (and groups of actors) as success factors for OISD projects; for example, the requirements analyst, the project board, the end user community, etc. However, three actors received substantially more coverage than all the others. These were (1) the project team, (2) the project manager and (3) the client organisation. This section presents each of these actors as OISD project success factors in terms of their effectiveness. A fourth actor related success factor is also discussed: effective client involvement. This factor could have been amalgamated into the discussion of the client organisation. However, the attention afforded to this factor by the interview participants was such that it was deemed a success factor in its own right.

4.4.4.1 Effectiveness of the project team

P3 declared that "a project is a huge team effort." In this respect, the effort expended by a supplier organisation to develop an IS solution is, for the main part, provided by the project team i.e. it is the project team that does the work. On very small projects, this team could be a single individual (probably with responsibility for other roles such as project management). However, for larger projects, dedicated teams of people are required to develop and deploy the solution. As such, it is important that not only the individual team members, but

the project team as a whole, have the appropriate attributes and competences. As one participant stated, “If you don’t have a competent team ... then you’re not going to be successful” (P8).

Clearly, individual project team members need to have the appropriate technical skills required for development and deployment (P3, P19, P26). Therefore, project teams require a variety of individuals (P3, P19); for example, requirements analysts, developers, testers, trainers, etc., each with skills that match the requirements of the project. In other words, “the right people delivering the right types of work” (P13). There are also advantages of having multi-skilled team members (P3, P19), so that (ideally) any individual should be able to carry out any task (P19). For example, “We would typically expect a [requirements] analyst ... to deal with specifying test plans and managing a test phase” (P19). Indeed, having team members with a broad range of skills tends to make the project team more agile (flexible) in that the team can respond quickly to situations as they arise (P19). Moreover, project team members in contemporary OISD projects require a good mix of industry/business/domain and application knowledge as opposed to just having technical competences (P9, P12, P13, P16, P17, P24). For example, a project team member should already have a background in a particular industry sector (P13). This helps them to understand the client’s domain (P16), “put themselves in the position of the person who’s doing the job” (P28) and think from the users’ perspective (P18). Not only does this aid communication between the supplier and the client (P13) but it also provides the potential to add business value to the client organisation (P6). This is an expectation that seems to have increased over the past decade or so (P6).

The interviews identified numerous personal characteristics that make for good project team members. These include being experienced (P8, P13, P18, P19, P21, P26, P32, P33), knowledgeable (P12, P16) and competent (P16, P25, P26, P33). They need to be enthusiastic (P11, P17), self motivated (P17) and genuinely interested in what they do (P17). Being confident (P18, P33), conscientious (P3) and honest (P8) are also favourable attributes. On the other hand, it is wholly inappropriate for an individual to have become a developer

simply because “there was money in it” (P18). Project team members also need to have degrees of energy (P8), commitment (P8, P12, P20) and “willingness to invest the time and work on obstacles as they start to appear” (P8). As such, they need to be prepared to work additional hours as and when required (P3, P18, P19). The desire to work closely with other people (P14) rather than “trying to outdo one another” (P18) is also important i.e. being a good team player (P3, P6, P10, P18, P21, P28, P32). Similarly, individuals with personal agendas can be detrimental to project team effectiveness (P3). Project team members also need to be prepared to take responsibility for various tasks (P3); for example, if a temporary team leader is required, one of the project team members will be prepared to do this (P3). From an organisational perspective, individuals also need to be empowered to make decisions to make the system work (P4) i.e. the project team “can make decisions – and the business will back them” (P6). And perhaps, above all, project team members must have a willingness to succeed (P3, P8). All that said, the identification of personal characteristics (akin to those described above) is not necessarily sufficient. As one participant explained, “Some people just seem to be capable of delivering successful projects” despite having “similar attributes, capabilities [and] experience” to others who are less capable (P33). That said, the interview participants described five overall team characteristics that have a significant influence on the success of the project as a whole. These are (1) gelling of the team, (2) co-location of the team, (3) balanced experience, (4) problem solving capability and (5) dedicated resources. All of these are discussed below.

Characteristic 1: gelling of the team

The first characteristic is based on the concept of “how well you gel as a team” (P8). As noted above, project team members need to be willing to work together (P3). They also need to be comfortable with one another (P18), be able to communicate with each other (P18) and be supportive of each other (P8), rather than working as a group of individuals (P3). In other words, teamwork is extremely important (P3). To achieve this, project team members need to think beyond their own activities (P6). This involves understanding the bigger picture and also what other team members are doing (P13, P14). It also requires

effective leadership, communication and honesty (P8), as well as clear roles and responsibilities (P8). The gelling process can also be facilitated by investing time together as a team (P8), thus providing an opportunity to understand the different dynamics of the individuals in project team (P8). This allows team members to understand what their peers consider important in the project, how they want to be treated and how they want others to behave (P8). Attaining this type of understanding can be easier if the project team members have previously worked together (P8). Cultural consistency, as opposed to language barriers and totally different working methods (P24), is also necessary for a project team to gel effectively. This, to a certain extent, explains why some of the participants disapproved of employing an offshore model for software development in an OISD project.

Characteristic 2: co-location of the team

The second characteristic of an effective project team is that the team members will be located close to one another i.e. they will have physical proximity (co-location) (P10, P13, P19, P21). Amongst other things, this alleviates barriers in communication between project team members. This allows them to communicate with one another in a manner that is both quick and easy (P19). It also enhances the visibility of problems and promotes discussion and cooperation (P10). In turn, this can lead to better decision making (P1). Being physically close to the customer is also important (P19, P20, P22, P25, P30) as it makes it easier for the project team to engage with the client (P20) and enhances information flow (P25). Thus, the supplier-client partnership is enhanced (P30). This helps explain why some suppliers find it invaluable to have teams co-located with their client side project teams and end users (and vice versa). For example, being on site to develop “a piece of software surrounded by the people who will use it” (P19).

Characteristic 3: balanced experience

Effective project teams need to be balanced in terms of their team members' experience levels (P13). Ideally, a project team will comprise sufficiently experienced individuals (P8, P11, P13, P21, P24, P25, P26, P27, P29, P32).

However, this rarely happens (P24) as many supplier organisations employ staff with varying degrees of experience (and ability). Hence, employees can range from seasoned professionals to relatively young people who have recently graduated from university (P1, P32). As a consequence, project teams can comprise of individuals with varying levels of experience (P1, P24). Clearly, the danger here is that the “experienced people ... might be outnumbered by the inexperienced people” (P26) thus diminishing the team’s productive capability and contributing to project failure.

Characteristic 4: problem solving capability

Effective project teams also tend to be good at dealing with problems (P4, P6, P18, P21, P25). Given that OISD projects encounter a multitude of issues, individual project team members need to be “able to identify ... problems” (P6) early, communicate these problems to those concerned (P14, P18) and be willing to ask for help in solving problems when they get stuck (P6, P13, P18). Similarly, team members also need to be willing and able to provide assistance to their peers as and when problems arise (P6).

Characteristic 5: dedicated resources

Finally, the project team, as a resource, “should be dedicated to the project” (P3) as opposed to sharing team members with other projects (P3) or “switching and changing people on a project from one minute to the next” (P13). Similarly, if client-side project team members are “doing their normal day to day job as well as having to do project tasks than that ... makes it more difficult” (P12).

In conclusion, OISD projects need effective project teams to be successful. Therefore having a project team with the appropriate characteristics and competences is paramount. As one participant stated, “If you’ve got the right people with the right mindset and attitude and everything like that, then a project will succeed, whatever you throw at it” (P3).

4.4.4.2 Effectiveness of the project manager

All OISD projects require some degree of project management. For projects of any significant size, the incumbent organisations (supplier and client side) each require an effective project manager with the appropriate characteristics and competences. Indeed, a number of participants considered the project manager's role to be a factor for project success (P3, P4, P10, P16, P19). As one suggested, "No project manager, no successful project" (P4).

One of the reasons for this is that projects cannot usually be managed by committee (P16). In such cases collective responsibility tends to blur project priorities resulting in a lack of real progress. Therefore, the majority of projects need a designated individual (per organisation) who has "the ultimate responsibility for seeing that [the] project actually works" (P16); preferably on a full time basis (P2, P4), as opposed to being "a bolt on to another role" (P2). Clearly, being such a key role, the characteristics of the individual assigned to this task can have a significant influence on the success (or otherwise) of the project.

However, before discussing these characteristics, it is worth remembering that project managers (and other project staff) do not operate in a vacuum. In this respect, their effectiveness is largely limited by the culture of their own organisations (supplier and client). For example, the project manager needs to be sufficiently empowered to manage the project (P4) and be provided with support from senior management when appropriate. It is also important that supplier and client organisations define what "a good project manager is" (P22), so that the project manager understands the ways in which they are expected to operate. The supplier organisation should also ensure that their project manager is a good cultural fit with the client organisation (P10) so that they can "[get] on very, very well with [the client's] people." As one participant stated, "You can't underplay the value that good cultural fit and personality fit can have" (P7). Finally, the supplier organisation should be prepared to spend money to recruit and invest in individuals with the appropriate project management skills (P2, P31). However, this was found to be a rather contentious issue in one

supplier organisation in which certain senior managers considered their project management staff to be of lesser value than the technically oriented staff.

The interviews identified various personality traits that make for an effective project manager. These include being well organised (P2, P6, P17, P18), approachable (P2, P15, P17), flexible (P10, P16), understanding (P2, P10), sociable (P15), and credible (P19). Additionally, they should be able to accept responsibility (P15, P19) but in no way should be egotistical (P15). They also need to be “cool under fire” and be able to “take the heat” when things get difficult (P4). Similarly, they need to be comfortable in any environment where change is a common factor (P4). They should expect things to change and problems to arise (P4). Being proactive by nature with regard to potential problems is also important (P8, P10, P15), as is the ability to “divorce your emotions from the reality of something that’s happened” (P8). In addition, project managers need to have good interpersonal skills. As one participant pointed out, “A good project manager with bad interpersonal skills is not a good project manager” (P4). Project managers may also be required to have the courage and confidence to stand their ground (P3, P10, P30) when dealing with more senior stakeholders; for example, to reject unrealistic demands, to secure additional resources, or even to deliver bad news. Finally, a project manager should not be overly technical. Although they need to have a technical understanding (P3), the ability to perform technical tasks tends to “take them away from their [project management] job” (P3). As one participant remarked, “If they do that, who’s looking at the project plan?” (P3).

Clearly, there are a number of text book project management competences that a project manager needs to possess (P19). These include being able to prepare and manage a project plan (P16, P25), manage budgets (P3, P25), etc. However, project managers also need a range of softer skills (P15). For example, they need to know how to treat people and how to manage them (P31); potentially difficult tasks given that various stakeholder groups may have different cultures and backgrounds. They also need to be able to communicate effectively (P2, P6, P15, P19, P24, P31) at all levels of the organisation (P31) i.e. from the project board to the end user community. To do so they have to be

able to make use of appropriate language and be able to translate technical matters into a business perspective (and vice versa). They also need to have a thorough understanding of the project's environment (P2, P4, P10, P19) which, for larger, more dynamic projects, can be very difficult to do (given the scale and complexity of some organisations) (P4). In general, it is perhaps these type of skills that really make for an effective project manager.

The interviewees also suggested that a key part of the project manager's role is the ability to build and maintain relationships (P3, P16); hence the need for good interpersonal skills. In larger projects there can be a number of such relationships, depending on the number of stakeholder groups (for example, with the project board, end users, other suppliers, etc.). However, a number of participants noted that the relationship between the project manager and the project team is of prime importance (P3, P16, P19). In essence, it is the project team that performs the work and therefore "has to have somebody to basically manage it" (P16). Hence, it is imperative that the project manager devotes time and effort to developing and maintaining this relationship. In addition, the interviewees suggested that the relationship with the client (in particular the project board) was also significant (P3, P4). For example, the relationship should be such that the project manager can stand up to the client to acquire extra resources (P3, P4, P30) or to arbitrate with the client if they are being difficult or unreasonable (P8).

Achieving this requires a range of activities, some of which seem to be relatively straight forward; for example, working with the project team (P14, P18) to ensure that they have a solid understanding of the project plan (P10). In a broader context project managers need "to be in there with [the team]" (P3), not just "sat in [their] little corner office" (P3). This involves understanding their team (P18) and being genuinely interested (P15) in what they do. It also involves providing appropriate support (P18) and ensuring that obstacles to progress are dealt with in a quick and timely manner (P15). Similarly, project managers need to inspire, motivate and mentor their teams (P4, P15, P19), making sure that "they're not stuck on something – they're not struggling" (P18) and enabling them to move forward and work together (P3). The consequences of these

actions seem to be two-fold. In the first instance, the actions inform the project team that they can rely on their project manager. Secondly, the actions tend to enhance the credibility of the project manager and earn the respect of the project team.

In summary, the role of project manager demands a special type of individual armed with a wide range of characteristics and skills. Given the influence that a project manager can exert on the success (or otherwise) of a project, there may actually be some truth in the suggestion that good project managers really are “worth their weight in gold” (P10).

4.4.4.3 Effectiveness of the client organisation

The third key stakeholder group identified by the interviews is that of the client (or customer) as an organisation. Not surprisingly, the effectiveness of the client organisation can influence the success or failure of an OISD project. In this respect, it would seem imperative that suppliers have a sound understanding of client characteristics and their possible effects.

One attribute of an effective client is that they have a very good idea of what they are trying to achieve (P6). They should also be able to articulate their objectives, as opposed to being unclear about what it is they want (P2). That said, it is also important that clients are not too adamant (or arrogant) regarding their expectations (P23, P25) i.e. they “aren’t too fixed in their attitudes” (P6), as dictating requirements might not necessarily reflect the best possible solution (P6, P9). Thus, clients should be open to advice from supplier organisations (as opposed to dictating to suppliers) to ensure that the project is as successful as possible (P9). As one participant stated, when describing a failed project, “The customer was one of these people who ... would not listen to advice from anyone” (P23).

It is also important that client organisations have an understanding, or better still, experience of OISD projects and the way in which they have to be managed. At a basic level, it helps if the client understands some of the difficulties of software development (P32) and the complexities of what the

supplier organisation is doing (P25). More so, it is important that the client organisation understands the importance of sound project management practices and the need for appropriate project governance. (P20).

There are many aspects of OISD projects that need to be carried out by the client organisation. Therefore, the ability of the client to get engaged, involved and get things done represents a key characteristic (P6, P11, P12). However, the effectiveness of a client to carry out tasks in a project environment can vary considerably depending on the culture of the organisation. At one end of the scale, some client organisations have a very proactive culture or “we can do this” attitude (P12). As one participant explained, “Ask them to do something and they’ll do it right away” (P12). However, at the other end of the scale, other organisations can be far less responsive. For example, with some clients, requests for information are simply denied (P12). Clearly, this kind of “we won’t do what we’re asked to ... we’ll do less” (P12) attitude can have a significantly detrimental effect of project success.

Client organisations also need to have the desire to be successful and hence demonstrate sufficient commitment, ownership and buy-in for their projects (P4, P10, P11, P13, P15, P21). Somewhat surprisingly, this is not always the case. In extreme cases, some client organisations seem to find it acceptable to “chuck millions of pounds down the drain” (P20) when it comes to OISD projects. In fact, in these organisations, there is almost an acceptance of failure. As one participant commented, “They just don’t seem to have this mindset of failure being unacceptable” and are quite prepared to move from one failed project to another (P20).

The political nature of the client organisation can influence project success (P2, P3, P13). The view of a number of participants was that personal politics, perhaps fuelled by a lack of commitment and buy-in, contributes to the probability of a project failing. Again, it is easy to see how individuals with their own personal agendas can cause significant infighting (P3, P12) and thus detract from working towards a common project goal (P3).

Client organisations exhibiting high levels of instability or change can also be problematic (P20). In general, destabilising influences distract client organisations from concentrating their efforts on the project. Although there are a large number of such influences; for example, threats of takeover, cost cutting initiatives, redundancies, business expansion, etc., a number of participants cited staff turnover as a common problem (P20, P27, P29). As one said, “I’ve got one customer whose staff are constantly turning over” (P27). Again, the loss of staff can have a significant effect in terms of delays, increased costs, etc. (P29). Conversely, the best projects are those staffed by client personnel who have been with the organisation for long periods of time (P12).

The size, complexity and structure of the client organisation can also be important (P10, P20). Some larger organisations have very hierarchical management structures (P19) comprising “layers and layers and layers of people” (P20) that make it difficult to determine how the client actually operates. In extreme cases, it can even make things difficult for client-side staff; for instance, “managers on their side who don’t know how to do things in their organisation” (P20). Hence, even the simplest tasks become slow and difficult. These structures can also make it hard to determine who to talk to and make it almost impossible to gain access to the essential client side staff, thus having a significant impact on communication (P20).

Certain client characteristics can even be considered to be dynamic over the course of the project. For example, system ownership should increase during the project depending on the degree of client buy-in (P15). A similar argument applies to user confidence. However, user confidence i.e. the confidence of end users to utilise the system (P11), comes about due to effective user training and user acceptance testing (P11).

Client characteristics can therefore have a major influence on the success of a project. It is important that supplier organisations have a comprehensive understanding of these characteristics to identify potential risks before they become real issues.

4.4.4.3 Effective client involvement

In addition to the characteristics described in the previous section, the client organisation needs to be actively involved in the project. As such, a number of participants considered the client's involvement (or participation) in a project to be a success factor (P4, P9, P11, P14, P16, P28). As one participant remarked, "To be successful ... we need to have the right number or the right range of people from their side of the project" (P14). Yet, although it almost seems like common sense that client organisations will put the necessary time and effort into their projects (P15), this is not always the case (P9, P11, P14, P16). As one participant stated, "A significant factor [is] that the key [client] resources that the project needs aren't allocated to it" (P15).

The root of this problem seems to be that some client organisations have "no idea of how much involvement and how much work they're going to have to do" in a project (P12). In fact, some customers are more than willing to "sit back and watch the supplier deliver" (P11) without realising that there are various deliverables that can only be provided by themselves (P6). Consequently, it is crucial that the client be provided with a full understanding of the tasks that have been allocated to them (P11) at the earliest opportunity (P12). Moreover, customers need to be fully aware that the time and effort required can be substantial. For example, a rule of thumb used by one participant suggests that client involvement is normally between seven and ten times that of the supplier (P4).

One of the reasons why clients need to be heavily involved in OISD projects is that there is a range of tasks that cannot be carried out without customer resources. To name but a few, these include the initial system selection (P4), decision making (P20, P24), specification of requirements (P11, P12, P20), document sign-off (P6, P14), end user training (P4, P9, P12), data setup (P4, P6, P16) and user acceptance testing (P12, P13). There are also tasks that should not be left to the supplier organisation, particularly if this can detract from the client's ownership of the project (P4). In particular, the client needs to own and actively manage the project from its own perspective (P4, P15), as opposed

to leaving the overall project management to the supplier. In other words, “This nonsense that some [clients] have ... of letting the supplier drive [the project]” (P4). A similar argument applies to organisational processes such as business transformation and change management (P8, P20, P23) which, from an ownership perspective, cannot realistically be undertaken by suppliers.

However, clients can find it difficult to provide appropriate resources in a timely manner. In general this is because businesses have “competing priorities ... in that everyone’s got other tasks to do that are out with the project” (P4). In other words, client staff have other priorities and day jobs to support their organisation’s “business as usual” activities (P4, P8, P11, P12, P14, P19, P31). As a result, it can be very difficult to secure people’s time in organisations (P31) and many OISD projects experience resource conflicts as the client staff find it hard to do “their normal day to day job as well as having to do project tasks” (P12).

The impacts of these conflicts tend to manifest themselves in a number of ways. The first is that the calibre of the individuals assigned to the project is often inadequate (P2). Not surprisingly, this tends to delay project progress (P6, P19, P28). Similarly, client staff are sometimes not authorised or empowered to carry out their tasks. In other cases, the amount of resource can be inadequate and/or provided at the wrong time (P9).

The interviews also revealed a number of stakeholder groups whose involvement can be considered both critical and problematic. The first of these is executive management, usually in the form of the project board (or steering committee) (P31). The project board is essential to the project by providing leadership and strong messages of support (P8). However, as project board members tend to be very senior and very busy (P20), they can find it difficult to devote the time that is necessary to actively engage in the running of projects (P31). In extreme cases, senior management have even been known to “float off never to be seen again for 18 months” (P20) after the initial project meetings have been concluded (P28).

Suppliers also need access to client side domain experts (P12, P20, P28) i.e. “the resource within the [client] company who’s going to provide [the supplier] with the domain knowledge” (P15). However, in some cases “the person who is allocated is the guy who’s got time as opposed to the real technical expert” (P15). This tends to result in misinformed decisions (P24) as the client side staff do not understand (1) what they are trying to do and also (2) the consequences of their decision making (P24). Similarly, suppliers’ questions are sometimes incorrectly answered by client personnel who are not qualified to answer them (P1).

Several participants also considered the client’s IT department to be particularly problematic (especially, it would seem, on smaller projects). In general, the main concern was the lack of support from the IT department (P23). As a simple example, one participant stated, “It’s really hard, in a big company, to get anything special done to a PC” (P28), adding that some client IT departments are “really, really inflexible and quite often desperately slow” (P28). On a more worrying note, another participant considered the actions of some IT departments to be quite malicious (P23), underpinned by a mixture of incompetence, laziness and snobbery (P23). In short, there are occasions when attempting to get the client’s IT department to carry out a particular task seems almost impossible (P28).

Finally, there seems to be merit in having a client side facilitator in OISD projects. That is “someone who can knock down barriers and cut through the bureaucracy” (P20) and maybe even break a few rules in order to get things done (P20). As one participant explained, “We were given one guy who ... sorted everything out – anything you asked for – sorted” (P20). Clearly, this type of client support can be extremely beneficial to the success of an OISD project. Indeed, the interviews provided some evidence that support from lower levels of the client organisation has supplanted the more traditional executive management support cited as a key success factor in earlier studies by other researchers.

4.5 Discussion

The primary contribution provided by this chapter is the 20 OISD project success factors presented in the previous section. By focussing on Scottish suppliers, the listing represents the first study to examine OISD project success factors from a UK supplier's perspective. The qualitative descriptions provided for each factor also differentiate the listing from much of the prior research in the field. Indeed, there are only two comparable studies that concentrate exclusively on the supplier's perspective. In the first, Moynihan (1996) provides a series of OISD project risk constructs for supplier organisations in Ireland. In the second, Taylor (2007) examines key risks identified by IT supplier organisations in Hong Kong. Although both studies identify a series of sub-factors, neither provides much descriptive information for the key risk factors they identify.

The descriptions provided in this chapter clearly show that each success factor contains a number of more detailed success factors. For example, effective requirements management requires effective requirements definition, effective change control and effective communication. Its reliance on the latter shows that requirements management and communication are not mutually exclusive. Requirements management is also affected by the client organisation's expectations, end user involvement and the business analysts' experience. Indeed, the descriptions contain many other causal relationships. For example, inadequate requirements are often the cause of problems during a project's testing phase. Poorly stated requirements can also lead to a project deliverable that does not reflect what the client organisation needs. Moreover, the descriptions show that these relationships can form causal chains. For example, organisational politics can lead to scope creep which, in turn, can lead to rework. Consequently, rework adversely affects both project timescales and budgets thus affecting project success. In other words, organisational politics does not influence project success directly. Instead, its influence is propagated through a causal chain comprised of other factors.

Extrapolating these examples from requirements management to the other success factors listed above suggests that there may be large number of detailed success factors, each with the potential to influence each other and combine to form causal chains that influence project success. Indeed, there is even evidence from the participants' definitions of project success that causal relationships apply to success criteria. For example, client satisfaction influences repeat business from the client and affects the long term supplier-client relationships.

Clearly then, there is merit in investigating OISD project success at a detailed level, not least because this has not been addressed by prior research. This would provide practitioners and researchers with a better understanding of (1) the number of detailed success factors (and success criteria) that might be involved, (2) the relationships that exist between them, (3) the causal chains by which individual success factors might propagate their influence to affect project success, and (4) the key factors and relationships involved in the propagation process.

4.6 Conclusion

This chapter has utilised the experiences of 33 IT professionals to discuss OISD projects from a Scottish suppliers' perspective. In particular, 20 success factors for OISD projects were identified and described. Various definitions of OISD project success were also presented.

The IT professionals defined project success using a variety of success criteria. Their responses correspond to a definition commonly used in the literature. The success criteria were presented in relation to (1) project management success and (2) organisational success. The success criteria for project management success are consistent with those provided in the literature i.e. schedule, budget and requirements adherence. The same can be said for the organisational success criteria i.e. client satisfaction and organisational benefit (client-side). However, the participants' responses clearly differentiated between the client and supplier organisation, thus adding an additional dimension to organisational success. From the supplier's perspective, additional success criteria

Chapter 4. 20 success factors for OISD projects

encompassed commercial aspects of the project (profitability and revenues received) and other benefits such as personal enjoyment and organisational improvements.

The main part of the chapter presented 20 success factors for OISD projects from a Scottish suppliers' perspective; the first time that this research area has been examined. The qualitative descriptions provided for each factor serve to enhance understanding in this area. However, the descriptions also show that, underneath the 20 factors, there exists a large number of more detailed success factors, each with the possibility of influencing other factors and combining to form causal chains to indirectly influence project success. There would certainly seem to be merit in investigating these detailed factors and the relationships that might exist between them.

This investigation is presented in the next chapter. It takes the form of a relationship analysis which seeks to provide a better understanding of success factors, at a detailed level, and the relationships between them.

5. Relationship analysis of OISD project success factors

5.1 Introduction

This chapter presents the findings of a relationship analysis of OISD project success factors. The objective of the analysis was to provide a better understanding of success factors at a detailed level and the relationships between them. In particular:

- (1) The causal chains by which success factors might propagate their influence to affect project success;
- (2) The number of success factors, success criteria and relationships that might be involved;
- (3) The relationships that exist between them;
- (4) The key factors and relationships involved in the propagation process.

This chapter is structured as follows. First of all, a number of relationship concepts are introduced. The nomenclature employed by this chapter is also presented. An overview of the analysis process follows. Next, the relationship data set and the active relationship network are discussed. The main part of the chapter presents the findings of the analysis:

- (1) Active causal chains identified by the analysis;
- (2) Causal loops identified by the analysis;
- (3) Factor receptivity and range;
- (4) Activity levels for success factors and criteria.

A number of special cases are then described. Prior to the chapter's conclusion, a discussion of the chapter's findings is provided.

5.2 Relationship concepts

Defining OISD project success factors in terms of their relationships allows factors to be discussed using a variety of different concepts. As the propagation process makes reference to these concepts, they are introduced briefly here³⁹.

A relationship represents a causal influence from one factor (the source factor) to another (the target factor). Relationships can also exist (1) between factors and success criteria (and vice versa), (2) between success criteria and (3) between success criteria and project success. The relationship types identified by this study are discussed in Section 5.4 below.

A factor has two relationship types: inbound and outbound (as depicted in Figure 5.1).

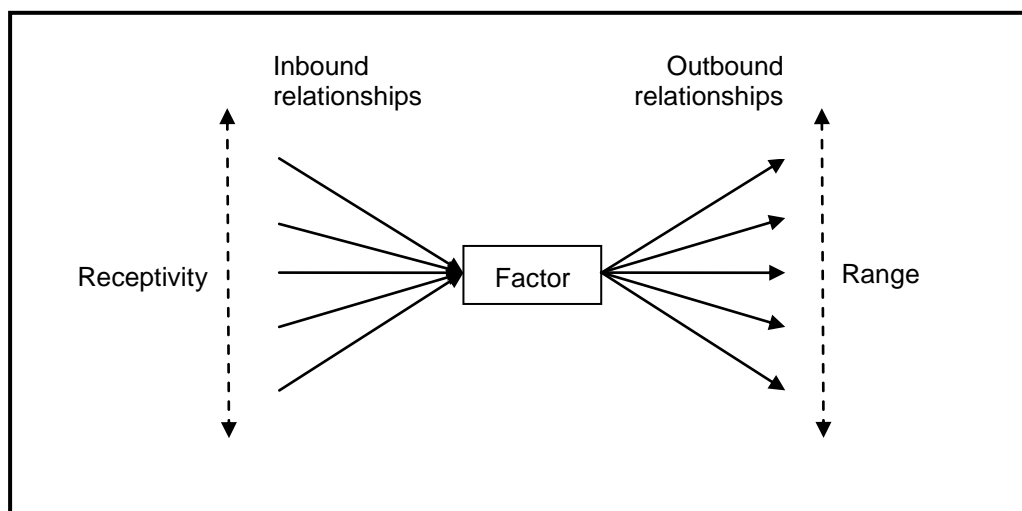


Figure 5.1. Factor receptivity and range

Inbound relationships represent the influence of other (source) factors on the factor whereas outbound relationships represent the factor's influences on other (target) factors.

³⁹ For further discussion of the basic concepts related to relationships, influence types, causal chains and casual loops, the reader is referred to back to the literature reviewed in Chapter 2; specifically, Sections 2.4.4 and 2.4.5.

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Factors that are influenced by other (source) factors are described as being receptive i.e. they are receptive to the influence of other factors. A factor's receptivity⁴⁰ (or receptiveness) is determined by the number of inbound relationships that it has. A factor with no inbound relationships i.e. zero receptivity, is referred to as a root factor.

Factors that influence other (target) factors are described as having a range⁴¹. A factor's range is determined by the number of outbound relationships that it has. A factor with zero range is referred to as being impotent.

Relationships have two influence types: (1) those having a *positive* effect on the target (or receiving) factor (or criterion), and (2) those having a *negative* effect. In quantitative terms, *positive* influences contribute to (cause an *increase* in) the target factor whilst *negative* influences detract from (result in a *decrease*). For example, the fitness for purpose of the project's business case can be considered to have a *positive* influence on the client organisation's buy-in for the project. In other words, the better the business case (in terms of its fitness for purpose), the more buy-in from the client organisation can be expected. However, the client organisation's buy-in can be considered to have a *negative* effect on the client organisation's resistance to change (associated with the project). Put another way, the higher the client organisation's buy-in, the less likely it is that the client organisation will resist the changes associated with the project (and vice versa).

A causal chain (or path) represents a sequence of relationships by which a base factor (root or receptive) propagates its influence through a series of receptive factors. A factor may have multiple causal chains.

⁴⁰ Also referred to as *in-degree centrality* in network theory (Wang, Mo, Fahui, & Fengjun, 2011, p. 714).

⁴¹ Also referred to as *out-degree centrality* in network theory (Wang, Mo, Fahui, & Fengjun, 2011, p. 714).

Some causal chains affect project success whilst others do not. Chains that affect project success are referred to as being active (those that do not are considered to be inactive or impotent). A base factor may have multiple active chains (and multiple inactive chains). The factors (base and receptive) and relationships in an active causal chain are also considered to be active because they are actively involved in propagating the base factor's influence to affect project success. An example of an active causal chain, containing a base factor and four receptive factors, is depicted schematically in Figure 5.2.

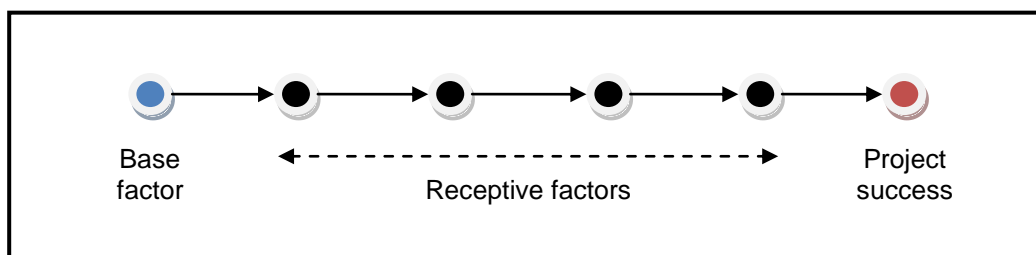


Figure 5.2. Schematic of an active causal chain

5.3 Causal diagram nomenclature

This chapter presents a number of casual chain examples in diagrammatic form (refer to Figure 5.3 for an example). In these diagrams, success (and failure) factors and success criteria are represented thus:

`type-id:entity:characteristic`

in which the `type-id` represents one of the project entity types listed in Table 5.1.

Type Id	Description
act	Actor
art	Artefact
cri	Criterion
ext	Externality
pro	Process
suc	Success

Table 5.1. Project entity types

The project entity types listed in Table 5.1 are the same as those identified in Chapter 2 to classify success factors (refer to Table 2.2) with the exception of *criterion* and *success*. The *criterion* entity type has been added to classify the success criteria data types identified in the relationship data set (described in Section 5.4). The *success* entity type has been added to represent project success.

Relationships between factors are represented as

-p->

for positive influences and

-n->

for negative influences.

The following abbreviations are also used (refer to Table 5.2):

Abbreviation	Term
c-o	Client organisation
s-o	Supplier organisation
p-	Project

Table 5.2. Abbreviations used in causal diagrams

This nomenclature allows factors (and criteria) and their causal chains to be depicted diagrammatically as shown by the example presented in Figure 5.3.

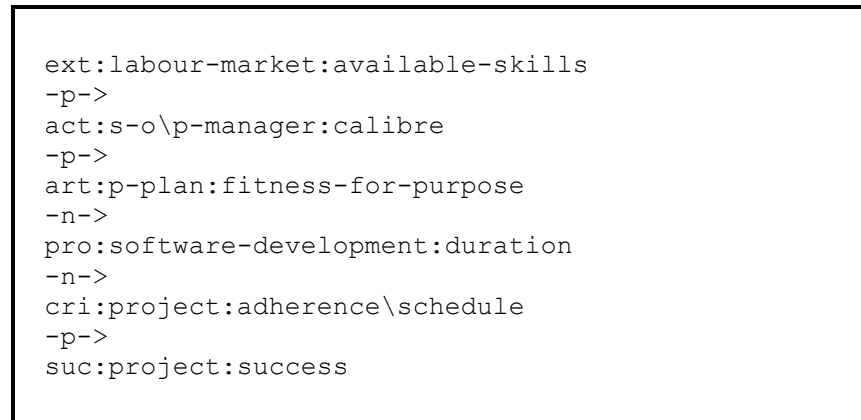


Figure 5.3. Example of a causal chain diagram

In Figure 5.3, the available skills in the labour market have a positive influence on the calibre of the project manager (supplier-side). In other words, an increase in the available skills in the labour market should lead to the recruitment of higher calibre project managers (and vice-versa). The calibre of the project manager is also depicted as having a positive influence on the fitness for purpose of the project plan. This means that higher calibre project managers can be expected to produce higher quality project plans than lower calibre project managers (and vice versa). Next, the fitness for purpose of the project plan has a negative influence on the duration of the software development process (i.e. causes it to decrease). Again, this means that higher quality project plans (measured by their fitness for purpose) should result in shorter software developments (and vice versa). In turn, the duration of the software development has a negative influence on the project's schedule adherence⁴²; in other words, the longer the software development, the worse the project's schedule adherence (and vice versa). Finally, the project's schedule adherence is a positive indicator of project success; or, put another way, the better a project adheres to its schedule, the more successful it will be (and vice versa). Hence, by virtue of its causal chain, the available skills in the

⁴² Note that, in this example, the two negative influences serve to cancel each other out, thus determining that the casual chain has a positive influence on project success. As a rule, an even number of negative influences denotes a positive chain, whereas a negative number denotes a negative chain.

labour market has a positive influence on project success; that is, the better the available skills in the labour market, the more likely it is that the project will be successful.

The nomenclature described above is also used to present factors (and criteria) in the chapter's tables.

5.4 Overview of the analysis process

The relationship analysis process is described in detail in Chapter 3 (see p. 112) and is summarised again here to support the discussion presented in the remainder of this chapter. The objective of the analysis process was to provide a better understanding of success factors, at a detailed level, and the relationships between them. In particular:

- (1) The causal chains by which success factors might propagate their influence to affect project success;
- (2) The number of success factors, success criteria and relationships that might be involved;
- (3) The relationships that exist between them;
- (4) The key factors and relationships involved in the propagation process.

The analysis process had three steps:

- (1) Construction of the relationship data set (coding)

Following the qualitative data analysis discussed in the previous chapter, the interview transcripts were reviewed again to identify success factors, success criteria and the relationships between them (for example, from one factor to another, from one factor to a criterion, etc.). In so doing, success factors and success criteria were coded as characteristics of entities. Collectively, these relationships (and their factors, criteria and project success) are referred to as the relationship data set.

(2) Factor propagation

The relationship data set was then constructed into a relationship network and analysed to identify the causal chains by which success factors propagated their influence to affect project success. Due to the size of the relationship data set, a small software application was developed to perform the propagation process. In essence, the propagation software was used to identify causal chains and estimate the activity of the factors and relationships involved in the propagation process.

(3) Analysis of the propagation software's output files

The propagation software produced a selection of output files (described in Appendix 3.5). The files provided descriptions of the causal chains and various statistics relating to the propagation process (for example, factor activity levels, causal chain lengths, etc.). The contents of the files were analysed to produce the findings presented in this chapter.

5.5 Relationship data set

As discussed above, the interview transcripts were analysed to identify success factors, success criteria and the relationships between them. In all, the analysis revealed 1,988 success (and failure) factors. Several definitions of project success, in the form of various success criteria, were also found. Consequently, all instances of success factors, success criteria and the term "project success" were coded in the form of entities and characteristics. Coding examples for these data types are presented in Table 5.3.

Data type	Entity type	Entity	Characteristic
Success factor	Actor	Project manager	Competence
	Artefact	Requirements	Stability
	Externality	Legislation	Introduction of
	Process	Project planning	Effectiveness
Success criterion	Criterion	Budget	Adherence
	Criterion	End users	Satisfaction
Project success	Success	Project	Success

Table 5.3. Entity-characteristic coding examples by data type

Analysis of the interview transcripts revealed numerous relationships which, collectively, formed the relationship data set. The majority of these relationships were between success factors i.e. from a source factor to a target factor. Relationships between success factors and success criteria were also found. For the main part, these relationships were from source factors to target criteria. However, the transcripts were also found to contain a number of (1) criteria to factor relationships i.e. from a source criteria to a target factor, and (2) criteria to criteria relationships i.e. from a source criteria to a target criteria. As several definitions of project success, in the form of various success criteria, were also provided during the interviews, relationships between these criteria and project success were also defined. These relationships were considered valid based on the premise that success criteria are indicators of project success. However, as the concept of a success factor directly influencing project success has been shown to be somewhat of a misnomer (see p. 63), all such relationships were considered erroneous and hence disregarded. Finally, a limited number of relationships in which project success influenced various success factors were also found. These were also excluded from the initial relationship data set as these relationships lie outwith the normal OISD project lifecycle i.e. project success constitutes the project's intended outcome. However, the relationships between project success and various success factors were analysed as a special case as part of the overall analysis process (discussed further in Section 5.8.3).

All of the valid relationship types discussed above are depicted in Figure 5.4. As the diagram shows, these relationships allow success factors to interact with one another and hence form causal chains that influence project success via one or more success criteria. As discussed above, causal chains that influence project success are referred to as active chains. Conversely, causal chains that do not influence project success are referred to as being inactive (for example, the causal chain that originates at Factor A and terminates at Factor B in Figure 5.4).

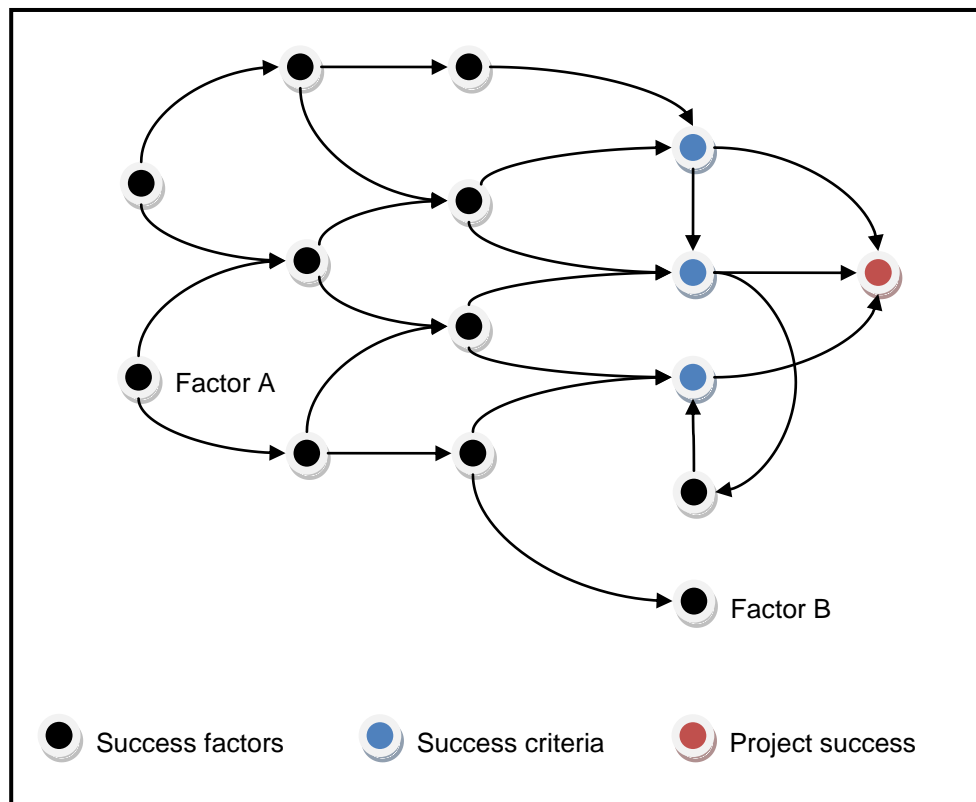


Figure 5.4. Examples of relationships between data types

Relationships were also found to have two influence types: (1) those having a positive effect of the target (or receptive) factor (or criteria), and (2) those having a negative effect (as defined above).

All relationships derived from the interview transcripts were combined into the relationship data set with the exception of two special cases: (1) relationships emanating from project success (as discussed earlier) and (2) relationships relating to project interventions (as project interventions do not form part of a

standard project life cycle). A selection of special cases identified during the analysis process, are discussed in Section 5.8.

Source factor/criteria	Influence	Target factor/criteria
act:c-o:attitude\can-do	Negative	art:issues:number-of
act:c-o\p-sponsor:competence	Positive	pro:p-governance:effectiveness
art:issues:severity	Negative	pro:project:progress
art:p-charter:fitness-for-purpose	Positive	art:requirements:stability
ext:competition\s-o:fierceness	Positive	pro:sales-process:overselling
pro:supplier-selection:effectiveness	Positive	act:s-o:competence
pro:change-control:effectiveness	Negative	pro:project:duration
act:c-o:buy-in	Positive	cri:p-deliverable:utilisation-by-c-o
cri:c-o:satisfaction	Positive	suc:project:success

Table 5.4. Examples of relationships between factors/criteria

The resultant relationship data set was found to comprise 2,075 unique relationships between 1,395 unique success factors, 19 unique success criteria and the term “project success” (1,415 network “nodes” in total). Examples of these relationships are presented in Table 5.4 with a larger selection provided in Appendix 5.1.

5.6 Active relationship network

The propagation software was used to perform multiple propagation runs (listed in Appendix 3.7). Overall, these propagation runs revealed an active relationship network comprising 916 active factors (as well as 14 active criteria), of which 597 were root factors and 319 were receptive factors. The active relationship network contained 1,449 unique relationships via which the 916 base factors influenced projects through an estimated 114 billion active chains. Interestingly, of the 916 factors, only 109 are contained in the OISD project

success factor literature⁴³, thus revealing 807 “new” success factors⁴⁴. These “new” factors are listed in Appendix 5.2 and discussed further in Chapter 6.

Data set/network	Factors/criteria	Relationships
Relationship data set	1,414	2,075
Active relationship network	930	1,449

Table 5.5. Factor/criteria counts for the relationship data set and active relationship network

As Table 5.5 shows, the active relationship network contains fewer factors/criteria and relationships than the relationship data set. This is because the active relationship network contains only active relationships and factors/criteria. Conversely, the relationship data set contains factors/criteria and relationships that play no part in influencing project success i.e. they are only contained in inactive casual chains that terminate at inactive/impotent factors/criteria. Indeed, the relationship data set was found to contain 626 inactive relationships and 484 inactive/impotent factors/criteria. In other words, approximately 30% of the relationship data set was found to be inactive/redundant.

⁴³ Based on the results of the success factor analysis performed as part of the literature review.

⁴⁴ This figure might be slightly overstated due to difficulties encountered while comparing the two sets of success factors identified by (1) the success factor analysis (prior research) and (2) those identified by the network analysis (this research). The two factor sets cannot be considered “like for like” due to the different perspectives they contain i.e. the perspective contained in prior literature is predominantly that of the client (or “in-house”) organisation whereas this research project addresses the perspective of the supplier organisation and clearly differentiates between success factors for client and supplier organisations; which the majority of prior research does not. To address this problem, the success factors identified by prior research were extended to reflect both organisations. However, by modifying the results of the success factor analysis a degree of distortion may have been introduced to the comparison process.

5.7 Findings

Having described the active relationship network, this section presents the findings of the analysis. The findings are presented in four sections: (1) linear causal chains, (2) causal loops, (3) factor receptivity and range, and (4) activity levels for success factors and criteria.

5.7.1 Linear causal chains

The vast majority of the causal chains in the active relationship network were linear (as opposed to causal loops, discussed below). The linear causal chains, of which there were an estimated 114 billion, propagated the influence of a base factor through one or more receptive factors/criteria to affect project success. In some cases, these chains were very short; the shortest being only two relationships in length and containing a base factor and a single success criterion only. For example, slippages in the software development process propagated their influence through a single success criterion (schedule adherence) to influence project success (as depicted in Figure 5.5).

```
pro:software-development:slippages
-n->
cri:project:adherence\schedule
-p->
suc:project:success
```

Figure 5.5. Causal chain example: software development slippages

However, instances of factors influencing project success via causal chains containing only two relationships (such as that depicted in Figure 5.5) were very much in the minority. Indeed, only 90 factors (8%) influence project success in this manner. The remaining 840 factors (92%) influence project success via active causal chains which, on average, are significantly longer than those described above i.e. 35 relationships/factors/criteria in length (weighted average). A selection of active causal chain examples are depicted in Appendix 5.3.

```
pro:p-start-up:effectiveness
-p->
act:c-o:understanding\project
-n->
art:issues:number-of
-p->
pro:project:cost
-n->
cri:project:adherence\budget
-p->
suc:project:success
```

Figure 5.6. Causal chain example: Project start-up effectiveness (I)

Consider, for example, how an effective project start-up might affect project success. In Figure 5.6, an effective project start-up increases the client organisation's understanding of the project. This reduces the number of issues in the project which, in turn, lowers the project's cost. The lower the project's cost, the better the budget adherence. Finally, good budget adherence is a positive indicator of project success. Thus, by propagating its influence through the causal chain, an effective project start-up has a positive influence on project success.

However, the propagation process also showed that an effective project start-up influences project success as shown in Figure 5.7.

```
pro:p-start-up:effectiveness
-p->
pro:p-governance:effectiveness
-p->
pro:change-control:effectiveness
-n->
art:requirements:scope-creep
-p->
pro:software-development:slippages
-n->
cri:project:adherence\schedule
-p->
suc:project:success
```

Figure 5.7. Causal chain example: Project start-up effectiveness (II)

Chapter 5. Relationship analysis of OISD project success factors

In Figure 5.7, an effective project start-up also has a positive influence on project success. However, it does so by way of a completely different causal chain. Indeed, the propagation process showed that an effective project start-up has a set of 467 million active causal chains. Each chain is unique, linear and, since an effective project start-up is considered to be a success factor, usually has a positive influence on project success. However, as a few receptive factors can act as both success and failure factors, this is not always the case. This apparent anomaly is discussed in Section 5.8.1.

An effective project start-up's chains also differ in terms of the entities, factors and relationships that they contain. In total, the chains comprise 49 unique entities, 157 unique factors and 383 unique relationships. The chains also vary significantly in length. Some, like those shown above (see Figures 5.6 and 5.7), are relatively short, whereas others are considerably longer (see Figure 5.8 for an example). On average (mean), effective project start-up chains are 35 relationships/factors in length with the longest containing 57 relationships.

The attributes described above for an effective project start-up also apply to all other success factors. Each factor influences project success using a set of linear causal chains. On average (mean) each factor has 122 million active causal chains. Again, each chain is unique, linear and should influence project success in manner that is commensurate with the factor being a success or failure factor respectively. In other words, success factors have a positive influence on project success whereas failure factors have a negative effect. However, as discussed above, there are exceptions to this rule (as discussed in Section 5.8.1 below)

Causal chains also differ in terms of the entities, factors and relationships that they contain. On average (weighted), causal chains comprise 44 unique entities, 147 unique factors and 359 unique relationships. The chains also vary in length. On average (weighted), casual chains are 35 relationships in length, with the longest containing 59 relationships. Causal chain statistics (akin to those described here) for 40 randomly selected base factors are provided in Appendix 5.4.



Figure 5.8. Causal chain example: Project start-up effectiveness (III)

5.7.2 Causal loops

Thus far, the discussion has been limited to linear causal chains. However, the active relationship network was also found to contain a large number of causal loops (refer to Appendix 5.5 for a selection of examples). As their name suggests, these causal loops comprise loops of relationships through which the propagation process has the potential to persist *ad infinitum* (refer to Figure 5.9).

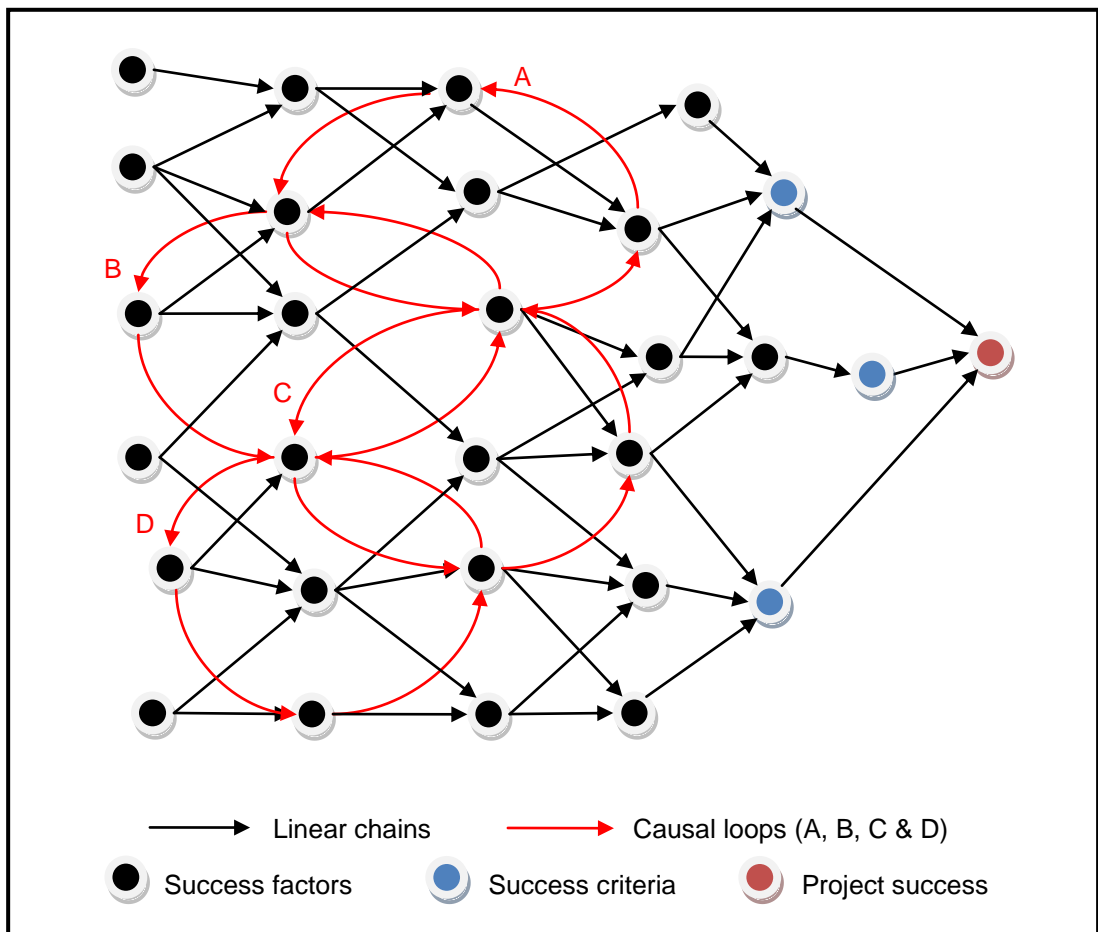


Figure 5.9. Schematic of four interacting causal loops
(causal loop influences travel in an anti-clockwise direction)

Consider, for example, how the number of (project) issues can form a causal loop. The causal chain shown in Figure 5.10 forms a causal loop simply because it “begins” and “ends” with the same factor i.e. the chain “loops” around the number of issues. This means that whenever there is a change in any of the factors contained in the loop, the effect of the change can be continually

propagated through the loop, affecting all of the factors in the loop (including itself) as it does so.

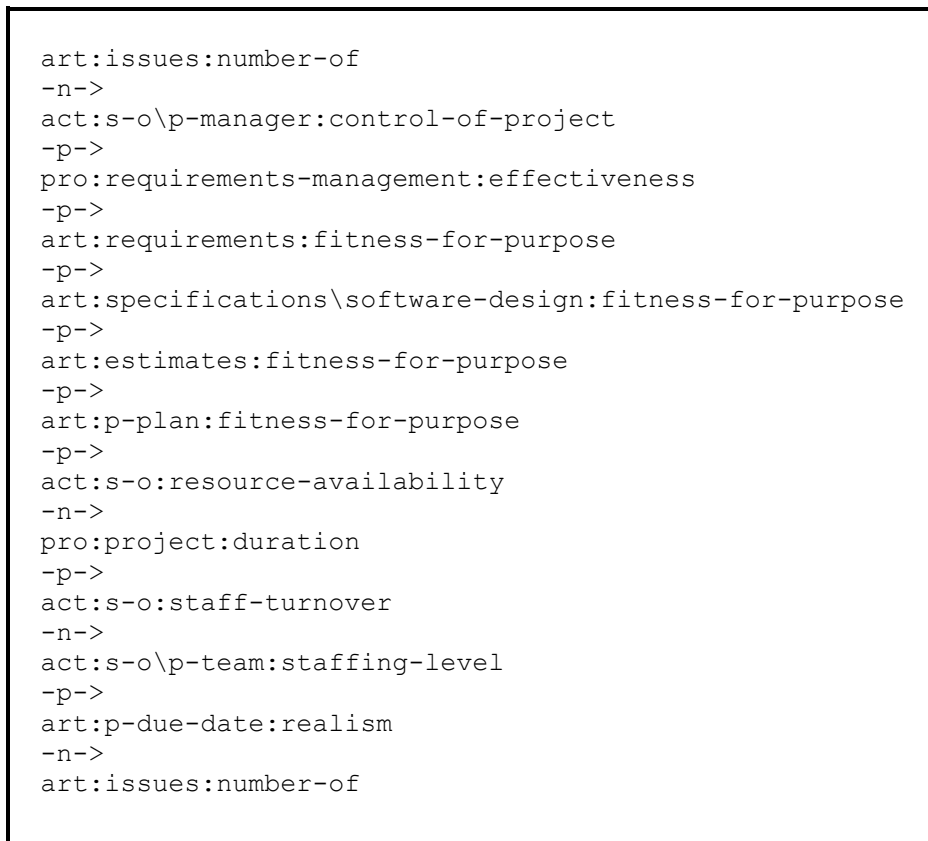


Figure 5.10. Causal loop example: Number of (project) issues

Individual factors can be contained in a large number of causal loops. For example, the project's duration, in its own right, was found in over two million causal loops. Similarly, the effectiveness of end users' training was found in 1.6 million loops. Indeed, the average (mean) number of casual loops for 20 randomly selected base factors (listed in Appendix 5.6) was found to be 1.14 million per factor. However, the estimated total number of unique causal loops in the active relationship network is only 2.94 million; a smaller number than might have been expected, due to the commonality of loops between factors.

In all, 105 (11%) of all factors in the network were found to appear in causal loops. Also, 45 (90%) of the 50 most active factors were contained in one or more causal loops. The analysis also found that these loops are not short i.e. each had an average (weighted) length of 31 relationships/factors, with the

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longest causal chain detected having a length of 50 relationships/factors. This suggests that causal loops might play a major part in the way that success factors influence project success.

Factor	Number of causal loops	Other factors in loop				
		art:requirements:fitness-for-purpose	pro:project:duration	art:issues:number-of	act:c-o:understanding\what-they-want	pro:change-control:effectiveness
art:requirements:fitness-for-purpose	1,785,370	-	96%	89%	14%	11%
pro:project:duration	2,002,974		-	88%	14%	13%
art:issues:number-of	1,956,959			-	13%	14%
act:c-o:understanding\what-they-want	605,486				-	8%
pro:change-control:effectiveness	717,146					-

Table 5.6. Causal loop interaction levels between the five most active factors

The way in which this occurs is further complicated because many of the causal loops were found to interact with each other. Consider, for example, the five most active factors listed in Table 5.6. The table shows that causal loops might contain one or more of these factors. For example, the requirements' fitness for purpose appears in 1,785,370 causal loops, 96% and 89% of which also contain the project's duration and the number of (project) issues respectively. In addition, the client's understanding of what they want and the effectiveness of the change control process also appear in 14% and 11% of the causal loops in which the requirements' fitness for purpose can be found. Further analysis of the active relationship network showed that each of the five factors appear in multiple, interacting loops, many of which also contained one or more of the other four factors. In other words, there is a high level of interaction between

these factors in causal loops, all of which is likely to affect the propagation processes through the linear chains in which the factors can be found.

Expanding this scenario to encompass the other 100 factors that appear in causal loops suggests that, not only do these loops play a major part in the way that the success factors influence project success, but the way in which this is achieved might be described as a highly complex phenomenon.

5.7.3 Activity levels

The propagation software estimates activity levels for factors, criteria and relationships based on their involvement in each active causal chain⁴⁵. This allows the software to establish the most active factors, criteria and relationships in the relationship network. Useful information can also be obtained by aggregating activity levels in terms of entity types, project types and individual entities. This section discusses activity levels for of each of the topics mentioned above.

5.7.3.1 Factor activity levels

The analysis showed that certain factors were more active than others in the active relationship network (linear chains only). For example the requirements' fitness for purpose was found to be more than twice as active as the project deliverable's fitness for purpose (refer to Table 5.7).

⁴⁵ Linear chains only, not causal loops.

Rank	Factor	Relative activity level
1	art:requirements:fitness-for-purpose	100
2	pro:project:duration	80
3	art:issues:number-of	73
4	act:c-o:understanding\what-they-want	60
5	pro:change-control:effectiveness	59
6	pro:training\c-o\end-users:effectiveness	54
7	art:requirements:scope-creep	54
8	pro:communication-with-c-o:effectiveness	53
9	art:p-deliverable:fitness-for-purpose	49
10	act:s-o:relationship-with-c-o	48

Table 5.7. The 10 most active factors in the active relationship network
(in which the relative activity levels are *relative* to the most active factor)

The analysis also showed that the bulk of the activity in the active relationship network was restricted to a core of 133 receptive factors. On average (mean), each of these factors were involved in the propagation of the influences of 674 unique base factors.

5.7.3.1 Criteria activity levels

The propagation process treats success criteria in exactly the same way as it does success factors⁴⁶. This allows the propagation software to estimate the activity levels for individual success criteria. Table 5.8 shows the 12 most active success criteria in the propagation process.

⁴⁶ Except that success criteria are not (normally) allowed to act as base factors in causal chains.

Rank	Success criteria	Relative activity level
1	cri:c-o:satisfaction	100
2	cri:project:benefit\to-c-o	63
3	cri:project:adherence\requirements	63
4	cri:project:adherence\p-budget	53
5	cri:c-o:payment-from	49
6	cri:project:profitability\to-s-o	34
7	cri:c-o:repeat-business-from	33
8	cri:p-deliverable:utilisation-by-c-o\end-users	32
9	cri:c-o\p-board:satisfaction	31
10	cri:c-o\end-users:satisfaction	26
11	cri:project:adherence\schedule	26
12	cri:p-deliverable:utilisation-by-c-o	26

Table 5.8. The 12 most active success criteria in the active relationship network
(in which the relative activity levels are *relative* to the most active criterion)

Similar to the case for success factors, the criteria listed in Table 5.8 formed a core of 12 success criteria to which the bulk of the activity in the active relationship network was restricted. On average (mean), each of these criteria were used as a success metric for 782 unique base factors. It was also found that 671 base factors impacted all 12 criteria whilst the remaining 245 affected a lesser number.

One reasonable interpretation of Table 5.8 is that the factors in the active relationship network, when taken as a whole, have a greater effect on success criteria with higher activity levels than those with lower levels. Thus, it can be said that the factors representing supplier-based OISD projects are more oriented towards client satisfaction than any other success criteria (see Table 5.8). Notably, providing client benefit also ranks highly (2nd) in the listing. And, it is interesting to note that, although requirements and budget adherence appear as ranked 3rd and 4th in Table 5.8, schedule adherence seems to be of lesser significance (ranked 11th). Thus, it can be proposed that supplier-based OISD projects are focussed more on (or are more biased towards) project success

than they are on project management success. That said, as the highest positioned, supplier-side criterion (payment from the client organisation) only ranks 5th in Table 5.8, it would seem that client-side project success assumes a greater significance than supplier-side project success.

5.7.3.3 Relationship activity levels

In comparison to the success factors and success criteria described in the previous sections, the difference in relative activity levels for the most active relationships was found to be relatively low. Thus, there is little value in presenting the 10 or so most active relationships in the active relationship network. However, the analysis did find that the bulk of relationship activity was restricted to a core of 361 relationships, each of which were involved in the propagation of influences for, on average (mean), 674 unique base factors.

Receptive element	Number of	Average (mean) base factors involved
Success factors	133	675
Success criteria	12	782
Relationships	361	674

Table 5.9. Core success factors, success criteria and relationship statistics

In summary, the activity analysis has, up until this juncture, shown that relationship network activity is dominated by a core set of receptive success factors, success criteria and relationships (as shown in Table 5.9).

5.7.3.4 Aggregated activity levels

In addition to determining the activity levels for factors, criteria and relationships, the analysis also produced a number of sets of aggregated activity statistics.

Project type	Base factor activity	Receptive factor activity
OISD	5%	3%
IS/IT	5%	4%
Organisational technology	1%	0%
Organisational	13%	15%
Generic	77%	78%

Table 5.10. OISD project success factors activity levels by project type

The first of these sets provides the factor activity levels by project type (as shown in Table 5.10). As Table 5.10 shows, base factor activity levels and those for the receptive factors that propagate their influences to affect project success are dominated by generic and, to a lesser extent, organisational factors. Indeed, OISD and IS/IT factors play relatively small parts as base or receptive factors.

Entity type	Base factor activity	Receptive factor activity
Actor	61%	39%
Artefact	15%	31%
External	2%	0%
Process	22%	31%

Table 5.11. OISD project success factor activity levels by entity type

The analysis also determined the factor activity levels by entity type (as shown in Table 5.11). As Table 5.11 shows, base factor activity is dominated by actor type success factors. However, receptive factor activity is more balanced, with slightly more emphasis placed on actors than artefacts and processes.

The activity levels for individual entities were also found to reflect entity type levels discussed above. From Table 5.12, it can be seen that actors, artefacts and processes all feature as the most active entities in the relationship network.

That said, the six highest ranking positions are dominated by actors, with the supplier-based project team assuming first position.

Rank	Entity	Relative activity level
1	act:s-o\p-team	100
2	art:requirements	94
3	act:c-o	85
4	act:c-o\end-users	70
5	act:s-o\p-manager	48
6	act:s-o	30
7	pro:software-development	27
8	art:issues	27
9	art:p-deliverable	26
10	pro:training\c-o\end-users	23

Table 5.12. The 10 most active entities in the active relationship network
(excludes the *pro:project* entity)

However, entity-based activity levels should be interpreted with a degree of caution. Although they do identify the most active actors, artefacts and processes, it should be remembered that entities are not success factors; unless, that is, they are qualified with a valid characteristic. Instead, entities should be considered as hosts for success factors (see p. 46). In other words, although entity activity levels are, to a certain extent, informative (as discussed above), it is the success factor activity levels that are important.

The final aggregated statistic set provided by the analysis was the most active relationships between entities. Again, the analysis found that inter-entity activity was dominated by a core set of 143 relationships between 43 entities. The 30 most active of these relationships are shown diagrammatically in Figure 5.11.

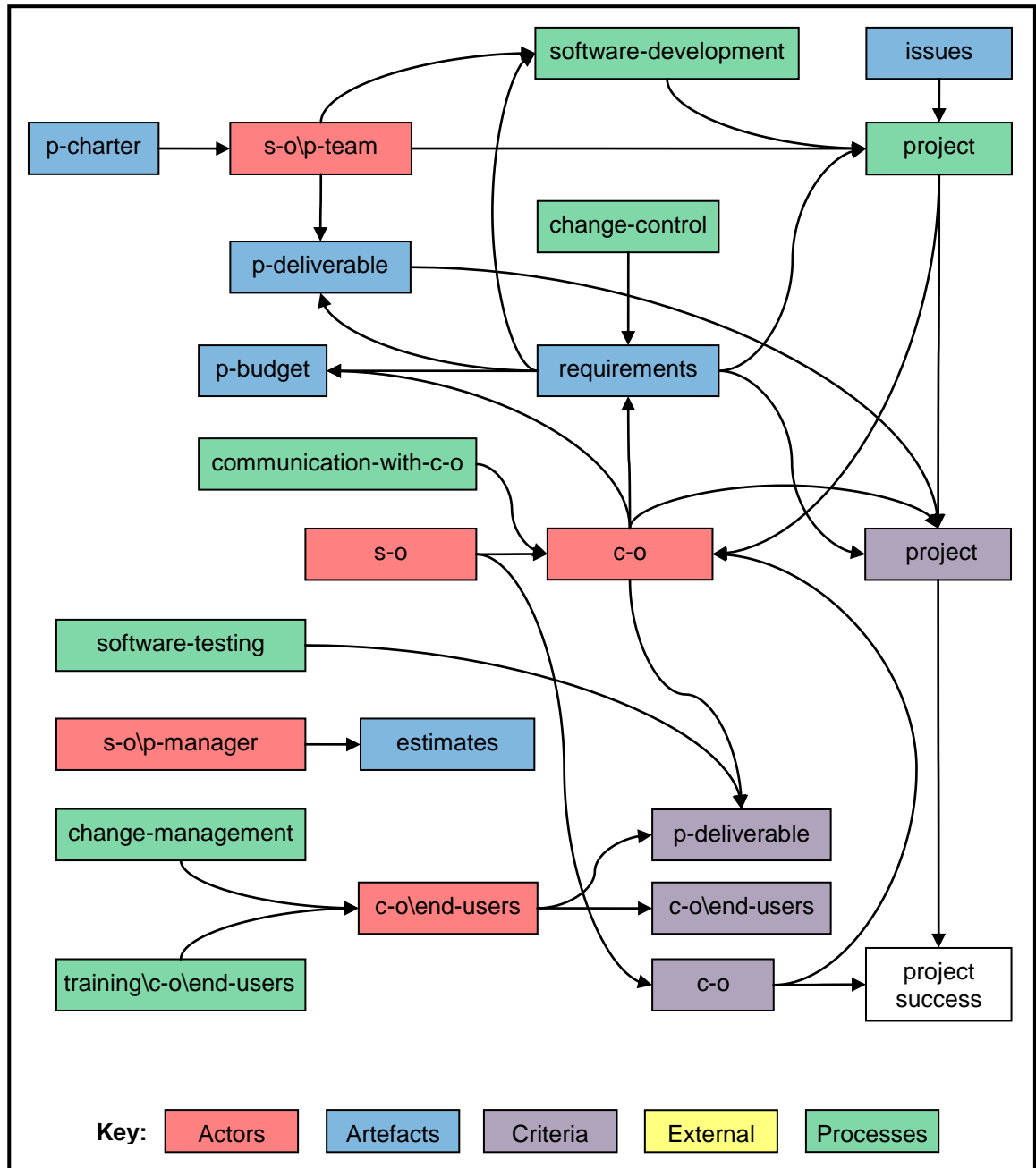


Figure 5.11. The 30 most active entity relationships in the active relationship network

However, the information that can be gleaned from Figure 5.11 is somewhat limited for two reasons. First, as Figure 5.11 is clearly incomplete, it contains only a few “key” linear causal chains. Second, as previously discussed, entities are not success factors and it is the relationships between success factors that is important.

5.7.4 Factor receptivity and range

In a casual chain (linear or loop), each receptive factor is (1) influenced by a single factor (receptive or root) and (2) influences a single factor (receptive). Thus, no account is made for factor receptivity and range (as defined above). However, as the analysis showed, factors (and criteria) can (1) be influenced by, and (2) can influence, large numbers of factors/criteria. In other words, factors can potentially have high levels of receptivity and range.

On average (mean), active receptive factors were each receptive to 3.1 factors. Similarly, active factors each had an average (mean) range of 2.2 factors. Indeed, the analysis showed that there were reasonable correlations between a factor's activity level and its (1) active receptivity⁴⁷ and (2) active range⁴⁸. In other words, factors with higher activity levels tended to have higher receptivity and range levels than less active factors (as shown in Table 5.13).

Factor set	Receptivity	Range
Top 10 most active factors	32.2	9.5
Core active factors (133)	7.0	2.6
All receptive factors (319)	3.1	2.2
Convergence/divergence points/factors (98)	8.8	3.9

Table 5.13. Average (mean) receptivity and range values by factor set

The analysis revealed that factors varied significantly in terms of the receptivity and range levels. For example, the number of project issues was found to be receptive to a total of 78 active factors (compared with a factor average of 3.1; refer to Table 5.13). Similarly, the requirements' fitness for purpose was found to influence (had a range of) 15 factors (compared with a factor average of 2.2; refer to Table 5.13).

⁴⁷ Pearson's correlation coefficient = 0.67.

⁴⁸ Pearson's correlation coefficient = 0.67.

Significantly, 98 factors were found to (1) be influenced by (be receptive to) two or more factors (8.8), and also (2) to influence (had a range of) two or more factors (3.9). As such, these 98 factors represent convergence/ divergence points in the network (refer to Table 5.13 and also Section 5.9 below).

5.8 Special cases

The analysis identified a number of special cases: (1) the project team's staffing level, (2) project success as a success factor, and (3) success criteria as success factors. Each merits further discussion, albeit for different reasons. This section discusses each case.

5.8.1 Project team's staffing level

An OISD project relies on its project team (in this case, that of the supplier organisation) to carry out the work to produce the project's deliverable and associated services (for example, end user training). It is therefore unsurprising that the propagation process identified the project team's staffing level (the number of project team members) as a highly active factor⁴⁹. The project team's staffing level was also found to influence project success by way of 38,763,883 active causal chains, one of which is depicted in Figure 5.12.

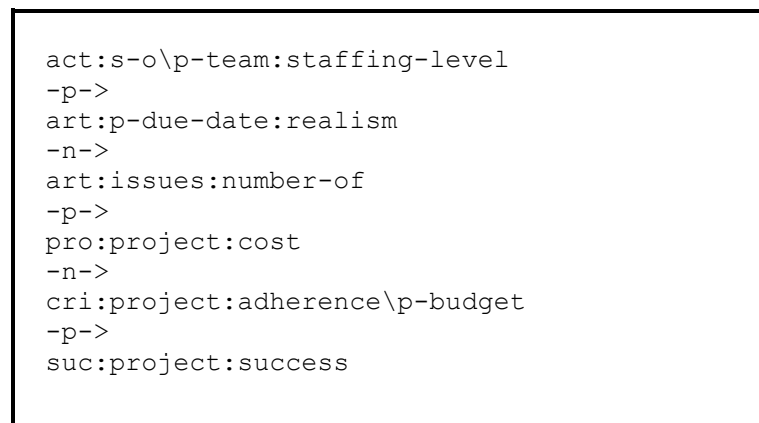


Figure 5.12. The project team's staffing level positively influencing project success

⁴⁹ Ranked as the 26th most active factor.

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In Figure 5.12, the project team's staffing level is shown to have a positive influence on project success i.e. the project team needs to be adequately staffed for the project to be successful. In other words, as the staffing level increases, the more likely it is that the project will be successful. However, these increases can also bring about some undesirable effects (refer to Figure 5.13).

In Figure 5.13, increasing the staffing level brings about problems with communication i.e. larger project teams tend to be more problematic in terms of internal (and, to a lesser extent, external) communication. Other issues include less effective teamwork and the project team being more difficult to manage; both of which are detrimental to project success. Thus, the project team's staffing level can also be seen to have a negative influence on project success.

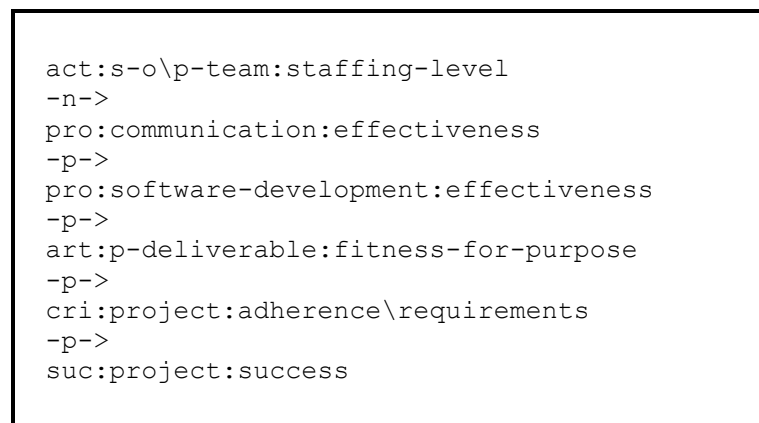


Figure 5.13. The project team's staffing level negatively influencing project success

This scenario is a form of Brook's Law (see Brooks, 1975) which, in a very simplified form, states that "adding manpower to a late software project makes it later" (Hart, 2008, p. 6). This, in part, is due to the reasons described above and, in particular communication issues⁵⁰. The scenario is also indicative of another issue not addressed by the OISD project success factor literature. As discussed in Chapter 2 (see p. 44), success factors can be restated as failure factors and vice versa. Therefore, a given factor (depending on how it is stated)

⁵⁰ But also the learning curve required to bring new project team members up to speed.

is either a success factor or a failure factor; but never both. However, this example contradicts this in that the project team's staffing level can be a success factor and a failure factor at the same time. Other factors in the relationship data set that can concurrently have both positive and negative effects include the proximity of the supplier-side project team to the client organisation⁵¹ and schedule pressure⁵². Thus, there is evidence to suggest that the strict delineation between success and failure factors espoused in the project success factor literature should be relaxed to acknowledge cases in which factors can concurrently have elements of both success and failure.

This scenario can have a serious impact on the way in which other factors influence project success. This occurs if the factor in question is receptive to the influence of other factors (as discussed above). In this case, the project team's staffing level is receptive to the direct influence of only two factors. However, the project team's staffing level is indirectly receptive to the influence of 677 base factors and, in so doing, has the potential to reverse their influence on project success as discussed above. In other words, a base success factor can exert a negative influence on project success through a causal chain that includes a relationship between the project team's staffing level and the effectiveness of the communication process.

5.8.2 Project success as a success factor

Under normal circumstances (as specified by the propagation software's input parameters; refer to Appendix 3.5), the propagation process considers encountering project success to be the condition by which active causal chains

⁵¹ Having the supplier-side project team close to the client organisation can enhance communication between the two groups but, over time, can refocus the team's affiliation from the supplier to the client. Sometimes referred to as "going native", this can lead to project teams acting in a way that is detrimental to the project and the client organisation; for example, carrying out work for the client that is outwith the scope of the project.

⁵² Although it can lead to short term productivity improvements, prolonged schedule pressure might increase project team stress and the likelihood of undesirable software development practices; for example, coding hacks (code that is implemented hurriedly without recourse to robust design, coding and testing).

are terminated. Consequently, there is no need to consider relationships “beyond” project success i.e. relationships in which project success influences other factors. However, the data set does contain a number of these relationships. These can be used to show how project success might influence the success of future projects. Consider the example depicted in Figure 5.14.

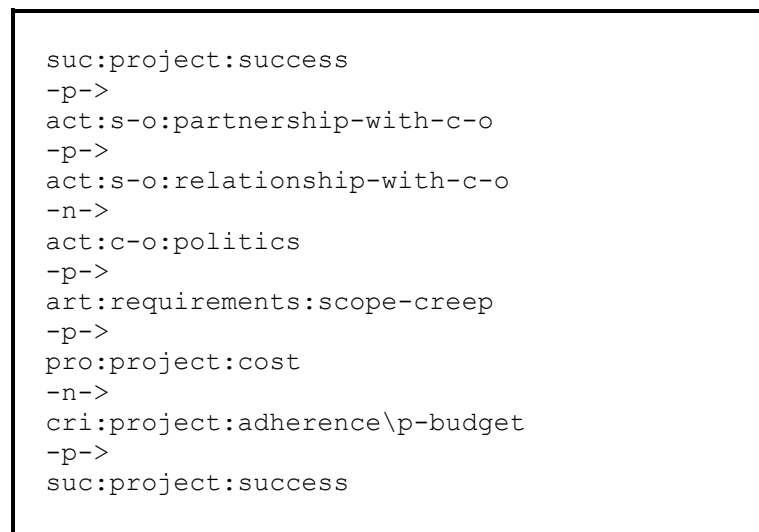


Figure 5.14. The influence of project success on future projects

In Figure 5.14, project success enhances the long term partnership between the supplier and client organisations. This partnership supports the shorter term supplier-client relationship identified by a number of participants as an OISD project success factor. This relationship can serve to alleviate the detrimental political aspects of the client organisation and, in turn, reduce scope creep. Reduced scope creep lessens the cost of the project and, hence, increases budget adherence which, in itself is a positive indicator of project success.

5.8.3 Success criteria as success factors

The project success factor literature clearly differentiates between success factors and success criteria (see p. 27). To summarise: success factors influence project success whereas success criteria are used to measure project success. The majority of active causal chains produced by the propagation process conform to this view (as shown, for example, in Figure 5.15).

```
act:c-o:changes-of-mind
-p->
art:requirements:scope-creep
-p->
pro:software-development:effort
-p->
pro:project:cost
-n->
cri:project:adherence\p-budget
-p->
suc:project:success
```

Figure 5.15. A typical active chain with multiple success factors and a single success criterion

However, the analysis provided examples of success criteria influencing other success criteria (refer to Figure 5.16).

```
act:c-o:buy-in
-p->
cri:p-deliverable:utilisation-by-c-o
-p->
cri:project:benefit\to-c-o
-p->
cri:c-o:satisfaction
-p->
cri:c-o:repeat-business-from
-p->
suc:project:success
```

Figure 5.16. An active chain with success criteria influencing other success criteria

The propagation process also provides examples of success criteria influencing success factors (refer to Figure 5.17) i.e. success criteria acting as success factors.

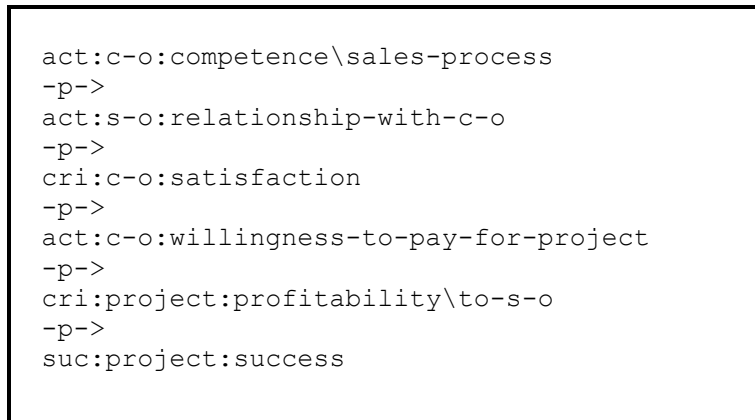


Figure 5.17. An active chain with a success criterion influencing a success factor

Again, these examples (and others contained in the active relationship network) blur the distinction provided in the literature that success factors and success criteria are mutually exclusive. Clearly, there are cases in which they are not. The interview data provides examples of a given success criterion being identified as such by one participant and as a success factor by another. It would therefore seem reasonable to suggest that there are occasions where success criteria are better described as success factors identified by different stakeholder groups as criteria for measuring project success.

5.9 Discussion

This chapter has presented the construction and analysis of an active relationship network of OISD project success factors. The purpose of this section is to provide a discussion of said content (excluding success criteria⁵³) with a view to providing a better understanding of the active network and how that might be relevant to the real-world OISD projects described by the interview participants.

A logical starting point for the discussion is that, on initial inspection, at least, the number of unique linear chains (of which there are an estimated 114 billion) would appear to be disproportionately high given the comparatively small size of

⁵³ Success criteria and various other aspects of the active network are discussed in the next chapter.

the active network (which contains only 1,449 active relationships). Put another way, is it possible for such a relatively small network to support such a high number of unique active linear chains? The short answer to this question is yes, but only if the network exhibits certain characteristics.

When discussing networks in relation to their characteristics, it is common practice to refer to those networks as having topologies (see, for example, Nedjah, da Silva, & de Macedo Mourelle, 2012; Zarifzadeh, Yazdani, & Nayyeri, 2012). Therefore, what is the topology of the active network such that it supports such a high level of active linear chains?

For a network of this size (1,449 active relationships) to support a high number of linear active chains (114 billion), its topology must satisfy two conditions i.e. the topology must exhibit:

- (1) Numerous long linear active chains;
- (2) Multiple convergence/divergence points in the network with sufficiently high receptivity and range values.

Consider, for example, the small network depicted in Figure 5.18.

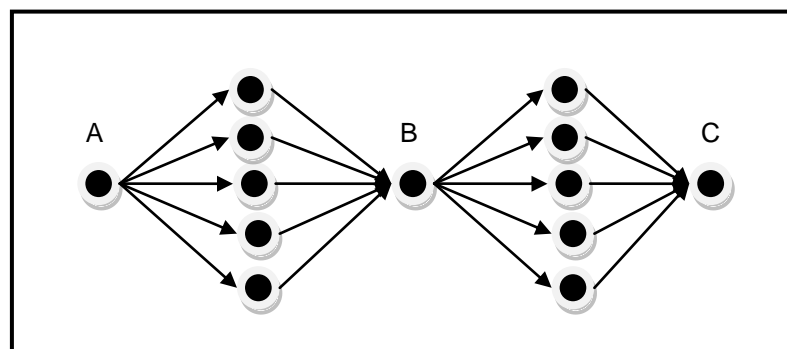


Figure 5.18. Example of a small network of success factors with a single convergence/divergence point

In Figure 5.18, there are five unique linear chains between factors A and B and also between factors B and C. However, the multiplicative effects of convergence/divergence point B (with receptivity and range values of five) means that there are 25 (not five) unique linear chains between factors A and

C. Hence, the network between A and C, with a total of 20 relationships, supports 25 unique linear chains each with a length of four relationships.

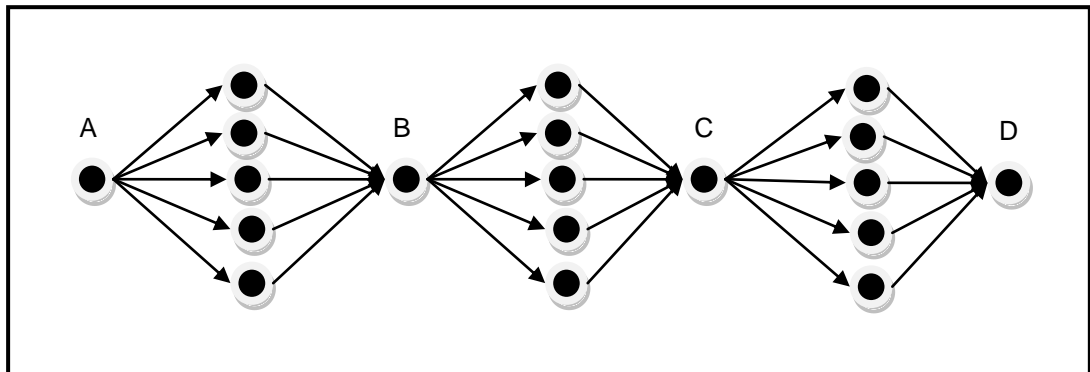


Figure 5.19. Example of a small network of success factors with two convergence/divergence points

Adding another convergence/divergence point, as depicted in Figure 5.19, serves to increase the number of unique linear chains (125) in relation the number of relationships in the network (30). Hence, the network between A and D, with a total of 30 relationships, now supports 125 unique linear chains, each with a chain length of six relationships⁵⁴.

Continuing to extend the network in this manner to a create long network of say, 32 relationships in length, results in a network topology containing only 160 relationships with 15 convergence/divergence points but supporting 152 billion unique linear chains. This example helps explain how a larger network like the active network described in this chapter (with 98 convergence/divergence points, a similar active chain length i.e. 35, and considerably more relationships i.e. 1449) can support such a large number of unique linear chains.

Clearly then, the convergence points in the active network are significant. More so, as explained above in Section 5.7.4, there is also a correlation between a factor's receptivity and range values in relation to its activity level. For example, the 10 most active factors in the active network (refer to Table 5.7) have, on

⁵⁴ Note that this does not include internal linear chains i.e. chains within chains; for example, those between points B and D which are, in their own right, also unique.

average (mean), the highest receptivity and range values of all the factors in the network. Indeed, the most active factor; the requirement's fitness for purpose has receptivity and range values of 67 and 15 respectively; values which exceed, by far, the average (mean) values of 3.1 and 2.2 respectively for all active factors in the network. This is the reason that the requirement's fitness for purpose is the most active factor in the network. Hence, the general rule is that the higher a factor's receptivity and range values, the higher the factor's activity level. Although this is not a hard and fast rule i.e. there are a few exceptions, it does apply to the vast majority of factors.

The significance of the most active factors can be further demonstrated by considering some of the network's other characteristics. As previously discussed, the network's propagation process is governed by 133 core factors and 361 core relationships. As the differentials between the activity levels of these relationships are relatively low, the network cannot be considered to contain any key relationships and thus any key linear chains. Indeed, even when examined at entity level, key linear chains are not evident (see p. 216 and Figure 5.11). Thus, from a project management perspective, the network presents a significant problem: given the complicated nature of the network (due to the large number of linear chains), and its additional level of complexity (provided by the existence of multiple causal loops), how might the network be managed, or at least monitored, in practice? Or, given that the network is not only too complicated, but is too complex to be "managed", how might a real-world project manager, over the course a project, assess the effectiveness of the network in propagating the influence of numerous base factors to affect project success?

Again, the solution to this problem is provided by the most active factors; those positioned at the "busiest" convergent/divergent points in the network as determined by their high receptivity and range values. As these factors are highly active, it is reasonable to assume they will be in a continual state of flux throughout the project life cycle (or portions thereof); in other words, they will be continually changing. Hence, the factors can be used as indicators of the network's performance and, as such, act as early, mid and late warning signs of

project performance over the project life cycle. Thus, the most active factors; in this case (1) the requirement's fitness for purpose, (2) the project's duration and the (3) number of project issues (refer to Table 5.7) should be closely monitored throughout the project by the project manager as indicators of project performance.

Finally, to complete the active network's topology, five additional characteristics need to be considered i.e. success criteria, core sets of active factors and relationships, multiple base factors, numerous causal loops and the possible existence of success factors that, under certain conditions, can contribute to project failure; for example, the project team's staffing level as discussed in Section 5.8.1. Hence, the active network's topology is described as follows:

- (1) Multiple (916) base success factors;
- (2) Numerous long linear active chains per base factor (on average, 122 million per factor, with an average length of 35 factors/relationships, resulting in a total of 114 billion linear chains);
- (3) Multiple (98) convergence/divergence points with high receptivity (8.8) and range (3.9) values;
- (4) Numerous (2.94 million) interacting causal loops;
- (5) A small number of success factors that, under certain conditions, can contribute to project failure (for example, the project team's staffing level);
- (6) Core sets of (133) active factors and (361) relationships that govern the network's propagation process;
- (7) A set of (12) success criteria.

The implications of this topology to research and practice are discussed further in the next chapter.

5.10 Conclusion

This chapter has presented a relationship analysis of OISD project success factors. Various findings were presented relating to active linear chains, causal loops and activity levels for success factors, success criteria, relationships and

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various aggregated data types. In addition to factor receptivity and range, a number of special cases were discussed.

The analysis revealed a complex active network that can be considered as a delivery system for the influences of multiple base factors to affect project success. The network's topology was found to comprise:

- (1) Multiple base success factors;
- (2) Numerous long linear active chains per base factor;
- (3) Multiple convergence/divergence points with high receptivity and range values;
- (4) Numerous interacting causal loops;
- (5) A small number of success factors that, under certain conditions, can contribute to project failure (for example, the project team's staffing level);
- (6) Core sets of active factors and relationships that govern the network's propagation process;
- (7) A set of success criteria.

The significance of the most active factors in the network; those located at convergence/divergence points with high receptivity and range values was also explained, as was the usefulness of incorporating success criteria to determine an OISD project's success bias.

To summarise thus far, this thesis has:

- (1) Introduced the research topic (Chapter 1);
- (2) Performed a critical review of the appropriate literature (Chapter 2);
- (3) Described the research methodology (Chapter 3);
- (4) Presented 20 success factors (and various definitions of project success) for supplier-based OISD projects (Chapter 4);
- (5) Presented a relationship analysis of OISD project success factors (Chapter 5).

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Hence, the next chapter will turn to a discussion of the above and, by examining the findings of this research project in relation to the existing body of knowledge for OISD project success factors (as portrayed by the literature review), determine the contributions to knowledge and theory made by the research presented in this thesis.

6. Discussion

6.1 Introduction

Having presented the findings of this research project, the purpose of this chapter is to provide a discussion of these findings and, with appropriate reference to the literature review, identify the contributions to knowledge and theory made by the project.

To this end, the remainder of this chapter is structured as follows. First, the preamble sets expectation levels for the contributions made by this research. A framework for assessing these contributions is also provided. Next, the contributions made by the findings relating to the identification and description of organisational information systems development (OISD) project success factors are presented. In addition to enhancing understanding of the actuality of real-world OISD projects, these include:

- (1) Factors identified by this research and also cited in the literature;
- (2) Factors identified by this research but not cited in the literature;
- (3) Factors cited in the literature but not identified by this research;
- (4) The development of factors cited in the literature;
- (5) Differences between supplier and client perspectives.

The contributions to knowledge and theory provided by the findings of the relationship analysis of OISD project success factors are then presented. These are discussed in conjunction with the utility and limitations of the relationship analysis. Next, the contributions related to OISD project success criteria are presented. These are:

- (1) Organisational success from the suppliers' perspective;
- (2) OISD project success criteria as influencers;
- (3) The relative importance of OISD project success criteria.

Prior to the chapter's conclusion, a number of additional contributions are presented.

6.2 Preamble

Prior to presenting the contributions to knowledge and theory made by this research project, it is worthwhile setting realistic expectation levels for these contributions. In addition, it is useful to define a framework against which the contributions can be assessed. This section deals with both of these matters.

6.2.1 Setting realistic expectation levels for the contributions made by this research project

The empirical fieldwork undertaken by this research investigated success factors for supplier-based OISD projects as perceived by IT professionals working for IS/IT solution providers in central Scotland. In other words, it offers a suppliers' perspective for a specific geographical and cultural region that, until this study, had not previously been investigated. The fieldwork comprised qualitative data collection processes followed by two complementary analyses. The first of these was a qualitative analysis that identified and described 20 success factors. The analysis also presented various definitions for project success. The second analysis was of a quantitative nature. Its findings described the way in which success factors influence project success. Before discussing the findings of these analyses, it is worthwhile determining the extent to which the findings might be expected to make contributions to knowledge and theory based on similar studies in the field.

6.2.1.1 OISD project success factor studies containing the suppliers' perspective

As demonstrated by the literature review, there have only been four studies that examined OISD project success factors from the suppliers' perspective (as listed in Table 6.1). Furthermore, these studies suggest that there is little difference between supplier and client perspectives regarding OISD project success factors. For example, Sharma, Sengupta & Gupta (2011) fail to differentiate between the two, while Hartman and Ashrafi (2002) and Cerpa and Verner (2009) reported only slight differences in perspective. Similarly,

Moynihan (1996) reported that most of the risk factors identified in his study had already been mentioned in the OISD project risk literature⁵⁵. That said, Moynihan's study did reveal some "subtle elaborations of these factors" (Moynihan, 1996, p. 364).

Study	Perspective(s)	Factor type	Geographical area(s)
Cerpa & Verner (2009)	Supplier and client	Success	USA, Chile & Australia
Hartman & Ashrafi (2002)	Supplier and client	Success	Canada
Moynihan (1996)	Supplier only	Risk	Ireland
Sharma, Sengupta & Gupta (2011)	Supplier and client	Risk	India

Table 6.1. Studies examining OISD project success, failure or risk factors containing the suppliers' perspective
(replicated from Table 2.10)

Although not an OISD project study, Taylor (2007) can also be considered to be comparable to this research project. As a qualitative study (as was Moynihan's), Taylor investigated risk factors for implementation-only IS/IT projects, exclusively from the supplier's perspective for packaged software suppliers based in Hong Kong. Again, although the majority of the risk factors identified in Taylor's study had previously been reported in prior studies (Taylor, 2007, pp. 7-12), a small number of additional factors were also identified (Taylor, 2007, p. 22). That said, the literature used by Taylor to represent "the IT project risk factor literature" (Taylor, 2007, p. 22) comprises only three studies.

It is also worth noting that both Taylor and Moynihan were concerned with identifying "new" factors; those not previously in the OISD project risk factor literature. Neither author attempted to provide a comparison between risk factors as perceived by supplier vis-à-vis client organisations. Also, although the findings of the four studies listed in Table 6.1 represent contributions to knowledge, none of the studies provided contributions to theory; a criticism that

⁵⁵ Based solely on the literature reviewed in previous study conducted by Barki, Rivard and Talbot (1993).

can be made of empirical OISD project success factor studies in general (Söderlund, 2004a, p. 187; Söderlund, 2004b, p. 659).

Hence, a realistic expectation for this study is that many of the factors it identifies will already have been reported in the OISD project success, failure and risk factor literature (as listed in Appendix 2.3). However, a number of new factors should also be expected, particularly at a detailed level and through the development of factors previously reported in the literature. It might also be possible to provide a comparison between success factors as perceived by supplier vis-à-vis client organisations. This is because the perspective presented by the OISD project success factor studies identified by the literature review is predominantly that of host (in-house/client) organisation (see p. 49). In fact, performing the success factor analysis described in the literature review (see p. 42), with the exclusion of the four articles listed in Table 6.1, produces remarkably similar results (as listed in Appendix 2.5) in terms of the most cited factors. Finally, because the qualitative analysis was concerned with identifying and describing the actuality of real-world OISD project success factors (a significant contribution in its own right), a contribution to theory in the research area was not anticipated.

6.2.1.2 Studies investigating causal interactions between OISD project success factors

Studies investigating causal interactions between success factors are discussed in Section 2.4.5 (see p. 63). Unfortunately, the majority of these studies are concerned with IT/IS projects, not OISD projects. In addition, as discussed in the literature review, these studies have a number of other limitations (see p. 63). First, all of the studies address only a small number of key success factors; on average (mean) 13 factors. Thus, they represent relatively simple scenarios, requiring the addition of more success factors to provide a better representation of complex OISD projects (Kim, 2004, p. 28; King & Burgess, 2008, p. 430). Thus, there is a significant opportunity for researchers to provide more comprehensive causal models that provide a better explanation of the behaviour of real-world OISD projects. Second, further research is required to validate, complement and extend the conceptual models presented by the

studies. Finally, and most importantly, because all the models are static in nature, they do not address the dynamic nature of real-world IS and OISD projects. Hence, there is ample opportunity for this research to provide original contributions to both knowledge and theory.

In particular, because the relationship analysis described in Chapter 5 addressed success factors and relationships at a detailed level, a more comprehensive causal model that better describes complex, real-world projects should be expected. Second, because studies of this type tend to have conceptual aspects, there is the possibility of enhancing OISD project success factor theory by explaining practice and building theory (Morris, 2010, p. 144). However, because the relationship analysis, as a rudimentary network analysis, did not address the dynamic nature of real-world OISD projects, a contribution should not be expected relating to the project dynamics.

6.2.2 A framework for contributions made by this research project

The contributions to knowledge and theory made by the research presented in this thesis should be determined in an objective manner. Thus, the research findings should be considered in relation (with reference) to the existing body of knowledge for OISD project success factors. In this thesis, the literature review (presented in Chapter 2) is the “lens” by which this research project has established its “viewpoint” (Creswell & Miller, 2000, p. 125) of the body of knowledge for OISD project success factors. In addition to discussing the background, context, criticisms and recommendations for further research in the field, this “viewpoint” identified five research directions for OISD success factors upon which the contributions made by this study can be objectively assessed. These are:

- (1) OISD project success factor lists;
- (2) OISD project success factor frameworks;
- (3) Individual OISD project success factors;
- (4) The influence of success factors on OISD project success;
- (5) Causal interactions between OISD project success factors.

In addition, success criteria for OISD projects (see p. 28), constitutes a sixth research direction against which contributions made by this study can also be assessed.

6.3 Contributions made by the findings relating to the identification and description of OISD project success factors

The first objective for this research project was to provide a better understanding of OISD project success factors from a suppliers' perspective. Initially, this was achieved by a qualitative analysis that identified and described 20 OISD project success factors (refer to Chapter 4). This also gave rise to a relationship analysis that identified a large number of detailed success factors (refer to Chapter 5). The findings of the two analyses are discussed below. The findings represent contributions to knowledge for two research directions⁵⁶: (1) OISD project success factor lists, and (2) given the thick, rich descriptions provided for each factor, individual OISD project success factors (in terms of describing the actuality of real world projects).

The OISD success factors identified by this research project can be divided into two categories, distinguished by their level of detail. The first category contains 20 high-level, entity-based success factors (listed in Table 6.2). As Table 6.2 indicates, 13 of these factors had already been identified in the OISD project success factor research literature (indicated as "No" in the "New?" column) while seven have been newly identified by this study (indicated as "Yes" in the "New?" column).

⁵⁶ Refer to the six research directions presented in Section 6.2.2 above.

Rank	Type	Factor	New?
1	Process	Effective requirements management	No
2	Actor	Effectiveness of the project team	No
3	Process	Effective communication	No
4	Actor	Effectiveness of the project manager	No
5	Process	An effective development approach	No
6	Actor	Effectiveness of the client organisation	No
7	Actor	Effective client involvement	No
8	Process	An effective sales process	Yes
9	Artefact	A fit for purpose project governance model	Yes
10	Process	An effective project start-up	Yes
11	Process	Effective project planning	No
12	Artefact	Fit for purpose technology	No
13	Process	Effective software testing	Yes
14	Process	Effective risk management	No
15	Process	Effective change management	No
16	Process	Effective stakeholder management	Yes
17	Process	Effective post implementation support	Yes
18	Process	Effective training	No
19	Process	Effective expectation management	No
20	Process	Effective lessons learning	Yes

Table 6.2. 20 OISD project success factors
(adapted from Table 4.2)

Further analysis of the success factors listed in Table 6.2 revealed that each of the factors comprised a number of more detailed factors/criteria and relationships between them. The subsequent relationship analysis went on to identify nearly 2,000 of these “detailed” factors (refer to Table 6.3).

Factor set	Number of factors/criteria identified
Interview participants	1,988
Relationship data set	1,414
Active relationship network	930

Table 6.3. Number of success factors/criteria by factor set

The detailed success factors (and criteria) identified by the relationship analysis can be divided into three distinct factor sets (refer to Table 6.3). The first of these contains the 1,988 success (and failure) factors (and criteria) identified by the interview participants. Although these are valid success factors/criteria, not all were contained in one or more relationships and, hence, could not be shown to influence project success. Thus, the 1,395 success factors/criteria contained in the relationship data set are more relevant. However, the relationship analysis revealed that only 916 of these factors (and 14 success criteria) actually influenced project success. Hence, these 916 success factors (and 14 success criteria) are the most relevant of all the factors identified in this study; not only were they cited as success factors by the interview participants, but the relationship information provided during the interviews allowed the relationship analysis to show that they did, indeed, influence project success.

As a simple list, the “top 20” success factor listing depicted in Table 6.2 seems somewhat unremarkable. That is, although it sits well with the success factors lists produced by prior research (see, for example, Table 2.1), and contains a number of factors not previously addressed by the literature, it does nothing to describe what these factors actually are. Consequently, the value that it adds to understanding of OISD project success factors is somewhat limited. However, this criticism is addressed, not only by the thick, rich narratives provided for each of the factors, but also by the 916 detailed success factors identified by the relationship analysis. Of the 916 factors, only 109 are contained in the literature, thus revealing 807 “new” success factors (listed in Appendix 5.2). However, although this would seem to be a large number of newly identified factors, it is worth remembering that the relationship analysis was conducted at a level of detail that has not been addressed by prior OISD project success factor studies.

By means of the thick, rich descriptions provided for the 20 success factors presented in Chapter 4 and the detailed factors identified by the relationship analysis (refer to Chapter 5), the findings of this research project provide a number of valuable insights into OISD project success factors. First, the findings enhance understanding of the actuality of real-world OISD projects; an aspect

of the findings that should not be underestimated, as the reader no longer has to refer back to the normative project management literature to determine what these factors might actually mean. The findings also confirm the significance of previously reported success factors (in the OISD project success factor literature). A number of additional factors are also identified and described. Notable omissions in the findings are identified, and differences between supplier and client perspectives discussed. The findings also develop a variety of factors, poorly described in the literature. The key findings relating to OISD project success factors are presented below.

6.3.1 Factors identified by this research and also cited in the literature

The 60 most commonly cited success factors in the OISD project success factor research literature are listed in Appendix 2.4. As discussed above, this listing predominantly reflects the in-house/client perspective. And, as had been anticipated, the majority of the entity-based success factors identified by this study (refer to Table 6.2) have corresponding (or similar) entries in Appendix 2.4 i.e. 13 of the factors had already been identified by prior research. These factors are listed in Table 6.4.

Type	Factor
Process	Effective requirements management
Actor	Effectiveness of the project team
Process	Effective communication
Actor	Effectiveness of the project manager
Process	An effective development approach
Actor	Effectiveness of the client organisation
Actor	Effective client involvement
Process	Effective project planning
Artefact	Fit for purpose technology
Process	Effective risk management
Process	Effective change management
Process	Effective training
Process	Effective expectation management

Table 6.4. OISD project success factors identified by prior research

Not only had this been anticipated, but it would have been disturbing if this had not been the case. It is relatively commonplace for IT professionals to advance their careers and, in so doing, move from in-house IT departments to external IS/IT solution suppliers (and vice versa). If OISD development projects were perceived to be radically dissimilar by supplier and client organisations, these moves would not be practicable. Thus, the findings of this research suggest that, the majority (13) of high level (entity-based) success factors are equally applicable to in-house and supplier-based OISD projects. That said, further claims can also be made. In particular, 12 of the 13 factors⁵⁷ are applicable to any organisational project; for example, effective project planning, effective risk management, etc.

6.3.2 Factors identified by this research but not cited in the literature

The findings of this research project contain numerous detailed success factors not found in the OISD project success factor literature. This is particularly true

⁵⁷ An effective development approach (Factor 5 in Table 6.2) is the only factor to be excluded as it is specific to OISD projects.

for factors identified at a detailed level (as listed in Appendix 5.2 and also discussed above in Section 6.3, p. 235). However, in relation to the high-level success factors listed in Table 6.2, seven can be considered to be newly identified by this study (as listed in Table 6.5).

Type	Factor
Process	An effective sales process
Artefact	A fit for purpose project governance model
Process	An effective project start-up
Process	Effective software testing
Process	Effective stakeholder management
Process	Effective post implementation support
Process	Effective lessons learning

Table 6.5. New OISD project success factors identified by this study

Although the reasons for the exclusion of these factors from the OISD project success factor literature are not clear, further discussion of the factors might provide an explanation. Consider, for example, an effective sales process (Factor 8 in Table 6.2) which, as a success or failure factor, does not feature in prior OISD project success factor studies; not even in the form of supplier selection or the client's procurement process (which was also acknowledged by some of the interviewees as a success factor). The need for an effective sales process was clearly articulated by a number of the interview participants. Although there are other means by which an IS solution provider might acquire a project (for example, by way of reputation or repeat business), the sales process still seems to represent the primary vehicle by which future business is secured. Yet the sales process was depicted by the interview participants to be a somewhat challenging and troublesome affair. The root cause of some of these difficulties lay with the client organisation; for example, senior managers who did not possess sufficient understanding of what they wanted⁵⁸.

⁵⁸ Interestingly, this issue has only previously been reported by Moynihan (1996) in his study of IS solution providers in Ireland. Therefore, based on empirical evidence provided to date

Conversely, other difficulties could be described as being self-inflicted; for example, over-selling on the part of the organisation's own sales staff. Whichever is the case, the sales process should be considered crucial to project success (no project, no success) and potentially challenging in its execution. Why then does it not appear in the OISD project success factor literature?

This might simply be because the projects addressed in prior studies are predominantly in-house development projects (see p. 49). It might also be because researchers have previously taken a relatively narrow view of the project life cycle; say, from project start-up to delivery (thus, excluding the sales process from the project life cycle). Similarly, the participants of prior studies may have taken the same view. This might also explain the exclusion of effective post implementation support and effective lessons learning. However, if the sales process has long been troublesome (as portrayed by this study), should not the participants in prior studies have been well aware of its consequences? Unfortunately, this might not necessarily be the case. For example, it is reasonable to suggest that client-side stakeholders are not exposed to the consequences of a badly executed sales process in the same way that the supplier's stakeholders are. And, given that the majority of client-side stakeholders (as participants in prior studies) play no part in the sales process (and, for that matter, post implementation support and lessons learning), it is quite possible that this lack of exposure (to the process and the consequences) is the reason that the sales process is not present in prior literature.

As for the remaining factors, the reasons are similarly unclear. However, one possible explanation is that the projects addressed by prior studies seem to be smaller rather than larger (see p. 49). Hence, the need for a fit for purpose project governance model is not as acute as for larger projects (see p. 170).

(including that from this project), this factor might be construed as only affecting OISD projects in the British Isles.

The interviews also suggested that this might also be the case for the three remaining factors. For example, effective software testing certainly becomes more difficult for larger projects (see p. 164), as does effective stakeholder management (see p. 150) and conducting an effective project start-up (see p. 141). However, the omission of software testing could also be because it is not viewed by client organisations as being important and hence, in situations where a project is behind schedule, becomes one of the first activities to be squeezed in terms of the time made available for it (see p. 164). The same is perhaps true for a project's start-up, with client organisations keen to get started on the development activities required to deliver the project deliverable.

6.3.3 Factors cited in the literature but not identified by this research

The literature contains a number of factors that were not identified by this research or, alternately, only received minimal attention in the interviews. For example, project monitoring and control appear in the literature (as two separate factors) but were hardly mentioned by the interview participants. Perhaps the relatively mundane nature of these processes caused the interview participants to relegate them to being "givens" and not requiring any discussion. Whatever the reason, they are not afforded any real significance in the interviews. Similarly, the project's target business processes, i.e. those that will be affected by the implementation of the information system, are absent (as success factors) in the interview transcripts. Although the reason for this is not clear, it is possibly because the interviews focussed very much on development, not implementation.

There is, however, one factor that is (almost) conspicuous by its absence in the findings of this study: the supportiveness of the project board (also referred to as executive management support and/or commitment). Admittedly, it was identified by one participant as an important factor, but, then again, only for large projects. Given that the OISD projects in this study are relatively small and that all of the other interview participants made no mention of the factor, it is reasonable to conclude that the project board supportiveness is not a significant success factor in this study. This is somewhat surprising because the

supportiveness of the project board can be found regularly in the uppermost ranks of “top 10” OISD project success factor lists. Indeed, it is the 2nd most highly ranked factor in Appendix 2.4. Why, then, is this not reflected in the findings of this study?

Again, there are a number of possible explanations for this. It may be due to bias introduced to quantitative surveys carried out by prior research. A relatively common practice employed by researchers was to identify important success factors in the literature and then incorporate these into their survey instruments. This helped ensure that project board supportiveness was a regular feature in questionnaires sent out to practitioners. In this way, the probability of project board supportiveness being identified by the respondents as a significant success factor was higher than it would be, say, in an open ended interview, in which the participants can identify factors as they see fit. Hence, the bias in the quantitative surveys might have maintained project board supportiveness as being more significant than is actually the case. However, it might also be because IS/IT projects have changed over recent decades in terms of their novelty, the fear associated with them and the need for support from upper levels of management. Coupled with the relatively small project sizes addressed by this research, it may well be the case that support from the project board (as a senior management group) is not as relevant as it was in the past. Instead of requiring senior management input, the necessary support for OISD projects can be delegated to lower levels of the organisation. Indeed, the interviewees provided a number of examples of this i.e. staff members acting as sponsors and facilitators of OISD projects and, thus, providing the necessary commitment and support to enable the project to be successful.

6.3.4 The development of factors cited in the literature

When considered as a research objective, the development (or, indeed, exploration) of factors cited in the literature represents “easy pickings” for any qualitative study investigating real-world OISD project success factors. This is simply because the vast majority of prior research does not explore or describe

the real-world factors that it identifies⁵⁹. This leaves the reader with little option but to refer back to the predominantly normative literature which, in the main, does not reflect the actuality of real-world projects (Crawford, Morris, Thomas, & Winter, 2006, p. 724). Hence, it can be argued that the thick, rich descriptions provided by this research project clearly enhance understanding of the actuality of real-world OISD projects and, in particular, their success factors, albeit for supplier-based projects from the perspective of IS/IT solution providers in central Scotland.

The development of factors cited in prior literature can also reveal important differences between the findings of prior, predominantly in-house/client based studies and the supplier perspective provided by this research. Consider, for example, the importance of employing an effective development approach (Factor 5 in Table 6.2), considered important by a number of interview participants. Although a few success factors relating to development methodologies can also be found in the literature, the approach favoured by the interview participants is at odds with the findings of previous studies. In particular, prior research provides a limited amount of support for evolutionary and agile approaches, whereas the findings of this research advocates an incremental approach. In fact, the interview participants considered agile software development to be wholly inappropriate for OISD development projects (and provided plausible evidence to support their view) (see p. 187). Hence, incremental software development represents a success factor that is not addressed in the literature.

However, it is the justification provided by the interview participants for employing an incremental approach that merits discussion. On the whole, the interview participants considered an incremental approach to be a success factor, not because it provided any direct benefit to the supplier organisation, but because it delivered benefits to the client organisation both quickly and

⁵⁹ Indeed, even when articles do provide descriptions (or additional data) for the factors they identify, these descriptions tend to be somewhat limited.

often. This suggests that IS solution providers can be described as being client oriented and even as having their clients' best interests at heart. Indeed, the findings of relationship analysis (discussed below) support this view. Not only did the analysis show supplier-based OISD projects to be oriented towards project success (as opposed to project management success), but the success criteria influenced most by OISD project success factors were also found to be client satisfaction followed by client benefit.

Of course, there are limitations to the benefit that might be derived from the development of factors. For example, the findings are based on the perceptions of a limited number of interviewees. Then again, the number of interviewees compares favourably with similar studies i.e. the sample size of 33 is larger than studies such as Moynihan (1996): 14 participants, and Taylor (2007): 22 participants. The sample also comprises highly experienced individuals who, therefore, can be considered to be experts in the field with appropriately informed views.

There are also consequences regarding the completeness of the findings. Although the thick, rich descriptions present substantial narratives for a wide range of success factors, it would be foolish to claim that the coverage is complete in terms of the factors covered and the detail provided. OISD project success factors is an enormous concept that, realistically, cannot be addressed in detail by a quarter of a million words collected through 33 interviews. Therefore, although the reader should be able to draw their own conclusions regarding the information provided by the interviewees, what should be deduced about what was *not* said?

Consider for example, effective risk management (see p. 149). The views of the interview participants clearly reflect the need for continuous risk management in which potential risks are continually monitored and reviewed to ensure that they are kept up to date. However, although this addresses the currency of risks throughout a project, it does not address how they should be dealt with; for example, through standard risk response strategies i.e. avoidance, transference, mitigation and acceptance (see, for example, Project

Management Institute, 2008, p. 303). Therefore, by way of their omission, does this mean that interview participants do not consider the use of these strategies to be success factors, or is it perhaps that they view these strategies as “givens”; factors that are simply *assumed* to be important and, hence, do not need to be mentioned? Likewise, although their omission most likely excludes the strategies from being considered as failure factors by the interview participants, perhaps they were simply omitted in the interviews simply because the participants *forgot* to mention them. In summary, although the thick, rich descriptions serve to enhance understanding of success factors for real-world OISD projects, they do bring with them certain limitations, the effects of which should be clearly understood.

As might be expected, certain types of factors were developed more than others. This is particularly well demonstrated by the “new” detailed factors identified by the relationship analysis (refer to Appendix 5.2). As Appendix 5.2 shows, the majority of “new” detailed factors are associated with actors found in a supplier-based OISD project and that the numbers of factors for the other entity types (artefacts, externalities and processes) are substantially less. Thus, actors have been developed further than the other entity types. As a result, the findings of this study suggest that project actors embrace substantially more success factors than previously indicated in the literature. However, is it actually the case that the literature does not adequately identify actor related success factors, or can it be explained by some other reason? Perhaps it was because the researcher inadvertently steered the interviewees to discuss actor related success factors. However, given the care taken to negate interviewer bias, this is unlikely. Therefore, a more adequate explanation might be that the interviewees were genuinely “people” focussed. After all, it is “people who deliver projects, not processes and systems” (Cooke-Davies, 2002, p. 189). On the other hand, perhaps people are simply easier to describe than, say, artefacts and processes. Similarly, perhaps the interview participants were of the opinion that they understood project actors better than the other entity types. All of these reasons are plausible explanations for the development of

actor related success factors provided by this research project. Unfortunately, the reader is still left to decide which, if any, of these explanations apply.

All of the above said, the development of thick, rich descriptions does serve to enhance understanding of OISD project success factors and the actuality of real-world OISD projects. A pertinent example of this is end user involvement, a success factor widely cited in the literature. One criticism of this factor *per se*, is that there is no explanation of what the end users are involved in. The findings of this research corroborate this; for example, that end users (discussed within the context of client involvement; see Factor 7 in Table 6.2) should be involved in project start-up, requirements elicitation and even the sales process (see p. 184). Another criticism of end user involvement *per se*, is that it often occupies the premier position in “top 10” success factors lists that do not contain any other involvement related factors. As a result, there is a danger that the involvement of end users assumes a disproportionately high significance at the expense of the involvement of other actors; for example, the project board. Again, this research addresses this by showing that a successful OISD project requires the involvement of other actors other than the end users; for example, the project board, domain experts and the client’s IT department (see p. 184).

6.3.5 Discussion of the differences between supplier and client perspectives

The discussion thus far has identified differences in perspective between the supplier and in-house/client organisations, regarding the significance of various success factors (for example, project board supportiveness). This has been based upon the new and existing factors identified by this study in relation to the OISD project success factor literature, as depicted by the results of the success factor analysis (see p. 42). As previously discussed, these results are considered to reflect an in-house/client perspective for smaller rather than larger projects (see p. 49).

Although the evidence presented in the literature review supports this view i.e. that the literature predominantly reflects an in-house/client perspective for relatively small projects (see p. 49), there are a number of caveats that should

be taken into account. The first is that researchers in the field are quite often remiss in clearly describing the scope of their research (see p. 41). For example, Wallace & Keil (2004) (Article 50 in Appendix 2.2) fail to clarify whether they are investigating software development from an in-house or supplier-based perspective; nor do they make it clear whether they are presenting a supplier or in-house/client perspective. Hence, although the literature appears to reflect an in-house/client perspective for relatively small projects, this cannot be guaranteed. The second problem is that prior research does not sufficiently describe the real-world success factors that it identifies. Consequently, this limits the extent to which this research can compare its findings with those presented in the literature. In summary, although the evidence presented in the literature review supports the view that the literature predominantly reflects an in-house/client perspective for relatively small projects, the caveats discussed above should be taken into account in relation to the discussion presented above in this section.

All of the above said, there are a number of additional differences that can be identified by this research. For example, one apparent difference is that suppliers clearly differentiate between success factors for the supplier and client organisations and associated stakeholder groups (for example, the supplier-side and client-side project teams). Based on the literature, this distinction is far less clear, perhaps because client organisations view their own responsibilities for the project to be far less than the supplier organisation. For example, as noted by a number of the participants, client organisations quite often underestimate their involvement in a project (see p. 184). This is contrary to the participants who, by identifying success factors for supplier and client-based actors, clearly perceive the success of an OISD project to be dependent on both organisations.

Supplier organisations also seem to be quite critical of their own competences. Indeed, the interview participants were quite open in discussing areas in which their organisations had failed (or were failing) or where improvements in performance were required (or had been made). A similar degree of constructive self-criticism by the client organisation is not as evident in the

literature. Perhaps this is because in-house/client organisations simply do not recognise their own failings. In fact, the interviewees provided a number of examples of this; for example, arrogant customers and those having unsatisfactory understanding of their requirements (see p. 184), without apparently being aware of these issues. But, again, it is not possible to provide a concrete explanation for these apparent differences in perception. Indeed, perhaps the reason why the interviewees were comfortable exploring factors in a self-critical manner was simply because the rapport built by the researcher provided a “safe” environment for them to do so.

6.4 Contributions made by the findings of the relationship analysis of OISD project success factors

The second objective of this research project was to provide a better understanding of the way in which OISD project success factors interact to influence project success. The qualitative analysis described above, by way of the thick rich descriptions provided for each factor, clearly showed that each of the 20 entity-based success factors comprised a range of detailed factors and relationships between them. Hence, a relationship analysis of OISD project success factors was performed. As the analysis was carried out at a very detailed level and identified 916 active factors, it does not seem to have a comparable study in the OISD project success factor literature. Indeed, the studies that have previously investigated causal interactions for IS and OISD project success factors have contained, on average (mean), only 12 factors in each⁶⁰ (see p. 41). In this respect, the relationship analysis can be described as an exploratory investigation, not normally associated with the qualitative research discussed above. The findings of the analysis constitute contributions to knowledge and theory for two research directions: (1) the influence of success factors on OISD project success and (2) causal interactions between OISD project success factors (refer to the six research directions presented in Section 6.2 above).

⁶⁰ Note, also, that the majority of these studies investigated IS/IT, not OISD, projects.

6.4.1 Utility and limitations of the relationship analysis

Prior to presenting these contributions (refer to Sections 6.4.2 and 6.4.3), a discussion of the utility and limitations of the relationship analysis is merited; that is, by considering the outputs of the analysis in relation to its inputs. As presented in Section 5.4, the input to the relationship analysis is the data generated by the data collection process (as described in Chapter 3) i.e. the interview transcripts. These transcripts were coded using a detailed data coding process. This allowed the relationship analysis to be performed, aided by a bespoke software application developed as part of the research project.

The output from the analysis helped to identify, describe and quantify a complicated active network constituting the delivery system for the influences of multiple base factors to affect OISD project success. In particular, the analysis showed that the network contained multiple (916) base success factors, each of which influenced project success through numerous long linear chains; on average, 122 million per factor, each with an average length of 35 factors/relationships, resulting in a total of 114 billion linear chains. The analysis also revealed the existence of numerous (2.94 million) interacting causal loops which, collectively, add a level of complexity to the behaviour of the network. In terms of factor activity, the analysis identified core sets of (133) active factors and (361) relationships that governed the network's propagation process. By investigating criteria activity, the analysis also revealed that the primary focus of supplier-based OISD projects was client-side organisational success (client satisfaction followed by client benefit), at the expense of supplier-oriented organisational success (payment from the client, etc.). The most active factors in the network; those located at convergence/ divergence points with high receptivity and range values were also shown to be significant in that they can be used to determine project performance over the lifecycle (or sections thereof) of the project.

However, the utility described above needs to be bounded by the limitations of the analysis (also discussed in Section 7.4.3). For example, the analysis addressed only the factor activity levels and, hence, ignored factor magnitude.

Similarly, the time taken by a source factor to influence a target factor was not taken into account. Factors were also considered to be mutually exclusive in terms of their causal chain sets. In addition, the consequences of a target factor being influenced simultaneously by the influences of multiple source factors were ignored. Finally, relationship types were modelled relatively simplistically i.e. as either positive or negative.

Hence, although the utility of the relationship analysis allows a number of contributions to knowledge and theory to be made (as described in the next two sections), these need to be bounded by the limitations described above. In particular, the analysis does not provide a complete picture of the complicated nature and inherent complexities of the active network. Similarly, the relatively small number of interviewees and the qualitative nature of the data collection and detailed coding processes negate the extent to which claims of generalisation of findings can be made. Indeed, as this research project was essentially a small scale study, in which the interview participants were identified using purposive, not random, sampling, attempts to generalise its findings would be inappropriate (Pickard, 2007, p. 59). Hence, this thesis makes no claims for the generalisation of its findings. Yet, this does not diminish the value of the research findings. Despite its limitations, the relationship analysis reveals levels of detail and complexity regarding the interaction of OISD project success factors that have not been addressed by prior research.

6.4.2 Contributions to knowledge

In addition to those described in Section 6.3, the primary contribution to knowledge provided by the relationship analysis is that it revealed a complex active network that may be considered as a delivery system for the influences of multiple base factors to affect OISD project success. The active network's topology was found to comprise:

- (1) Multiple (916) base success factors;
- (2) Numerous long linear chains per base factor (on average, 122 million per factor, with an average length of 35 factors/relationships, resulting in a total of 114 billion linear chains);
- (3) Multiple (98) convergence/divergence points with high receptivity (8.8) and range (3.9) values;
- (4) Numerous (2.94 million) interacting causal loops;
- (5) A small number of success factors that, under certain conditions, can contribute to project failure (for example, the project team's staffing level);
- (6) Core sets of (133) active factors and (361) relationships that govern the network's propagation process;
- (7) A set of (12) success criteria.

The most active factors in the network; those located at convergence/divergence points with high receptivity and range values were also shown to be significant in that they can be used to determine project performance over the lifecycle (or sections thereof) of the project. The three most active factors were found to be (1) the requirement's fitness for purpose, (2) the project's duration and the (3) number of project issues (refer to Table 5.7). The inclusion of success criteria also allowed the network to be used to provide an indication of success bias for supplier-based OISD projects i.e. that the primary focus of supplier-based OISD projects is client-side organisational success (client satisfaction followed by client benefit), at the expense of supplier-oriented organisational success (payment from the client, etc.). This topic is discussed further below in Section 6.5.3.

The relationship analysis builds upon previous studies carried out in this research direction (see p. 63). Prior studies enhance understanding of the causal interactions between success factors by identifying networks of casual chains and causal loops. Unfortunately, these networks are overly simplistic and do not provide satisfactory explanations of the behaviour of complex OISD projects. By addressing success factors and their relationships, the relationship analysis helps address this issue by producing a more comprehensive active

network that better reflects the complexities of contemporary OISD projects. The analysis also helps address the problem of managing, or at least monitoring, such a complex network. This is achieved by monitoring the most active factors in the network, which by being in a constant state of flux, can be used as early, mid and late warning signs or, in other words, indicators of ongoing project performance. As the relationship analysis showed, the most active factors are those found at the convergence/divergence points in the network with the highest receptivity and range values. The active network also contains a set of success criteria that can be used to determine the success bias for the OISD projects studies; for example, that supplier-based OISD projects are orientated more towards client-side than supplier-side project success. All in all, the resultant active network produced by the network analysis is a significant improvement on those found in the research literature.

6.4.3 Towards a network topology theory for OISD project success factors

The findings of the network analysis provide an excellent opportunity to enhance project success factor theory by explaining practice (as presented in the previous section) and building relevant theory (Morris, 2010, p. 144).

The evidence presented in the literature review suggests that real-world OISD projects (and projects in general) are inherently messy, ambiguous and confusing (Bredillet, 2005, p. 3). Contemporary OISD projects are also regarded as being complex (Alojairi & Safayeni, 2012, p. 16; Bredillet, 2005, p. 3; British Computer Society, 2004, p. 15; Crawford, Morris, Thomas, & Winter, 2006, p. 724; Fortune & White, 2009, p. 37; Williams, Klakegg, Walker, Andersen, & Magnussen, 2012, p. 44; Winter & Smith, 2006, p. 13; Xia & Lee, 2004, p. 69), with complexity cited as a failure factor in a number of studies (for example, Charette, 2005; Tiwana & Keil, 2004; Wohlin & Andrews, 2002). This view can be traced back to the early 1980s in that the management of OISD projects “is a very complex undertaking in which a complex network of interrelationships and interactions exists” (Abdel-Hamid & Madnick, 1983, p. 346).

Although the conceptual causal relationship models offered by prior research in the field (see p. 63) are useful for developing understanding of the interaction of

IS and OISD project success factors, they have a number of limitations. In particular, all of the studies address only a small number of key success factors and causal chains. Their treatment of causal loops and success criteria is also limited. Thus, they represent relatively simple scenarios, requiring the addition of more success factors, relationships and criteria to provide a better representation of complex OISD projects (Kim, 2004, p. 28; King & Burgess, 2008, p. 430). As this simplicity does not reflect the complex nature of contemporary projects (Bredillet, 2005, p. 3; Crawford, Morris, Thomas, & Winter, 2006, p. 724; Fortune & White, 2009, p. 37; Winter & Smith, 2006, p. 13), project success factor theory can only be described as weak in its ability to provide credible explanations of the behaviour of complex, real-world OISD projects.

Hence, the active network identified by the relationship analysis can be used to produce a more credible theory for the behaviour of complex, real-world OISD projects (and possibly broader project types such as IS/IT projects, organisational technology projects, organisational projects and even projects in general). Thus the following theory is proposed.

In real-world, supplier-based OISD projects, its incumbent success factors form a complex active relationship network that serves to deliver the influences of its success factors to affect project success. The topology of this network comprises the following constructs:

- (1) Multiple base success factors;
- (2) Numerous long linear chains per base factor;
- (3) Multiple convergence/divergence points with high receptivity and range values;
- (4) Numerous interacting causal loops;
- (5) The possible inclusion of small number of success factors that, under certain conditions, can contribute to project failure;
- (6) Core sets of active factors and relationships that govern the network's propagation process;
- (7) A set of success criteria.

The factors representing convergence/divergence points with high receptivity and range values serve to act as indicators of project performance over the lifecycle of the project. The inclusion of success criteria can also be used to determine the success bias/orientation of the project.

In summary, the network topology theory presented above contains elements that reflect the complex nature of real-world OISD projects. Hence, this theory is better placed than the simplistic conceptual/theoretical models found in the research literature to explain the behaviour of real-world OISD projects.

6.5 Contributions made by the findings related to OISD project success criteria

Although the primary focus of this research project was OISD project success factors, its findings also provide a number of useful insights into (1) success criteria for OISD projects and (2) the influence of success factors on OISD project success (refer to the six research directions presented in Section 6.2.2 above). These findings were derived from both the qualitative success factor analysis (Chapter 4) and the relationship analysis (Chapter 5).

During the interview process, the participants defined project success using a variety of success criteria (for example, schedule adherence, client satisfaction, etc.). These criteria are in accordance with a definition of project success that is commonly found in the literature i.e. the intended, successful outcome of a project. The success criteria can also be classified under (1) project management success and (2) organisational success (see p. 28). The success criteria for project management success are consistent with those provided in the literature i.e. schedule, budget and requirements adherence. The same can be said for the organisational success criteria i.e. client satisfaction and organisational benefit (client-side). Thus, so far, the findings can be said to correspond to the existing body of knowledge (as described in the literature review).

6.5.1 Organisational success from the suppliers' perspective

However, in relation to organisational success, the findings go on to make a clear distinction between the client and supplier organisations. As this distinction is not evident in the OISD project success literature, it constitutes a new dimension for organisational success for OISD projects. Thus, in addition to client satisfaction and client-side organisational benefit, the findings demonstrate the importance of benefit and satisfaction for the supplier organisation.

The research literature has, quite rightly, argued that project success criteria need to be extended beyond the realm of project management success (as denoted by the golden triangle) to encompass additional criteria such as organisational benefit (see p. 28). To recount the view of one interview participant: "So what if the project was a little over budget or was delivered a month late," when it delivered the anticipated benefit to the business (P10). However, although this provides the opportunity for organisational success to be measured against important client-side criteria (for example, client-side benefit and satisfaction), it does not explicitly take the needs of the supplier organisation into account. And, for supplier-based OISD projects, client-side benefit and satisfaction are of prime importance.

IS/IT solution providers are commercial organisations that share a common goal: to make money (see, for example, Goldratt & Cox, 1984). If they were unable to do so, these organisations would quickly cease to trade. Hence, over the longer term, the primary criteria, from a supplier's perspective, are not related to project management success or client-side organisational success. On the contrary, their primary success criteria need to reflect their ability to make money, as determined by the requisite return on investment and net profit level specified in their business plan/model. Therefore, on a project by project basis, key criteria will include the net profit derived from each project and, from a cash flow perspective, the timing of payments from the client.

In addition, supplier-side satisfaction (and enjoyment) is also an important success criterion. As the interview participants stated, getting paid is important

(P5, P22), but projects can also be enjoyable (P23, P28, P33). Extending this, in particular to the supplier-side project team, satisfaction (or even enjoyment) is an important part of project life. OISD projects are hard, not just for the project manager, but for the other stakeholders too. Therefore, it is important that the project team (and other stakeholders) derive satisfaction from their project experiences; otherwise productivity is likely to fall and, in the longer term, staff turnover might increase. And, for a supplier organisation, both of these potential outcomes can have serious consequences for their OISD projects and their business in general.

Hence, a contribution to knowledge made by the findings thus far, is the identification and description of supplier-side organisational success criteria for OISD projects. These criteria are particularly important for IS/IT solution providers and, therefore, an additional dimension of project success, demanding consideration during OISD projects. That said, the other success criteria identified by the interview participants are also extremely relevant. Budget adherence underpins financial performance for the client and supplier, and schedule adherence can also be key to both organisations. Clearly, requirements adherence is particularly important to the client, but also has ramifications for the supplier as well. In terms of organisational success, client satisfaction and benefits are hallmarks of a successful project and reflect the reasons why the project was undertaken in the first place. However, without criteria to measure the supplier's ability to make money and, to a lesser extent, the satisfaction of their staff, supplier organisations would soon cease to exist; hence, demonstrating the significance of these criteria for supplier-based OISD projects.

6.5.2 OISD project success criteria as influencers

The research literature makes a clear distinction between success factors and success criteria. Indeed, they may be considered as mutually exclusive. As previously discussed (see p. 27), theory states that success factors influence project success whereas success criteria are measures of project success. Thus, although success criteria are measurements, they are, in no way,

influencers. However, the relationship analysis carried out as part of this research project, suggests that these definitions are overly simplistic. Indeed, this research provides evidence that OISD success criteria are, in fact, influencers; not only as indicators of project success, but also as influencers of other success criteria and success factors. In addition, project success can also be shown to influence the success of subsequent projects. Consider, for the sake of argument, two examples presented in the previous chapter; as depicted in Figures 6.1 and 6.2 respectively.

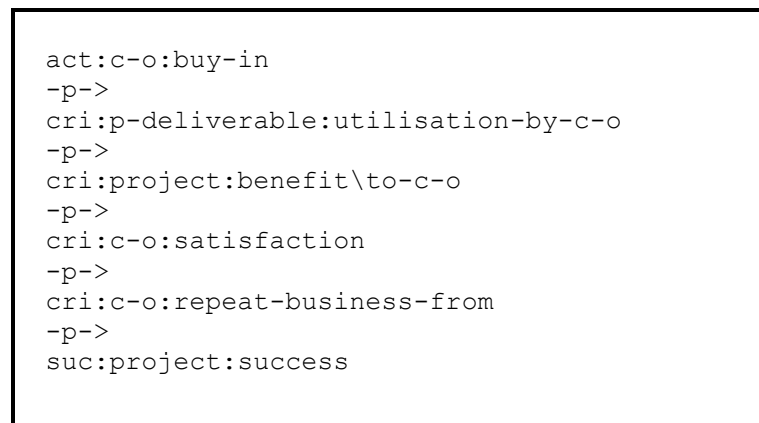


Figure 6.1. An active chain with success criteria influencing other success criteria
(replicated from Figure 5.16)

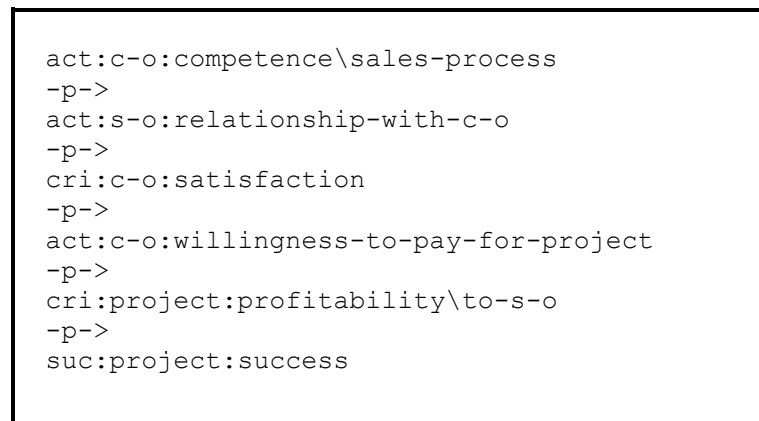


Figure 6.2. An active chain with a success criterion influencing a success factor
(replicated from Figure 5.17)

In the relationship data set, success criteria were modelled as indicators of project success. Consequently, the active relationship network provided numerous examples of success factors influencing project success via a limited

number of success criteria. However, the findings also revealed examples of success criteria influencing other success criteria (refer to Figure 6.1) and, also, success criteria influencing success factors (refer to Figure 6.2). These findings suggest that it is overly simplistic to define success criteria solely as measurements of project success. Not only are success criteria indicators of project success (and, hence, can be said to influence project success), but they are influencers, not only of other success criteria, but also of success factors.

A similar argument can be made for project success. Again, consider an example presented in the previous chapter (see p. 220). As Figure 6.3 shows, project success can also act as a success factor, albeit, not by influencing itself, but by influencing the success of subsequent projects performed for the same client.

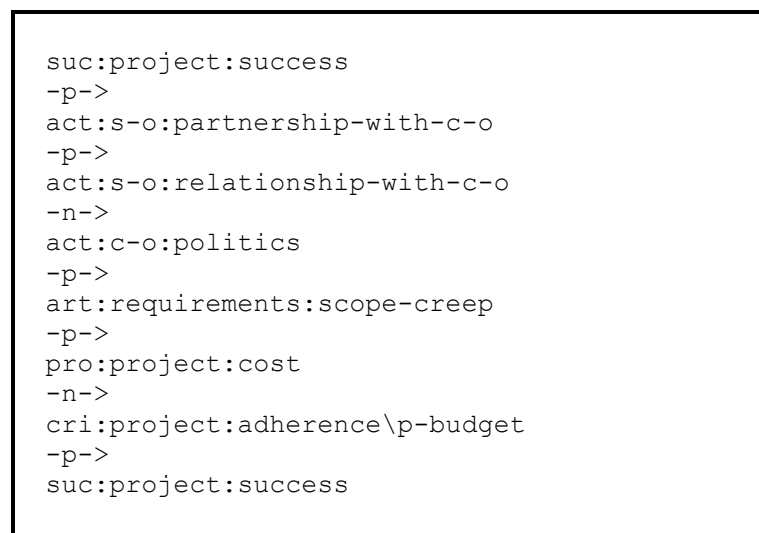


Figure 6.3. The influence of project success on future projects
(replicated from Figure 5.14)

These findings also represent a contribution to knowledge (and theory, as discussed in the next section). The examples described above (and others contained in the active relationship network) blur the distinction provided in the literature that success factors and success criteria (and, for that matter, project success) are mutually exclusive. Clearly, for supplier-based OISD projects, there are cases in which they are not. Indeed, the interview data provided examples of success criteria being identified as such by one participant and as

a success factor by another. Therefore, it seems reasonable to modify current theory by suggesting that success criteria are actually success factors (and, hence, influencers) identified by certain stakeholder groups as criteria for measuring project success.

6.5.3 The relative importance of OISD project success criteria

The literature contains a number of studies that have investigated the influence of a given success factor on project success. These studies have been carried out for OISD, IS/IT and generic projects (see p. 60) and their results determine if the factor under investigation has a positive, negative or no influence on project success. Success criteria are not normally taken into account as part of these investigations.

Rank	Success criteria	Relative activity level
1	cri:c-o:satisfaction	100
2	cri:project:benefit\to-c-o	63
3	cri:project:adherence\requirements	63
4	cri:project:adherence\p-budget	53
5	cri:c-o:payment-from	49
6	cri:project:profitability\to-s-o	34
7	cri:c-o:repeat-business-from	33
8	cri:p-deliverable:utilisation-by-c-o\end-users	32
9	cri:c-o\p-board:satisfaction	31
10	cri:c-o\end-users:satisfaction	26
11	cri:project:adherence\schedule	26
12	cri:p-deliverable:utilisation-by-c-o	26

Table 6.6. The 12 most active success criteria in the active relationship network
(replicated from Table 5.8)

As discussed in the previous section, the relationship analysis conducted as part of this research, did take success criteria into account. This enabled the analysis to calculate the activity levels of individual success criteria. The analysis revealed that the factors contained in the active relationship network

had a greater effect on certain criteria than they did on others (as shown in Table 6.6).

As Table 6.6 shows, the factors in the active relationship network, when taken as a whole, have a greater effect on client satisfaction than any other success criterion. Put another way, this shows that, based on the overall effect of their success factors, supplier-based OISD projects are oriented towards client satisfaction. Indeed, as client benefit ranks 2nd in Table 6.6, supplier-based OISD projects can be viewed as being oriented towards organisational success (as defined in the literature; 28). However, as the highest positioned supplier-oriented organisational success criterion ranks only 5th in Table 6.6, it would seem that client-side organisational success assumes a greater significance than supplier-side organisational success. A similar differential can also be seen for project management success i.e. supplier-based OISD projects are more oriented towards requirements and budget adherence (ranked 3rd and 4th respectively) than they are to schedule adherence (ranked 11th).

In summary, the research literature recognises that, within the golden triangle, budget, schedule and requirements adherence might not be equally important (see p. 19). For example, schedule adherence might be preferred over budget adherence. A contribution to knowledge made by this analysis is the suggestion that, for project management success, supplier-based OISD projects are more oriented towards requirements adherence and, to a lesser extent budget adherence; but significantly less so to meeting the project's due date.

However, the primary focus of supplier-based OISD projects seems to be client-side organisational success (client satisfaction followed by client benefit), although this is at the expense of supplier-oriented organisational success (payment from the client, etc.). Although this might seem to contradict the argument presented in Section 6.5.1 that supplier-oriented organisational success is of prime importance, a better interpretation seems to be that supplier-oriented organisational success is best served by focussing on client-side organisational success.

6.6 Additional contributions

In addition to the primary contributions to knowledge and theory presented above, this research project also provided a number of additional contributions. These contributions are described in this section.

6.6.1 The literature review as a contribution to knowledge

The literature review should also be considered as a contribution to knowledge in its own right. With a few exceptions (most notably, Ika, 2009), there is a lack of articles with the sole purpose of performing a comprehensive review of literature covering research into project success factors (and related topics such as project success and project success criteria). A comprehensive literature review for OISD project success factors has yet to be published. Unfortunately, for project management, all too many researchers are not familiar with the “depth of literature” in the field and are failing to acknowledge the contributions made by prior research (Morris, 2010, p. 143). Consequently, the publication of articles containing comprehensive literature reviews would serve to enhance understanding of the literature and assist knowledge development in the field of OISD project success factors. In this respect, the literature review presented in this thesis assists in satisfying this need. By performing a critical review of the literature in the field and, thereafter, deriving appropriate recommendations for further research, the literature review represents a contribution to knowledge in the field of OISD project success factors, by either its inclusion in a PhD thesis or its potential for future publication.

6.6.2 Implications for project management theory

Whilst discussing the background to this research project, project management was subjected to ample criticism regarding its theoretical basis (see p. 22) and bodies of knowledge (see p. 24). In particular, project management theory was criticised for being predominantly normative and, as such, not reflecting the actuality of real-world projects. In addition to being similarly berated, project management’s bodies of knowledge were also accused of treating all projects as a homogeneous concern and thus failing to explain how project management can be applied to different types of project. However, although these

shortcomings appear to be valid, the findings of this research project suggest that the criticisms noted above might be somewhat overstated.

In the literature review, Turner's theory on project management was cited as typifying normative project management theory. This was because its corollaries (predominantly processes) and roles (listed in Appendix 2.1) are representative of the normative project management material that dominates the project management literature (see p. 22). Interestingly, many of the entity-based success factors identified by the interview participants (listed in Table 6.2) reflect Turner's corollaries and roles. For example, in terms of roles, both lists (Appendix 2.1 and Table 6.2) contain the project manager and project team, while other roles in Turner's theory can be found in the narratives provided for each success factor; for example, end users and the project sponsor. Similarly, a number of processes cited by the interviewees as success factors also appear in Turner's theory as corollaries; for example, risk management, requirements management and project planning (an aspect of time management). In addition, Turner's project contract and procurement management can be considered as the client's perspective of the sales process cited by the interview participants. Finally, from these thick, rich narratives, references to other processes cited in Turner's theory can be found; for example, resource management, benefits management and project management (management of the project).

Another feature of the interviews was that they contain no criticisms of the normative success factors (also found in Turner's theory) identified by the interview participants. Instead, the interviewees were prone to provide criticisms regarding the misuse (or abuse) of certain normative processes; for example, risk management, the sales process and project planning. Therefore, given these criticisms, and the evidence provided in the previous paragraph, it would seem that the interviews provide a degree of support for normative project management. And, by providing various examples of normative processes and roles in real-world OISD projects, the overall view of interview participants would seem to indicate that the criticisms presented in the literature review are, at least in part, unwarranted.

Project type	Definition
OISD	Projects that involve bespoke software development to deliver an information system for end users in a host organisation.
Information system (IS/IT)	Projects that deliver an information system for end users in a host organisation e.g. an enterprise resource planning (ERP) implementation project.
Organisational technology	Projects that deliver a technology product for end users in a host organisation e.g. a project to introduce a new manufacturing technology to production operatives.
Organisational	Projects not involving the delivery of a technology product in a host organisation (most likely some kind of organisational change) e.g. a business process re-engineering (BPR) project.
Generic	Projects that require the use of generic project management principles e.g. a new product development (NPD) project.

Table 6.7. Project types
(replicated from Table 2.3)

This research also produced findings that relate to the extent to which project management can be applied to different types of project. As part of the success factor analysis (conducted as part of the literature review) and also the relationship analysis (presented in Chapter 5), all of the success factors identified were assigned to one of five project types (as listed in Table 6.7).

Project type	Literature review success factor analysis	Relationship analysis	
		Base factor activity	Receptive factor activity
OISD	5%	5%	3%
IS/IT	4%	5%	4%
Organisational technology	9%	1%	0%
Organisational	21%	13%	15%
Generic	61%	77%	78%

Table 6.8. OISD project success factors activity levels by project type
(derived from Tables 2.9 and 5.10)

The results of these analyses (presented in Table 6.8) show that, in terms of OISD and related project types, generic project management, as espoused in the literature, is not sufficient to apply to all of the success factors that are pertinent to OISD and IS/IT projects. However, what the results do show is that

the success factors for OISD projects (and IS/IT projects) are related predominantly to generic and, to a lesser extent, organisational project types. Indeed, the proportions provided for generic and organisational project types in Table 6.8 are most probably understated as the proportions provided for OISD and IS/IT project types relate more to delivery process (those concerned with producing the project's deliverable) than project management processes. Hence, it can be concluded that a high proportion of project management theory and/or best practices, as purported in the normative project management literature (for example, the project management bodies of knowledge) is relevant, and therefore transferrable, to OISD and IS/IT projects.

6.6.3 The fieldwork process as a contribution to knowledge

Although the research instruments described in Chapter 3 are by no means original or exclusive to this research project, their collective use does constitute a fieldwork approach that has not been employed by previous OISD project success factor studies. And, given that this research project has produced original contributions to both knowledge and theory (as discussed above), the fieldwork approach can also be considered as a contribution in its own right. For example, it has the potential to be used, and perhaps adapted and/or improved, for future research studies in both academic and professional contexts.

In this respect, a number of aspects of the fieldwork approach merit discussion. First, the fieldwork identified and adopted a specific syntax (comprising entities and characteristics) to represent success factors throughout the course of the research. In addition to providing consistency throughout the project, the syntax is also ideally suited for success factor modelling by means of simulation software or contemporary object-oriented languages (for example, Java or C#).

The use of semi structured interviews, more reminiscent of open ended interviews⁶¹, also proved particularly effective in gathering data for the qualitative and quantitative (network) analyses. Not only did this approach allow

⁶¹ Given that the main part of the interview concentrated on the main research question.

the qualitative analysis to identify 20 entity-based success factors, but it provided the basis for rich, thick descriptions for each of the factors. The significance of these descriptions should not be undervalued. First, they enhance understanding of the actuality of real-world OISD projects. Second, they reveal that entity-based success factors are not mutually exclusive and, more so, comprise collections of more detailed success (and failure) factors and relationships between them. Finally, the relationship analysis was used to quantitatively analyse the detailed factors contained in the interview transcripts and also the relationships between these factors (as well as various success criteria and project success). The results of this analysis revealed an active relationship network which, being more extensive than those presented by prior studies, and exhibiting certain characteristics in terms of its topology, is better suited to explaining the behaviour and complexities of contemporary, real-world OISD projects.

6.7 Conclusion

This chapter has presented the contributions to knowledge and theory provided by this research project. The scope of these contributions is both wide and varied. The identification and description of 20 entity-based success factors enhances understanding of the actuality of real-world, supplier-based OISD projects. Similarly, the active network produced by the relationship analysis has shown that the way in which success factors influence project success is a complex process, again more representative of the actuality of real-world projects. Hence, the active network was used as a basis for a network topology theory that might better explain the behaviour of complex OISD projects. A number of lesser contributions to knowledge and theory were also made in relation to OISD project success criteria. Finally, a number of additional contributions were described. In summary, the contributions presented in this chapter enhance understanding of the actuality of real-world supplier-based OISD projects and improve upon the theoretical basis for OISD project success factors.

Hence, all that remains to complete this thesis is a reflective discussion of its content thus far with emphasis on aspects such as how well the original research objectives have been met, the fitness for purpose of the research methodology and recommendations for further research. This discussion is provided in the next and final chapter.

7. Conclusions

7.1 Introduction

The purpose of this chapter is to reflect upon the work described thus far and offer pertinent conclusions for the thesis. In the next section, the extent to which the project has met its research aims and objectives is discussed. This is followed by a discussion of the fitness for purpose of the research methodology. Next, a number of recommendations for further research are presented. The chapter ends with conclusions for the thesis as a whole.

7.2 Meeting the original research objectives

The aim of this research project was to provide a better understanding of the reasons why OISD projects succeed or fail. Achieving this aim required a critical review of the research literature for OISD project success factors and closely related subject areas. The literature review gave rise to two specific research objectives, both of which are discussed below.

7.2.1 Research objective 1: To provide a better understanding of OISD project success factors from a suppliers' perspective

To satisfy the first research objective, this research project investigated success factors for OISD projects from the perspective of IS/IT solution suppliers in central Scotland.

20 success factors for supplier-based OISD projects were identified and described. The thick, rich descriptions provided for each factor enhance understanding of the actuality of real-world OISD projects. These descriptions also revealed that each of the 20 factors comprised a range of more detailed factors and relationships. The importance of several factors found in the predominantly in-house/client OISD project success factor literature was confirmed; for example, effective requirements management and effective communication. A number of additional factors were also identified; for example, an effective sales process and an effective project start-up, as were

some notable omissions; for example, project board supportiveness. Hence, important differences between supplier and client perspectives were revealed. Understanding of a variety of factors, poorly described in the OISD project success factor literature, was also enhanced.

7.2.2 Research objective 2: To provide a better understanding of the way in which OISD project success factors interact to influence project success

To satisfy the second research objective, this research project conducted a relationship analysis of OISD project success factors at a detailed level. In summary, the analysis investigated the way in which success factors propagated their influences to affect project success. The findings of this analysis greatly surpassed the expectations of the researcher.

The way in which OISD project success factors propagate their influences to affect project success was revealed to be a complex phenomenon comprising a sizeable network of active factors. The topology of the network can be described by the following constructs:

- (1) Multiple (916) base success factors;
- (2) Numerous long linear chains per base factor (on average, 122 million per factor, with an average length of 35 factors/relationships, resulting in a total of 114 billion linear chains);
- (3) Multiple (98) convergence/divergence points with high receptivity (8.8) and range (3.9) values;
- (4) Numerous (2.94 million) interacting causal loops;
- (5) A small number of success factors that, under certain conditions, can contribute to project failure (for example, the project team's staffing level);
- (6) Core sets of (133) active factors and (361) relationships that govern the network's propagation process;
- (7) A set of (12) success criteria.

The most active factors in the network; those located at convergence/divergence points with high receptivity and range values were also shown to be

significant, in that they can be used to determine project performance over the lifecycle (or sections thereof) of the project. The three most active factors were found to be (1) the requirement's fitness for purpose, (2) the project's duration and (3) the number of project issues. The inclusion of success criteria also allowed the network to provide an indication of success bias for supplier-based OISD projects.

The active network described above was found to be more representative of contemporary, complex OISD projects than the simplistic causal models provided by prior research. Hence, the network topology described above was used to provide a more satisfactory theory that better explains the way in which success factors propagate their influences to affect OISD project success.

7.2.3 An implicit research objective: To provide a better understanding of OISD project success criteria

This research project did not set out to provide a better understanding of OISD project success criteria. Indeed, the question: "How do you define project success?" was only added to the interview process to provide context for the main research question⁶². With hindsight, the significance of this contextual question was underestimated. Indeed, the question, "How can you say what the correct success factors are until you have identified the criteria?" (Turner, 1996 cited by Ika, 2009, p. 9) implies that the question: "How do you define project success?" in its own right gives rise to a third research objective, albeit implicitly: to provide a better understanding of OISD project success criteria.

Various success criteria (for example, budget adherence and client satisfaction) were identified as indicators of project management success and organisational success. Some of these criteria (for example, supplier satisfaction and supplier-side project profitability) are not described in the literature and, hence identify a new supplier-side dimension for OISD project success. Supplier-based OISD projects were also found to be (1) oriented more towards organisational

⁶² And also to help prevent interviewee lockjaw.

success than project management success and (2) more oriented to towards client-side than supplier-side organisational success. OISD project success criteria were also found to extend beyond being measures of success. Not only are success criteria indicators of project success, but they can be seen to influence success factors and other success criteria.

7.2.4 Additional contributions to knowledge provided by this research project

Over and above the findings described above, this research project provided three additional contributions. As discussed in Chapter 6 (see p. 262) these are (1) the literature review and (2) the fieldwork process as contributions to knowledge, and (3) the implications for project management theory based on the findings of this research. Although these contributions are of a lesser stature than those described above, they do assist in further demonstrating the achievements made by this research.

7.2.5 A summary of the contributions provided by this research project

The findings for this research represent important and original contributions to knowledge and theory. The findings are both wide and varied. Not only do they identify and describe 20 factors that contribute to supplier-based OISD project success, but the way in which these factors, at a detailed level, propagate their influences to affect project success is shown to be phenomenally complex. These findings make important contributions to knowledge by describing the actuality of real-world OISD projects. The active network revealed by the relationship analysis also makes an important contribution to OISD project success factor theory. The implicit and additional findings discussed above also make contributions, albeit to a lesser extent, to knowledge and theory. All in all, the findings show that the concepts of OISD project success factors and success criteria are far more complicated than portrayed in the literature. Thus, the project's research objectives can be considered to have been met; and the overall research aim: to provide a better understanding of the reasons why OISD projects succeed or fail, to be satisfied.

7.3 Fitness for purpose of the research methodology

The research methodology proved particularly effective in fulfilling the research objectives described above. Yet, the chosen research methodology is important and should be evaluated independently of the research outcomes (Hall, 2004, p. 194). Here, the research methodology described in Chapter 3 is reviewed in relation to the strengths and weaknesses (and also difficulties and limitations) of the approach.

Commencing with the weaknesses, a number of these were to be expected, especially as this was a student research project conducted by a solitary researcher. For example, endeavouring to secure additional, similarly-skilled researchers to assist in the project (for researcher triangulation) proved particularly difficult. Other difficulties (see p. 117) were of a more generic nature; that is, they represent potential risks for socially-oriented qualitative research projects in general. Although comparing favourably to the numbers involved in similar studies, fewer participants than anticipated were secured for the data collection process. Also, despite the use of coding books and a predefined syntax for the representation of success factors, the coding processes employed in the qualitative and quantitative (relationship) analyses still retained degrees of subjectivity. Indeed, the relationship analysis, as a rudimentary network analysis, might have been performed using more elaborate instruments; perhaps utilising those associated with the field of network theory. Difficulties resulting from the size of the relationship network in relation to the propagation software also represents a potential weakness, although the arguments presented in Chapter 3 (see p. 381) serve to nullify this issue.

Despite these weaknesses, the research methodology exhibits several strengths. The decision to utilise a predominantly qualitative approach was justified by the literature review. The use of open ended questions in the interviews was also a significant strength as it provided sufficient rich, thick descriptions to support both qualitative and quantitative analyses. However, the key strengths of the research methodology can be attributed to the measures implemented to ensure the validity and reliability of the research findings (see p.

119 and p. 123 respectively). In summary, the strengths of the research methodology more than compensated for its weaknesses and, hence, the research methodology can be considered fit for purpose in relation to achieving the project's aims and objectives.

7.4 Recommendations for further research

A number of key recommendations for further research were identified by this research project. These recommendations are discussed below (and a number of more general recommendations presented in Appendix 7.1).

7.4.1 Research into success factors for supplier-based OISD projects from the suppliers' perspective

The literature review made a clear case for further research into OISD project success factors from the supplier's perspective. The literature review also suggested that this would be achieved best through empirical studies of a qualitative nature. In particular, the provision of thick, rich description would greatly enhance understanding of the actuality of success factors for real-world OISD projects.

This research has gone some way to address this need. However, there is still a requirement for additional studies to confirm or refute the findings of this and other studies into OISD project success factors from a supplier's perspective. Hence, there is still considerable scope for additional work, not least to perform research in different cultural and geographical locations. For example, to date there have only been two studies performed in Europe: this research project and Moynihan (1996). Therefore, studies performed in other European countries would allow comparison of the perspectives of IS solution suppliers across Europe.

7.4.2 Relationship analyses of OISD project success factors

This research project suggests that the way in which success factors influence project success is a complex phenomenon. For example, the relationship analysis revealed an active network containing nearly one thousand base success factors that, collectively, influenced project success through 114 billion

causal chains. The identification of nearly three million causal loops showed that this process is so complicated, that it may be described as a complex phenomenon. As the active network was found to be more representative of contemporary, complex OISD projects than the simplistic causal models provided by prior research, the findings of the relationship analysis were extended to provide a more satisfactory theory that helps explain the way in which success factors propagate their influences to affect real-world OISD project success.

Thus, further research is required to confirm, refute or improve upon the findings of the relationship analysis and the resultant theory in relation to their application to supplier-based OISD projects in general. Indeed, it is possible that the theory provided by the relationship analysis is applicable to a wider range of project types. Hence, there is the opportunity to perform research beyond the scope of OISD projects; for example, relationship and network analyses for IS/IT projects, organisational projects and even projects in specific industry sectors; for example, pharmaceuticals and utilities.

7.4.3 Research to enable OISD success factor modelling

Comprehensive understanding of OISD success factors and the way in which they affect project success is unlikely to be achieved until success factors can be modelled using computer simulation techniques. But, as discussed in the literature review, a great deal of preparatory research is required before simulation techniques can be applied to OISD project success factors.

This research project has taken a small step in preparing the data required for the simulation of OISD project success factors. It has identified a range of detailed factors that had not been identified by prior studies. These factors have been presented as entity-characteristics, a format ideally suited for object-oriented software development and contemporary computer simulation techniques. More importantly, this research has revealed a complex active network containing 916 success factors, 14 success criteria and 1,449 unique relationships between the factors, criteria and project success. This network constitutes the basis for a computer simulation of OISD project success factors.

Indeed, the propagation software developed as part of this research project could be described as an extremely simple simulation tool.

However, a great deal more research is required before a comprehensive computer simulation can be performed. For example, the relationship analysis in this research project only addressed factor activity levels. It did not address factor magnitude (instead, assuming that each factor had equal magnitude). Similarly, the time taken by a source factor to influence a target factor was not taken into account (instead, this was assumed to happen instantaneously). Factors were also considered to be mutually exclusive in terms of their causal chain sets. In addition, the consequences of a target factor being influenced simultaneously by the influences of multiple source factors were ignored. Finally, influence types were modelled simplistically i.e. as either positive or negative.

Further research is required to address all of the above and other aspects required for the development of realistic computer simulations of OISD project success factors. In addition, there is also a need for more relationship and network analyses to confirm, refute or build upon the findings of this research.

7.5 Conclusions from the research

This chapter has presented the conclusions for this research project. The discussion has shown that the project's research aims and objectives have been met and that it has made original contributions to knowledge and theory. The fitness for purpose of the research methodology was also shown to be satisfactory when assessed in terms of its strengths and weaknesses. A number of avenues for further research were also recommended.

In the introduction to this thesis it was argued that the notion of project success factors was an alluring concept (see p. 1). By attracting numerous researchers, a large number of OISD project success factors have been identified. Researchers have also shown that a number of factors have a positive influence on IS/IT and OISD project success. Unfortunately, research has done little to describe what these factors actually are. In addition, research into the

interaction of success factors has been restricted to relatively few factors. As a result, the literature still presents OISD project success factors as a relatively simple concept.

This thesis has offered a fresh perspective. The findings of this research suggest that the concept of OISD project success factors, at least from the perspective of Scottish IS solution suppliers, is far from simple. Although the research identified 20 entity-based success factors, these were found to comprise a range of more detailed factors and relationships between them. More so, the way in which OISD project success factors propagate their influences to affect project success was shown to be highly complex. Even success criteria were shown to be more complicated than presented in the project success literature. Hopefully, this new perspective; that OISD project success factors are actually a highly complex phenomenon, will attract the attention of researchers and that future studies will build upon the findings of this research project.

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Appendices

Appendix 1.1. A profile of the researcher's experience and beliefs

Experience (adapted from the researcher's curriculum vitae)

Since September 2004, the researcher has been a doctoral research student at Edinburgh Napier University. His research has been concerned with providing a better understanding of success factors for organisational information systems development projects. During this time, the researcher has also lectured in software project management at the university. He is currently writing up his thesis on a part-time basis and hopes to gain his PhD early in 2013.

Prior to this, the researcher was a principal consultant within the supply chain management practice of SAP (UK). However, in 2002 he resigned from this position so that he could return to Scotland to look after his two sons. During this time he also developed software solutions for small/medium sized businesses (on a self employed basis) before returning to Napier University to study for a masters degree in software engineering (awarded in 2005; with distinction). The researcher also has a BSc in energy engineering (from Napier College) and an MBA (from Edinburgh University).

Before joining SAP, the researcher worked as a project manager leading a team of IT specialists engaged in the support and development of planning and scheduling systems (primarily i2 and Oracle products) across Motorola's Personal Communication Sector (PCS) in Europe.

Previously, he spent five years as European enterprise modelling manager with Motorola Manufacturing Systems. During this time he successfully completed ten i2 Factory Planner implementations, in the role of team lead and/or technical consultant, in a range of manufacturing environments and cultures around the world. He also presented planning and scheduling workshops and was involved as a consultant in a number of major process mapping/re-engineering initiatives.

Before joining Motorola, the researcher gained a tremendous amount of practical manufacturing experience. Starting as a production engineer, his career progression encompassed the roles of MRPII project coordinator, production manager and production controller with NEI and Rolls-Royce. He also spent two years as a manufacturing systems consultant with a leading software house providing ERP implementation consultancy, project management and technical support to a variety of manufacturing customers.

In summary, the researcher has acted as team lead/project manager/principal consultant for more than twenty information systems implementations and has acquired significant experience in leading teams through all stages of the project life cycle. As a hands-on professional, he has gained demonstrable experience in developing and executing project plans, performing in depth requirements analysis, producing functional requirements, building data models, developing system designs, coding solutions, producing and executing test plans, and developing and delivering training material.

Beliefs

During his professional IT career, the researcher has developed certain beliefs regarding the success of OISD and IS projects. First of all, competence is paramount (success is highly unlikely if you don't know what you're doing) and, more often than not, is based on appropriate experience. For a project manager, this means having excellent technical, business, people and learning skills. These skills also need to be mirrored across the project team to match the demands of the project. Skill deficiencies in the project team become operational responsibilities of the project manager and should be addressed as such. Although the project manager should not (normally) engage in technical activities, technical skills are still important to enhance understanding of the project and improve communication with technical parties (especially the project team).

Typically, an IS or OISD project will face a number of challenges, although these tend to differ on a project by project basis. None-the-less, the project manager still needs to attend to numerous aspects of project management if the

project is to be successful. Many of these aspects tend not to be considered as failure factors. Instead, they are givens; taken for granted and seldom acknowledged. In this respect, success and failure factors are different. Although a project can fail due to a few failure factors, a successful project depends on numerous success factors.

The project manager's primary purpose is to optimise the work of the project team. At a basic level, this entails making sure that barriers that impede the progress of the project team are removed or minimised. It also involves protecting the project team from detrimental external influences, and identifying and exploiting factors that enhance project team productivity. However, it is often necessary to ensure that the demands being placed on the project team are realistic and fair; for example, through effective management of the client's expectations.

The researcher believes in an eight step implementation approach. The objectives of the approach are to deliver a solution that (1) produces the maximum business benefit (at the earliest opportunity) and (2) is owned by the business. It has eight steps:

- (1) Assess the problem;
- (2) Initiate the project;
- (3) Confirm the requirements;
- (4) Design;
- (5) Build;
- (6) Test;
- (7) Implement;
- (8) Use the solution.

All that said, the majority of project management practices, as espoused in text books, institutional literature⁶³ and commercially available training courses⁶⁴

⁶³ For example, that provided by the Project Management Institute (PMI) and the Association for Project Management (APM).

⁶⁴ For example, PRINCEII (Projects in controlled environments).

have relevance. However, they should be applied with a good measure of common sense. In particular, heavy-weight methodologies can be extremely detrimental to small to medium sized projects. As such, the researcher considers the use of cut-down versions of these methodologies and also the use of specific elements of these methodologies to be good practice. As a rule, project management techniques must add value to a project and their use should be respected by the project team.

Appendix 2.1. Turner's theory of project management: corollaries and roles

Corollaries (outcomes: processes unless otherwise indicated)

1. Project contract and procurement management;
2. Information management;
3. Financial management;
4. Resource management;
5. Project appraisal;
6. Project definition;
7. Work breakdown structure (*artefact*);
8. Risk management;
9. The management of the project;
10. The project and project management life-cycles (*artefacts*);
11. Scope management;
12. Requirements management;
13. Benefits management;
14. Project organisation (*actor*);
15. Quality management;
16. Cost management;
17. Time management (project planning).

Roles (actors)

1. Project owner;
2. Ends users;
3. Project sponsor;
4. Resources (project team);
5. Project broker⁶⁵;
6. Project steward⁶⁶;
7. Project manager.

⁶⁵ “Works with the owner and sponsor to define the required outcome (benefit) from the project, and the output (change) which will achieve that” (Turner, 2006c, p.189).

⁶⁶ “Works with the owner and sponsor to define the required outcome (benefit) from the project, and the output (change) which will achieve that” (Turner, 2006c, p.189).

Source: Turner (2006c, p. 189). Refer also to Turner (2006a; 2006b; 2006c; 2006d).

Appendix 2.2. OISD project success factor studies

ID	Article	Project/system/ process type	Factor type	T	D	P	Domain	DS	Methodology (or data source)	Notes
1	Averweg & Erwin (1999)	Decision support systems	Critical success factors	D	I	I	Decision support systems in South Africa.	I	Unknown number of structured interviews (business managers, end users, IT personnel and academics) in 18 non-government organisations.	Primary development language seems to be user oriented 4GLs.
2	Bannerman (2008)	Software projects	Major risk factors	B	B	I/C	Software projects in government agencies in an Australian state.	I	23 structured interviews (project/IT/business managers) and qualitative analysis.	Includes projects implementing packaged software products.
3	Berntsson-Svensson & Aurum (2006)	Software projects	Success factors	B	B	I/C	Financial services, consulting and telecommunications industries in Swedish and Australian companies.	S	Survey (and some open ended questions) completed by software practitioners and managers. Sample size not provided.	
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	Evidence (written and oral) from 70 directors, managers, project managers and software engineers from the private and public sectors, as well as academic experts. Methodology not specified.	No mention of in-house development. Perspective seems to be that of the client.
5	Brocke, Uebernickel, & Brenner (2009)	IT projects	Success factors	B	B	I/C	European telecommunications firm.	C	Five case studies (two development projects). Methodology not specified.	
6	Bussen & Myers (1997)	Executive information systems	Risk factors	D	I	I	Large organisation in New Zealand.	C	Case study.	

ID	Article	Project/system/ process type	Factor type	T	D	P	Domain	DS	Methodology (or data source)	Notes
7	Butler & Fitzgerald (1999)	IS development process	Critical success factors	D	I	I	Large Irish telecommunications company.	I	Qualitative, case-based research (four development projects). 38 interviews with participants in development process. Qualitative data analysis, constant comparative analysis and network analysis.	
8	Cash & Fox (1999)	Computer systems	Elements (of success)	U	U	I/C	Generic.	A	Not specified. Seems to be based on anecdotal evidence.	
9	Cerpa & Verner (2009) *	Software development	Failure factors	D	B	B	Software developers from the USA, Australia, and Chile.	S	Survey of software practitioners describing 70 failed projects.	
10	Charette (2005)	Software projects	Failure factors	U	U	U	Not specified.	U	Not specified.	Does not explicitly state that this is an OISD article but makes reference to sloppy development practices (p. 133).
11	Chow & Cao (2008)	Agile software projects	Critical success factors	D	U	U	Agile software projects.	S	Survey of agile professionals (constituting 109 projects in 25 countries) and multiple regression techniques (quantitative)	Not possible to tell if "client" is internal or external.
12	Evans, Abela, & Beltz (2002)	Software projects	Risk characteristics	B	U	U	Probably USA based projects (including development projects providing data processing applications).	O	Based on a risk assessment company's database containing 12 years of project assessments.	
13	Ewusi-Mensah (1997)	Information systems development projects	Critical issues	D	U	U	Project abandonment	U	Not specified (based on previous research by author).	
14	Gaitros (2004)	Large software development projects	Common errors	D	U	U	Generic software development.	A	Anecdotal (based on author's experience).	

ID	Article	Project/system/ process type	Factor type	T	D	P	Domain	DS	Methodology (or data source)	Notes
15	Han & Huang (2007)	Software projects	Software risks	D	U	U	Generic software projects.	S	Web based survey of 115 project managers combined with statistical analysis.	
16	Hartman & Ashrafi (2002) *	IS/IT projects	Critical success factors	B	B	B	Canadian software projects.	I	36 structured interviews (covering 12 projects).	
17	Jiang & Klein (1999)	Information systems development	Risks	D	U	U	Information systems development in the USA.	S	Survey (86 useable questionnaires) of IS project managers combined with statistical analysis.	Perspective is probably client/in house (based on wide variety of organisational settings) but not possible to verify.
18	Jiang & Klein (2001)	Software projects	Risks	D	U	U	IS software development in the USA.	S	Survey (152 useable questionnaires) of IS project managers, project leaders and professionals, combined with statistical analysis.	Refer to Jiang & Klein (1999).
19	Jiang, Klein, & Ellis (2002)	Software development	Risks	D	U	U	Information systems development in the USA.	S	Survey of 152 IS project managers combined with statistical analysis.	
20	Jones (2004)	Software project management practices	(Opposing) major factors	D	B	U	Large software projects (probably in the USA) including information systems, corporations and government agencies.	U	Analysis (no details provided) of 250 projects.	
21	Kanter & Walsh (2004)	Software development project	Major problem areas	D	I	I	IT organisation in a large , decentralised company in USA.	C	Case study (presented anonymously).	
22	Keil, Cule, Lyytinen, & Schmidt (1998)	Software projects	Risk factors	D	U	U	Software development projects in Finland, Hong Kong, and the USA.	P	Three panels of experienced software project managers from Finland, Hong Kong, and the USA. Use of Delphi method.	
23	Kim & Peterson (2001)	Information systems	Success factors	D	I	I	Internal information systems development in the USA.	S	79 questionnaires completed by software developers working for large conglomerate companies in the USA. Statistical analysis.	

ID	Article	Project/system/ process type	Factor type	T	D	P	Domain	DS	Methodology (or data source)	Notes
24	Klein, Jiang, & Tesch (2002)	System development projects	Leading indicators	D	U	I/C	IS development in companies in the USA.	S	Survey of 239 experienced IS professionals (IS department managers, IS project leaders, IS analysts and others) from six large private organizations in the USA.	
25	Leishman & Cook (2004)	Software projects	Risk factors	B	U	U	Software projects.	A	Anecdotal evidence.	Makes a single reference to software companies.
26	Magal, Carr, & Watson (1988)	Information centres (ICs)	Critical success factors	U	U	I/C	ICs in the USA.	S	Survey of 311 IC managers, directors and analysts combined with statistical analysis.	Includes application development.
27	Mahaney & Lederer (2003)	Information systems development projects	Reasons for failure and risk factors	D	B	I/C	Information systems development in the USA.	I	Structured interviews with 12 IS 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	Interviews 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	Post implementation project reviews in an unspecified organisation	Does not explicitly state that this is an OISD article but makes reference to code development tools (p. 6).
30	Milis & Mercken (2002)	ICT investment projects	Success factors	U	U	I/C	ICT investment projects (no details provided).	I	Limited field study of four ICT projects in Belgian banks. Grounded theory approach. 16 in-depth interviews and document analysis. Qualitative data analysis.	
31	Moore (1979)	MIS software development projects	Characteristics	D	B	U	MIS software development projects.	S	Survey of 24 department (project) managers in various organisations. Statistical analysis.	

ID	Article	Project/system/ process type	Factor type	T	D	P	Domain	DS	Methodology (or data source)	Notes
32	Moynihan (1996) *	Information systems projects	Factors/themes	D	S	S	Information systems projects in Ireland.	I	14 personal construct elicitation sessions with experienced application systems developers managing bespoke software-intensive application development projects for external clients.	
33	Nakatsu & Iacovou (2009)	Software development projects	Key risk factors	D	S	C	Offshore and domestic outsourcing.	P	A two-panel Delphi study (one domestic and one offshore). 32 participants: experienced IT project managers.	
34	Procaccino, Verner, & Lorenzet (2006)	Software development	Process success drivers	D	B	U	Software development in USA.	S	Online survey of 30 developers at 20 US based software development organizations/departments.	
35	Reel (1999)	Software projects	Critical success factors	U	U	U	Software projects.	A	Not specified. Assumed to be anecdotal.	
36	Richardson & Ives (2004)	Software development processes	Reasons for project failure	D	U	U	Software development projects.	O	Based on findings of previous studies (no specified).	
37	Ropponen & Lyytinen (2000)	Software development	Risk components	D	B	U	Software development in Finland.	S	Survey of 83 Finnish project managers. Statistical analysis.	
38	Salmeron & Herrero (2005)	Executive information systems	Critical success factors	D	U	I/C	Executive information systems.	O	Analytic hierarchy process (AHP) based research based on 18 EIS users.	
39	Sauer & Cuthbertson (2003)	IT project management in the UK	Risk factors	B	B	U	IT project management in the UK.	S	Web survey of 1,456 IT project managers.	
40	Sharma, Sengupta, & Gupta (2011) *	Software projects	Risk factors (dimensions)	D	S	B	Software projects in India.	S	300 questionnaires (IT professionals) and quantitative analysis.	Makes specific reference to in-house and outsourced development.

ID	Article	Project/system/ process type	Factor type	T	D	P	Domain	DS	Methodology (or data source)	Notes
41	Standish Group (1995)	IT application development	Success factors	U	U	U	US companies with an MIS (8380 applications). Companies, operating in a range of industries, vary in size.	S	Surveys (365 respondents), focus groups and personal interviews (IT executive managers).	
42	Standish Group (2001)	IT application development	Success factors	U	U	U	Not specified (refer to notes).	S	Not specified (refer to notes).	Domain and methodology details assumed to be similar to Standish Group (1995).
43	Standish Group (2009b)	IT application development	Success factors	U	U	U	Not specified (refer to notes).	S	Not specified (refer to notes).	Domain and methodology details assumed to be similar to Standish Group (1995).
44	Taylor (2000)	IT projects	Critical success factors	U	U	U	IT projects in the UK.	I	Detailed questioning of 38 members of the BCS, APM and Institute of management.	
45	Tesch, Kloppenborg, & Frolick (2007)	Software development projects	Risks	D	U	U	Software development projects (USA).	S	Survey of 23 project management professionals (PMP) practitioners followed by group (panel) work.	
46	Tiwana & Keil (2004)	Software development	Key risk drivers	D	U	C	Software development projects.	S	Survey of 61 IS/IT directors in a variety of companies and statistical analysis.	Perspective seems to be predominantly client based.
47	Ugwu & Kumaraswamy (2007)	ICT projects	Critical success factors	B	U	C	ICT projects in the construction industry.	S	Survey of 40 client based stakeholder groups.	QS = quantity surveyor?
48	(Verner & Evanco, 2005)	In-house software development	Project management practices	D	I	I	In-house software development (in Australia and the USA?).	S	Survey (questionnaire) or 101 in-house development practitioners and statistical analysis.	

ID	Article	Project/system/ process type	Factor type	T	D	P	Domain	DS	Methodology (or data source)	Notes
49	Verner, Overmyer, & McCain (1999)	Software development projects	Success and failure factors	D	U	U	Software development projects (in the USA).	I	Interviews with 20 software developers.	
50	Wallace & Keil (2004)	Software development projects	Risk factors	D	U	U	Software development projects.	S	Web based survey of 507 software project Managers and statistical analysis.	
51	Wallace, Keil, & Rai (2004)	Software projects	Risks	D	U	U	Software projects.	S	Mainly a survey of 507 software project managers and statistical analysis.	
52	Walsh & Kanter (1988)	Application development	Major problem areas	D	I	I	Application development.	C	Case study.	
53	Warkentin, Moore, Bekkering, & Johnston (2009)	Information systems development projects	Risks	D	U	I/C	Information systems development projects.	S	Two different open-ended questionnaires administered in two stages to IT professionals (eight in each stage).	
54	Wateridge (1995)	IT projects	Success factors	U	U	U	IT projects.	U	Prior research.	
55	Wohlin & Andrews (2002)	Software projects	Success drivers	D	I	I	Software projects.	C	Case study is from 12 software projects from one company with many divisions.	
56	Yeo (2002)	Information system projects	Critical failure factors	U	U	U	Information system projects.	S	Survey of 92 participants (associated with a failed IT project) and statistical analysis.	

Key:

T: type (D: development only, B: both development and packaged system implementation, U: unknown or vague, but development verified in or inferred by article content).

D: development (B: both, I: in-house, S: supplier-based, U: unknown or vague).

P: perspective (B: both, C: client, I: in-house, S: supplier, U: unknown or vague).

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

*: studies containing a supplier's perspective (article column).

Appendix 2.3. Success (and failure) factors contained in OISD project success factor studies

Nomenclature

Success (and failure) factors were coded as entity-characteristic combinations and are hence depicted thus:

Entity (x): characteristic¹, characteristic², ... characteristic^x.

where

x: number of characteristics attributed to the entity (factors per entity)

Actors

Change agents (1): existence of.

Client/host organisation (43): ability\to handle implementation, ability\to manage goal conflict, ability\to manage privately held information, ability\to manage shirking, ability\to manage task programmability, business readiness, commitment, competence\management, competence\project management, culture, emotional security, energy for project, enthusiasm for project, expectations\realism, experience\similar projects, geographical distribution, involvement, involvement\project requirements, involvement\project vision, language differences with, level of change to be experienced, level of control of project, opinion\information technology improving productivity, optimism\unwarranted, organisational units involved, ownership, point of contact\individuality, point of contact\role, politics, regional differences with, relationship with suppliers, resistance to change, responsibility, restructuring, staff turnover, supportiveness, top down management style, turnover, understanding\CSFs, understanding\requirements, understanding\what they want, willingness\to handle implementation, work environment.

Domain experts (2): access to, availability.

End users (40): attitude\positive, commitment, communication amongst, competence\information technology, conflict amongst, cooperativeness, departments\number of, disparity, effectiveness, enthusiasm, expectations, expectations\realism, experience, experience\activities to be supported by project deliverable, experience\information technology, feedback from, hierarchical levels, involvement, involvement\adequate time for, involvement\answering questions, involvement\coding walkthroughs, involvement\estimating, involvement\project team, involvement\requirements

definition, involvement\software design, involvement\software development, number of, opinion\project deliverable meeting their needs, opinion\use of information technology in the workplace, ownership, resistance to change, satisfaction, staff turnover, supportiveness, training needs, understanding\application type, understanding\project deliverable\capabilities, understanding\project deliverable\limitations, understanding\project roles, understanding\software development.

Implementation team (1): number of members\fit with project.

Partner organisations (2): competence, engagement of.

Project board (17): commitment, competence, competence\information technology, competence\leadership skills, confidence, effectiveness, expectations\realism, experience, involvement, lessons learned, ownership, perceived benefit from project deliverable, priority for project, readiness for the use of project deliverable, strength, supportiveness, willingness\to provide resources.

Project champion (2): competence\leadership skills, existence of.

Project manager (14): characteristics, competence, competence\leadership skills, competence\managerial skills, competence\people skills, competence\project management, competence\social skills, conflict with other project managers, effectiveness, experience, power, supportiveness\adding extra personnel to meet an aggressive schedule\late in project, supportiveness\long working hours, understanding\end users needs.

Post implementation support team (1): competence.

Project sponsor (13): commitment, competence, existence of, involvement\approval obtained at each stage, involvement\is consulted at all stages of development, involvement\is consulted at all stages of implementation, involvement\is informed of the project status at each stage, involvement\project objectives, involvement\project requirements, involvement\project vision, seniority, staff turnover, supportiveness.

Project stakeholders (8): competence, conflict amongst, continuous debate amongst, continuous evaluation amongst, early identification of, involvement, involvement\project team, politics.

Project team (60): ability\to carry out tasks efficiently, ability\to understand human implications of project deliverable, ability\to work with project board, ability\to work with uncertain objectives, adequately trained, attitude\positive,

characteristics, collaboration, commitment, communication\intra team, communication amongst, competence, competence\administrative skills, competence\availability when required, competence\fit with project, competence\information technology, competence\interpersonal skills, competence\negotiation skills, competence\skills mix, competence\social skills, competence\software development, competence\teamwork, competence\technical, competence\when required, conflict amongst, degree of fracture, diversity, effectiveness, experience, experience\application type, experience from working on project, focussed, hard working, high performing, involvement\decision making, involvement\ex project, level of feedback received from project manager, morale, number of members, number of members\fit with project, pressurisation of, remuneration for working long hours, role clarity, role definition, staff turnover, understanding\application area, understanding\application type, understanding\development environment, understanding\development methods, understanding\development platform, understanding\development tools, understanding\client/host organisation\business sector, understanding\client/host organisation\country, understanding\client/host organisation\culture, understanding\client/host organisation\issues, understanding\client/host organisation\language, understanding\client/host organisation\operations, understanding\client/host organisation\target operations, understanding\requirements, willingness to be constrained by formal standards.

Project team\systems architect (1): effectiveness.

Supplier organisation (8): adequate staffing, commitment, competence\technical, dependency on, number of, supportiveness, understanding\project complexity, understanding\requirements.

Supplier organisation\consultants (1): number of.

Artefacts

Best practices (1): utilisation of.

Business case (1): fitness for purpose.

Business data (1): fitness for purpose.

Change requests (3): agreement of, conflict amongst, number of.

Control system (1): fitness for purpose.

Design specification (2): fitness for purpose, stability.

Estimates (4): accuracy, developer driven, fitness for purpose, reliability.

Evaluation mechanisms (1): fitness for purpose.

Issues\communication (1): number of.

Issues\implementation (1): number of.

Issues\information (1): number of.

Issues\technical (1): number of.

IT infrastructure (2): fitness for purpose, standardisation.

Methodologies\development (3): fitness for purpose, fit with project, utilisation of.

Methodologies\development\agile (1): utilisation of.

Methodologies\development\formal (1): fitness for purpose.

Methodologies\development\life cycle models (1): fitness for purpose.

Methodologies\project management (1): utilisation of.

Methodologies\project management\practices\essential (1): utilisation of.

Methodologies\project management\practices\formal (1): utilisation of.

Monitoring system (1): fitness for purpose.

Objectives\business (1): clarity.

Project budget (2): fitness for purpose, level of detail.

Project contracts (1): outcome based.

Project deliverable (24): architecture\fitness for purpose, complexity, criticality, customisation, ease of use, ease of validation, fitness for purpose, flexibility, functionality, links to other systems, links to other systems\future, need for new software, operational efficiency, perceived utility, performance, productivity, reliability, reversibility, sensitivity, sophistication, standardisation, tailoring, technology acquisition, utilisation of.

Project deliverable\hardware (4): complexity, fitness for purpose, need for new hardware, standardisation.

Project deliverable\software\database (1): complexity.

Project deliverable\technology (6): availability, complexity, fitness for purpose, maturity, stability, utilisation of\on prior projects.

Project deliverable\user interface (1): fitness for purpose.

Project documentation (1): fitness for purpose.

Project due date (3): artificial, determined with adequate requirements, realism.

Project milestones (2): fitness for purpose, granularity.

Project mission (1): clarity.

Project objectives (13): agreement of, alignment to client/host organisation, challenging, clarity, communication of, completeness, fitness for purpose, realisation of, realism, robustness, stability, understanding of, utilisation of\to convince others.

Project plan (9): currency, fitness for purpose, has built in resource buffers, incorporates project risks, level of detail, negative effect on project team\life, negative effect on project team\motivation, realism, reasonableness.

Project resources (4): consistent application of, loss of to competing projects, sufficiency, utilisation of.

Project specification (3): ability to meet, completeness, stability.

Project success criteria (3): agreement of, continuous evaluation of, fitness for purpose.

Project team environment (1): fitness for purpose.

Project vision (1): clarity.

Requirements (22): accuracy, agreement of, availability, clarity, communication of, completeness, conflict amongst, correctness, currency, excessiveness, fitness for purpose, ignored for the sake of technology, known in advance, level of detail, minimisation, negotiation of, optimisation, realism\accepted by project team as such, scope creep, stability, strategic content, understanding of.

Requirements\business (2): ambiguity, stability.

Reward mechanisms (1): fitness for purpose.

Software maintenance procedures (1): fitness for purpose.

Structured development methods (1): availability of.

Test environment (1): completeness.

Test specification (1): completeness.

Tools\development (2): availability, fitness for purpose.

Tools\measurement (1): fitness for purpose.

Warning signs (2): lateness, recognition of.

External (externalities)

Business environment (2): influence of, stability.

Commercial pressures (1): influence of.

Government ordinances (1): influence of.

Macro-economic policies (1): influence of.

Micro-economic policies (1): influence of.

Processes

Benefits realisation (1): effectiveness.

Change control (3): clarity, effectiveness, formality.

Change management (4): adequately resourced, at organisational level, effectiveness, resolution of industrial relations/change management issues.

Client management (1): effectiveness.

Communication (8): breakdowns, clarity, effectiveness, lack of, openness, pleasantness, requirements for, trustworthiness.

Communication\with end users (1): effectiveness.

Configuration management (1): effectiveness.

Conflict management (1): effectiveness.

Contingency planning (1): adequately resourced.

Contract management (1): effectiveness.

Cost management (2): accuracy, effectiveness.

Data conversion (1): effectiveness.

Decision making (1): timeliness.

Estimating (2): effectiveness, to agreed targets.

Expectation management\end users (1): effectiveness.

Human resource management (1): effectiveness.

Interface management (1): effectiveness.

Issue management (2): effectiveness, proactive approach to.

Personnel management (1): effectiveness.

Personnel recruitment (1): delays in.

Personnel selection (1): effectiveness.

Post mortem reviews (1): effectiveness.

Programme management (1): leadership.

Project (14): adherence\business purpose, benefit\quantification of, benefit\to client/host organisation, complexity, conflict amongst, cost, delivery strategy, functional decomposition, getting a quick start, politics, schedule pressure, similarity to previous projects, size, urgency.

Project closure (1): authorities\definition of.

Project conceptualisation (1): effectiveness.

Project control (2): effectiveness, responsiveness to project status.

Project control\suppliers (1): effectiveness.

Project execution (1): effectiveness.

Project governance (1): effectiveness.

Project management (3): effectiveness, evolutionary, proactive approach to.

Project monitoring (3): effectiveness, monitors progress closely, to agreed targets.

Project monitoring\milestone tracking (1): effectiveness.

Project monitoring\suppliers (1): effectiveness.

Project\processes (6): alignment to development approach, existence of, following of, maturity, review at the end of each phase, standardisation.

Prototyping (1): rapidity.

Requirements analysis (1): effectiveness.

Requirements definition (4): effectiveness, number of methods used, thoroughness, utilisation of prototypes.

Requirements elicitation (2): effectiveness, time available for.

Requirements management (2): effectiveness, risks associated with.

Resource management (2): delays in, effectiveness.

Risk analysis (2): assumptions\fitness for purpose, effectiveness.

Risk assessment (2): continuous, effectiveness.

Risk management (3): continuous, effectiveness, proactive approach to.

Role/responsibility definition (1): effectiveness.

Software design (1): effectiveness.

Software development (8): cost, development environment, development language, duration, effectiveness, evolutionary approach, freedom of choice of platform, methods used.

Software development\walkthroughs (1): frequency.

Software implementation (1): delays in.

Software testing (1): effectiveness.

Software testing\UAT (1): effectiveness.

Subcontracting (1): risks associated with.

System implementation (1): effectiveness.

Target business processes (5): complexity, level of change, level of managerial activity being supported, maturity, number of.

Training (1): effectiveness.

Training\end users (1): effectiveness.

Training\project team (1): effectiveness.

Victory celebrations (1): prematurity.

Appendix 2.4. The 60 most cited success (and failure) factors contained in OISD project success factor studies

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
	Actor	Client/host organisation	Involvement	4
	Actor	End users	Involvement\requirements definition	4
	Actor	Project board	Commitment	4
	Actor	Project board	Involvement	4

Rank	Entity type	Entity	Characteristic	Citations
	Actor	Project team	Understanding\ host organisation\ operations	4
	Artefact	Project objectives	Fitness for purpose	4
	Artefact	Project plan	Fitness for purpose	4
	Artefact	Requirements	Understanding of	4
	Process	Change management	Effectiveness	4
	Process	Requirements definition	Effectiveness	4
35	Actor	Client/host organisation	Commitment	3
	Actor	Client/host organisation	Ownership	3
	Actor	Client/host organisation	Politics	3
	Actor	End users	Commitment	3
	Actor	End users	Resistance to change	3
	Actor	Project sponsor	Existence of	3
	Actor	Project team	Number of members\ fit with project	3
	Actor	Supplier organisation	Number of organisations	3
	Artefact	Issues\ technical	Number of	3
	Artefact	IT infrastructure	Fitness for purpose	3
	Artefact	Methodologies\ development	Utilisation of	3
	Artefact	Project budget	Fitness for purpose	3
	Artefact	Project deliverable	Complexity	3
	Artefact	Project deliverable	Fitness for purpose	3
	Artefact	Project deliverable	Links to other systems	3
	Artefact	Project objectives	Stability	3
	Artefact	Project resources	Sufficiency	3
	Artefact	Requirements	Communication of	3
	External	Business environment	Stability	3
	Process	Communication	Lack off	3
	Process	Expectation management	Effectiveness	3
	Process	Project reporting	Effectiveness	3
	Process	Requirements management	Effectiveness	3
	Process	Role/responsibility definition	Effectiveness	3
Process	Software development	Effectiveness	3	

Rank	Entity type	Entity	Characteristic	Citations
	Process	Training\end users	Effectiveness	3

Table 1. The 60 most cited OISD project success factors
 (success factors with three or more citations from a sample of 56 articles)

Appendix 2.5 The 52 most cited success (and failure) factors contained in OISD project success factor studies that do not include a suppliers' perspective

Rank	Entity type	Entity	Characteristic	Citations
1	Actor	End users	Involvement	18
2	Process	Project planning	Effectiveness	14
3	Actor	Project board	Supportiveness	13
	Actor	Project team	Competence	13
5	Process	Project management	Effectiveness	11
6	Artefact	Requirements	Fitness for purpose	10
7	Artefact	Requirements	Stability	9
8	Artefact	Requirements	Clarity	7
	Process	Communication	Effectiveness	7
10	Actor	Project team	Competence\ fit with project	6
	Artefact	Project deliverable\technology	Maturity	6
	Process	Project control	Effectiveness	6
	Process	Project monitoring	Effectiveness	6
	Process	Risk management	Effectiveness	6
15	Actor	Client/host organisation	Staff turnover	5
	Actor	Project manager	Experience	5
	Actor	Project team	Competence\ technical	5
	Artefact	Estimates	Fitness for purpose	5
	Artefact	Requirements	Completeness	5
	Process	Change control	Effectiveness	5
	Process	Estimating	Effectiveness	5
	Process	Project	Size	5
23	Actor	Client/host organisation	Involvement	4
	Actor	Project board	Commitment	4
	Actor	Project board	Involvement	4
	Actor	Project team	Experience	4
	Actor	Project team	Understanding\ host organisation	4
	Artefact	Project objectives	Fitness for purpose	4
	Artefact	Requirements	Understanding of	4

Rank	Entity type	Entity	Characteristic	Citations
	Process	Change management	Effectiveness	4
	Process	Project	Complexity	4
	Process	Requirements definition	Effectiveness	4
33	Actor	Client/host organisation	Commitment	3
	Actor	Client/host organisation	Politics	3
	Actor	End users	Commitment	3
	Actor	End users	Involvement\ requirements management	3
	Actor	End users	Resistance to change	3
	Actor	Supplier organisation	Number of organisations	3
	Artefact	Issues\technical	Number of	3
	Artefact	IT infrastructure	Fitness for purpose	3
	Artefact	Methodologies\development	Utilisation of	3
	Artefact	Project budget	Fitness for purpose	3
	Artefact	Project objectives	Stability	3
	Artefact	Project plan	Fitness for purpose	3
	Artefact	Project resources	Sufficiency	3
	Process	Communication	Effectiveness	3
	Process	Expectation management	Effectiveness	3
	Process	Project reporting	Effectiveness	3
	Process	Requirements management	Effectiveness	3
	Process	Role/responsibility management	Effectiveness	3
	Process	Software development	Effectiveness	3
	Process	Training\end users	Effectiveness	3

Table 1. The 52 most cited OISD project success factors
(success factors with three or more citations from a sample of 52 articles)

Appendix 3.1. Entity-based coding book

Actors

Change agents, client organisation, domain experts, end users, host organisation, implementation team, partner organisations, project board, project champion, project manager, post implementation support team, project sponsor, project stakeholders, project team, project team\systems architect, supplier organisation, supplier organisation\consultants, supplier organisation\project team\offshore.

Artefacts

Business case, business data, change requests, control systems, estimates, evaluation mechanisms, issues\communication, issues\implementation, issues\information, issues\system operation, issues\technical, IT infrastructure, measurement tools, methodologies\project management, methodologies\project management\practices\essential, methodologies\project management practices\formal, methodologies\software development, methodologies\software development\agile, methodologies\software development\formal, methodologies\software development\life cycle models, monitoring systems, objectives\business, project budget, project contracts, project deliverable, project deliverable\hardware, project deliverable\software\database, project deliverable\technology, project deliverable\user interface, project documents, project due date, project milestones, project mission, project objectives, project plan, project resources, project specification, project success criteria, project team work environment, project vision, requirements, reward mechanisms, software development tools, software maintenance procedures, software testing environment, specifications\software design, specifications\software testing, warning signs.

Externalities

Best practices, business environment, commercial pressures, government ordinances, macro-economic policies, micro economic policies.

Processes

Benefits realisation, change control, change management, client management, communication, communication with end users, configuration management, conflict management, contingency planning, contract management, cost management, data migration, decision making, estimating, expectation management\end users, human resources management, interface management, issue management, project closure, project conceptualisation, project control, project control\suppliers, personnel recruitment, personnel selection, project execution, project governance, project management, project monitoring, project monitoring\suppliers, post mortem reviews, project planning, project quality control, project reporting, programme management, project, project\processes, prototyping, project start-up, requirements analysis, requirements definition, requirements elicitation, requirements management, resource management, risk analysis, risk assessment, risk management, role/responsibility definition, software design, software development, software development\walkthroughs, software testing, software testing\user acceptance testing, subcontracting, system implementation, target business processes, training, training\end users, training\project team, victory celebrations.

Appendix 3.2. Letter of invitation for prospective interview participants

[Name]
[Position]
[Company]
[Address1]
[Address2]
[Address3]
[Postcode]

19 September 2008

Dear [Name]

Success Factors in Information Systems Projects

Napier University is currently undertaking research into the factors that influence the success of organisational information systems (IS) development projects. A key part of the research is to discuss project success factors with a range of industry experts and, in particular, solicit the views of supplier companies engaged in the delivery of IS solutions to their client organisations. [Company] could make an important contribution to this research project.

I would like to conduct interview(s) sometime between the beginning of October and the end of this year. Ideally, the interview participants should have experience of delivering IS projects as consultants, project managers or software developers. Each interview lasts no more than one hour and all information provided is treated anonymously and in the strictest confidence.

In return for participation, [Company] will be provided with early access to the research findings. These will be presented in the form of a comprehensive report based on consolidated data from all participant organisations. I am sure you will find this both interesting and valuable.

I would be grateful if you could complete the green reply form and return it to me using the prepaid envelope. I will also telephone you in about a week with a view to discussing further [Company]'s involvement in this work. In the meantime, if you have any questions or require any further information, please do not hesitate to contact me.

I look forward to hearing from you.

Yours sincerely

Robert J. Irvine BSc MBA MSc
PhD Research Student
t: (0131) 455 2773, e: r.irvine@napier.ac.uk

Appendix 3.3. Response form for prospective interview participants

F.A.O. Robert J. Irvine, Room C44, Napier University, 10 Colinton Road, Edinburgh, EH10 5DT

Success factors in information systems projects

Reply Form

Please complete either part A or B of this form and return using the enclosed prepaid envelope

Thankyou

[Name]
[Company]
[Address]
[Postcode]

Part A

Yes, [Company] is interested in participating in the research

The person to contact is:

Myself

Other – please specify:

Name:

Position:

Contact details:

(e.g. telephone number, email address, etc.)

Part B

No, [Company] is not interested in participating in the research

All data collected will be treated anonymously and in the strictest confidence

Appendix 3.4. Interview participant guidelines

This appendix contains the slides used as a guide for the participants during the fieldwork interviews.

Participant Guidelines for Research Interviews

Robert J. Irvine

NAPIER UNIVERSITY
EDINBURGH

Interview Outline

1. *Introduction* - an overview of the research followed by the objectives and guidelines for the interview;
2. *Subject matter* - a discussion of the participant's views on what influences the success and failure of organisational information systems projects;
3. *Conclusion* - an overview of the next steps and the opportunity to ask questions and address any issues or concerns.

Part One: Introduction

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Research Aim

To provide a better understanding of the reasons why Organisational Information Systems Development (OISD) projects succeed or fail.

Interview Objective

To determine the reasons for
the success or failure of OISD projects

by interviewing individuals who have
significant experience in these projects

as principal stakeholders e.g.

consultants,
project managers,
or project team members, etc.

from the perspective of 'supplier' organisations.

Additional Information/Guidelines

The Researcher

Assurance of confidentiality

Minimising interview bias

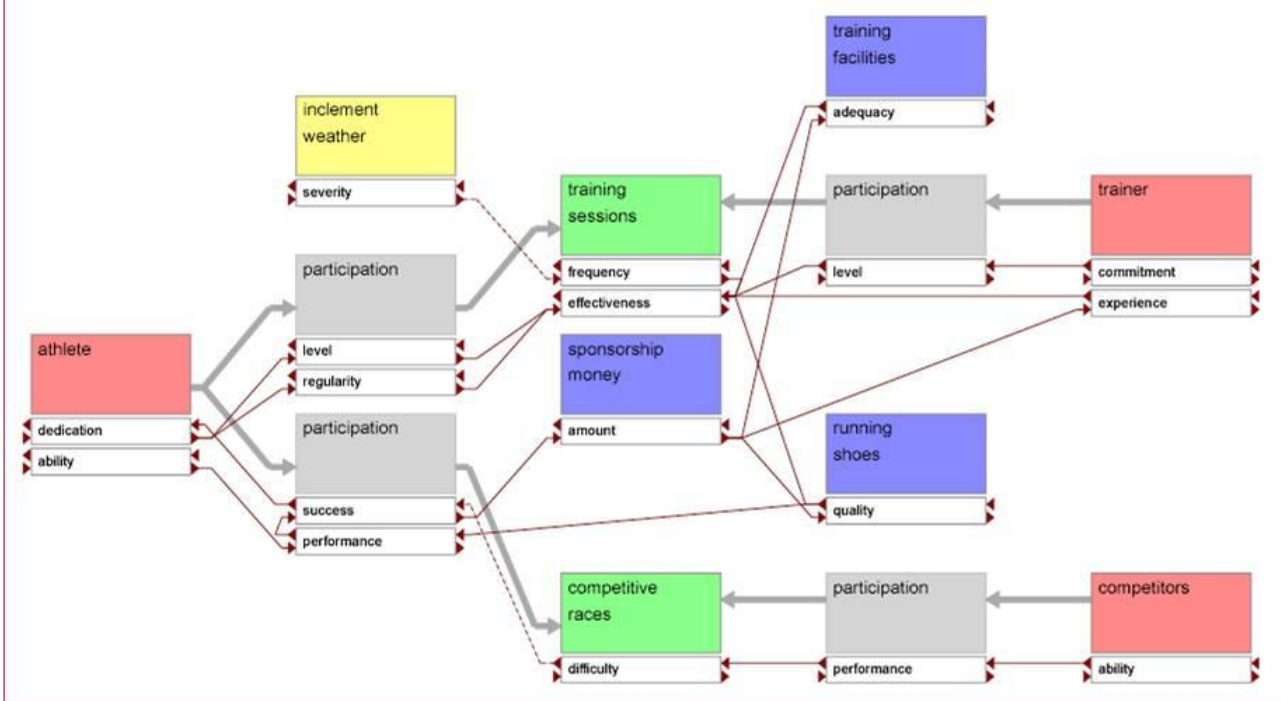
Views based on experience

Transcript method

Participant comfort

7

Entity Map Example



Part Two: Discussion

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Participant Perspective

In my experience as a [*project role*],
[*a particular factor*] is significant to the
success or failure of an organisational
IS development project because ...

[*discussion*]

Part Three: Conclusion

What Next?

- The interview content will be transcribed and analysed;
- Participants may be contacted (via telephone) if any follow up questions are identified;
- Key statements will then be derived from the transcript;
- The statements will then be analysed in conjunction with those derived from the other interviews;
- The participants will receive a report of the final analysis.

Questions?

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Appendix 3.5. Requirements specification for the propagation software

1 Stage one requirements

1.1 Functional requirements

Functionality is required to:

- (1) Read the input files (described below) and construct the relationship network;
- (2) For each factor in the relationship network (or otherwise as specified by the parameters in the parameters.txt input file):
 - (1) Propagate the factor's influence to all of its target factors (one by one), repeating the process while the termination code of the target factor is found to be zero;
 - (2) When a non-zero termination code is encountered (as listed below), terminate the propagation process and record the reason for termination;

Code	Description (reason)
0	Continue with propagation process
1	[suc:project:success] encountered
2	Factor causes loop
3	Maximum chain length exceeded
4	Factor is impotent (has no outbound relationships)

- (3) If the termination code equals one:
 - (1) Increment the activity level for each of the factors and relationships involved in the propagation process;
 - (2) Write the details of the causal chain to the output.txt file (described below);
 - (4) Once the chain has been terminated, repeat all of the steps above for the next factor in the relationship network;
- (3) Write the output files (as described below).

1.2 Input files

1.2.1 *parameters.txt*

Field #	Description
1	Id
2	Value

Parameter Id	Description
AGREEMENTLEVEL	Minimum interview count (agreement amongst interviews) used by the propagation process to determine if a factor should be treated as a base factor. Base factors are those with an interview count greater than or equal to the agreement level.
DATAFOLDER	The data folder within which the input and output subfolders will be located. Note: this value must also be implemented as a command line argument.
MAXCHAINLENGTH	Maximum chain length allowed by the propagation process

1.2.2 *relationships.txt*

Field #	Description
1	Source factor Id
2	Source factor's project type (1 to 5)
3	Influence type: (dir)ectly or (inv)ersely proportional. These map to -p-> (positive) and -n-> (negative) respectively for output reports.
4	Target factor Id
5	Target factor's project type (1 to 5)

1.3 Output files

1.3.1 *chains.txt (flat file)*

For each unique chain generated by the propagation process, write the source factor id, influence type, target factor id, chain length, relationship path and termination details (code and reason).

1.3.2 *log.summary.txt* (flat file)

Write a summary of the propagation process (e.g. parameters, data set analysis, run time properties, propagation analysis and termination analysis). Incorporate entity and factor breakdown by entity type and project type as appropriate.

1.3.3 *log.entities.txt*

For each entity in the relationship network, write the following data:

Field #	Description
1	Entity Id
2	Activity level
3	Total inbound relationship count
4	Active inbound relationship count
5	Total outbound relationship count
6	Active outbound relationship count
7	Target entity count (number of other entities influenced by this entity)

1.3.4 *log.factors.txt*

For each factor in the relationship network, write the following data:

Field #	Description
1	Factor Id
2	Project type
3	Activity level
4	Active chain count
5	Average chain length
6	Total inbound relationship count
7	Active inbound relationship count
8	Total outbound relationship count
9	Active outbound relationship count
10	Total loop count
11	Average loop length
12	MCL chain count
13	Inactive (impotent) chain count

1.3.5 *log.factors.base.txt*

Identical to *log.factors.txt* but only for base factors with interview counts greater than or equal to the *AGREEMENTLEVEL* parameter.

1.3.6 *log.relationships.txt*

For each relationship in the relationship network, write the following data:

Field #	Description
1	Source factor Id
2	Relationship type
3	Target factor Id
4	Activity level

1.3.6 *log.entities.targets.txt*

For (source) entities in the relationship network that have active relationships with their target entities, write the following data:

Field #	Description
1	Source entity Id
2	Target entity Id
3	Activity level

2 Stage two enhancements

2.1 Functional requirements

Functionality required to:

- (1) Cope with the large number of unique propagation chains:
 - (1) Implement total, active and output chains;
 - (2) Add new parameters to restrict/modify the propagation process;
 - (3) Split output files;
- (2) Restrict data input (relationships) by record and interview Id;
- (3) Implement interview counts by entity, factor and relationship.

2.2 Input files

2.2.1 parameters.txt (new parameters)

Parameter	Description
ACTIVECHAINLIMIT	Limits the number of active chains
ACTIVITYUPDATECODE	Activity update code: 1 - detailed, 2 – estimated. Note: is now redundant - should be set to 2 only.
AGREEMENTLEVEL	Agreement level between interviews required for a base factor to be propagated. Can be used to propagate selected factors only.
BASEFACTORID	Limits the propagation process to this factor (overrides factor range parameters)
CHAINSPEROUTPUTFILE	Number of (output) chains per output (chains) file
DATASETNAME	Name of the data set e.g. <i>All interviews</i>
FACTORRANGEBEGIN	Limits the propagation process to factors greater than or equal to this factor
FACTORRANGEEND	Limits the propagation process to factors less than or equal to this factor
MAXOUTPUTCHAINS	Maximum number of output chains
PROPAGATIONNAME	Name of the propagation e.g. <i>Project interventions</i>
PROPAGATE	Should the propagation process be executed (<i>yes/no</i>). Normally set to <i>yes</i>
TERMINATIONCODE	Termination code used by the propagation process to denote an output chain. Note: is now redundant - should always be set to 1
TERMINATIONFACTORID	Factor used by the propagation process to denote an active chain (normally <i>suc:project:success</i>)

2.2.2 relationships.txt (modified)

Field #	Description
1	Interview Id (new) (ignore record if interview Id is not present in <i>interviews.txt</i>)
2	Source factor Id
3	Source factor's project type
4	Influence type
5	Target factor Id
6	Target factor's project type
7	Read record (new) (<i>yes/no</i>) (ignore record if not set to <i>yes</i>)

2.2.3 *interviews.txt* (new)

Field #	Description
1	Interview Id

2.3 Output files

2.3.1 *chains.n.txt* ($n=1\dots x$)

As above but only for a restricted number of active causal chains as specified by the parameters in the *parameters.txt* file.

2.3.2 *log.summary.txt*

Update to include new propagation data. In particular, differentiate between total and active chains (entities and factors).

2.3.3 *log.entities.txt* (modified)

For each entity in the relationship network, write the following data:

Field #	Description
1	Entity Id
2	Interview count (new)
3	Activity level
4	Total inbound relationship count
5	Active inbound relationship count
6	Total outbound relationship count
7	Active outbound relationship count
8	Target entity count

2.3.4 *log.factors.txt* (modified)

For each factor in the relationship network, write the following data:

Field #	Description
1	Factor Id
2	Interview count (new)
3	Project type
4	Activity level
5	Active chain count (renamed)
6	Average active chain length (renamed)
7	Total inbound relationship count
8	Active inbound relationship count
9	Total outbound relationship count
10	Active outbound relationship count
11	Total loop count
12	Average loop length
13	MCL chain count
14	Impotent chain count

2.3.5 *log.factors.base.txt* (modified)

Modifications as for *log.factors.txt*.

2.3.6 *log.relationships.txt* (modified)

For each relationship in the relationship network, write the following data:

Field #	Description
1	Source factor Id
2	Relationship type
3	Target factor Id
4	Interview count (new)
5	Activity count

2.3.7 *log.entities.targets.txt*

No modifications required.

2.3.8 *log.interviews.txt* (new)

For each interview in the relationship network, write the following data:

Field #	Description
1	Interview Id

3 Stage three enhancements

3.1 Functional requirements

Functionality required to:

- (1) Count the interactions between all factors and those contained in the *interactions.txt* file;
- (2) Count the interactions between all factors and the base factor when the base factor and target factor are set to the same value.

3.2 Input files

3.2.1 *parameters.txt* (new parameters)

Parameter	Description
PROCESSLOOPDATA	Should loop data be processed (<i>true</i> or <i>false</i> : defaults to <i>false</i>)

3.2.2 *interactions.txt* (new)

Field #	Description
1	Factor Id

3.3 Output files

3.3.1 *output.n.txt*

No modifications required.

3.3.2 *log.summary.txt*

Add *PROCESSLOOPDATA* parameter and interactions count.

3.3.3 *log.entities.txt*

No modifications required.

3.3.4 *log.factors.txt (modified)*

For each factor in the relationship network, write the following data:

Field #	Description
1	Factor Id
2	Interview count
3	Project type
4	Activity level
5	Active chain count
6	Average active chain length
7	Total inbound relationship count
8	Active inbound relationship count
9	Total outbound relationship count
10	Active outbound relationship count
11	Total loop count
12	Average loop length
13	MCL chain count
14	Impotent chain count
15	Interaction level

3.3.5 *log.factors.base.txt (modified)*

Modifications as for *log.factors.txt*.

3.3.6 *log.relationships.txt*

No modifications required.

3.3.7 *log.entities.relationships.txt*

No modifications required.

3.3.8 *log.interviews.txt*

No modifications required.

3.3.9 *log.interactions.txt* (new)

For each factor in the relationship network, write the following data:

Field #	Description
1	Factor Id
2	Chains with loops count
3	Average loop length
4 ...x	Number of interactions with factor[1...n] as specified in <i>interactions.txt</i> (n=number of factors in <i>interactions.txt</i> , x=3+n)

Appendix 3.6. Class design for the propagation software

1 General

Implements the functionality described in the propagation software requirements document (Appendix 3.5) as an object-oriented (console) application written in C# (developed using Microsoft's Visual Studio 2005).

2 Classes

The application comprises seven classes:

Class	Description
Chain	Used to instantiate chain objects used by the propagation process
Counter	Used to instantiate counter objects used to count interactions between factors and those specified in the <i>interactions.txt</i> input file
Entity	Used to instantiate entity objects derived from the <i>relationships.txt</i> input file
Factor	Used to instantiate factor objects derived from the <i>relationships.txt</i> input file
Loop	Used to instantiate loop objects identified during the propagation process
PropagationApp	Used to instantiate the propagation application object which in turn executes the propagation process
Relationship	Used to instantiate relationship objects derived from the <i>relationships.txt</i> input file

2.1 Chain class

The class contains the following accessible (read only) properties:

Property (type)	Description
Id (string)	Identifier (assigned when the causal chain is terminated)
IsDirect (bool)	Does the source factor have a directly (as opposed to inversely) proportional relationship with the target factor? Note: direct = positive and inverse = negative
Length (int)	Length
SourceFactor (Factor)	Source factor
TargetFactor (Factor)	Target factor
TerminationCode (int)	Termination code
TerminationReason (string)	Termination reason

The class contains the following methods:

Method signature	Description
public void AddRelationship(Relationship objRelationship)	Adds a relationship
public Chain Duplicate()	Returns a duplicate chain
private ArrayList DuplicateRelationshipList()	Duplicates the chain's relationship list (used by the Duplicate() method)
public bool FactorCausesLoop(Factor objFactor)	Does the factor cause a loop in the chain? If so, updates the factor's loop and interaction data.
public void IncrementInteractionLevels()	Increments interaction levels between factors and base factor (loop analysis mode only)
private void ResetRelationshipList(ArrayList newList)	Resets the chain's relationship list (used by the Duplicate() method)
public static void SetPropagationApp(PropagationApp objPropagationApp)	Sets (stores) the propagation application object
public void Terminate(int intId, Factor objTargetFactor, int intTerminationCode, string strTerminationReason)	Terminates the chain
public string ToString()	Returns a string representation of the chain
public void UpdateChainData()	Updates the chain's activity data

2.2 Counter class

The class contains the following accessible (read only) properties:

Property (type)	Description
Id (string)	Id (factor Id)
Total (int)	Total

The class contains the following methods:

Method signature	Description
Increment()	Increments the counter's total
ToString()	Returns a string representation of the counter

2.3 Entity class

The class contains the following accessible (read only) properties:

Property (type)	Description
ActiveInboundRelationshipCount (int)	Active inbound relationship count
ActiveOutboundRelationshipCount (int)	Active outbound relationship count
ActivityLevel (int)	Activity level
Id (string)	Id
InterviewCount (int)	Interview count
IsActive (bool)	Is the entity active?
TargetEntityCount (int)	Target entity count
TargetEntityCounterList (SortedList)	List of target entity counters
TotalInboundRelationshipCount (int)	Total inbound relationship count
TotalOutboundRelationshipCount (int)	Total outbound relationship count
Type (string)	Type (act, art, cri, ext, pro or suc)

The class contains the following methods:

Method signature	Description
public void AddFactor(Factor objFactor)	Adds a factor
public void AddInterview(string strId)	Adds an interview Id
public void AddTargetEntityCounter(Counter objCounter)	Adds a target entity counter
public string ToString()	Returns a string representation of the entity
public void UpdateActivity()	Updates the entity's activity
Public void UpdateTargetEntityActivity(string strId)	Updates the entity's target entity activity

2.4 Factor class

The class contains the following accessible (read only) properties:

Property (type)	Description
ActiveChainCount (int)	Active chain count
ActiveBaseFactorCount (int)	Active base factor count (number of base factors that depend on this factor to propagate their influences to affect project success)
ActiveBaseFactorList (SortedList)	List of active base factors (see above)
ActiveInboundRelationshipCount (int)	Active inbound relationship count (active vulnerability)
ActiveOutboundRelationshipCount (int)	Active outbound relationship count (active potency)
ActiveVulnerableFactorCount (int)	Active vulnerable factor count (see below)
ActiveVulnerableFactorList (SortedList)	List of active vulnerable factors affected by this factor
ActivityLevel (int)	Activity level
ActiveRelationshipCount (int)	Active relationship count (see below)
ActiveRelationshipList (SortedList)	List of active relationships
AverageActiveChainLength (double)	Average active chain length
AverageActiveChainPosition (double)	Average active chain position (position relative to end of chain)
AverageLoopLength (double)	Average loop length
ChainsWithLoopsCount (int)	Chains with loops count
Entity (Entity)	Entity
Id (string)	Id
ImpotentChainCount (int)	Impotent chain count

Property (type)	Description
InteractionCounterList (SortedList)	List of interaction counters
InteractionLevel (int)	Level of interaction with base factor (loop analysis mode only)
InterviewCount (int)	Interview count
IsActive (bool)	Is the factor active?
IsBase (bool)	Is the factor a base factor?
IsImpotent (bool)	Is the factor impotent (factor has no outbound relationships)?
IsPotent (bool)	Is the factor potent (factor has outbound relationships)?
IsRoot (bool)	Is the factor a root factor (factor has no inbound relationships)?
IsVulnerable (bool)	Is the factor vulnerable (factor has inbound relationships)?
LastNumericId (int)	Last numeric Id (static property) used to create unique numeric Ids for factors
LoopCount (int)	Loop count
MCLChainCount (int)	MCL chain count
NumericId (int)	Numeric Id
ProjectType (int)	Project type
ShouldPropagate (bool)	Should the factor be propagated?
TotalInboundRelationshipCount (int)	Total inbound relationship count (total vulnerability)
TotalOutboundRelationshipCount (int)	Total outbound relationship count (total potency)

The class contains the following methods:

Method signature	Description
public void AddActiveBaseFactor(Factor objFactor)	Adds an active base factor
public void AddActiveRelationship(Relationship objRelationship)	Adds an active relationship
public void AddActiveVulnerableFactor(Factor objFactor)	Adds an active vulnerable factor
public void AddInboundRelationship(Relationship objRelationship)	Adds an inbound relationship
public void AddInteractionCounter(Counter objCounter)	Adds an interaction counter
public void AddInterview(string strId)	Adds an interview Id

Method signature	Description
public void AddOutboundRelationship(Relationship objRelationship)	Adds an outbound relationship
public void IncrementInteractionLevel()	Increments the interaction level between the factor and the base factor (loop analysis mode only)
public void Propagate()	Initiates propagation with a new chain
public void Propagate(Chain objChain)	Terminates the chain or propagates to target factors
public void Propagate(Chain objChain, Relationship objRelationship)	Adds a relationship to the chain and propagates
private void PropagateToTargets(Chain objChain)	Propagates to target factors
public static void SetPropagationApp(PropagationApp objPropagationApp)	Sets (stores) the propagation application object
public string ToString()	Returns a string representation of the factor
public void UpdateActivity()	Updates the factor's activity
public void UpdateChainData(int intChainLength)	Updates the factor's chain data
public void UpdateCumulativeActiveChainPosition(int intChainPosition)	Updates the cumulative active chain position (used to calculate the average chain position)
public void UpdateLoopData(int intChainLength)	Updates the factor's loop data
public void UpdateRelationshipActivity()	Updates the factor's relationship activity

2.5 Loop class

The class contains the following accessible (read only) properties:

Property (type)	Description
Id (string)	Loop Id
Length (int)	Loop length

The class contains the following methods:

Method signature	Description
public void AddRelationship(Relationship objRelationship)	Adds a relationship
public bool ContainsFactor(string strId)	Determines whether or not the loop contains a specified factor (returns true or false)
public void CreateId()	Creates a unique Id for the loop

2.6 PropagationApp class

The class contains the following accessible (read only) properties:

Property (type)	Description
ActiveChainCount (int)	Active chain count
ActiveChainLimit (int)	Active chain limit (for reporting purposes)
ActivityUpdateCode (int)	Activity update code (1: detailed, 2: estimate). Note: is now redundant, 2 only.
AgreementLevel (int)	Agreement level
AverageActiveChainLength (double)	Average active chain length
AverageTotalChainLength (double)	Average total chain length
MaxChainLength (int)	Maximum chain length
ProcessLoopData (bool)	Should loop data be processed?
RootFactorsOnly (bool)	Should propagation process be limited to root factors only?
TerminationCode (int)	Termination code
TerminationFactorId (string)	Termination factor's Id

The class contains the following methods:

Method signature	Description
public void AddLoop(Loop objLoop)	Adds (stores) a causal loop (when detected by the propagation process)
private double CalculateAverageLoopLength()	Returns the average loop length
private void ClearOutputDirectory()	Clears the output data directory (folder)
private void DisplayMessage()	Writes an empty string to the console

Method signature	Description
private void DisplayMessage(Object objMessage)	Writes an object (usually a string) to the console
private int EntityCountByEntityType(string strType, bool boolOnlyActive)	Returns the entity count (total or active) by entity type
private int FactorCountByEntityType(string strType, bool boolOnlyActive)	Returns the factor count (total or active) by entity type
private int FactorCountByProjectType(int intType, bool boolOnlyActive)	Returns the factor count (total or active) by project type
private string FormatNumber(int intNumber)	Formats (comma delimits) a number
private Entity GetEntity(string strId)	Gets (retrieves) an entity object
private Factor GetFactor(string strId)	Gets (retrieves) a factor object
private Relationship GetRelationship(string strId)	Gets (retrieves) a relationship object
private bool IsWithinRange(Factor objFactor)	Checks if the factor is within the output range
private Entity MakeEntity(string strId)	Makes (creates/gets and returns) an entity object
private Factor MakeFactor(string strId)	Makes (creates/gets and returns) a factor object
private Relationship MakeRelationship(Factor objSource, string strType, Factor objTarget)	Makes (creates/gets and returns) a relationship object
public static void Main(string[] strArgs)	The application's entry point
private void ProcessLoops()	Processes the stored caused loop for reporting purposes
public void ProcessOutputFileCounters()	Processes the output file counters (used to manage the number of output (chain) files)
public void ProcessTerminatedChain(int intTCode, string strTReason, Chain objChain, Factor objFactor)	Processes a terminated chain (updates application counters and writes chain details to output file)
private void PropagateFactors()	Performs the propagation process
public string[] ReadFile(string strFileName)	Reads a file and returns its contents
private void ReadInteractions()	Reads the interactions data file
private void ReadInterviews()	Reads the interviews data file
private void ReadParameters()	Reads the parameters data file

Method signature	Description
private void ReadRelationships()	Reads the relationships data file
private void RunApp()	Runs the application (reads input files, performs propagation and writes output files)
public string ToString()	Returns a string representation of the propagation application
public void UpdateLongestChainLength(int intChainLength)	Updates the longest chain length
private void WriteLogs()	Writes the output logs (entities, factors, relationships, interactions and summary)
public void WriteToOutputFile()	Writes an empty string to the current output file
public void WriteToOutputFile(Object objObject)	Writes a string to the current output file

2.7 Relationship class

The class contains the following accessible (read only) properties:

Property (type)	Description
ActiveBaseFactorCount (int)	Active base factor count (see above)
ActivityLevel (int)	Activity level
AverageActiveChainPosition (double)	Average active chain position (see above)
Id (string)	Id
InfluenceType (string)	Influence type
InterviewCount (int)	Interview count
IsActive (bool)	Is the relationship active?
SourceFactor (Factor)	Source factor
TargetFactor (Factor)	Target factor

The class contains the following methods:

Method signature	Description
public void AddActiveBaseFactor(Factor objFactor)	Add an active base factor (see above)
public void AddInterview(string strId)	Adds an interview Id
public string ToString()	Returns a string representation of the relationship
public void UpdateActivity()	Updates the relationship's activity

Appendix 3.7. List of propagation runs performed during the relationship analysis

Run	Base factor(s)	MCL	Additional information
1	All factors	10	
2	All factors	11	
3	All factors	12	
4	All factors	13	
5	All factors	14	
6	All factors	15	
7	All factors	16	
8	All factors	17	
9	All factors	18	
10	All factors	19	
11	All factors	20	Maximum practicable MCL value for the propagation of all factors
12	act:c-o:arrogance	100	Factor analysis (random factor)
13	act:c-o:expectations	100	Factor analysis (random factor)
14	act:c-o:infighting	100	Factor analysis (random factor)
15	act:c-o:understanding\p-status	100	Factor analysis (random factor)
16	act:c-o\domain-experts:availability	100	Factor analysis (random factor)
17	act:c-o\end-users:comfort-level	100	Factor analysis (random factor)
18	act:c-o\end-users:involvement	100	Factor analysis (random factor)

Run	Base factor(s)	MCL	Additional information
19	act:c-o\p-board:staff-turnover	100	Factor analysis (random factor)
20	act:c-o\p-sponsor:involvement	100	Factor analysis (random factor)
21	act:c-o\p-sponsor:understanding\issues	100	Factor analysis (random factor)
22	act:c-o\p-team:empowerment	100	Factor analysis (random factor)
23	act:s-o:ability\learning	100	Factor analysis (random factor)
24	act:s-o:need-for-business	100	Factor analysis (random factor)
25	act:s-o:trustworthiness	100	Factor analysis (random factor)
26	act:s-o\p-manager:competence	100	Factor analysis (random factor)
27	act:s-o\p-manager:competence\communication-skills	100	Factor analysis (random factor)
28	act:s-o\p-manager:trustworthiness	100	Factor analysis (random factor)
29	act:s-o\p-team:energy	100	Factor analysis (random factor)
30	act:s-o\p-team:fear-of-losing-face	100	Factor analysis (random factor)
31	act:s-o\p-team:proximity-to-c-o	100	Factor analysis (random factor)
32	act:s-o\p-team:staffing-level	100	Factor analysis (random factor)
33	art:existing-system:account-of	100	Factor analysis (random factor)
34	art:issues:early-resolution-of	100	Factor analysis (random factor)
35	art:p-charter:fitness-for-purpose	100	Factor analysis (random factor)
36	art:p-deliverable:ease-of-use	100	Factor analysis (random factor)
37	art:p-objectives:fitness-for-purpose	100	Factor analysis (random factor)
38	art:p-plan:fitness-for-purpose	100	Factor analysis (random factor)
39	art:prototypes:utilisation-of	100	Factor analysis (random factor)

Run	Base factor(s)	MCL	Additional information
40	art:requirements:clarity	100	Factor analysis (random factor)
41	art:requirements:fitness-for-purpose	100	Factor analysis (random factor)
42	ext:business-environment:recession	100	Factor analysis (random factor)
43	pro:communication:effectiveness	100	Factor analysis (random factor)
44	pro:communication-with-c-o:face-to-face	100	Factor analysis (random factor)
45	pro:estimating:effectiveness	100	Factor analysis (random factor)
46	pro:personnel-recruitment:effectiveness	100	Factor analysis (random factor)
47	pro:p-start-up:effectiveness	100	Factor analysis (random factor)
48	pro:software-development:difficulty	100	Factor analysis (random factor)
49	pro:software-development:hacks	100	Factor analysis (random factor)
50	pro:software-testing:effectiveness	100	Factor analysis (random factor)
51	pro:training\c-o\end-users:amount-of	100	Factor analysis (random factor)
52	requirements:fitness-for-purpose	100	Loop analysis (most active factors): TF=BF
53	pro:project:duration	100	Loop analysis (most active factors): TF=BF
54	art:issues:number-of	100	Loop analysis (most active factors): TF=BF
55	act:c-o:understanding\what-they-want	100	Loop analysis (most active factors): TF=BF
56	pro:change:control:effectiveness	100	Loop analysis (most active factors): TF=BF
57	act:c-o:understanding\what-they-want	100	Loop analysis (random factor): TF=BF
58	act:c-o\end-users:feedback-from	100	Loop analysis (random factor): TF=BF
59	act:c-o\end-users:involvement	100	Loop analysis (random factor): TF=BF
60	act:s-o\p-manager:understanding\s-o\p-team	100	Loop analysis (random factor): TF=BF

Run	Base factor(s)	MCL	Additional information
61	art:estimates:fitness-for-purpose	100	Loop analysis (random factor): TF=BF
62	art:issues:number-of	100	Loop analysis (random factor): TF=BF
63	art:p-budget:fitness-for-purpose	100	Loop analysis (random factor): TF=BF
64	art:p-charter:fitness-for-purpose	100	Loop analysis (random factor): TF=BF
65	art:p-plan:fitness-for-purpose	100	Loop analysis (random factor): TF=BF
66	art:p-specification:fitness-for-purpose	100	Loop analysis (random factor): TF=BF
67	art:requirements:fitness-for-purpose	100	Loop analysis (random factor): TF=BF
68	art:requirements:priorities	100	Loop analysis (random factor): TF=BF
69	art:requirements:scope-creep	100	Loop analysis (random factor): TF=BF
70	pro:change-control:effectiveness	100	Loop analysis (random factor): TF=BF
71	pro:communication-with-c-o:effectiveness	100	Loop analysis (random factor): TF=BF
72	pro:communication-with-c-o\end-users:effectiveness	100	Loop analysis (random factor): TF=BF
73	pro:project:duration	100	Loop analysis (random factor): TF=BF
74	pro:project:schedule-pressure	100	Loop analysis (random factor): TF=BF
75	pro:training\c-o\end-users:effectiveness	100	Loop analysis (random factor): TF=BF
76	All factors	15	Criteria analysis (cri:c-o:satisfaction)
77	All factors	15	Criteria analysis (cri:project:benefit\to-c-o)
78	All factors	15	Criteria analysis (cri:project:adherence\requirements)
79	All factors	15	Criteria analysis (cri:project:adherence\p-budget)
80	All factors	15	Criteria analysis (cri:c-o:payment-from)
81	All factors	15	Criteria analysis (cri:project:profitability\to-s-o)

Run	Base factor(s)	MCL	Additional information
82	All factors	15	Criteria analysis (cri:c-o:repeat-business-from)
83	All factors	15	Criteria analysis (cri:p-deliverable:utilisation-by-c-o\end-users)
84	All factors	15	Criteria analysis (cri:c-o\p-board:satisfaction)
85	All factors	15	Criteria analysis (cri:c-o\end-users:satisfaction)
86	All factors	15	Criteria analysis (cri:project:adherence\schedule)
87	All factors	15	Criteria analysis (cri:p-deliverable:utilisation-by-c-o)
88	All factors	2	Special case: identification of shortest chains
89	All factors	5	Special case: analysis of success criterion relationships
90	pro:p-intervention:effectiveness	15	Special case: project intervention
91	suc:project:success	15	Special case: project success as a success factor (TF=BF)
92	All factors	15	Special case: target factor set to act:s-o\p-team:staffing-level

Notes:

- (1) Target factor set to *suc:project:success* in all propagation runs unless otherwise stated;
- (2) TF=BF: Target factor set equal to base factor;
- (3) A maximum chain length (MCL) value of 15 allows all active base factors in the relationship network to be identified;
- (4) Base factors for propagation runs 11 to 30 were randomly selected.

Appendix 3.8. Difficulties and limitations encountered during the fieldwork process

Despite appropriate planning, design and testing, a number of difficulties and limitations were encountered during the research. Although these did not detract significantly from the quality of the research, they should still be disclosed. The following are of particular note.

Fieldwork process: Stage 2: Interview arrangement

The research did not secure its target of 40 interviews, although it did exceed its lower limit of 30. There were a number of reasons for this. First, only 58 letters were sent to prospective companies. With hindsight, it may have been prudent to identify (by way of an additional company directory) and send out letters to a third batch of companies. Second, the researcher failed to make contact with a number of participants despite repeated telephone calls. Third, a number of the potential participants stated that they had no interest in the research while others did not consider themselves to be IS suppliers. One participant declined because he had already participated in a number of similar interviews. However, the main reason for failing to reach the target of 40 interviews seems to have been the economic downturn (or “credit crunch”) that was becoming prevalent at the time. As one company explained, they could not spare the time to be interviewed i.e. they could not release personnel, even for an hour, to spend time on non-revenue generating work. The economic downturn may also have been the reason for several companies withdrawing from the research after agreeing to participate. For example, when approached, one major database provider stated: “We can definitely help you with this.” Unfortunately, no interviews took place with this company. Similar scenarios took place with a number of other companies. This attrition was particularly disappointing as, at one stage, the research had provisionally secured its target of 40 interviews.

The research failed to secure a participant population that matched the required job functions. Originally, the intent was to secure participants who were either project managers, consultants or software developers. However, the final sample included two additional groups: software development managers and

company directors. Although all of these individuals had hands-on OISD project experience, the addition of these extra groups diluted the possibility of conducting comparisons between the views provided by the different job functions. For example, it was not possible to compare the views of consultants and project managers, simply because each job function group now had fewer members than had been originally anticipated.

The time and effort taken to secure interview participants took considerably longer than expected i.e. nearly five months of elapsed time and approximately five weeks' worth of effort. There were a number of reasons for this, the majority of which became apparent during the follow-up step (Step 2.6). First, the company information obtained from Stage 1 proved to be incorrect. In addition to the undelivered letters, one company had moved premises and the letter was lost in the process. This led to a prolonged series of telephone calls to locate the named contact. Similarly, in a number of cases, the named contact was found to be no longer with the company. Usually, this led to a series of telephone calls until an appropriate individual could be located. In all of the cases, this person had not had sight of the letter (see below). A number of contacts also reported that they had not received the letter; although others remembered having sight of the letter, primarily due to the green response form, but did not know its current location. In these cases, one of three courses of action were followed:

- (1) Sufficient information to secure involvement was to provided to the participant during the telephone conversation;
- (2) The letter was resent;
- (3) Supplementary information was emailed to the participant.

A number of the named contacts also proved extremely difficult to reach. Basically, at the time of repeated telephone calls, all were seemingly unavailable. Indeed, in a few cases, despite repeated attempts, it proved impossible to contact the named individual.

Fieldwork process: Stage 3: Data collection

Some of the interviews proved quite difficult to control. There were several reasons for this. An advantage of using open-ended questions was that it provided the participant with licence to identify and discuss subject matter of their own choice. The participants also had control of the amount of coverage they gave each subject and the order in which it was articulated. However, this freedom came at a price in that it allowed the participants to deviate from subject matter pertinent to the research question. Another control related problem manifested itself in two of the interviews. In both cases, the participants began to discuss their views as soon as the initial pleasantries had been concluded. That is, prior to the introductory presentation and before the recorder had been switched on. In both cases the researcher interjected as quickly as possible to ask if it would be possible to record the conversation from that point, to which both agreed. The final reason relates to the post-interview activities. Normally, the main part of the interview process was terminated once the participant felt that they had exhausted their views on the subject matter, at which point the recorder would be switched off. The participant would then be provided with the opportunity to ask any question which they might have. The next stages of the research were also explained to the participant. However, on all occasions the conversation between the researcher and the participant continued beyond this point. In a few cases, the participants began to discuss other issues that were relevant to the research, prompting the researcher to ask if it would be possible to switch the recorder back on.

The research process had no control over the participants' motivation or preparation for their interviews. The same was true for the "truthfulness" of the participants in terms of the information they provided. It was also extremely difficult to identify and quantify each of these characteristics. However, a number of participants did provide some useful indicators. For example, several participants clearly expressed their motivation for taking part in the research. One participant, from a large multinational consultancy firm, explained that he was participating because the company believed in building links with educational establishments. Another stated that he considered the research

objectives to be interesting and the results to be potentially valuable. One participant even stated that he had decided to participate in the research because it would force him to examine the way in which he performed his job as a project manager. A few participants also provided indications of the amount of preparation they had made prior to the interview. One participant used a PowerPoint presentation to structure his responses. Another brought notes and clearly indicated that she had spent time talking to other project managers in the organisation prior to the interview. Conversely, one participant clearly stated that he should have given more thought to the subject matter prior to the interview. Finally, as to the “truthfulness” of the participants, there was no indication that any of the participants were providing erroneous information. On the contrary, a number of the participants clearly indicated where they had no direct experience of a given scenario and were instead providing a view based on second hand information. In such cases, the information provided was excluded from the research.

A few of the interviews were held in locations with considerable background noise; the worst of which being coffee houses. Consequently, some of the interview recordings were found to contain inaudible segments that could not be fully transcribed. Although these segments were quite short, they did represent a minor loss in the data collection process.

As mentioned above, one participant declined to be recorded, forcing the researcher to take notes during the interview. This presented three problems, each of which detracted from the quality of the information obtained from the interview. First, having no shorthand skills, the researcher was not capable of producing a verbatim account of the interview. Second, the time taken making notes detracted from the researcher’s ability to engage in the interview. Third, it was decided that the notes should be reviewed and recorded immediately after the interview. However, this process served to introduce a degree of distortion of the information originally provided by the participant.

A great deal of care was taken to minimise interview bias in order that the participants would express their views without influence from the researcher

and the interview process. For example, the researcher's views on the subject matter were not presented in any form either before or during the interview (although they would sometimes be discussed after the interview was complete). Also, participants were never asked a direct question that might lead them to discuss a particular success factor. For example, "Do you think that risk management plays an important part in OISD projects?" However, interview bias can never be completely eliminated. For example, any interjection by the interviewer during the interview constitutes bias as it interferes and thus influences the participants' responses. More so, the participant's perception of the interviewer may well influence the responses they provide. This is a valid criticism of the research because not all of the interview participants were treated equally. For example, if the researcher perceived the interviewee to be somewhat apprehensive about the interview process, he would attempt to put him or her at ease (for example, pointing out that the participant's career to date, although quite short, was very relevant to the research) in an attempt to maximise rapport between the interviewer and interviewee.

The aim of the research was to investigate success factors for OISD projects. However, by employing an interview technique, the research did not collect data directly from projects, as would have been the case, for example, by direct observation or through access to project documentation. Instead, the data collected by the interview process reflects the views and experiences of practitioners involved in OISD projects.

Fieldwork process: Stage 4: Qualitative analysis

The coding and analysis of transcripts can be considered, at least in part, to be a subjective process, relying, among other things, on the skills of the researcher as opposed to any objective criteria. As a result, transcripts can be coded and analysed in different ways. Consider, for example, the coding process. The transcripts were coded in such a way that requirements management emerged as the factor with the most coverage. However, requirements management could also have been coded based on its constituent activities e.g. elicitation, triage and specification (Davis, Hickey, & Zweig, 2004, p. 397).

Fieldwork process: Stage 5: Relationship analysis

The factor propagation process, performed by the propagation software, gave rise to two problems. Both of these problems were due to the large number of active causal chains (those influencing project success) in the relationship network. The set of active causal chains in the relationship network is otherwise referred to as the solution space.

At the start of the quantitative analysis stage, the researcher's expectation was for a solution space comprising perhaps two or three thousand causal chains, each containing (on average) 10 relationships/factors. Collectively, these chains would influence project success via four or five success criteria. As the data coding process proceeded (identifying success factors and relationships), it was unclear as to whether or not this expectation would be met⁶⁷. However, when the software was first used to execute the propagation process, runtime errors indicated that the solution space was far larger than expected.

The first problem was that the software wrote the details of the active causal chains to a single output file. This approach is appropriate for relatively small solution spaces (for example, those comprising 10 thousand causal chains) but not for those containing larger volumes of data. Indeed, in this case, the solution space was so large that it caused fatal runtime errors. To rectify this, the software was modified to write active chain details to a series of smaller output files. Two parameters were implemented to control the size and number of these files. As the actual size of the solution space was still unknown at this point, a number of other parameters were also added to the software. These parameters allowed the software to propagate subsets of factors hence limiting the solution space explored. These, and other, parameters affecting the output generated by the propagation process are described in Appendix 3.5 (requirements specification for the propagation software).

⁶⁷ A case of "not being able to see the wood for the trees."

The second problem is best explained in relation to one of the software's parameters: the maximum chain length (MCL) parameter. As its name suggests, the MCL parameter limits the length of causal chains identified by the propagation process. In summary, causal chains exceeding this length are simply discarded by the software. The parameter was implemented as a safety measure to ensure that propagation process could not, for whatever reason, generate a causal loop of infinite length thus causing the software to "run away"; that is, fail to terminate properly. However, the MCL parameter also serves to limit the size of the solution space explored during the propagation process. Given the expectation for the solution space (as described above), it was envisaged that a MCL value of around 15 would suffice.

Running the propagation process with the MCL parameter set to 15 caused the software to discard a large number of causal chains. This meant that the actual solution space was larger than that being explored and that the MCL parameter value should be increased. However, increasing the MCL value has other effects (refer to Table 1).

MCL	Active chains	Run time
10	1,871,584	0h 03m
11	4,134,456	0h 06m
12	8,832,575	0h 14m
13	18,276,244	0h 31m
14	36,548,070	1h 04m
15	70,712,931	2h 09m
16	132,514,714	4h 17m
17	240,753,472	8h 07m
18	424,740,287	14h 50m
19	728,827,213	26h 39m
20	1,104,742,289	42h 02m

Table 1. Active chain counts and run time values for MCL values between 10 and 20

As Table 1 shows, incrementing the MCL value increased the number of active chains identified by the propagation process. As discussed above, this is

because the MCL value restricted the size of the solution space that can be explored by the software. A positive number of discarded chains (i.e. those that exceed the MCL value) indicated that the solution space was only being partially explored and that the MCL value should be increased. However, incrementing the MCL value significantly increased the time required to perform the propagation process. And, with the runtime approximately doubling with each MCL increment (refer to Table 1), running the software with a MCL value above 20 became impracticable. The question therefore is: Does this actually matter? In other words, for the purposes of this research, was it acceptable to explore only subsets of the actual solution space?

An investigation of the entire solution space would have been the ideal. This would have allowed the analysis to provide definitive values for the total number of active chains, the number of factors involved and precise activity levels for these factors. However, because the software can investigate subsets of the solution space, it can still be used to provide estimates of these values. For example, because it was found that the relative activity levels of the most active factors and criteria changed little as the MCL value was increased beyond a value of 15, the software can still be used to provide descriptive statistics for factor and criteria activity levels in the propagation process. The software, can also be used to perform propagation runs on a factor by factor basis, the results of which can be aggregated and extended to provide estimates for the total number of causal chains and loops. Hence, although the entire solution space cannot be explored, the software is still fit for purpose in providing a better understanding of the way in which OISD project success factors interact to influence project success (the second research objective).

Appendix 4.1. Interview participant details

Participant	Role	Experience (years)		Application domain(s)	Typical project size	
		Role	Total		Team members	Duration (months)
P1	Software developer (contractor)	5	5	Various	3	4
P2	Software developer (contractor)	5	5	Various	4	6
P3	Consultant	7	11	Various	3	6
P4	Consultant	25	30	Various	4	9
P5	Software developer (sole trader)	4	25	Various	1	6
P6	Software developer	10	12	Web, e-commerce	4	12
P7	Director	8	8	Various (hardware)	10	18
P8	Consultant	12	12	Various	8	9
P9	Consultant	20	20	Financial, commercial	1	6
P10	Project manager	30	30	Various	12	18
P11	Consultant	18	18	Financial, commercial	3	4
P12	Consultant	10	10	Financial, commercial	3	4
P13	Director	14	14	Various	10	12
P14	Project manager	6	11	Various	6	9
P15	Development manager	2	10	Various	4	9
P16	Consultant	20	20	Commercial	6	12
P17	Software developer	8	8	Various	4	6

Participant	Role	Experience (years)		Application domain(s)	Typical project size	
		Role	Total		Team members	Duration (months)
P18	Development manager	4	12	Law	3	4
P19	Director	1	6	CRM	8	12
P20	Project manager	5	20	CRM	12	18
P21	Director	10	20	Various	10	18
P22	Project manager	11	13	Various	6	9
P23	Consultant	6	10	Various	3	3
P24	Project manager	12	30	Various	6	9
P25	Director	5	16	CRM	15	18
P26	Consultant	11	11	CRM	8	12
P27	Software developer (sole trader)	11	16	Various	1	4
P28	Software developer (sole trader)	2	30	Various	1	6
P29	Software developer (sole trader)	3	7	Various	2	4
P30	Project manager	2	15	Various	20	24
P31	Consultant	20	30	Various	10	18
P32	Development manager	4	12	Law	3	4
P33	Managing director	13	35	Automated documentation	3	3
Total:		324	532	Mean:	6	10
Mean:		10	16			

Appendix 5.1. Relationship examples from the relationship data set

Item	Source factor/criteria	Influence	Target factor/criteria
1	act:c-o:attitude\can-do	Negative	art:requirements:scope-creep
2	act:c-o:expectations	Negative	cri:c-o:satisfaction
3	act:c-o:responsiveness	Negative	art:issues:number-of
4	act:c-o:understanding\what-they-want	Positive	art:p-deliverable:fitness-for-purpose
5	act:c-o\end-users:competence	Positive	pro:software-testing\uat:effectiveness
6	act:c-o\end-users:involvement\p-start-up	Positive	act:c-o\end-users:buy-in
7	act:c-o\p-board:buy-in	Positive	act:c-o\p-board:involvement
8	act:c-o\p-sponsor:competence	Positive	pro:p-governance:effectiveness
9	act:c-o\p-team:empowerment	Positive	pro:change-control:effectiveness
10	act:s-o:ability\learning	Positive	act:s-o:understanding\information-technology
11	act:s-o:honesty	Positive	act:s-o:relationship-with-c-o
12	act:s-o:understanding\risks	Negative	art:issues:number-of
13	act:s-o\p-manager:ability\to-say-no	Positive	pro:change-control:effectiveness
14	act:s-o\p-manager:competence\estimating	Positive	art:estimates:accuracy
15	act:s-o\p-manager:ego	Negative	act:s-o\p-manager:ability\to-manage-project
16	act:s-o\p-manager:trustworthiness	Positive	act:s-o:relationship-with-c-o
17	act:s-o\p-team:ability\learning	Positive	act:s-o\p-team:competence
18	act:s-o\p-team:commitment	Positive	act:s-o\p-team:productivity

Item	Source factor/criteria	Influence	Target factor/criteria
19	act:s-o\p-team:competence\issue-resolution	Positive	pro:software-development:progress
20	act:s-o\p-team:confidence	Positive	act:s-o\p-team:ability\to-provide-bad-news
21	act:s-o\p-team:gel	Positive	act:s-o\p-team:teamwork
22	act:s-o\p-team:proximity-to-c-o	Positive	act:c-o:involvement
23	act:s-o\p-team:teamwork	Positive	act:s-o\p-team:productivity
24	act:s-o\p-team:understanding\p-vision	Positive	act:s-o\p-team:buy-in
25	act:s-o\sales-team:ethics	Negative	pro:sales-process:overselling
26	art:change-requests:sign-off	Positive	art:requirements:fitness-for-purpose
27	art:issues:number-of	Positive	pro:project:cost
28	art:p-charter:fitness-for-purpose	Positive	act:s-o\p-team:understanding\risks
29	art:p-deliverable:usability	Positive	art:p-deliverable:fitness-for-purpose
30	art:p-docs:ambiguity	Negative	art:p-docs:fitness-for-purpose
31	art:prototypes:fitness-for-purpose	Positive	act:c-o\end-users:feedback-from
32	art:requirements:detail	Negative	art:requirements:scope-creep
33	art:requirements:fitness-for-purpose	Negative	pro:software-development:effort
34	art:software-development-tools:maturity	Positive	pro:software-development:effectiveness
35	cri:c-o:satisfaction	Positive	suc:project:success
36	cri:project:benefit\to-c-o	Positive	cri:c-o:satisfaction
37	pro:change-control:effectiveness	Negative	art:requirements:scope-creep
38	pro:communication-with-c-o:face-to-face	Positive	act:s-o:relationship-with-c-o
39	pro:expectation-management:effectiveness	Positive	act:c-o:buy-in

Item	Source factor/criteria	Influence	Target factor/criteria
40	pro:p-conceptualisation:consensus	Positive	pro:p-conceptualisation:effectiveness
41	pro:project:complexity	Positive	art:issues:number-of
42	pro:project:duration	Positive	act:c-o:staff-turnover
43	pro:project:schedule-pressure	Positive	art:issues:number-of
44	pro:requirements-definition:effectiveness	Positive	art:requirements:clarity
45	pro:risk-management:effectiveness	Negative	art:issues:number-of
46	pro:sales-process:overselling	Positive	act:c-o:expectations
47	pro:software-development:hacks	Negative	art:p-deliverable:fitness-for-purpose
48	pro:software-testing:duration	Negative	cri:project:adherence\schedule
49	pro:supplier-selection:effectiveness	Positive	act:s-o:relationship-with-c-o
50	pro:training\c-o\end-users:amount-of	Positive	cri:p-deliverable:utilisation-by-c-o\end-users

Note: all of the examples in the table can also be found in the active relationship network i.e. all of the relationships are active.

Appendix 5.2. OISD project success factors identified by the relationship analysis as base factors but not cited in the literature

The success (and failure) factors listed in this section were identified as base factors by the relationship analysis conducted as part of this research project but were not cited by the success factor analysis performed as part of the literature review.

Nomenclature

Success (and failure) factors were coded as entity-characteristic combinations and are hence depicted thus:

Entity (x): characteristic¹, characteristic², ... characteristic^x.

where

x: number of characteristics attributed to the entity (factors per entity).

Actors

Client organisation (77): arrogance, assumptions\validity, attitude\can do, bullying of supplier organisation\probability of, business objectives\clarity, business priorities\changes in, business processes\changes in, business requirements, business units\number of, buy-in, changes of mind, comfort level, competence\communication skills, competence\sales process, corporate governance, cost cutting exercises, culture\blame, culture\supportive of open honest communication, employees\number of, engagement of, expectations, expectations\alignment with project deliverable, expectations\competence\so, familiarity with supplier organisation\project team, financial pressures, infighting, influence over supplier organisation, interest in project, involvement\meetings\progress, involvement\meetings\supplier organisation\project review boards, involvement\project conceptualisation\background research, involvement\project conceptualisation\business case development, involvement\procurement process, involvement\requirements definition, involvement\sales process, involvement\software design, lessons learned, new product introductions\number of, open access to, operations\complexity, operations\peculiarities, organisation\degree of, personal agendas, reasonableness, resource availability, responsiveness, risk\aversion to, size, stability, structure\clarity, structure\layers\number of, supportiveness\for project manager, terminology\degree of, trustworthiness, understanding\business case, understanding\change

management, understanding\client organisation\operations, understanding\communication plan\need for, understanding\information technology, understanding\project deliverable, understanding\project governance, understanding\project governance\need for, understanding\project, understanding\project\effort\client organisation, understanding\project\involvement in, understanding\project\technical challenge, understanding\project start-up\prior to, understanding\project status, understanding\risks, understanding\scope creep\effects of, understanding\sign off\need for, understanding\supplier organisation-client organisation relationships, understanding\software development, understanding\what they want\flexibility, willingness to accept that they are building the wrong project deliverable, willingness to pay for project, willingness to provide funding.

Client organisation\domain experts (2): involvement\software testing, understanding\client organisation\operations.

Client organisation\end users (38): ability\to reach agreement, accessibility, belief that they are being listened to, buy-in, changes of mind, comfort level, comfort level\project deliverable, competence, confidence\utilisation of project deliverable, control of, desire\for project deliverable, emotional investment, expectations\volatility, fear of change imposed by project, fear of project objectives, ideas from, interest in project, involvement\ex project, involvement\meetings\workshops\requirements, involvement\optimal, involvement\project start-up, involvement\requirements elicitation, involvement\sales process, involvement\software testing, involvement\software testing\UAT, likelihood of providing information, perception of project deliverable, perception of supplier organisation\project team, personal agendas, understanding\client organisation\operations, understanding\project deliverable, understanding\project deliverable\how to use, understanding\project deliverable\reason for, understanding\supplier organisation\terminology, understanding\what they think they want, understanding\what they want, willingness to take responsibility, willingness to take responsibility for software testing\UAT\sign off.

Client organisation\facilitators (1): effectiveness.

Client organisation\IT department (1): protectionism.

Client organisation\middle management (1): control of.

Client organisation\project board (17): buy-in, communication amongst, effort, involvement\ex-project, involvement\project start-up,

involvement\requirements elicitation, management style, personal agendas, popularity with staff, proximity to supplier organisation\project team, staff turnover, understanding\client organisation\business rules, understanding\client organisation\industry sector, understanding\client organisation\operations, understanding\client organisation\workflow, understanding\issues, understanding\project.

Client organisation\project manager (7): authority, competence\decision making, empowerment, involvement\change control, involvement\requirements definition, length of service\with client, understanding\client organisation\who to talk to.

Client organisation\project sponsor (10): competence\decision making, direction from\consistency, involvement, involvement\ex project, involvement\project start-up, management of client organisation\project team, responsibility for project, understanding\issues, understanding\project, understanding\risks.

Client organisation\project team (6): ability\to perform multiple roles, empowerment, involvement\change control, involvement\continuous, understanding\business case, willingness to make decisions.

Client organisation\project team\requirements analysts (1): involvement\project conceptualisation.

Client organisation\stakeholders (6): comfort level\roles, fear of accountability, involvement\meetings\workshops\requirements, involvement\requirements elicitation, understanding\project deliverable, understanding\project\roles.

Communication participants (11): ability to question, cultural diversity, experience, language differences amongst, number of, proximity amongst, qualifications, understanding\common, understanding\other participants, willingness to communicate, willingness to explain matters.

Decision makers (5): communication amongst, distribution\number of, distribution\seniority, experience, qualifications.

Project documentation authors (5): ability\to structure an argument, competence\writing skills, competence\writing skills\documentation structuring, competence\writing skills\spelling, competence\writing skills\utilisation of grammar.

Supplier organisation (43): ability\learning, ability\to provide resources, ability\to say no, accreditation\quality, actions\accidental,

actions\intentional, attitude\can do, awareness\information technology, business priorities\ex project, business view\long term, commercial pressures, competence\communication skills, competence\issue management, competitive pressures, culture\blame, culture\supportive of open honest communication, fear of losing repeat business from client, financial pressures, honesty, involvement\meetings\supplier organisation\project review boards, involvement\requirements definition, need for business, partnership with client organisation, passion\for providing solutions that work, proximity to client organisation, quality accreditation, relationship with client organisation, relationship with client organisation\trust, resource availability, resource availability\learning, supportiveness\for project manager, supportiveness\technical, training policy, trustworthiness, understanding\client organisation\business environment, understanding\client organisation\business requirements, understanding\client organisation\culture, understanding\client organisation\terminology, understanding\information technology, understanding\project, understanding\project\effort\supplier organisation, understanding\risks, understanding\supplier organisation-client organisation relationships.

Supplier organisation\executive management (8): ability\to manage project manager, communication with client organisation\project board, effort, involvement, involvement\meetings\supplier organisation\project review boards, involvement\project governance, relationship with client organisation\project board, understanding\supplier organisation\project team.

Supplier organisation\project manager (101): ability\to ask questions, ability\to deal with supplier organisation\project team issues, ability\to deliver bad news\honestly, ability\to deliver bad news\quickly, ability\to explain matters, ability\to filter information, ability\to handle work load, ability\to implement project governance, ability\to manage project, ability\to manage supplier organisation\project team, ability\to manage third party supplier organisations, ability\to say no, ability\to trust others, ability\to use client organisation \terminology, ability\to work without management intervention, ability to obtain sign off, affiliation, approach, background\operations, characteristics\approachability, characteristics\emotional detachment, characteristics\flexibility, characteristics\is understanding, characteristics\native language\foreign, characteristics\proactive, characteristics\to enhance supplier organisation\project team work environment, characteristics\to provide morale support to supplier organisation\project team, characteristics\to work alongside supplier organisation\project team, communication with

supplier organisation\project team\regularity, competence\arbitration skills, competence\change management, competence\coaching skills, competence\communication skills, competence\communication skills\multi-level, competence\decision making, competence\estimating, competence\issue escalation, competence\issue identification, competence\issue management, competence\issue resolution, competence\motivational skills, competence\negotiation skills, competence\people management\soft, competence\project planning, competence\relationship management, competence\resource management, competence\technology management, control of project, courage\to ask for funding, cultural background, desire\to be successful, ego, empowerment, evaluation criteria\iron triangle, experience\volatile business environments, fit with project, focus on project management tasks, instinct, investment in, involvement\project monitoring, involvement\project start-up, involvement\sales handover, involvement\sales process, involvement\sales process\bidding, involvement\with supplier organisation\project team, lessons learned, ownership, performance criteria\project budget, performance criteria\requirements, performance criteria\schedule, personality\fit with client, priority given to project management role, proximity to supplier organisation\project team, relationship with client organisation\project board, relationship with supplier organisation\project team, respect\from others, trustworthiness, understanding\client organisation, understanding\client organisation\business plans, understanding\client organisation\expectations, understanding\client organisation\industry sector, understanding\client organisation\operations\roles, understanding\client organisation\project management, understanding\client organisation\programme management, understanding\client organisation\requirements, understanding\client organisation\structure, understanding\issue escalation\paths, understanding\issues, understanding\project deliverable, understanding\project governance, understanding\project, understanding\project\from beginning, understanding\project status, understanding\project tasks, understanding\project vision, understanding\requirements, understanding\risks, understanding\supplier organisation\project team, understanding\supplier organisation\project team\competence, utilisation level, workload.

Supplier organisation\post-implementation support team (4): involvement, understanding\client organisation\operations, understanding\issues\post implementation support, understanding\project deliverable\utilisation of.

Supplier organisation \project team (135): ability\learning, ability\to ask questions, ability\to identify potential software defects, ability\to perform multiple roles, ability\to provide bad news, ability\to say no, ability\to utilise available resources, absences, access to client organisation\end users, accountability\definition of, affiliation\to client, age of, aversion to spend time on project documentation, background\industry sector, benefits package\fitness for purpose, buy-in, characteristics\inquisitiveness, characteristics\knowing when to ask for assistance, characteristics\self motivated, characteristics\takes pride in work, characteristics\tendency to admit mistakes, characteristics\to admit they do not understand, characteristics\unwillingness to fail, communication with client, communication with client organisation\end users, communication with client organisation\project team, communication with third party supplier organisations, competence\business, competence\communication skills, competence\decision making, competence\estimating, competence\feature management, competence\interpretation skills, competence\issue resolution, competence\listening skills, competence\multi skilled, competence\people management, competence\problem solving, competence\requirements elicitation, competence\research skills, competence\software development tools, competence\writing skills, competitiveness\with third party supplier organisations, confidence, confidence\as perceived by client organisation\end users, coordination\with third party supplier organisations, cultural diversity, desire\to keep client happy, effort\communicating with client, effort\expended, empathy\with client, empowerment, energy, enthusiasm, experience\access to, experience\industry sector, experience\technical, fear of losing face, flexibility to work overtime, friction with third party supplier organisations, gel, interest in project\as perceived by client organisation\end users, interest in project tasks, involvement\communication with client organisation\end users, involvement\meetings\workshops\design, involvement\meetings\workshops\requirements, involvement\post implementation support, involvement\project planning, involvement\procurement process, involvement\requirements definition, involvement\sales handover, involvement\sales process, involvement\with client organisation\end users, lessons learned, likelihood of asking questions, likelihood to ask for help, likelihood to second guess\client organisation\end users, management of\ease of, motivation, optimism, overtime worked, overtime worked\unpaid, personal agendas, pressure\personally applied, productivity, professionalism, proximity amongst, proximity to client, proximity to client organisation\end users, proximity to client organisation\project team, proximity to third party supplier organisations, relationship with client, relationship with client

organisation\end users, relationship with third party supplier organisations, respect for supplier organisation\project manager, responsibilities\definition of, structure\definition of, task variation, teamwork, understanding\client organisation\business objectives, understanding\client organisation\business strategy, understanding\client organisation\expectations, understanding\client organisation\industry sector, understanding\client organisation\stakeholders, understanding\client organisation\structure, understanding\client organisation\technology, understanding\client organisation\terminology, understanding\client organisation\who to talk to, understanding\project benefits, understanding\project deliverable\potential benefits, understanding\project deliverable\usability, understanding\people management, understanding\project objectives, understanding\project, understanding\project\dependencies, understanding\project\outcome, understanding\project\roles, understanding\project\slippages, understanding\project politics, understanding\project tasks, understanding\project tasks\other team members, understanding\project tasks\priorities, understanding\project vision, understanding\requirements\client organisation\end users, understanding\risks, understanding\roles and responsibilities, understanding\roles and responsibilities\other team members, understanding\system implementation, visibility of future project tasks, willingness to ask for help, willingness to take responsibility, willingness to work overtime, willingness to work together, work environment.

Supplier organisation\project team\consultants (2): involvement\excessive, lessons learned.

Supplier organisation\project team\requirements analysts (12): ability\to block requirements outwith project specification, ability\to dig deeper, ability\to say no, characteristics\firm but fair, competence, competence\listening skills, effectiveness, involvement\requirements elicitation, involvement\sales process, understanding\application type, understanding\business, understanding\client organisation\industry sector.

Supplier organisation\project team\software testers (2): involvement\software build, proximity to\supplier organisation\project team.

Supplier organisation\sales team (11): ethics, experience, involvement\post sales, involvement\sales handover, involvement\supplier organisation\commercial aspects, promises realism, responsibility for project success, sales commission, understanding\project deliverable, understanding\project, understanding\software development.

Third party supplier organisations (4): fit with project, politics, responsiveness to supplier organisation\project team requests, understanding\project objectives.

Artefacts

Business case (2): benefit\to client organisation\end users, referral back to.

Change requests (2): documentation of, sign off.

Coding standards (1): fitness for purpose.

Client specification (1): fitness for purpose.

Decisions\software design (5): compromise, documentation of, fitness for purpose, number of, political content.

Estimates (1): granularity.

Existing system (2): account of, scale\integrity.

Invitation to tender (2): fitness for purpose, vagueness.

Issues (3): early identification of, early resolution of, number of.

Issues\organisational\client organisation (1): number of.

Issues\software defects (4): early resolution of, number of, severity, time available for\resolution.

IT infrastructure\hardware (1): fitness for purpose.

IT infrastructure\operating system (1): fitness for purpose.

Methodologies\project management (1): fitness for purpose.

Methodologies\software development\formal (1): utilisation of.

Project assumptions (1): fitness for purpose.

Project budget (8): existence of, fat, realism, sign off, stability, training provision, utilisation of\effectiveness, wriggle room.

Project charter (2): fitness for purpose, length\appropriateness.

Project deliverable (18): configurability, defects, efficiency, extensibility, familiarity to client organisation\end users, fit with client organisation\end user working practices, functionality\end user computing, hacks, integrity,

interference from third party applications, intuitiveness, maintainability, reliability\functionality, reliability\maintainability, scalability, stability, structure, usability.

Project deliverable\interim (1): early delivery of.

Project deliverable\third party (1): availability.

Project deliverable\user interface (2): aesthetics, familiarity to client organisation\end users.

Project documentation (7): ambiguity, length\appropriateness, readability, sign off, structure\logical, understanding of, utilisation of.

Project documentation\client organisation\end users\instructions (1): fitness for purpose

Project due date (2): existence of, rigidity.

Project objectives (1): achievability.

Project plan (4): accuracy, dependencies\account of, sign off, training provision.

Project proposal/bid (3): assumptions\documentation of, assumptions\understanding of, fitness for purpose.

Prototypes (4): features\requested by client organisation\end users, fitness for purpose, potential risk associated with, utilisation of.

Project specification (4): continuous referral to, fitness for purpose, supportiveness\of s o client relationship, wriggle room.

Project success criteria (1): definition of.

Quality framework (1): fitness for purpose.

Requirements (15): agreement of\client organisation, alignment with client organisation\end users\requirements, alignment with project budget, alignment with project charter, amount of, documentation of, language used\consistency, length of time to delivery, meaningfulness, minimum implementation footprint, priorities, readability, scope shrinkage, sign off, tangibility.

Software components (1): fitness for purpose.

Software development artefacts (3): appropriate utilisation of, maturity, support for.

Software development tools (4): improvements in, maturity, usefulness, utilisation of.

Specifications\requirements (1): fitness for purpose.

Standards\software development (4): fitness for purpose, number of, PRINCE2 likeness, standardisation.

External

Business environment (1): recession.

Competition\client (1): new product introductions\number of.

Competition\supplier (1): fierceness.

Exchange rates (1): stability.

Information technology (1): rate of change.

Legislation (2): adherence to, introduction of.

Mass market software (2): cost, quality.

Professional qualifications (1): standardisation.

Takeovers\client organisation (1): threat of.

Processes

Change control (3): adherence to, evaluation of trade-offs, robustness.

Change management (2): disruption to client, effort.

Client complaint process (1): effectiveness.

Communication (3): discussion, face to face, honesty.

Communication with client (14): clarity, continuous, effectiveness, face to face, informality, medium\fitness for purpose, multi level, openness, regularity, regularity\need for, through third party supplier organisations, time available for, utilisation of communication logs, utilisation of client terminology.

Communication with client organisation\end users (1): face to face.

Data preparation (1): effectiveness.

Decision making (1): effectiveness.

Dependency management (1): effectiveness.

Expectation management (1): effectiveness.

Issue escalation (2): effectiveness, rapidity.

Issue identification (1): effectiveness.

Issue management (1): timeliness.

Issue monitoring\software defects (1): effectiveness.

Issue resolution (2): effectiveness, rapidity.

issue resolution\software defects (1): effectiveness.

Meetings\progress (3): effectiveness, involvement\from client, regularity.

Meetings\supplier organisation\project review boards (3): effectiveness, format\open forum, regularity.

Meetings\supplier organisation\quality review (1): effectiveness.

Meetings\workshops\design (1): effectiveness.

Meetings\workshops\project team on boarding session (1): effectiveness.

Meetings\workshops\requirements (1): effectiveness.

Personnel recruitment (1): effectiveness.

Post implementation support (3): effectiveness, effort\issues\outwith project deliverable, language differences with client organisation\end users.

Procurement process (2): analysis, involvement of correct client organisation\personnel.

Project conceptualisation (1): consensus.

Project governance (3): cost, early introduction of, management of.

Project management (1): cost.

Project (28): commercial model, complications, definition of, delivery\incremental, difficulty, duration, efficiency, effort, evolution, fit with client organisation\business objectives, fit with supplier organisation, fit with supplier organisation\experience, fit with supplier organisation\industry sector, fit with supplier organisation\technology, flexibility\commercial, flexibility to adjust project deliverable, methodology, novelty, opportunity leverage, price\fixed, priority\volatility, rigidity, scale of implementation\integrity, schedule pressure\short term, scope\fixed, slippages, technical innovation, uniqueness.

Project start-up (5): available information, controlled, explanation to client organisation\change control, explanation to client organisation\sign off, pre meeting data gathering.

Project tasks (1): adherence\schedule.

Relationship building (1): effectiveness.

Relationship management (1): effectiveness.

Relationship management\client organisation\end users (1): effectiveness.

Requirements definition (6): access to client organisation\domain experts, approach\iterative, boundaries\clarity, utilisation of face to face meetings, utilisation of test plans, utilisation of use cases.

Requirements elicitation (2): personnel involved in\number of, proximity to client.

Resource management (1): ability\to provide additional support.

Resource planning (1): effectiveness.

Sales process (12): available information, commercial negotiations, due diligence, guess work, management of, objectiveness, overselling, overselling\project deliverable, overselling\project duration, relationship building, suitability of projects being bid for, thoroughness.

Sales process\bidding (2): available information, communication with client organisation\face to face.

Sales process\client organisation\internal (1): overselling.

Software coding (1): effectiveness.

Software development (12): coordination, difficulty, difficulty\unforeseen, effort, effort\rework, hacks, incremental, off shoring, progress, revision cycles, slippages, time available for.

Software testing (6): automation, defects detected, duration, management of, thoroughness, time available for.

Software testing\integration (1): effectiveness.

Software testing\UAT (3): amount of, defects detected, sign off.

Stakeholder management\project board (1): effectiveness.

Supplier selection (3): effectiveness, supplier organisation references\obtainment of, weighting system\fitness for purpose.

System implementation (2): effectiveness, parallel running with existing system.

System implementation\design (1): effort.

System implementation\planning (1): effort.

Training\client organisation\end users (10): amount of, approach, approach\train the trainer, class size, cost, peers in training classes\number of, preparation for, time available for, training material, utilisation of business data.

Training\supplier organisation\project manager (4): effectiveness, fit with project management role, on the job, p manager mentoring.

Training\supplier organisation\project team (4): amount of, on the job, resource availability, time available for.

Appendix 5.3. Active causal chain examples

```

art:requirements:fitness-for-purpose
-p->
art:business-case:fitness-for-purpose
-p->
act:c-o:buy-in
-n->
act:c-o:resistance-to-change
-n->
cri:p-deliverable:utilisation-by-c-o
-p->
cri:project:benefit\to-c-o
-p->
cri:c-o:satisfaction
-p->
act:c-o:willingness-to-pay-for-project
-p->
cri:project:profitability\to-s-o
-p->
suc:project:success

```

Example 1. Fit for purpose requirements

```

art:p-plan:fitness-for-purpose
-p->
act:s-o:resource-availability
-p->
act:s-o\p-team:staffing-level
-n->
act:s-o\p-team:management-of\ease-of
-n->
act:s-o\p-manager:workload
-n->
act:s-o\p-manager:ability\to-manage-project
-n->
act:c-o:politics
-n->
art:requirements:priorities
-p->
art:p-deliverable:fitness-for-purpose
-p->
cri:c-o:satisfaction
-p->
suc:project:success

```

Example 2. Fit for purpose project plan


```

art:p-charter:fitness-for-purpose
-p->
act:s-o\p-team:understanding\roles-and-responsibilities
-p->
act:s-o\p-team:buy-in
-p->
act:s-o\p-team:productivity
-n->
pro:software-development:duration
-p->
pro:project:duration
-p->
act:c-o\end-users:staff-turnover
-n->
pro:training\c-o\end-users:effectiveness
-p->
act:c-o\end-users:understanding\p-deliverable
-p->
cri:p-deliverable:utilisation-by-c-o\end-users
-p->
suc:project:success

```

Example 3. Fit for purpose project charter

```

pro:communication:effectiveness
-p->
act:s-o\p-manager:understanding\risks
-p->
act:s-o\p-manager:competence\p-planning
-p->
pro:p-planning:effectiveness
-n->
art:issues:number-of
-n->
act:s-o\p-manager:control-of-project
-p->
pro:requirements-management:effectiveness
-p->
art:requirements:fitness-for-purpose
-p->
art:p-deliverable:fitness-for-purpose
-p->
cri:c-o\p-board:satisfaction
-p->
suc:project:success

```

Example 4. Effective communication

```

act:c-o\end-users:involvement
-p->
art:requirements:fitness-for-purpose
-p->
art:business-case:fitness-for-purpose
-p->
act:c-o:willingness-to-provide-funding
-p->
art:p-budget:fitness-for-purpose
-p->
act:s-o\p-team:staffing-level
-n->
act:s-o\p-team:management-of\ease-of
-n->
act:s-o\p-manager:workload
-n->
act:s-o\p-manager:ability\to-manage-project
-n->
act:c-o:politics
-n->
act:s-o\p-team:work-environment
-p->
act:s-o\p-team:teamwork
-p->
act:s-o\p-team:competence\issue-resolution
-n->
art:issues:number-of
-n->
act:s-o\p-manager:control-of-project
-p->
pro:requirements-management:effectiveness
-n->
pro:project:duration
-n->
act:c-o:involvement
-p->
act:s-o:relationship-with-c-o
-p->
pro:communication-with-c-o:effectiveness
-p->
act:c-o:comfort-level
-p->
pro:communication:effectiveness
-p->
act:s-o\p-manager:understanding\risks
-p->
act:s-o\p-manager:competence\p-planning
-p->
act:s-o\p-manager:effectiveness
-p->
art:p-deliverable:fitness-for-purpose
-p->
cri:c-o:satisfaction
-p->
suc:project:success

```

Example 5. End users' involvement

```

act:c-o:arrogance
-n->
act:c-o:understanding\project\technical-challenge
-p->
pro:sales-process:due-diligence
-n->
pro:sales-process:overselling
-p->
act:c-o:expectations
-p->
pro:software-development:difficulty
-n->
art:software-components:fitness-for-purpose
-p->
art:p-deliverable:fitness-for-purpose
-p->
cri:c-o:satisfaction
-p->
cri:c-o:repeat-business-from
-p->
suc:project:success

```

Example 6. Client arrogance

```

act:s-o\p-manager:competence\communication-skills
-p->
act:s-o\p-team:respect-for-s-o\p-manager
-p->
act:s-o\p-team:buy-in
-p->
act:s-o\p-team:productivity
-n->
pro:software-development:duration
-p->
pro:project:duration
-n->
act:c-o:buy-in
-p->
cri:p-deliverable:utilisation-by-c-o
-p->
cri:project:benefit\to-c-o
-p->
cri:c-o:satisfaction
-p->
suc:project:success

```

Example 7. Project manager's communication skills

```

pro:training\c-o\end-users:amount-of
-p->
pro:project:cost
-n->
cri:c-o:satisfaction
-p->
act:c-o:willingness-to-pay-for-project
-p->
cri:project:profitability\to-s-o
-p->
suc:project:success

```

Example 8. Amount of end users' training

```

art:existing-system:account-of
-p->
art:requirements:fitness-for-purpose
-p->
art:business-case:fitness-for-purpose
-p->
act:c-o:willingness-to-provide-funding
-p->
art:p-budget:fitness-for-purpose
-p->
act:s-o\p-team:staffing-level
-n->
act:s-o\p-team:management-of\ease-of
-n->
act:s-o\p-manager:workload
-n->
act:s-o\p-manager:ability\to-manage-project
-n->
act:c-o:politics
-n->
act:s-o\p-team:work-environment
-p->
act:s-o\p-team:teamwork
-p->
act:s-o\p-team:competence\issue-resolution
-n->
art:issues:number-of
-n->
act:s-o\p-team:confidence
-p->
(continued on next page)

```

Example 9. Taking account of the existing system

```

(continued from previous page)
-p->
act:s-o\p-team:ability\to-provide-bad-news
-p->
art:estimates:fitness-for-purpose
-p->
act:s-o\p-manager:control-of-project
-p->
pro:resource-management:effectiveness
-p->
pro:issue-identification:effectiveness
-p->
pro:issue-resolution:effectiveness
-n->
pro:project:slippages
-p->
pro:project:duration
-p->
act:c-o\end-users:staff-turnover
-n->
pro:training\c-o\end-users:effectiveness
-p->
act:c-o\end-users:feedback-from
-p->
art:prototypes:features\requested-by-c-o\end-users
-p->
act:c-o\end-users:buy-in
-n->
act:c-o\end-users:resistance-to-change
-n->
act:c-o\end-users:involvement
-p->
pro:communication-with-c-o\end-users:effectiveness
-p->
art:requirements:detail
-n->
art:requirements:scope-creep
-p->
pro:software-development:slippages
-p->
pro:project:schedule-pressure
-n->
pro:software-testing:time-available-for
-p->
pro:software-testing:effectiveness
-n->
art:issues\software-defects:number-of
-n->
art:p-deliverable:fitness-for-purpose
-p->
cri:project:benefit\to-c-o
-p->
suc:project:success

```

Example 9 (continued). Taking account of the existing system

```

pro:p-start-up:effectiveness
-p->
act:c-o:understanding\project
-n->
art:issues:number-of
-n->
act:s-o\p-manager:control-of-project
-p->
pro:requirements-management:effectiveness
-p->
art:requirements:fitness-for-purpose
-p->
art:business-case:fitness-for-purpose
-p->
act:c-o:buy-in
-p->
cri:p-deliverable:utilisation-by-c-o
-p->
cri:project:benefit\to-c-o
-p->
suc:project:success

```

Example 10. Effective project start-up

```

pro:estimating:effectiveness
-p->
art:estimates:fitness-for-purpose
-p->
act:s-o\p-manager:control-of-project
-n->
art:issues:number-of
-p->
pro:project:difficulty
-p->
pro:software-development:effort
-p->
pro:project:cost
-n->
cri:c-o:satisfaction
-p->
act:c-o:willingness-to-pay-for-project
-p->
cri:project:profitability\to-s-o
-p->
suc:project:success

```

Example 11. Effective estimating

```

act:c-o\p-sponsor:understanding\issues
-p->
act:c-o\p-sponsor:involvement
-p->
pro:p-governance:effectiveness
-p->
pro:change-control:effectiveness
-p->
art:requirements:priorities
-p->
art:p-plan:fitness-for-purpose
-n->
art:issues:number-of
-n->
art:p-deliverable:fitness-for-purpose
-p->
cri:project:benefit\to-c-o
-p->
cri:c-o:satisfaction
-p->
suc:project:success

```

Example 12. Project sponsor's understanding of (project) issues

```

act:c-o\p-board:staff-turnover
-p->
art:change-requests:number-of
-p->
pro:project:duration
-n->
act:c-o:buy-in
-n->
act:c-o:resistance-to-change
-n->
cri:p-deliverable:utilisation-by-c-o
-p->
cri:project:benefit\to-c-o
-p->
cri:c-o:satisfaction
-p->
act:c-o:willingness-to-pay-for-project
-p->
cri:project:profitability\to-s-o
-p->
suc:project:success

```

Example 13. Staff turnover in the project board

```

act:s-o\p-team:staffing-level
-n->
act:s-o\p-team:management-of\ease-of
-n->
act:s-o\p-manager:workload
-n->
act:s-o\p-manager:ability\to-manage-project
-n->
act:c-o:politics
-n->
act:s-o\p-team:work-environment
-p->
act:s-o\p-team:teamwork
-p->
act:s-o\p-team:competence\issue-resolution
-n->
art:issues:number-of
-n->
act:s-o\p-manager:control-of-project
-p->
pro:requirements-management:effectiveness
-p->
art:requirements:fitness-for-purpose
-p->
art:business-case:fitness-for-purpose
-p->
act:c-o:willingness-to-provide-funding
-p->
art:p-budget:fitness-for-purpose
-n->
art:change-requests:number-of
-p->
pro:project:duration
-n->
act:c-o:involvement
-p->
act:s-o:relationship-with-c-o
-p->
pro:communication-with-c-o:effectiveness
-p->
act:c-o:comfort-level
-p->
pro:communication:effectiveness
-p->
act:s-o\p-manager:understanding\risks
-p->
act:s-o\p-manager:competence\p-planning
-p->
act:s-o\p-manager:effectiveness
-p->
art:p-deliverable:fitness-for-purpose
-p->
cri:c-o:satisfaction
-p->
suc:project:success

```

Example 14. Project team's staffing level


```

pro:software-development:difficulty
-n->
art:software-components:fitness-for-purpose
-n->
pro:software-development:duration
-p->
pro:project:duration
-p->
pro:project:priority\volatility
-n->
art:p-plan:fitness-for-purpose
-n->
art:issues:number-of
-n->
art:p-deliverable:fitness-for-purpose
-p->
cri:project:benefit\to-c-o
-p->
cri:c-o:satisfaction
-p->
suc:project:success

```

Example 15. Software development difficulty

```

ext:business-environment:recession
-p->
act:c-o:politics
-n->
act:s-o\p-team:work-environment
-p->
act:s-o\p-team:teamwork
-p->
act:s-o\p-team:competence\issue-resolution
-n->
art:issues:number-of
-n->
act:s-o\p-manager:control-of-project
-p->
pro:requirements-management:effectiveness
-p->
art:requirements:fitness-for-purpose
-p->
cri:p-deliverable:utilisation-by-c-o\end-users
-p->
suc:project:success

```

Example 16. Recession in the business environment

```

art:p-deliverable:ease-of-use
-p->
art:p-deliverable:fitness-for-purpose
-p->
cri:project:benefit\to-c-o
-p->
cri:c-o:satisfaction
-p->
act:c-o:willingness-to-pay-for-project
-p->
cri:project:profitability\to-s-o
-p->
suc:project:success

```

Example 17. Project deliverable's ease of use

```

pro:personnel-recruitment:effectiveness
-p->
act:s-o\p-team:competence
-p->
act:s-o\p-team:management-of\ease-of
-n->
act:s-o\p-manager:workload
-n->
act:s-o\p-manager:ability\to-manage-project
-n->
act:c-o:politics
-n->
act:s-o\p-team:work-environment
-p->
act:s-o\p-team:teamwork
-p->
art:p-deliverable:fitness-for-purpose
-p->
cri:c-o:satisfaction
-p->
suc:project:success

```

Example 18. Effective personnel recruitment

```

act:s-o\p-team:proximity-to-c-o
-p->
act:c-o:involvement
-p->
act:s-o:relationship-with-c-o
-p->
pro:communication-with-c-o:effectiveness
-p->
act:c-o:understanding\what-they-want
-p->
art:estimates:fitness-for-purpose
-p->
art:p-plan:fitness-for-purpose
-n->
art:issues:number-of
-n->
art:p-deliverable:fitness-for-purpose
-p->
cri:project:profitability\to-s-o
-p->
suc:project:success

```

Example 19. Proximity of the project team to the client organisation

```

pro:communication-with-c-o:face-to-face
-p->
act:s-o:relationship-with-c-o
-p->
pro:issue-resolution:effectiveness
-n->
art:issues:number-of
-n->
pro:training\c-o\end-users:time-available-for
-p->
pro:training\c-o\end-users:effectiveness
-p->
pro:software-testing\uat:effectiveness
-p->
art:p-deliverable:fitness-for-purpose
-p->
cri:project:adherence\requirements
-p->
cri:p-deliverable:utilisation-by-c-o\end-users
-p->
suc:project:success

```

Example 20. Face-to-face communication with the client

Appendix 5.4. Active chain statistics for 40 randomly selected active base factors

Item	Base factor	Active Chain Count	Average Active Chain Length	Longest Active Chain Length	Active Entity Count	Active Factor Count	Active Relationship Count
1	act:c-o:arrogance	113,608,368	36.7	58	43	146	362
2	act:c-o:expectations	32,754,486	34.6	54	42	142	342
3	act:c-o:infighting	15,441,811	32.6	52	40	136	321
4	act:c-o:understanding\p-status	3	3.0	4	3	5	7
5	act:c-o\domain-experts:availability	86,042,615	34.9	55	42	139	339
6	act:c-o\end-users:comfort-level	126,737,278	34.9	57	41	139	340
7	act:c-o\end-users:involvement	127,299,456	32.9	55	41	139	341
8	act:c-o\p-board:staff-turnover	17,279,133	33.2	52	42	139	331
9	act:c-o\p-sponsor:involvement	466,672,537	35.8	58	49	158	384
10	act:c-o\p-sponsor:understanding\issues	466,672,537	36.8	59	49	159	385
11	act:c-o\p-team:empowerment	132,121,875	34.3	56	42	140	342
12	act:s-o:ability\learning	12	4.8	7	7	11	20
13	act:s-o:need-for-business	113,608,368	34.7	56	43	144	360
14	act:s-o:trustworthiness	246,409,812	34.4	55	41	140	343
15	act:s-o\p-manager:competence	12	4.8	7	7	11	20
16	act:s-o\p-manager:competence\communication-skills	14,703,888	36.0	55	41	135	325

Item	Base factor	Active Chain Count	Average Active Chain Length	Longest Active Chain Length	Active Entity Count	Active Factor Count	Active Relationship Count
17	act:s-olp-manager:trustworthiness	246,409,812	34.4	55	41	140	343
18	act:s-olp-team:energy	14,703,876	34.0	53	41	135	322
19	act:s-olp-team:fear-of-losing-face	23,612,860	35.3	55	41	140	341
320	act:s-olp-team:proximity-to-c-o	505,963,634	35.8	57	41	143	351
21	act:s-olp-team:staffing-level	38,763,883	31.9	52	41	139	338
22	art:existing-system:account-of	41,945,193	33.2	55	42	141	338
23	art:issues:early-resolution-of	15,441,811	32.6	52	40	136	321
24	art:p-charter:fitness-for-purpose	29,407,721	35.0	55	41	137	325
25	art:p-deliverable:ease-of-use	13	4.7	6	6	10	20
26	art:p-objectives:fitness-for-purpose	2	2.0	2	2	3	4
27	art:p-plan:fitness-for-purpose	22,662,472	31.7	51	41	135	328
28	art:prototypes:utilisation-of	364,239,914	34.4	58	41	143	355
29	art:requirements:clarity	29,319,619	33.7	53	41	139	339
30	art:requirements:fitness-for-purpose	66,720,075	32.1	54	41	141	340
31	ext:business-environment:recession	197,177,022	34.8	57	45	147	366
32	pro:communication:effectiveness	87,295,247	32.9	53	41	138	338
33	pro:communication-with-c-o:face-to-face	523,703,261	34.8	56	42	142	351
34	pro:estimating:effectiveness	46741,253	33.8	54	42	138	337

Item	Base factor	Active Chain Count	Average Active Chain Length	Longest Active Chain Length	Active Entity Count	Active Factor Count	Active Relationship Count
35	pro:personnel-recruitment:effectiveness	181,966,632	35.7	57	42	144	356
36	pro:p-start-up:effectiveness	466,672,537	34.7	57	49	157	383
37	pro:software-development:difficulty	32,754,483	33.6	53	42	141	340
38	pro:software-development:hacks	24	4.3	7	7	11	21
39	pro:software-testing:effectiveness	36	5.5	7	8	12	23
40	pro:training\c-o\end-users:amount-of	6	3.5	5	6	8	18

Total:	4,894,853,577						
Mean:	122,371,339						
Weighted average:		35.0	56.6	43.8	146.4	358.5	
Minimum:		2	2	2	3	4	
Maximum:		37	59	49	159	385	

Total active base factors:	930
Estimated total active chains:	113,805,345,665

Appendix 5.5. Active causal loop examples

```

act:c-o:understanding\what-they-want
-p->
art:c-specification:fitness-for-purpose
-p->
art:p-specification:fitness-for-purpose
-p->
act:c-o:understanding\project
-n->
art:issues:number-of
-p->
pro:project:slippages
-p->
pro:project:duration
-n->
act:c-o:involvement
-p->
act:s-o:relationship-with-c-o
-p->
pro:communication-with-c-o:effectiveness
-p->
act:c-o:understanding\what-they-want

```

Example 1

```

act:c-o\end-users:feedback-from
-n->
art:issues:number-of
-n->
act:s-o\p-manager:control-of-project
-p->
pro:requirements-management:effectiveness
-p->
art:requirements:fitness-for-purpose
-n->
art:requirements:scope-creep
-p->
pro:software-development:effort
-p->
pro:project:duration
-p->
act:c-o\end-users:staff-turnover
-n->
pro:training\c-o\end-users:effectiveness
-p->
act:c-o\end-users:feedback-from

```

Example 2

```

act:c-o\end-users:involvement
-p->
art:requirements:fitness-for-purpose
-p->
art:business-case:fitness-for-purpose
-p->
act:c-o:buy-in
-n->
act:c-o:resistance-to-change
-p->
pro:change-management:effort
-p->
pro:change-management:effectiveness
-p->
act:c-o\end-users:buy-in
-p->
art:requirements:agreement-of
-p->
pro:change-control:effectiveness
-p->
art:requirements:priorities
-p->
art:p-budget:fitness-for-purpose
-p->
act:s-o\p-team:staffing-level
-n->
act:s-o\p-team:management-of\ease-of
-n->
act:s-o\p-manager:workload
-n->
act:s-o\p-manager:ability\to-manage-project
-n->
act:c-o:politics
-n->
act:s-o\p-team:work-environment
-p->
act:s-o\p-team:teamwork
-p->
act:s-o\p-team:competence\issue-resolution
-n->
art:issues:number-of
-p->
pro:project:duration
-p->
act:c-o\end-users:staff-turnover
-n->
pro:training\c-o\end-users:effectiveness
-n->
act:c-o\end-users:fear-of-change-imposed-by-project
-p->
act:c-o\end-users:resistance-to-change
-n->
act:c-o\end-users:involvement

```

Example 3


```

act:s-o:relationship-with-c-o
-n->
act:c-o:politics
-n->
act:s-o\p-team:work-environment
-p->
act:s-o\p-team:teamwork
-p->
act:s-o\p-team:competence\issue-resolution
-n->
art:issues:number-of
-n->
act:s-o\p-manager:control-of-project
-p->
pro:requirements-management:effectiveness
-n->
pro:project:duration
-n->
act:c-o:involvement
-p->
act:s-o:relationship-with-c-o

```

Example 4

```

act:s-o\p-manager:understanding\s-o\p-team
-p->
act:s-o\p-manager:ability\to-deal-with-s-o\p-team-issues
-p->
act:s-o\p-team:productivity
-n->
pro:software-development:duration
-p->
pro:project:duration
-n->
act:c-o:involvement
-p->
act:s-o:relationship-with-c-o
-p->
pro:communication-with-c-o:effectiveness
-p->
act:c-o:comfort-level
-p->
pro:communication:effectiveness
-p->
act:s-o\p-manager:understanding\s-o\p-team

```

Example 5

```

art:estimates:fitness-for-purpose
-p->
art:p-plan:fitness-for-purpose
-p->
act:s-o\p-team:competence\fit-with-project
-n->
pro:software-development:slippages
-p->
pro:project:schedule-pressure
-p->
art:issues:number-of
-n->
pro:training\c-o\end-users:time-available-for
-p->
pro:training\c-o\end-users:effectiveness
-p->
act:c-o\end-users:feedback-from
-p->
art:specifications\software-design:fitness-for-purpose
-p->
art:estimates:fitness-for-purpose

```

Example 6

```

art:issues:number-of
-p->
pro:project:difficulty
-p->
pro:software-development:effort
-p->
pro:software-development:duration
-p->
pro:project:duration
-n->
act:c-o:involvement
-p->
act:s-o:relationship-with-c-o
-n->
act:c-o:politics
-p->
art:requirements:scope-creep
-n->
art:p-plan:fitness-for-purpose
-n->
art:issues:number-of

```

Example 7

```

art:p-charter:fitness-for-purpose
-p->
act:s-o\p-team:understanding\roles-and-responsibilities
-p->
act:s-o\p-team:buy-in
-p->
act:s-o\p-team:productivity
-n->
pro:software-development:duration
-p->
pro:project:duration
-n->
act:c-o:involvement
-p->
act:s-o:relationship-with-c-o
-p->
pro:communication-with-c-o:effectiveness
-p->
act:c-o:understanding\what-they-want
-p->
art:p-charter:fitness-for-purpose

```

Example 8

```

art:p-budget:fitness-for-purpose
-p->
act:s-o\p-team:staffing-level
-p->
art:p-due-date:realism
-n->
art:issues:number-of
-n->
act:s-o\p-manager:control-of-project
-p->
pro:requirements-management:effectiveness
-p->
art:requirements:fitness-for-purpose
-p->
art:business-case:fitness-for-purpose
-p->
act:c-o:willingness-to-provide-funding
-p->
art:p-budget:sign-off
-p->
art:p-budget:fitness-for-purpose

```

Example 9

```

art:p-plan:fitness-for-purpose
-p->
act:s-o:resource-availability
-p->
act:s-o\p-team:staffing-level
-n->
act:s-o\p-team:management-of\ease-of
-n->
act:s-o\p-manager:workload
-n->
act:s-o\p-manager:ability\to-manage-project
-n->
act:c-o:politics
-n->
act:s-o\p-team:work-environment
-p->
act:s-o\p-team:teamwork
-p->
act:s-o\p-team:competence\issue-resolution
-n->
art:issues:number-of
-n->
act:s-o\p-manager:control-of-project
-p->
pro:requirements-management:effectiveness
-p->
art:requirements:fitness-for-purpose
-p->
art:business-case:fitness-for-purpose
-p->
act:c-o:buy-in
-n->
act:c-o:resistance-to-change
-p->
pro:change-management:effort
-n->
pro:change-management:effectiveness
-p->
act:c-o\end-users:buy-in
-n->
act:c-o\end-users:resistance-to-change
-n->
act:c-o\end-users:involvement
-p->
art:specifications\software-design:fitness-for-purpose
-p->
art:estimates:fitness-for-purpose
-n->
pro:software-development:duration
-p->
pro:project:duration
-n->
art:p-plan:accuracy
-p->
art:p-plan:fitness-for-purpose

```

Example 10

Appendix 5.6. Causal loop statistics for 20 randomly selected active factors

Item	Factor	Active Loop Count	Average Active Loop Length	Longest Active Loop Length	Active Entity Count	Active Factor Count	Active Relationship Count
1	act:c-o:understanding\what-they-want	605,486	32.2	50	33	85	174
2	act:c-o\end-users:feedback-from	855,146	30.9	50	33	94	195
3	act:c-o\end-users:involvement	1,325,860	31.1	50	33	95	198
4	act:s-o:relationship-with-c-o	1,113,539	31.1	50	34	89	190
5	act:s-o\p-manager:understanding\s-o\p-team	1,403,164	30.7	50	33	93	195
6	art:estimates:fitness-for-purpose	1,516,620	30.5	50	33	95	198
7	art:issues:number-of	1,956,959	30.1	50	33	95	198
8	art:p-budget:fitness-for-purpose	1,097,433	30.7	50	33	95	198
9	art:p-charter:fitness-for-purpose	2	10.0	10	7	11	12
10	art:p-plan:fitness-for-purpose	1,822,480	30.4	50	33	95	198
11	art:p-specification:fitness-for-purpose	219,002	32.5	50	31	78	157
12	art:requirements:fitness-for-purpose	1,785,370	30.4	50	33	95	198
13	art:requirements:priorities	466,755	31.6	50	33	95	198
14	art:requirements:scope-creep	1,422,284	30.7	50	33	95	198
15	pro:change-control:effectiveness	717,146	32.0	50	33	95	196
16	pro:communication-with-c-o:effectiveness	878,143	31.7	50	33	86	181

Item	Factor	Active Loop Count	Average Active Loop Length	Longest Active Loop Length	Active Entity Count	Active Factor Count	Active Relationship Count
17	pro:communication-with-c-o\end-users:effectiveness	983,771	31.6	50	33	96	198
18	pro:project:duration	2,002,974	30.0	50	34	99	211
19	pro:project:schedule-pressure	975,703	30.0	50	33	95	198
20	pro:training\c-o\end-users:effectiveness	1,609,613	30.5	50	33	95	198

Mean:	1,137,873						
Weighted average:		30.7	50.0	33.1	94.2	196.7	
Minimum:		10	10	7	11	12	
Maximum:		33	50	34	99	211	

Note: all factors in sample were known to appear in causal loops prior to random selection.

Appendix 7.1. Additional recommendations for further research

In addition to the key recommendations presented in Chapter 7, a number of additional recommendations were also identified. These are discussed below.

7.1.1 Recommendations to improve knowledge development in the field of OISD project success factors

As demonstrated in Chapter 2, research into OISD project success factors continues to be a vibrant research area (as does research into IS project success factors). Yet, knowledge development in the field seems to have been impeded due to the disparate nature of its success factor studies. Moreover, the literature review encountered a number of issues that might hinder the development of knowledge in the field. Hence, this section presents a number of recommendations to improve knowledge development in the field of OISD project success factors.

Research into OISD project success factors has done little to define its basic terms. In particular, the majority of studies do not provide adequate descriptions for the factors they identify. Studies that seek to identify project success factors are classified as descriptive research; that is, they describe real-world projects. However, there is evidence to suggest that real-world success factors differ substantially from their normative counterparts, as presented in the project management literature. In other words, theory and reality are somewhat different for OISD project success factors (although this research provided evidence that this disparity might be somewhat overstated). To address this issue, more qualitative studies are required. This would allow the use of thick, rich description to leave the reader with little doubt as to the meaning of the factors identified.

There is also a need to clarify the lexicon of terms (labels) used to identify success factors. In essence, these terms need to be properly defined and synonymous terms identified and resolved. Consider, for example, project board (executive management) support; a widely cited success factor for OISD projects. Although some authors use the term “support” (for example, Brocke,

Uebernickel & Brenner, 2009; Milis & Mercken, 2002), others use the term “commitment” (for example, Keil, Cule, Lyytinen & Schmidt, 1998; Sauer & Cuthbertson, 2003), seemingly to describe the same concept. However, other authors (for example, Sharma, Sengupta & Gupta, 2011; Wallace & Keil, 2004) use both terms in their studies, suggesting that support for a project and commitment to a project are not synonymous. Although it can be argued that the project board’s commitment to a project is not evidence of their ability to provide support for the project, it is also evident that some authors seem to consider the terms to be synonymous. Hence, clarification for these and other terms is required.

The 56 studies that formed the basis of the success factor analysis (performed as part of the literature review) covered both in-house and supplier-based software development. However, in the majority of studies (33 articles), this distinction was not clear. The same can be said for studies that investigated “software projects.” Again, it was sometimes unclear as to whether these studies were investigating OISD projects or projects that were undertaken to produce non-organisational software products (for example, embedded software, computer games, etc.). Hence, there is a need for OISD project success factor researchers to take greater care in defining the scope of their research.

The success factor analysis found that, until relatively recently, there had been little opportunity for “learning” from prior studies, with many articles failing to provide limitations, lessons learned or recommendations for further research. Similarly, discussions of validity and reliability were also found to be rare and, in some cases, the research methodology was not made clear. Hence, OISD project success factor researchers also need to take greater care in these areas.

With a few exceptions (most notably, Ika, 2009), there is a lack of articles with the sole purpose of performing a comprehensive analysis of prior research into project success (and, hence, success factors and success criteria) with a view to determining the state-of-the-art of the research area and providing

recommendations for further research. There are no such articles focussing on OISD projects. Unfortunately, all too many project management researchers are not familiar with the “depth of literature” in their field and are failing to acknowledge the contributions made by prior research (Morris, 2010, p. 143). Hence, the provision of retrospective articles of this type would serve to enhance understanding of the literature and assist knowledge development in the field of OISD project success factors.

7.1.2 Research into the management of OISD project success factors

Prior research has identified numerous success factors for OISD projects. Although it has failed to identify a “critical few” that apply to all OISD projects, it is reasonable to suggest that research in the field has contributed to the awareness of project managers regarding OISD project success factors. However, for OISD projects to be successful, project managers also need to understand how to address success factors during the course of the project (Larsen & Myers, 1999, p. 397). Unfortunately, the research literature offers little advice on how success factors can be used to help alleviate the problems faced by project managers in practice (Clarke, 1999, p. 139; Nakatsu & Iacovou, 2009, p. 64). Indeed, the literature is almost completely silent on the subject of success factor management. Hence, project managers have been left to attend to OISD success factors as they have always done: intuitively (Jugdev & Müller, 2005, p. 24). Clearly then, there is requirement for research into the management of OISD project success factors.

This research adds a new dimension to this requirement. If, indeed, OISD projects do contain a large number of success factors, numerous linear chains and a large core of causal loops, how should success factors and the way in which they influence project success be managed? Although this research showed how highly active factors (those located at convergence/divergence points in the network with high receptivity and range values) can be used to monitor project performance, the issue of how success factors should be managed remains extremely pertinent; an issue that presents a wide range of descriptive and theoretical opportunities for research in the field.

7.1.3 Extending the recommendations for further research beyond OISD project success factors

The recommendations for further research presented in this appendix and in Chapter 7 relate specifically to the field of OISD project success factors. However, there is also a need to extend the scope of these recommendations beyond OISD projects to encompass IS/IT projects and projects in general. For example, the need for qualitative research that makes appropriate use of thick, rich description is equally well-founded for generic, IS/IT and OISD projects as it is for supplier-based OISD projects.