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The influence of business managers' IT competence on IT project success

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Abstract

Unacceptably low IT project success rates continue to be a persistent problem for organisations and the lack of business involvement in IT projects has been suggested as an important contributor to failures. Adopting a Resource Based View, this paper explores the concept of IT competence of business managers and teases out what the relative impact of each of the components of IT competence is on IT project success. Based on a survey of 108 business managers, results yielded surprising insights. In particular, knowledge of applications exerts a strong influence on project success.

Keywords: Competences; IT project management; IT capability; Business process improvement

1. Introduction

The basis for any business to stay competitive is its capability to execute Business Processes efficiently and continuously, and its capability to handle new Business Processes using Information Technology (IT) (Anand et al., 2013; Huffman and Whitman, 2015). Research "has been concerned with how firms optimally use their core competencies and key assets and resources to extend their product and market reach" (Bharadwaj et al., 2013, p. 473). IT project success rates are still reported as low (Hidding and Nicholas, 2017). In an update of their 1994 Chaos study, the Standish group found that only 29% of IT projects were successful in terms of delivery on time, within budget and according to scope in 2015 (Chaos Report, 2015). This low success rate has been a persistent problem for companies over the years (Gu et al., 2014; Hidding and Nicholas, 2017), and is widely recognised as one of the most pressing problems facing the IT profession (Liu and Wang, 2014). It is particularly problematic as the costs and risks of managing IT projects are often underestimated, and remain a challenge for many organisations (Dalcher, 2016; Marchewka, 2010). This led to the question, as business managers are one of a firm's key assets, and IT project success rates are low, should one of their competencies include IT projects?

A number of studies have been conducted due to the reasons of low IT project success rates. One of the reasons frequently proffered is the inferior quality or lack of a business manager's interest, alignment, understanding, integration, relationship, fusion (or similar words) in IT and IT projects (Luftman et al., 2013; Reich and Benbasat, 2014). Shared domain knowledge between IT and business executives has one of the strongest impacts on alignment (Elbashir et al., 2013; Reich and Benbasat, 2014). IT professionals tend to think that business people lack IT knowledge (Lu and Ju, 2014) and vice versa, plus poor communication between the business and IT is seen to contribute to the lack of success (Marchewka, 2010; Reich and Benbasat, 2014). Knowledge can only be shared between the two groups by enabling communication and empathy (Elbashir et al., 2013).

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However, despite their sometimes dubious contribution, many stressed the need for strong executive involvement in the achievement of project success (Chandler and Thomas, 2015) and the important role of business managers in embedding a system post-implementation (Chaos Report, 2015; Marchewka, 2010). Yet other researchers have emphasized the importance of shared knowledge and/or shared responsibility. Basically, IT executives do not possess sufficient knowledge of the business or business strategy, and business leaders don't know enough about IT (Chan and Reich, 2007; Luftman et al., 2013; Reich and Benbasat, 2014). Shared knowledge between IT and business managers helps achieve alignment between IT and business objectives (Chan and Reich, 2007; Reich and Benbasat, 2014), and Brown et al. (2003) argued that organisational structures that encourage IT and business units to share responsibility for the management of IT assets lead to more efficient running of IT systems.

There are thus strong indications of the importance of the involvement of business managers in IT projects, and yet further indications of the need for them to possess some IT knowledge or competence (Reich and Benbasat, 2014). Paradigm shifts have taken place in the technology-oriented business environment, and business managers are required to deal with a broad spectrum of contemporary challenges that include innovation, intense competition, globalization, technical complexities and the advancement of technology itself (Pahlke et al., 2011). As far back as 1996, Rockart et al. (1996) identified the need for appropriate IT education of business managers. However, there needs to be clarity on what and how much IT knowledge or ability is required from business people.

In answer to the need for a measure of the IT capability, knowledge or competence of business managers, Bassellier et al. (2001) developed a conceptual model for IT competence which they tested in 2003 by exploring the influence of business managers' IT competence on championing IT (Bassellier et al., 2003). Until that research, IT competence had only been explored at the organisational level (Sambamurthy et al., 1994), and not at the individual level. In particular, Bassellier et al. (2003) showed that an increase in business managers' IT competence influenced their intentions to champion IT use in their departments.

Recent research has suggested that "new ways of thinking about IT project management may be fruitful" (Hidding & Nicholas, 2017, p. 1). No study was found that addressed the influence of business managers' IT competence on IT project success. Given the problem of low project success rates, and indications that business managers' IT competence might well have a positive effect on project success, this research aimed to explore such a proposition. More specifically, it aimed to determine what the respective impact was of the various components of business managers' IT competence on project success.

The following sections cover the relevant theoretical background and the literature which supports the development of the conceptual model and the hypotheses. The methodology is described, including the development of the research instrument, the data collection, and the analysis of the collected data. Finally, the findings and their implications are discussed, limitations of the research are identified, and areas for future research are suggested.

2. Theoretical background

The notion of IT competence is derived from a resource-based view (RBV) of the organisation. The RBV maintains that an organisation consists of a unique set of resources, and the way in which they are used, controlled and disposed of by management determines the value of the organisation (Gordon and Tarafdar, 2007; Kraaijenbrink et al., 2010; Son et al., 2014). The RBV has come to mean that organisations achieve and sustain competitive advantage through the acquisition and deployment of a unique set of resources (Lin and Wu, 2014; Zhou and Li, 2010). The unique characteristics of resources that can provide and sustain a competitive advantage are that they are Valuable, Rare, Inimitable or difficult to imitate, and Non-substitutable (VRIN) by other resources (Lin and Wu, 2014; Melville et al., 2004; Nevo and Wade, 2011). Accumulating VRIN resources such as business managers "to enhance competitive advantage has become fundamental academic and managerial strategic thinking" (Lin & Wu, 2014, p. 407). Varying combinations of resources impact a firm's competitive advantage, sustainability and business performance differently ((Lin and Wu, 2014). The RBV maintains that capabilities that refer to a firm's ability to assemble, integrate and deploy resources, usually in combination (Bharadwaj, 2000) thereby transforming inputs into outputs of greater worth.

Sambamurthy et al. (1994) presented one of the first studies of IT competence of organisations using the RBV. Feeny and Willcocks (1986) also used the RBV as a basis for identifying a set of core IT competencies of the organisation. Wiengarten et al. (2013) explored the role of organisational factors on IT business value using RBV. However, such studies were looking at IT competencies at an organisational level. The need existed for a clear definition and conceptualization of individual managers' competencies using the RBV as a theoretical lens.

3. Literature review

The literature review covers the two main areas of our research: business managers' IT competence; and IT project success.

3.1. Business managers' IT competence

In 2001, Bassellier et al. drew on the RBV in developing a model which conceptualized IT competence at an individual level. The model was adapted in 2003 as part of a study which measured the influence of business managers' IT competence on their likelihood of championing IT (Bassellier et al., 2003). In developing a measure of IT competence, Bassellier et al. (2001) explored various aspects of the construct. What became apparent was that there were two components of IT competence: IT conceptual knowledge; and IT experiences (capability), which Grant described in 1996. The two components of competence echoed the ideas of Cook and Brown (1999) who saw it as the difference between knowledge and knowing.

Similarly, the taxonomies of Nonaka (1994) and Polanyi (1967) differentiated between explicit (can be taught and explained) knowledge and tacit (experience) knowledge. Bassellier et al. (2001) pursued this approach, and identified the split between what people possess and what people do, as reflected by the knowledge and experience concepts. Although this conceptualization suggests that IT competence can be measured by capturing IT knowledge and IT experience, Bassellier et al. (2003) acknowledged that whilst the concept of tacit knowledge (experience) is easily understandable, it is not easy to measure or model.

Bassellier et al.'s (2001) model was based on the principle that although a business manager's primary area of expertise may be in an area other than IT, s/he can be classified as competent in IT if they possess some degree of both IT knowledge and IT experience. Bassellier et al. (2001) was considerate of both the breadth and depth of requisite knowledge and experience for business managers, and recognised that neither would need to be as extensive as that of an IT manager, but rather that business managers needed to have sufficient knowledge and experience to be able to understand the other's perspective and the benefits of the different types of IT. This view is supported by research done by He and Guo (2014) who found that 42% of sampled business recruiters required managerial candidates to have project management skills. "The proliferation of IT imposes strong requirements of IT knowledge and skills on business professionals across all occupations" (He and Guo, 2014, p. 22). Bassellier et al. (2001) conceived of IT knowledge as being made up of five distinct areas of knowledge: *knowledge of technologies*, *knowledge of applications*, *knowledge of system development*, *knowledge of management of IT*, and *access to IT knowledge*. He and Guo (2014) categorised IT knowledge into somewhat similar categories excluding "Access to IT knowledge". IT experience is made up of *experience in IT projects*; and *experience in the general management of IT* (Bassellier et al., 2001). IT experience focused on both the breadth and depth of relevant activities in which the business manager might have been involved. Bassellier et al. (2003) argued that the intensity of involvement would generally determine the amount of learning, and thus competence that would be gained from the experience. Lin et al. (2014) argued that the more IT knowledge and experience a manager has, the more motivated they are to be involved in IT projects. Each of Bassellier et al.'s (2003) IT competence factors is defined in Fig. 1

Given that Bassellier et al. (2001) based their work on pre-2000 literature, one might well question the topicality and relevance of the requisite knowledge and experience that they identified. The springboard for their first four IT knowledge components had been an MBA programme suggested by Silver et al. (1995). An additional component plus the two IT experience components were derived from expert practitioner and academic input. To determine the components' currency, we compared them to the suggested curriculum for undergraduate studies in IS. Although this curriculum is at a lower academic level than the MBA programme, people are generally much more exposed to technology nowadays, than 15 and more years ago, and are also more familiar with different types of technology and different applications. In a study of over 100 job positions, He and Guo (2014, p. 11) "suggest that IT knowledge and skills are significantly considered during the recruiting process, even if the target position is not IT-related." We thus deemed such a comparison acceptable.

Topi et al. (2010) devised IS curriculum guidelines with the aim of equipping a business student, who might wish to major in IS, with sufficient IS knowledge so as to be able to become an IS manager if study of the discipline is pursued. They identified seven core courses: foundations of IS; data and information management; enterprise architecture; IS project management; IT infrastructure; systems analysis and design; and IS strategy, management, and acquisition. Generally the suggested curriculum marries up well with Bassellier et al.'s (2001) proposed components although Topi et al. (2010) focused on knowledge. However, their suggested core courses all match up with Bassellier's coverage, focusing as they both do, on general basics rather than specific expertise. The need to increase IT education for managers is coming from business recruiters (He and Guo, 2014).

3.2. IT project success

There is general agreement that project success is a multi-dimensional construct (Basten et al., 2011; Gingnell et al., 2014). However there is disagreement on which dimensions best represent project success (Basten et al., 2011; Gingnell et al., 2014; Rai et al., 2002). The traditional manner, probably prompted by the Project Management Institute guidelines, of assessing project success was according to whether the project adhered to planning in terms of being within budget, on schedule and according to specifications (Chaos Report, 2015; Gingnell et al., 2014). These three dimensions were also called the 'Triple Constraint' (Gingnell et al., 2014; Pinto, 2004). Some authors added a fourth dimension; were the benefits to the organisation assumed in the project business case realised? (McCormick, 2006; Robertson and Williams, 2006). Gingnell et al. (2014) reviewed literature on IT project success, and identified 21 clusters including user involvement, executive management support, clear goals and objectives, project management skills, and internal communications.

Of the project success factor rankings by Marchewka (2010) in Table 1, success factors which are particularly pertinent to this research include user involvement, executive management support, clear business objectives, and project management expertise, as the research is examining the influence of business managers' (users) IT competence on IT project success.

One way of addressing the issue of the definition of project success is by viewing the concept as consisting of two parts: project management success and project success (Basten et al., 2011; Marchewka, 2010). Project management success represents the internal, rather short-term view of the project, with a focus on the successful accomplishment of cost, time and quality objectives, the manner in which the project management process was conducted, and the satisfaction of stakeholder needs (internal efficiency) (Basten et al., 2011). Project success,

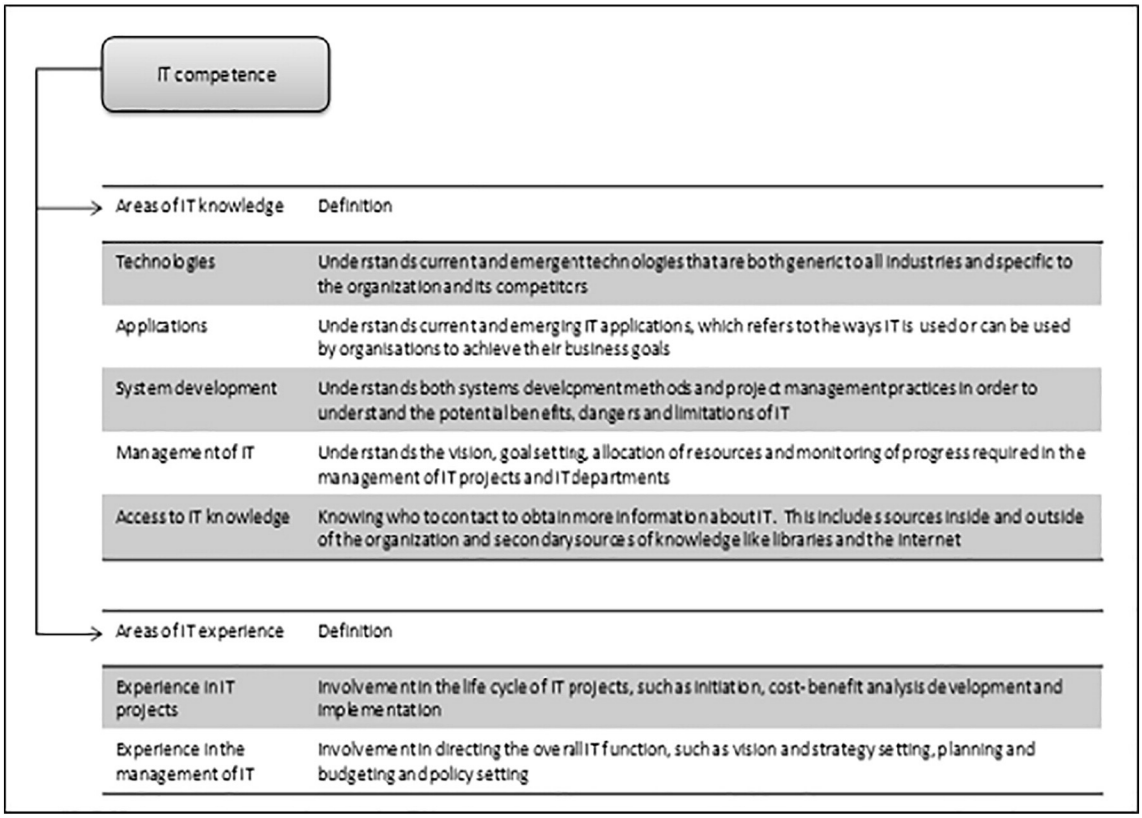

Fig. 1. Definitions of the dimensions of business managers' IT competence (Bassellier et al., 2003).

on the other hand, focuses on the triple constraint (budget, schedule and specifications) (Chaos Report, 2015; Gingnell et al., 2014), and the effects of the project's final product in terms of meeting the organisational objectives; the satisfaction of the users' needs (project purpose); and the satisfaction of the stakeholders' needs with regard to the product (Agarwal and Rathod, 2006). Project success represents external effectiveness, and has an external and longer term perspective.

Whilst this two-part division of project success dimensions has been embraced by many, Thomas and Fernandez (2007) found three categories of project success: project management success (on-time, on-budget, sponsor satisfaction, steering group satisfaction, project team satisfaction, customer/user satisfaction, stakeholder satisfaction); technical success (customer/user satisfaction, stakeholder satisfaction, system implementation, met requirements, system quality, system use) and business success (business continuity, met business objectives, delivery of benefits). Most companies used between 2 and 11 success criteria, and at least one criterion from each category.

A further confounding aspect of project success definition and measurement is that IT projects that fail to deliver on the agreed specification and with agreed scope changes, may still deliver value or benefits to the organisation and would also be seen as successful (McCormick, 2006). On the other hand, Glass (2005) argued that an IT project that is classified as functionally brilliant, but slightly over budget and over schedule may be deemed as a

Table 1
Summary of IT project success factor rankings (Marchewka, 2010).

Rank	1994	2001	2006
1	User involvement*	Executive support*	User involvement*
2	Executive management support*	User involvement*	Executive management support*
3	Clear statement of requirements*	Experienced project manager	Clear business objectives*
4	Proper planning*	Clear business objectives*	Optimising scope*
5	Realistic expectations*	Minimised scope*	Agile process
6	Smaller project milestones	Standard software infrastructure	Project management expertise
7	Competent staff*	Firm basic requirements*	Financial management
8	Ownership*	Formal methodology	Skilled resources*
9	Clear vision and objectives*	Reliable estimates	Formal methodology
10	Hard-working, focused team*	Other	Standard tools and infrastructure

failure, but could in reality be a success for an organisation. A project that fails according to standard criteria, but helps prepare for the future may be seen as successful (Avison and Torkadeh, 2009). To execute projects successfully, managers need to be equipped with a comprehensive understanding of all aspects of the project, and there needs to be coordination between business units (Sull et al., 2015).

In summary, it appears that project success is a multi-dimensional construct, which reflects the expectations of different stakeholder groups. Project success is generally regarded as consisting of two main categories of dimensions: those that focus on how the project was actually managed; and those that focus on what the outcomes of the project were in terms of what was expected.

4. Conceptual model and research hypotheses

The involvement of the business people in IT projects is vital (Gingnell et al., 2014). Cadle and Yeates (2004) argued that IT project success is all about involving business people at every stage in the project to ensure that the project realises the full business benefits. Bassellier et al. (2003) also recognised the importance of involvement. Marchewka (2010, p. 7) compiled listings from the literature of the top IT project success factor rankings in 1994, 2001 and 2006. As seen in Table 1 business managers influence the majority of the factors, which are indicated with asterisks (*).

One way to improve the quality of business input into IT projects is through business people increasing their IT competence (Bassellier et al., 2003; Brown et al., 2003; Hirschheim et al., 2006), and another is through IT professionals obtaining a solid understanding of the business (Avison and Torkadeh, 2009; Marchewka, 2010). Whilst organisations have started to respond to this challenge by demanding more business acumen from their IT staff (Bassellier and Benbasat, 2004), business people can similarly be expected to be more IT competent (Bassellier et al., 2003). So the question can be asked whether an increased level of IT competence of business people can result in the improvement of IT project success rates.

There thus appears to be clear indications of the importance of business managers' IT competence in IT project success. Possibly the most telling indication came from Bassellier et al. (2003) who emphasized specific IT project management knowledge and experience as two of their seven dimensions of IT competence. More specifically, we were guided by Bassellier et al.'s (2003) formulation of the seven dimensions of competence but kept in mind the need for topical relevance and according adaptations. Rather than acquire a generalized understanding of business manager's IT competence and its contribution to IT project success, we sought to understand what the impact was of each of the specific components of IT competence. Such an understanding would enable more specific remedial action if necessary.

Fig. 2 contains the research model, which is an adaptation of the Bassellier et al. (2003) model.

The intention of the research was to understand the specific influence of the different dimensions of business managers' IT competence on IT project success. Hence we hypothesize the following:

H1. Business managers' knowledge of technologies will have a positive impact on project success.

H2. Business managers' knowledge of applications will have a positive impact on project success.

H3. Business managers' knowledge of systems development will have a positive impact on project success.

H4. Business managers' knowledge of management of IT will have a positive impact on project success.

H5. Business managers' knowledge of access to IT knowledge will have a positive impact on project success.

H6. Business managers' experience in IT projects will have a positive impact on project success.

H7. Business managers' experience in IT management will have a positive impact on project success.

5. Methodology

The study aimed to identify whether a causal relationship exists between the various components of business managers' IT competence and IT project success. Consequently a positivist approach was adopted which employed a quantitative methodology. A survey was used for the data collection as shown in Appendix A. Sections C–I of the questionnaire are linked to the hypotheses (C to H1, D to H2 etc.).

5.1. Instrument development

A survey instrument was compiled, with the seven independent variables covering the two main components of IT competence, IT knowledge and IT experience. The variables consisted of the items based largely on Bassellier et al.'s (2003) well-validated instrument. Nonaka (1994) suggested that the quality of experience is improved by variety, and the depth of the experience is linked to the intensity of experience. This implies that competent managers would be involved in a wide range of activities of high intensity. The definitions that Bassellier et al. (2003) used for their seven dimensions (see Fig. 1) were suitable for this study, and the items chosen to reflect these dimensions were slight adaptations, for currency, of their items.

With regard to project success, in this study it seemed wise to include aspects that pertained to the specifications, operational and financial requirements of the project, as well as meeting the needs of the users and the business as a whole. In that way the two aspects of project management success and ultimate project success (Basten et al., 2011) would be addressed. 'IT project success' was thus defined according to six success criteria. A

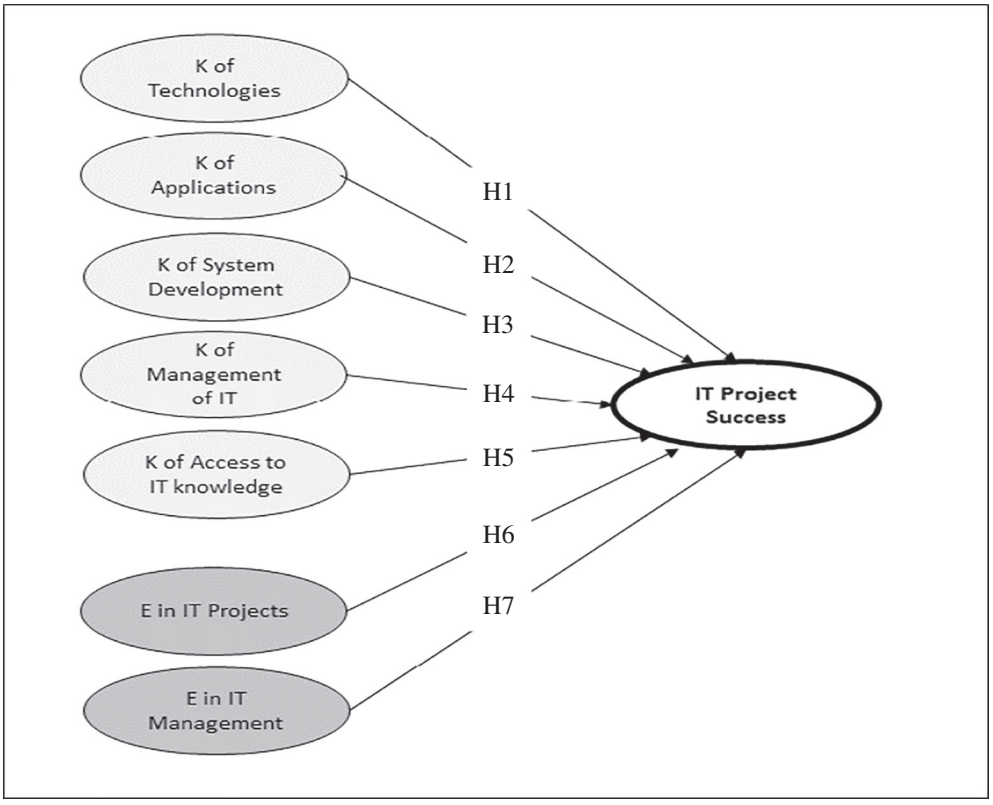

Fig. 2. Conceptual model.

successful IT project is one which is implemented and used, is delivered on time, within budget, according to scope, according to agreed quality, and realises the expected benefits. Table 2 summarises the criteria and lists supporting literature for the definition.

In the landmark Chaos research conducted in the USA by the Standish Group (1995) and its subsequent repetitions, IT project success was assessed according to an index. This was undoubtedly to get around the challenge of identifying suitable dimensions for assessing success. IT projects were classified under three headings:

Successful projects met the time, budget, quality and scope required.
Challenged projects completed and became operational but cost more, overran and delivered less functionality.
Impaired projects were cancelled during the development stages.

Project success was rated either 1, 2 or 3, 3 signifying a successful project.

Following the Standish Group (1995) lead, an index was used but calculated differently. Our questions assessed IT project success according to the six criteria identified in the literature. It was decided to capture information for the last three projects to ensure non-skewing of the data by outlier projects, and also to concentrate on more recent experience. For each IT project respondents were required to indicate whether it had satisfied each of the six project success criteria, or not. A success score, equal to the number of success criteria that the project satisfied, was calculated for each project. For example, if a project was implemented and used, and delivered on time,

Table 2
IT project success criteria.

#	Success criteria	Reference
1	**Implemented** and used by the business.	Chong et al. (2014), Standish Group (1995)
2	Delivered within the allocated **time.**	Gingnell et al. (2014), Kerzner (2009), McCormick (2006), Robertson and Williams (2006)
3	Delivered within the budgeted **cost**.	Gingnell et al. (2014), Kerzner (2009), McCormick (2006), Robertson and Williams (2006)
4	Delivered within the agreed **scope**. Scope changes to be approved by the business.	Chong et al. (2014), Gingnell et al. (2014), Kerzner (2009), Robertson and Williams (2006)
5	Realised the expected commercial and user **benefits** as outlined in the business case.	McCormick (2006), Robertson and Williams (2006), Shenhar et al. (2001)
6	Delivered according to an agreed **quality**.	Cadle and Yeates (2004), Gingnell et al. (2014)

with no other success criteria being met, its success score would be two.

The questionnaire used consisted of forty-four questions grouped into nine sections (A–I), is available on request. Section A was on the general characteristics and demographics of the respondents (business managers). Section B captured the success characteristics of the last three IT projects in which each business manager had been involved. The responses were dichotomous for each criterion. Sections C to I contained questions pertaining to business managers' IT competence. The questions were measured according to a five point Likert type scale. Sections C to G measured IT knowledge, whilst sections H and I measured IT experience.

The instrument used for measuring IT competence is consistent with the instrument used by Bassellier et al. (2003). The dimensions in the instrument had been successfully tested for composite reliability and validity (Bassellier et al., 2003) and were only slightly changed for the current research. The project success measures were also adapted from reliable instruments and reflected the general approach to project success assessment.

5.2. Data collection

The sample comprised business managers from large companies from a broad range of business sectors, including finance and business services, mining and quarrying, transport, storage and communications. Although business managers at all hierarchical levels were included, IT managers and employees who did not supervise other people were excluded.

"Purposive sampling relies on the researchers' situated knowledge of the field and rapport with members of targeted networks" (Barratt and Lenton, 2014, p. 3). Purposive sampling was employed in a deliberate effort to include companies in which IT systems played such an integral part in the day to day operations, that the likelihood of finding a significant sample of business managers that had been involved in IT projects was high. In addition, these business managers were asked to forward the questionnaire to applicable business managers in their network. Snowball sampling and purposive sampling are examples of non-probability sampling methods and may result in bias, meaning there is a chance that the sample does not represent the population accurately (Bryman and Bell, 2007).

Emails were sent to individuals in organisations known to the primary researcher. They then posted it to business managers within the organisation. The email contained a description of the survey and a website link to the questionnaire. Business managers had the option to participate in the research by following the link and responding to the questionnaire. It is therefore unknown how many individuals received the email, but there were 140 respondents of which 108 were usable.

As indicated, the respondents were from different hierarchical levels in their companies, with 66 (61%) classifying themselves as middle management, 25 (23%) as first level management and 17 (16%) as executive management.

5.3. Data analysis and findings

Before the analysis began, a success score, equal to the number of success criteria that the project satisfied, was calculated for each project. Each respondent thus had one score for each project.

Structural equation modelling (SEM), using a Partial Least Squares (PLS) approach, was employed for the data analysis. Whilst covariance-based SEM is used to confirm or reject theories, PLS SEM is used primarily to develop theories in exploratory research (Hair et al., 2014). It is thus recommended for exploratory research which is what this study was. Plus, PLS is appropriate for addressing complex structural models with many constructs, for situations where normal distributions cannot be guaranteed, and where the sample size is on the small side (Hair et al., 2014) — all of which applied to this study. PLS-Graph, version 3.0, was the software package used. SEM is used to estimate multiple and simultaneous relationships between a number of explanatory variables (including both observed and latent variables) and a dependent variable (Mazzocchi, 2008). SEM uses a competing model strategy to test a number of alternate theories against an available dataset and in this manner an optimal theory is resolved (Mazzocchi, 2008). The approach comprises an assessment of the measurement model and an assessment of a structural model (Compeau and Higgins, 1995). A bootstrapping procedure was used to estimate the significance of the factor loadings in the measurement model and the significance of the path coefficients in the structural model.

5.4. Measurement model

For the measurement model, two important assessments are of convergent validity, which is sometimes regarded as including internal consistency (reliability), and discriminant validity (Igbaria et al., 1995). Convergent validity is indicative of the extent to which constructs are internally consistent. Consequently, all item loadings should be significant although various loadings have been suggested (e.g. above 0.7 by Fornell and Larcker, 1981; above 0.5 by Aubert et al., 1994), depending on the type of research (confirmatory or exploratory). In general 0.6 and above is regarded as acceptable. As can be observed in Table 3, all items of the independent variables demonstrated high loadings with a high degree of significance (p-value < 0.001) onto their respective constructs. Scale reliability, or the internal consistency, of each construct was assessed according to their composite reliability. Composite reliability is regarded as superior to Cronbach's alpha because it reflects the actual item loadings rather than each item being weighted similarly (Fornell and Larcker, 1981). The composite reliability for each construct was above the recommended 0.7 (Nunnaily, 1978).

5.5. Structural model

The predictive ability of the model was assessed according to the explanatory effect of the independent variables on the dependent variable. The explained variance in the dependent variable should be above 0.1 (Chan, 1992). The size of the

Table 3
Item loadings and reliability of factors.

	Item loadings	Composite reliability
Knowledge of technologies		0.896
C1	0.7885	
C2	0.7974	
C3	0.8337	
C4	0.7281	
C5	0.8232	
Knowledge of applications		0.891
D1	0.8668	
D2	0.8378	
D3	0.6680	
D4	0.7503	
D5	0.6497	
D6	0.7666	
Knowledge of systems development		0.934
E1	0.8555	
E2	0.8770	
E3	0.8436	
E4	0.8198	
E5	0.8034	
E6	0.8319	
Knowledge of IT management		0.915
F1	0.7282	
F2	0.7314	
F3	0.8526	
F4	0.8534	
F5	0.8359	
F6	0.8383	
F7	0.5780	
Knowledge of access to information		0.903
G1	0.7943	
G2	0.8955	
G3	0.9172	
Experience in IT projects		0.931
H1	0.961	
H2	0.8782	
H3	0.7859	
H4	0.8342	
H5	0.8720	
Experience in general IT management		0.936
I1	0.8162	
I2	0.9314	
I3	0.8883	
I4	0.9023	

paths between the independent and dependent variables should be substantial (>0.2) and significant (Goo et al., 2004).

Convergent validity was determined by means of the square root of the average variance extracted (AVE) which should be above 0.7, thereby indicating that at least half the variance of each measure was attributable to the respective construct (Fornell and Larcker, 1981).

Discriminant validity was assessed to ensure that factors represented sufficiently distinct constructs. Not only should each item loads more highly onto their respective factor than any other factors (Chin, 1998) but the square root of the AVE of each construct should be greater than the correlations between that construct and other constructs (Fornell and Larcker, 1981). As is evident in Table 4 both convergent validity and discriminant validity were demonstrated.

As is evident in Fig. 3, the explained variance (R^2) in project success was 0.158, and thus acceptable. Only two paths were substantive, those between knowledge of applications and project success, and between knowledge of IT management and project success. However, only the path between knowledge of applications and project success was significant ($p < 0.1$).

6. Discussion

The results of this research provide some interesting perspectives on the impact of business managers' IT competence on project success. The first deals with the extent of the impact, and what the relative impact is of each of the components of IT competence. The second deals with our measure of project success.

The overall impact of business managers' IT competence on project success is good. When one considers the number of things that can impact project success, our findings indicate that business managers' IT competence can, and does, exert a substantial influence on project success. This supports the assertions of Cadle and Yeates (2004), Gingnell et al. (2014) and Luftman and Rajkumar (2007) on the merit and benefit of having business managers involved in IT projects.

However, although all the seven components of IT competence together contributed to project success, only *knowledge of applications* seemed to have a significant influence. This is understandable in light of the definitions (Bassellier et al., 2003) used in this research. The definitions of most of the other IT knowledge components, except *access to knowledge*, pertain to generic IT knowledge. Although both *knowledge of technologies* and *knowledge of applications* bear strong reference to what is/might develop in the market place and be used either by the organisation or their external stakeholders, including their competitors, the applications could be seen as the combination/

Table 4
Inter-construct correlations and square roots of average variances extracted.

	K tech	K apps	K sys dev	K IT maint	K access	Exp IT proj	Exp gen IT
K tech	*0.795*						
K apps	0.678	*0.823*					
K sys dev	0.715	0.63	*0.794*				
K IT maint	0.713	0.568	0.637	*0.798*			
K access	0.607	0.401	0.542	0.655	*0.809*		
Exp IT proj	0.557	0.516	0.732	0.642	0.579	*0.761*	
Exp gen IT	0.592	0.467	0.515	0.647	0.494	0.59	*0.768*

Italicized numbers represent the square roots of the AVEs.

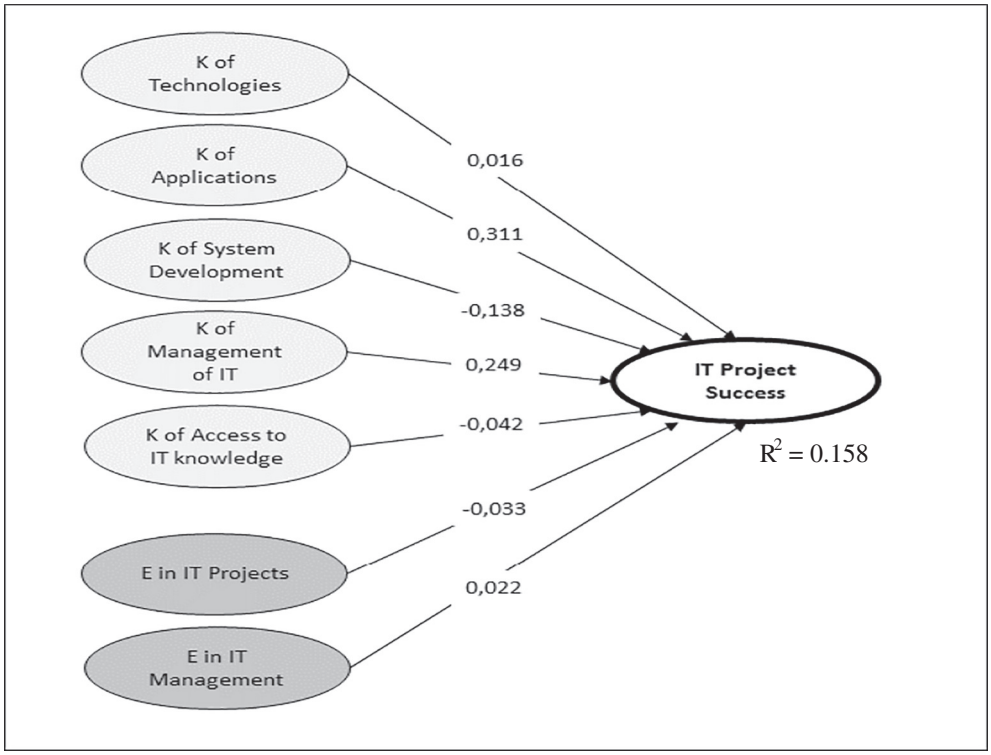

Fig. 3. Business managers' IT competence and project success.

culmination of the technologies and thus subsuming them. However, of all of the components, the way in which the applications are configured and used in an organisation, probably reflects the resources based view most closely. It is how the organisation employs their applications that will give them the competitive advantage. It could be interpreted as being most directly relevant to a manager's area of responsibility and providing the most immediate manifestation of their activities. Therefore, if the business manager could have substantial knowledge in this regard, it would possibly be more beneficial than having greater competence in other respects. One way to achieve this would be by involving business managers substantially in drawing up the specifications, including consideration of related applications, and then by continuous involvement in the development and testing of system applications prior to the implementation.

Surprisingly, *knowledge of systems development*, *knowledge of access to IT knowledge*, and *experience in IT projects* all demonstrated a negative relationship with IT project success. This could quite possibly be the case of too little knowledge being a dangerous thing. To a certain extent the *knowledge of systems development* and *experience in IT projects* reflect different aspects of the same thing: IT projects. Although one would have expected a positive relationship and a positive impact, it has been reported that the involvement of non-IT stakeholders can actually work detrimentally and confound and confuse proceedings, even causing errors. This would not have been their intention but can result in time and cost delays, to say the least. Similarly, often, with the best intentions, business managers may be influenced by some suppliers or colleagues to whose IT knowledge they had access, and insist on a certain course of action. If that business manager is particularly influential in an organisation, then there could be similar confusions, delays, and even inappropriate decisions.

Our measure of project success was new. It was an improvement on the rather limited approach that has been used previously, thereby addressing concerns expressed by Basten et al. (2011) and Rai et al. (2002), and it embraces the two components of project success and project management success (Basten et al., 2011). The fact that it was assessed as a score out of 6 is unusual but in doing so, we followed the lead of using an index like the Standish Group (1995) and which has become an industry guideline. Not only is this an advance on a rather unresolved area in IS, but also it presents managers with a far more holistic perspective on how to assess IT project management success.

7. Conclusion

This research set out to determine what the relative influence is of the components of business managers' IT competence on IT project success. The overall impact of business managers' IT competence was substantial. In particular, *knowledge of applications* was a very significant aspect of IT competence insofar as the influence on project success is concerned.

The research has a number of limitations: firstly, the sample size was relatively small. Even though it is adequate, a larger sample would have added to the validity of the findings.

Secondly, the way in which project success was measured could be reassessed. The names of the criteria could be retained but instead of an index-type score for each project, the criteria could each be measured according to a number of Likert-scaled items. Further research could explore the development of a sound, valid instrument for measuring project success. Both academia and practitioners would benefit considerably.

From an academic perspective, this research has addressed a call for attention to be paid to the contribution of individual business managers' IT competence, and involvement, in IT project success. A comprehensive measure for project success was developed and applied as a way of providing an index of project success for each respondent and each project. From a business practitioner's perspective, CEOs and CIOs would do well to include business managers in the IT project teams — but with caution. Their insights and contributions could add much to the eventual project success but could also serve to hinder matters.

Conflict of interest statement

There is no conflict of interest.

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Appendix A. Questionnaire

Item	Section A: General questions	
A1	In which country are you based at the moment?	United Kingdom South Africa Other (please specify):
A2	If your answer to question 1 is 'Other', please indicate the country you are based in	
A3	In which business sector does your company operate?	Finance and business services Retail services (including motor trade and repair services) Wholesale trade, commercial agents and allied services Transport, storage and communications Manufacturing Construction Mining and quarrying Agriculture Electricity, gas and water Catering, accommodation and other trade Community, social and personal services Other (please specify):
A4	If your answer to question 3 is 'Other', please indicate your company's business sector	
A5	How many people does your company employ?	Less than 50 More than 50, but less than 200 More than 200
A6	What is your level at the company?	Executive management (e.g. CEO, COO, CFO, CIO) Middle management First level management
A7	What is your job title?	

Item	Section B: IT project success	Project 1	Project 2	Project 3
	For the last three IT projects you were involved in, please answer the following questions by checking the box if the statement is true:			
B1	The project was implemented and used by the business	Yes/No	Yes/No	Yes/No
B2	The project was delivered in time with no slippage	Yes/No	Yes/No	Yes/No
B3	The project was delivered within the budgeted costs	Yes/No	Yes/No	Yes/No
B4	The project was delivered according to the agreed scope (or all scope changes agreed by the business)	Yes/No	Yes/No	Yes/No

Appendix A (*continued*)

Item	Section B: IT project success	Project 1	Project 2	Project 3
B5	The expected commercial and user benefits, as assumed in the business case, were realised	Yes/No	Yes/No	Yes/No
B6	The project was delivered within an agreed quality	Yes/No	Yes/No	Yes/No
B7	The project was not implemented at all	Yes/No	Yes/No	Yes/No

Item	Sections C–I: Business manager IT competence	
	Please rate your **knowledge of technologies** from 1 to 5, using the scale below:	Scale
C1	What is your general knowledge of personal computers (e.g. desktops, laptops, palmtops)?	a
C2	What is your general knowledge of client-servers?	a
C3	What is your general knowledge of computer networks?	a
C4	What is your general knowledge of databases?	a
C5	What is your general knowledge of multimedia?	a
	Please rate your **knowledge of applications** using the scale below:	
D1	What is your general knowledge of e-mail?	a
D2	What is your general knowledge of the internet?	a
D3	What is your general knowledge of e-commerce (buying and selling over the internet)?	a
D4	What is your general knowledge of collaborative and social software (e.g. calendaring, text chat, wiki, social networks)?	a
D5	What is your general knowledge of Enterprise Resource Planning (e.g. SAP, Oracle)?	a
D6	What is your general knowledge of Integrated Software (e.g. Microsoft Office)	a
	Please rate your **knowledge of system development** using the scale below:	
E1	What is your general knowledge of the traditional system development life cycle?	a
E2	What is your general knowledge of end-user computing?	a
E3	What is your general knowledge of prototyping?	a
E4	What is your general knowledge of outsourcing?	a
E5	What is your general knowledge of acquisition of software packages?	a
E6	What is your general knowledge of project management practices?	a
	Please rate your **knowledge of management of IT** using the scale below:	
F1	Indicate your level of knowledge about the current hardware (e.g. computers, communication networks) assets of your business unit?	a
F2	Indicate your level of knowledge about the current IT applications (including software, data) assets of your business unit?	a
F3	How informed are you about the IT budget in your business unit?	a
F4	How informed are you about the IT strategies in your business unit?	a
F5	How informed are you about the IT policies in your business unit?	a
F6	How informed are you about the IT vision statements in your business unit?	a
F7	How knowledgeable are you about your competitors' use of IT?	a
	Please rate your **knowledge of access to information** using the scale below:	
G1	How knowledgeable are you about IT or business people to contact within your organisation as source of information about IT?	a
G2	How knowledgeable are you about IT or business people to contact outside your organisation as source of information about IT?	a
G3	How knowledgeable are you about secondary sources of knowledge as source of information about IT?	a
	Please rate from 1 to 5 **your experience in IT projects** using the scale below:	
H1	How often have you participated in and/or led in initiating new IT projects?	b
H2	How often have you participated in and/or led in identifying the cost and benefits of IT projects before they are developed and/or the preparation of business cases?	b
H3	How often have you participated in and/or led in managing IT projects?	b
H4	How often have you participated in and/or led in developing IT systems?	b
H5	How often have you participated in and/or led in implementing IT projects?	b
	Please rate your **experience in general management of IT** using the scale below:	
I1	How often have you participated in and/or led in creating an IT vision statement regarding how IT contributes to business value and strategy?	b
I2	How often have you participated in and/or led in developing IT strategy?	b
I3	How often have you participated in and/or led in creating IT policies?	b
I4	How often have you participated in and/or led in setting IT budgets?	b

Notes: Scale a: 1 — poor; 2 — below average; 3 — average; 4 — good; 5 — excellent. Scale b: 1 — never; 2 — hardly ever; 3 — a few times; 4 — a number of times; 5 — many times.

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