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International Journal of Project Management 33 (2015) 299–310

International Journal of Project Management

www.elsevier.com/locate/ijproman

Plans versus people: Comparing knowledge management approaches in IT-enabled business projects

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Received 23 November 2013; received in revised form 20 April 2014; accepted 29 April 2014
Available online 29 May 2014

Abstract

This paper evaluates the impact of two approaches to knowledge management in projects — one focused on aligning project documents ("the Plan-based approach") and another focused on developing shared understanding between different teams within a project ("the People-based approach"). A theoretical model and hypotheses are proposed and explored using data from a survey of 212 IT-enabled business projects. Results indicate that the people-based approach is more strongly influential on a project's success in securing business benefits. Although the plan-based approach is less influential, it does positively influence business benefit attainment and also supports the people-based approach. Thus, attaining shared understanding within the project team and aligning key documents are both important goals for a project's knowledge management strategy.

Keywords: Knowledge management; Codification; Socialization; Knowledge alignment; Project performance

1. Introduction

Knowledge is an important resource for organizational tasks (Grant, 1996) and the management of knowledge affects an organization's ability to accomplish these tasks successfully (Wiig, 1997). In this paper, we consider knowledge management within projects (Gann and Salter, 2000; Lindner and Wald, 2011) and apply organizational knowledge management concepts recognizing that projects can be conceptualized as temporary organizations (Lundin and Soderholm, 1995; Packendorff, 1995). The specific context we consider is information technology (IT)-enabled business projects. These projects require the challenging combination and coordination of technical, organizational and business knowledge to achieve successful outcomes (Markus, 2004). Since knowledge is a key component of these projects, the IT-enabled business project provides a useful context in which knowledge management within projects can be studied.

In practice, knowledge in projects can be managed by focusing on knowledge embedded in plans and on knowledge embodied in people (Madhaven and Grover, 1998). In focusing on plans,[1] knowledge management is directed towards codifying detailed, specific knowledge about the application domain in an effort to make explicit the shared understanding of future states (Wand and Weber, 1993; Khatri et al., 2006). In focusing on people, project managers encourage social interaction to build an environment enabling the integration of many kinds of knowledge from multiple sources to produce mutual understanding (Nonaka, 1991; Ruuska and Vartiainen, 2005).

The normative practice-oriented literature on projects tends to focus on plans and documents as the major knowledge deliverables en route to full project delivery (Reich and Wee, 2006). In contrast, much of the research literature attempts to counter-balance this emphasis on codification by demonstrating the importance of less explicit knowledge and the need for

[1] In this paper "plans" refers to any codified knowledge document pertaining to a project, such as a design, plan, model, program code, task list, chart or schedule. These are all considered "plans" because they are statements of intention about the future system, product, process or organization.

http://dx.doi.org/10.1016/j.ijproman.2014.04.012
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socialization, communities of practice and the development of shared understanding (Brown and Duguid, 1991; Bresnen et al., 2003; Nonaka and von Krogh, 2009). In an organizational context, Hansen et al. (1999) described the choice between plans and people as a choice between "codification" and "socialization" approaches to knowledge management. Reflective practitioners likely recognize the importance of both plan-based and people-based approaches. However, there are no studies that compare the effectiveness of these two perspectives and hence there is no research-based guidance as to the emphasis project managers should place on building comprehensive plans or building shared understanding among people as management approaches.

This paper is the third in a series which has investigated the concept of knowledge management within IT-enabled business projects. The first paper (Reich et al., 2012) conceptualized knowledge management as a three dimensional concept comprising knowledge stock, enabling environment and knowledge practices. We suggested that knowledge management enabled the creation and alignment of three types of project-based knowledge that are critical to achieving desired business outcomes: technical design knowledge, organizational change knowledge and business value knowledge. The factor analysis and regression testing of survey data from 212 IT projects statistically supported the model's conceptualization of the key constructs and showed that knowledge management within IT projects contributes to the creation and alignment of the important project-based knowledge.

The second paper (Reich et al., 2014) used structural equation modeling to test the relationships between knowledge management and various aspects of performance in IT-enabled business projects. Analysis of the previously collected survey data showed that project managers who achieve knowledge alignment among the people and the artifacts from three parts of the project – the IT team, the business change team, and the governance team – can have a significant positive impact on the achievement of business value from the project.

This paper investigates the question: "Which knowledge management approach has the stronger positive impact on project performance — managing plans or managing people?" We present a theoretical model of project-based knowledge management and examine evidence from the same survey data. The findings indicate that a people-based approach to knowledge management is critical to project performance. In addition, a plan-based approach that concentrates on aligning documents complements the people-based approach and contributes further to project performance.

The section that follows provides background for our theoretical model of knowledge management in projects. In this model, the focus is placed on the alignment of knowledge across three knowledge areas through both a codification and socialization process. Improved social and document alignment is theorized to lead to improved project performance as measured by the quality of the project outcome and the satisfaction of the organization with the outcome. The model is used to develop hypotheses regarding the impact of knowledge management on the production of documents, document alignment, social alignment and project performance outcomes. Measures of these constructs along with a survey method are described. Results from a structural equation model analysis are provided and these results are followed by a discussion and conclusion.

2. Background

The terms "knowledge" and "knowledge management" lack universal definitions (Nonaka and von Krogh, 2009). What they refer to often depends upon the context and level of analysis. For example, at the industry or firm level of analysis, the knowledge-based theory of the firm (Grant, 1996) suggests that knowledge be viewed as a strategically significant organizational resource embodied in multiple entities including organizational culture, policies, routines and employees. Alternatively, at the functional level, the community of practice literature (Brown et al., 1989; Brown and Duguid, 1991) suggests that knowledge is situated in a learning community and is not a firm level resource. The knowledge in a community of practice is not separable from the activity, context and culture within which the knowledge is being developed.

Our focus on knowledge management is placed within the context of an IT-enabled business project, an entity that has a mandate to deliver change to the "base" organization (Andersen, 2008). The IT-enabled business project is a unit typically composed of individuals who have different disciplinary backgrounds, belong to a different part of the base organization or to an external organization, and consequently often have different goals and objectives. This complexity creates challenges for integrating technology and human systems as has been detailed in socio-technical literature (Mumford, 2003). Successful exploitation of IT requires the integration and coordination of knowledge areas across technical, organizational and business unit knowledge dimensions (Markus, 2004). As Peppard and Ward (2004, p. 183), describe it:

> "Managing IS/IT and delivering business value is essentially a set of knowledge-based activities: a complex and multidimensional set of tasks and processes, incorporating many different but interdependent types of knowledge. It involves integrating and coordinating knowledge from many individuals from different disciplines and backgrounds, with varied experiences and expectations, located in different parts of the organization."

We have noted that knowledge from various sources has to be managed within an IT-enabled project. There are also different types of knowledge to be managed. The classic distinction between explicit and tacit knowledge provides a starting point (Polanyi, 1966). Tacit knowledge, strictly defined, defies codification. This paper relaxes that definition and incorporates the knowledge conversion processes described by Nonaka (1994) and by Nonaka and von Krogh (2009) such that knowledge that has not previously been articulated is tacit but that when such knowledge is expressed in documents we refer to this as a process of codification (Hansen et al., 1999). When knowledge is shared through interaction or conversation with other people we call this the process of socialization (Hansen et al., 1999) .

Codification relies on documents and socialization relies on people. Both of these processes should be managed with specific goals in mind in order to maximize effectiveness. Asking everyone to write down what they know or asking team members to have conversations with everyone on the project team will not likely accomplish any meaningful project goal. Indeed these activities could represent a significant waste of resources. We suggest that the appropriate goal of codification and socialization is the integration and coordination of the knowledge as noted in Peppard et al. (2007). We call the state of integration and coordination that results knowledge alignment.

Alignment is a construct initially defined in an organizational context (e.g. Waterman et al., 1980). In IT research, alignment refers to the relationship between the strategy of the IT department and the strategy defined for the organization as a whole (Chan and Reich, 2007). When these strategies are not aligned, the organization is less effective than it could be (Chan et al., 1997).

The IT alignment construct includes two dimensions: strategic and social (Reich and Benbasat, 2000; Chan and Reich, 2007). The strategic element refers to the linkages created between documents, for example the references made to the organizational strategy in the IT strategy document and vice-versa. Strategic alignment requires the process of codification. Social alignment refers to the relationships between what people in various organizational units know about each other's strategies. This dimension relies on the process of socialization and is a result of the shared experiences, interactions and conversations between people in different organizational units. Because strategic and social dimensions are achieved by different means, an organization might have differing levels of strategic alignment among their documents and social alignment among the members of their management team. These two dimensions of IT alignment are analogous to the two dimensions of knowledge alignment in projects as suggested in Reich et al. (2014).

3. Conceptual and theoretical models

This two-dimensional conception of knowledge alignment forms the basis of the conceptual model shown in Fig. 1. After this model is explained, the resulting theoretical model is presented in Fig. 2 and hypotheses which flow from it are described.

3.1. Conceptual model

The conceptual model in Fig. 1 builds from the theory of project-based knowledge management proposed in Reich et al. (2012, 2014). At the core of the theory is the recognition of different knowledges held by the individuals and specialist teams comprising a project team. From the manager–user–system designer roles described in socio-technical systems (Bostrom and Heinen, 1977; Mumford, 2003) to the organizational governance–business unit–IT unit roles described in Peppard (2007), it is clear that project teams with business and technical components contain individuals with significantly different knowledges and roles. While one can argue about labels and categorizations of these teams, it is impossible to deny the challenges of managing knowledge in these contexts.

Knowledge alignment in this context is not knowledge overlap. While some core knowledge is necessary for understanding (referred to as trans-specialist knowledge by Postrel (2002)), the goal of knowledge alignment is not to create the same knowledge across all project team members. Instead, the goal of knowledge alignment is to integrate and coordinate knowledges so that the explicit knowledge in documents and the comprehension among individuals enables each team member to understand the planned tasks and the mutual dependencies to achieve the intended organizational benefit.

As proposed in Fig. 1, there are two basic processes, codification and socialization, to accomplish knowledge alignment.

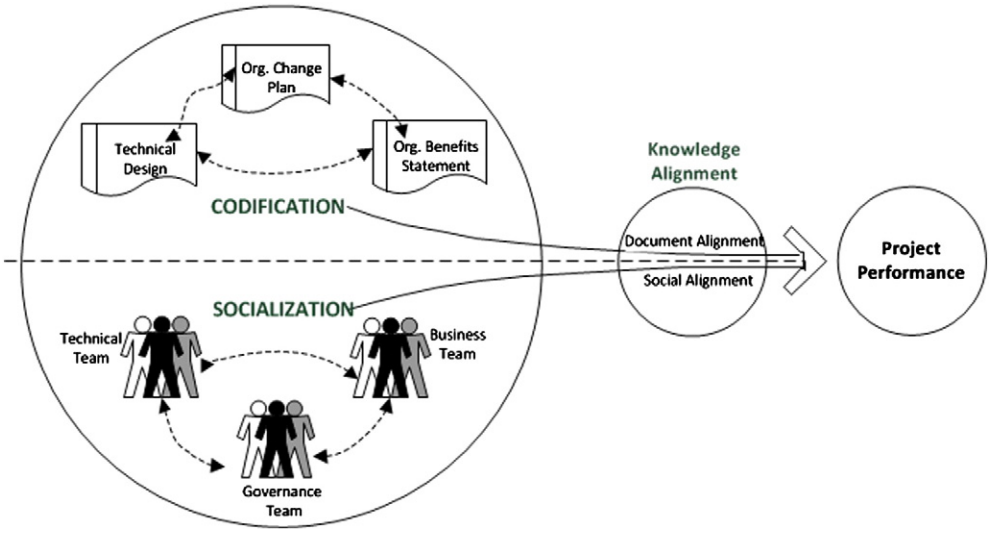

Fig. 1. Conceptual model of knowledge alignment.

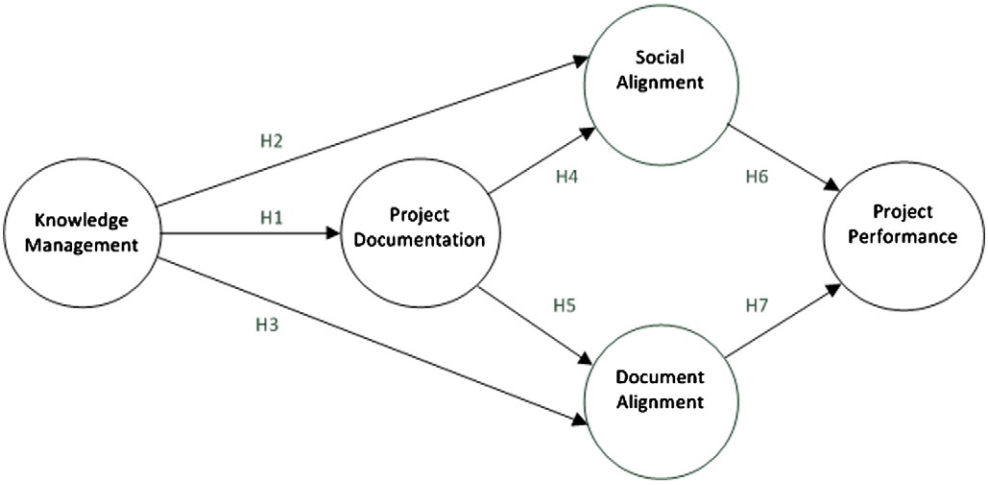

Fig. 2. The role of social and document alignment between knowledge management and project performance.

Codification is the process of creating and using documents for sharing knowledge. Documents can exist separately and independently from other documents or they can be interrelated and take into account the knowledge in other documents. When a document refers to knowledge in one or more other documents, this is referred to as document alignment as shown in the top half of Fig. 1. This top half of Fig. 1 represents the "Plan-based" approach to knowledge management in projects.

Socialization is the process of people interacting to create shared understanding. Technical and business teams, for example, can exist separately and independently or they can be linked together through conversation and shared experiences. Interaction helps technical team members better understand the context of the business team and vice-versa and has been shown to be important in similar contexts (Levesque et al., 2001; He et al., 2007). The bottom half of Fig. 1 provides a model of the process of socialization which results in social alignment and represents the "People-based" approach to knowledge management in projects.

While project team members may have their own specialist knowledge and expertise (Postrel, 2002), a knowledge-aligned project team develops and shares core understandings of the technical, organizational and governance solutions for the project. They have not only the explicit knowledge aligned across important project documents but also have created social interactions and experiences to help align their understanding of other teams within the project. As proposed in Fig. 1, knowledge alignment increases the probability that the project will achieve high levels of performance.

3.2. Theoretical model

The theoretical model shown in Fig. 2 is an expansion of the model developed and tested by Reich et al. (2014). It separates knowledge alignment into its two dimensions – social and document alignment – and tests the influence of each on project performance. Each construct in Fig. 2 is defined below. Hypotheses follow.

3.2.1. Knowledge management

The theory of project-based knowledge management (Reich et al., 2012) suggests that knowledge management has three elements that can be developed by a project manager. A manager can alter the knowledge stock by changing the quantity and/or expertise of the people selected to be part of the project. A manager can also develop a knowledge-enabling environment by providing technology support and/or facilitating the social environment for sharing knowledge. Knowledge stock and enabling environment can then be used in support of knowledge practices such as knowledge sharing and knowledge mapping. Taken together, these three elements – knowledge stock, enabling environment, and knowledge practices – constitute knowledge management within a project.

In the theoretical model in Fig. 2, knowledge management is hypothesized to play a threefold role in the attainment of high levels of project performance by influencing the production of project documentation, alignment of project documents and fostering shared understanding (social alignment) between project teams.

3.2.2. Project documentation

Project documentation is defined as "a set of explicit statements of current knowledge within the project team" (these are named "project-based knowledges" within Reich et al. (2012)). Examples would include a technical design plan that provides a statement of the technical team's knowledge about important aspects of the technical solution. Another example is an organizational change plan that provides the business team's statement of the organizational changes necessary to realize the benefits from the project. A third example is a document created by the governance team describing the organizational benefits expected from the project.

The project manager faces a choice in requiring comprehensive project documentation. The development of these documents is seen as a standard operating procedure in some plan-based methodologies. However, the effort of developing explicit statements can take valuable resources from the effort to actually

accomplish the end goal of the project. Particularly under conditions of resource and time pressure, the project manager may consider having the team rely less on explicit statements and more on conversation and interaction to share information.

However, developing comprehensive project documentation is important for several reasons. The contents are easily communicated. They are codified and therefore contain meaning even without the presence of a team member to accompany them. Finally, specific documents may act as a catalyst for discussion among the members of a team, becoming boundary objects between different disciplines (Bechky, 2003).

3.2.3. Social alignment and document alignment

Separating knowledge alignment into document alignment and social alignment provides a clear distinction between a plan-based approach and a people-based approach to knowledge management in projects.

In this research, an IT-enabled project is conceptualized as a collection of three broadly defined teams: 1) the technical team charged with developing the technical aspects of the mandate; 2) the business team representing business units who will implement the technology and changes to the business processes; and 3) the governance team including sponsors and others who provide oversight for the project and define anticipated project outcomes. Social alignment is defined as "the shared understanding about the project process and deliverables developed among teams within a project." Social alignment is hypothesized to positively influence project performance.

In this research, we have focused on three sets of documents as being instrumental to the planning and delivery of IT-enabled business projects: 1) the technical design documents; 2) the organizational change plans; and 3) the organizational benefits statements.[2] Document alignment is defined as "the acknowledgement and agreement among the content of documents within a project." Document alignment is hypothesized to positively influence project performance.

3.2.4. Project performance

Performance in projects is a multidimensional construct. In this study, we considered only one aspect of performance, the business benefits that flow from the project. We did not include other measures such as on time, on budget performance, business continuance, or project team satisfaction or learning.

4. Hypotheses

There are seven hypotheses proposed in Fig. 2. Each is described below, with supporting literature and rationale.

H1. Higher levels of knowledge management (KM) will be positively related to project documentation (PD).

Higher levels of knowledge management, as defined above, include higher levels of expertise, willingness to share and knowledge sharing practices within the project. Theoretically we would expect that these attributes would result in the production of more complete project documents. Empirically, this relationship was demonstrated in Reich et al. (2014).

H2. Higher levels of knowledge management (KM) will be positively related to social alignment (SA).

Social alignment is defined as the shared understanding developed between the technical, organizational and governance teams in an IT-enabled change project. Higher levels of knowledge management include higher levels of knowledge practices within an enabling environment that supports the development of trust. These two elements should lead to an increased level of shared understanding between project team members and hence higher levels of social alignment.

H3. Higher levels of knowledge management (KM) will be positively related to document alignment (DA).

In H1 we hypothesized that higher levels of knowledge management will be positively related to project documentation. Unlike social alignment, the construct document alignment requires some level of project documentation as there can be no document alignment without documents. One could argue that the direct relationship between knowledge management and document alignment might be mediated by the construct project documentation. The question is what level of mediation to hypothesize. In the absence of previous theory, we hypothesize that high levels of knowledge management (e.g. knowledge mapping and knowledge sharing) would generally lead to higher levels of document alignment. We therefore do not expect the relationship to be fully mediated and suggest a significant positive relationship between knowledge management and document alignment.

H4. Higher levels of project documentation (PD) will be positively related to social alignment (SA).

When a team develops a set of project documents, it is often necessary to coordinate information both within the team and between the team and adjoining teams (Postrel, 2002). For example, a business team identifying the skills required for users of a new system will need to understand the quality of the interface and documentation made available by the system. This requirement may lead them to communicate with the technical team. The more comprehensive and explicit the team tries to make its documents, the more communication will occur and shared understanding will result. This line of reasoning suggests a direct positive relationship between the level of project documentation and the level of knowledge alignment.

H5. Higher levels of project documentation (PD) will be positively related to document alignment (DA).

Research in IT software development has identified many different kinds of knowledge that need to be codified to impart

[2] These "teams" and "documents" are conceptualized solely for the purpose of this research. Actual projects may use different structures and names. We explain later in the paper how these concepts were empirically operationalized.

knowledge (Khatri et al., 2006). The wider the variety of project documents, the more that they will need to reference each other in order to be ontologically "expressive" (Wand and Weber, 1993). Therefore we expect that a focus on developing more complete project documentation will lead to high levels of alignment between these documents.

H6. Higher levels of social alignment (SA) will be positively related to project performance (PP).

Social alignment is the level of shared understanding across technical, governance and organizational teams. Bresnen et al. (2003) has suggested that as shared understanding increases, the potential for a project team to deliver expected organizational benefits increases. The shared understanding helps the teams address problems and generate alternatives to unforeseen complications that might arise while delivering a project or during the post-implementation period. Knowledge alignment and project performance are therefore expected to be positively related. The strength of this relationship provides an estimate of the effect of the people-based knowledge management on project performance.

H7. Higher levels of document alignment (DA) will be positively related to project performance (PP).

While aligned documents do not directly deliver any business benefits, they represent a set of linked statements about the future. In IT research, aligned business and IT strategy documents have been linked to organizational performance (Sabherwal and Chan, 2001). In a project context, this relationship should hold and potentially be stronger, since there is less time between implementation and benefit realization. We therefore expect a positive relationship between document alignment and project performance. The strength of this relationship provides an estimate of the effect of the plan-based knowledge management on project performance.

Hypotheses H6 and H7 are designed to provide insight into the relative importance of plan-based and people-based knowledge management in IT-enabled business projects.

5. Sample and measures

This analysis extends previous work to include a separate consideration of the social and document alignment constructs that were introduced by Reich et al. (2014). The discussion on the sample and measures therefore follows and summarizes the discussion in that article.

5.1. Sample

Two groups of practicing project managers were targeted with the same survey in 2010: 1) members of the Project Management Institute IS Community of Practice — 365 participants of which 198 completed the entire survey (54% valid responses) and 2) members of the Computer Weekly (www.computerweekly.com) general management database — 108 participants of which 54 completed the entire survey (50% valid responses). Tests for differences in key project variables including budget, duration, person months, and elapsed time were undertaken and no significant differences were found. Therefore the samples were combined.

The sample removed abandoned projects as well as outlier and anomalous projects (e.g. very small, extremely large, confusing dates, poor quality responses). Overall, 40 of the survey results were removed due to the issues noted above leaving a sample of 212. Assuming a medium effect size (0.15) and a significance level, $\alpha = 0.005$, the sample size of 212 provides a power, $(1-\beta)$, estimated by G*Power (Faul et al., 2009) of over 0.97 which is well beyond the 0.80 threshold recommended in Cohen (1988, p. 59).

The average reported project budget across the 212 participants was 3.2 million ($US) with an average duration of 14.6 months. Each project had 20.1 full time equivalent (FTE) positions working on average with 11.4 FTE's working in information technology roles and 8.7 working in business roles. All respondents were project managers. Of the total, 61% worked as employees and 39% as external contractors. Females made up 21% of the respondents.

5.2. Measures

Items from previously developed scale measures were used. There were five constructs in the research model (Fig. 2) and measures for each are described below. Appendix A provides the items used in this survey.

5.2.1. Knowledge management

Knowledge management is composed of three dimensions — knowledge stock, enabling environment, and knowledge practices. Items taken from Reich et al. (2012) were used for each of these dimensions and averaged before they were combined into an overall measure of the knowledge management construct. Enabling Environment (5 items) reflects aspects of both the technical and social environment, specifically the level of technology support (Barki et al., 2001) and the trust within the teams (Nelson and Cooprider, 1996). Knowledge Stock (3 items) measured the knowledge and expertise of the business team, the IT team and the governance team. Knowledge Practices (7 items) reflects the level of knowledge mapping and knowledge sharing (Faraj and Sproull, 2000) within the project.

5.2.2. Project documentation

Three items developed by Reich et al. (2012) were used, asking the extent to which the project team had created comprehensive documents containing the technical design, organizational change plan and expected business benefits for the project.

5.2.3. Social alignment

Social alignment is defined as the shared understanding component of alignment (Reich et al., 2014.) Two items taken from this article measured the shared understanding between

the technical team, the business team and the governance team for the project.

5.2.4. Document alignment

Document alignment is defined as an appropriate correspondence between the documents developed in a project. Two items taken from Reich et al. (2012, 2014) measured the alignment between the technical design and the organizational change plan and between the organizational change plan and the statement of organizational benefits.

5.2.5. Project performance

Project performance was conceptualized as a combination of realized benefits along with future benefits (Gable et al., 2008). Two items were used to measure project performance (PP). One item recorded the perceived level of client satisfaction with the benefits received. The second item considered quality actually delivered in relation to the quality that was originally expected as used in Gemino et al. (2008).

We did not include a consideration of performance in the form of budget, schedule and scope variance. Reich et al. (2014) had already shown no significant relationship between knowledge alignment and project management performance so no significant effects were expected when the knowledge alignment variable was divided.

6. Analysis and results

The model was analyzed using partial least squares (PLS) techniques as implemented in SmartPLS version 2.0.M3. Structural equation modeling was chosen over more traditional regression-based techniques in estimating multiple latent variables with multiple indicators (Gefen et al., 2011). The PLS technique was chosen over covariance techniques (such as LISREL) because PLS does not require measurement errors to be uncorrelated. This is an advantage in studies where the measures have not been well established and may exhibit some covariance (Gefen et al., 2011). Further, PLS handles formative constructs more readily than covariance based SEM techniques (Chin et al., 2010; Diamantopoulos, 2011) and the dependent variable in this study was estimated formatively.

Common method variance (CMV) may lead to systematic measurement errors that either inflate or deflate the observed relationships between constructs (Doty and Glick, 1998). We considered CMV in the survey design and included constructs measured with multiple methods (Campbell and Fiske, 1959) as well as using different measurement methods for the predictor and dependent variables (Podsakoff et al., 2003; Burton-Jones, 2009). CMV was assessed through a Harmon one-factor test (Podsakoff and Organ, 1986). Five factors were identified mirroring the five constructs in the model. These results suggest that CMV was not a significant concern.

The left-hand side of Table 1 summarizes the reliability of constructs included in this model. The composite reliability and average variance extracted (AVE) provide an estimate of the internal reliability for each construct. Composite reliability is a measure of the internal consistency of a reflective construct (Werts et al., 1974). Results demonstrate that the composite reliability of all reflective constructs met the standard of 0.80 set in Gefen et al. (2000) and Gefen et al. (2011). Average variance extracted (AVE) captures the variance measured by the latent construct and should be greater than 0.50, indicating that over half of the variance for each measure is explained by the model (Hair et al., 2009). This standard was met by all reflective constructs in the model.

Discriminant validity measures whether a latent construct is more closely related to its own measures than to measures of other constructs in the model (Chin et al., 2010). In addition, the correlation between constructs is compared to the square root of the AVE (to keep dimensions constant). The right hand side of the table shows correlations between latent constructs on the off-diagonal elements of the correlation matrix. The square root of the AVE is shown on the diagonal elements. For adequate discriminant validity, the inter-correlations (off diagonal elements) should be less than the square root of AVE (Hair et al., 2009; Chin et al., 2010; Gefen et al., 2011). Results in Table 1 demonstrate that the reflective constructs used in this study meet these requirements for discriminant reliability.

Fig. 3 displays the path coefficients for the structural equation model that tests the 7 hypotheses. The path coefficients were tested using *t*-values developed through the PLS bootstrapping technique (Chin, 1998).

The results shown in Fig. 3 and Table 2 show that one direct path from knowledge management (KM) to document alignment (DA) was not significant. All other paths were significant at the $p = 0.001$ level. Therefore, six of the seven hypotheses were supported. Starting at the dependent variable, it is clear that both social alignment (SA) and document alignment (DA) are significant predictors of project performance (PP) with R^2 of 0.34. Both document alignment (DA) and social alignment (SA) are well explained with R^2 equal to 0.56 for both constructs. Project documentation (PD) is very strongly related to document alignment (DA), and less so to social alignment (SA). Knowledge management is a strong predictor of social alignment and project documentation but not document alignment. These path estimates provide results for Hypotheses H1 through H7. They are restated in Table 2 and discussed in the next section.

7. Discussion and implications

This paper investigated whether a project manager should invest time and resources into developing comprehensive, linked planning documents (the Plan-based approach) or into developing shared understanding (the People-based approach) in an IT-enabled business project. This investigation can be broken down into three questions that explore the impact of these two approaches on business value gained from a project

1) Do Plan-based and People-based knowledge management approaches impact project performance?
2) Are these approaches substitutes or are they complementary?
3) Which approach is more influential?

Table 1
Construct reliability measures and correlations.

Latent variable (no. of measures)	Composite reliability	Average variance extracted (AVE)	Latent construct correlation				
			Knowledge management	Project documentation	Document alignment	Social alignment	Project performance
Knowledge management (3)	0.81	0.57	0.75 [a]				
Project documentation (3)	0.87	0.68	0.46	0.82 [a]			
Document alignment (2)	0.91	0.84	0.42	0.74	0.91 [a]		
Social alignment (2)	0.94	0.89	0.71	0.52	0.51	0.94 [a]	
Project performance (2)	NA [b]	NA [b]	0.34	0.50	0.49	0.52	NA [b]

[a] Square root of average variance extracted.
[b] Composite reliability and AVE not calculated for formative constructs.

Knowledge alignment was separated into document alignment and social alignment to better understand the separate effects of the codification and socialization processes on project performance. A theoretical model of project based knowledge management was presented and hypotheses were developed and tested using a structural equation modeling approach.

The results show that the model with separate alignment dimensions is able to explain over one third of the variance in project performance based on only two variables — social alignment and document alignment. Each of these variables had significant, positive effects on project performance. This is a very encouraging result, given that gaining business value from a project is subject to a wide variety of exogenous and other project-based variables during and after the project is officially completed. Because both social and document alignment were influential, we can answer the first question with a yes — both Plan-based and People-based knowledge management approaches positively impact project performance.

The second question is whether document alignment and social alignment are substitutes or complements in influencing project performance. If they are substitutes, then a project manager can choose which technique to employ, knowing that the outcome will be achieved. If they are complements, then each has its own unique contribution to the outcome and a wise project manager would employ both.

Document alignment is well explained ($R^2 = 0.56$) by the presence of high levels of project documentation. Because there is no statistically significant relationship between knowledge management and document alignment, we can say that document alignment is made possible through the production of project documents which is facilitated by knowledge management practices. Social alignment is also well explained ($R^2 = 0.56$) by this model. As expected, it is strongly influenced by knowledge management. However, it also is influenced by the level of project documentation. This analysis demonstrates that while document alignment (codification) and social alignment (socialization) are both strongly related to project performance, they are developed through different paths. Therefore the answer to Question 2 is that they are complementary techniques.

The answer to the third question – which approach is more influential – can be addressed through path analysis. There are two statistical approaches. At a high level, both document alignment and social alignment directly influence project performance at the 0.001 level of significance and we could conclude that their influence is the same. Digging deeper statistically entails calculating the total effect of each approach.

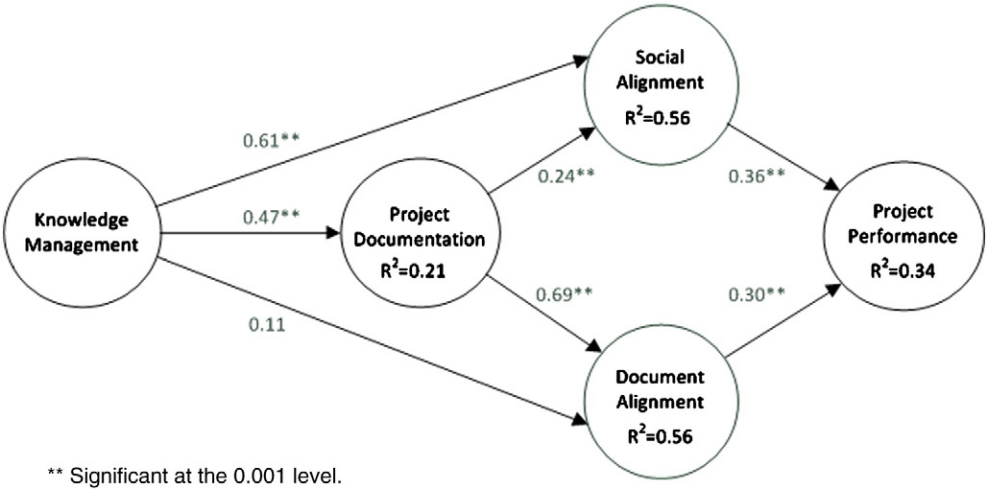

Fig. 3. Structural equation model results. **Significant at the 0.001 level.

Table 2
Summary of hypotheses and results.

	Hypothesis	Path coeff.	*t*-Value	Result	Conclusion
H1	Higher levels of KM will be positively related to higher levels of PD.	.47	6.67	Significant 0.001 level	Supported
H2	Higher levels of KM will be positively related to higher levels of SA.	.61	11.24	Significant 0.001 level	Supported
H3	Higher levels of KM will be positively related to higher levels of DA.	.11	0.98	Not significant	Not supported
H4	Higher levels of PD will be positively related to levels of SA.	.24	3.32	Significant 0.001 level	Supported
H5	Higher levels of PD will be positively related to higher levels of DA.	.69	14.08	Significant 0.001 level	Supported
H6	Higher levels of SA will be positively related to higher levels of PP.	.36	4.05	Significant 0.001 level	Supported
H7	Higher levels of DA will be positively related to higher levels of PP.	.30	3.31	Significant 0.001 level	Supported

This is done in three steps: 1) identify each path that connects the approach to the dependent variable, 2) calculate the effect of each path, and 3) sum the effects. The result of this calculation[3] is that the total effect of social alignment on project performance is 0.62. The total effect of document alignment on project performance is 0.43.

Based on this analysis, we conclude that a knowledge management focus on people is about 50% more influential on project performance than one focused on plans. It should be noted, however, that a small part (0.04) of the effect of the people strategy is contributed by the production of project documentation.

7.1. Implications for research

There are a number of implications that result from this study. Below we suggest more research into project documentation, exploring a contingency approach, and utilizing the communities of practice and boundary spanning literatures. We end by calling for further research into knowledge alignment.

The strength of the influence of project documentation on social alignment was a surprise to us. We had expected a positive, but weak impact. This finding suggests that research focusing on explicit knowledge creation might be productive. This research was able to explain only 21% of the variance in project documentation; therefore exploration of contributing factors would be useful.

Our finding that both people-based and plan-based approaches are influential does not test for a contingency focus. Research that tests whether a focus on plans is useful for a certain kind of project (e.g. a technically complex one) and a focus on people is useful on another kind of project (e.g. an organizationally complex one) would be helpful.

One implication is to underscore the importance of understanding how the socialization process impacts project performance. There may be an opportunity to expand this research using concepts from the communities of practice (Brown and Duguid, 1991; Wenger, 2000) literature. Although this was developed with permanent organizations in mind, it should be possible to explore how many of the tenets associated with communities of practice would be possible in a project environment. We have suggested that there are three conceptual "teams" in an IT-enabled business project; the technology team, the business team and the governance team. This parsimonious framework might be a suitable starting point to examine communities of practice within the project context.

On another level, there may be an opportunity to examine whether a project as a whole can resemble a community of practice. Individuals from different "teams" are formally or informally bound to their own disciplinary communities by the problems they address and the specialist language they speak. Then they are thrust into the temporary structure of an IT project and asked to interact with others and develop into a cohesive project team. The community of practice literature (Wenger, 2000; Bresnen et al., 2003) provides the concepts and structures to assess whether a project can successfully develop the shared meaning and understanding necessary to be called a community of practice.

A challenge in managing IT projects is to find ways to integrate knowledge across the technical, business and executive teams. When previously established disciplinary or organizational communities begin to collaborate within a newly formed project team, the lack of a shared work context can lead to poor communication because members of the different communities describe elements of the work in different ways using the context most familiar to them (Bechky, 2003). Results of this study suggest that codification, through the development of planning documents, might overcome this decontextualization and support social alignment between the teams on a project. The technical design, organizational change plan and statement of organizational benefits might act as boundary objects (Star and Griesemer, 1989) that can link communities of practice together (Wenger, 1998). A deeper understanding of the role of documents as boundary spanning objects in fostering knowledge alignment would be beneficial.

This research has shown that there is merit in pursuing both the tenets of practitioner literature, which stresses document alignment, and the research literature, which stresses social alignment. However, we can explain less than 60% of the variance in these key constructs. Further research is needed to determine other factors that influence document and social alignment and to explore the knowledge alignment concept more deeply.

7.2. Implications for practice

The main practical outcome from this research is what it implies for project managers about how to focus their knowledge management activities. The three elements of knowledge management (e.g. expert people, an environment conducive to sharing knowledge, and knowledge practices) are

[3] See Appendix B for the calculation of these two effects.

influential when they are focused on ensuring that different groups understand each other and that the plans for the technology, the organizational change, and the business benefits are aligned. It would be very useful for the practitioner community to develop normative guidelines to achieve these ends.

Practitioner literature on project management is full of advice to create documents (e.g. data models, use cases, test plans) that codify various parts of the project. What this research demonstrates is that the development of high quality documents is, in itself, a knowledge management strategy that can help to bridge the gaps in understanding between different disciplines and roles within a project. By requiring that comprehensive documents be developed, managers are encouraging team members to deeply understand how the future will be created and what relationships between different elements have to be in place before benefits can be achieved. Further, a process such as requiring teams to achieve "sign-off" on key documents from other teams creates the opportunity for levels of document alignment that lead to increased shared understanding and higher levels of project performance.

Extending firm level research (Brynjolfsson and Hitt, 2000), we believe that organizational change plans are the "linchpin" documents that tie the technology inputs to the business benefits. These plans explain how the technology will enable new business processes and structures which will lead to business benefits. They itemize the changes that the organization will need to make to fully utilize the new technologies. The IT project management discipline lacks a detailed understanding of the content and structure of these documents and many business projects fail to develop them. Our data shows that this failure will have strong negative consequences with respect to attainment of business value. This is a task for the practitioner community — to develop normative guidelines for the creation of these important planning documents.

The strength of the relationship between document alignment and project performance is somewhat difficult to understand since most of the content of the documents has been materialized (e.g. through working code, training programs, and organizational changes) by the time the project has been implemented and the business is trying to absorb the technology and develop new processes. What may be happening is that a set of linked plans developed before the "go-live" date creates a "strategy map" similar to those advocated for organizations (Kaplan and Norton, 2004). Changes to this "map" can be made as implementation progresses and the linkage between the technology, business process, and benefit realization can be maintained. Aligned documents might serve as an initial "proxy" for an aligned team — a team that understands what each member is responsible for and how their actions are interrelated and coordinated. The results in this paper suggest however that aligned documents are only part of the story. Social alignment is critical in performance and represents a separate management dimension. Practitioner guidelines should make clear the need to ensure that important documents created by one team are linked to key documents developed by other teams, but more importantly, that the teams find ways to communicate, beyond documents, in order to achieve higher performance.

7.3. Limitations

There are several limitations to this study but the most important revolve around the measurement of project performance. We used two extant items but more work needs to be done to develop our ability to validly measure project performance. There are difficult issues of timing (when to collect data) and of respondents (who to ask) to resolve.

We have relied on the project manager as our single information source. It would be useful, in future studies, to find methods to confirm project manager assessments by including project sponsors in the survey. This proved very difficult for us to accomplish but would provide added assurance about the project performance measures.

8. Conclusion

This study started from the presumption that IT projects are knowledge intensive and that the alignment of knowledge was important in developing project performance. What we found was that both elements of alignment — the alignment of more tacit knowledge (e.g. a focus on people) through socialization and the alignment of explicit information through codification (e.g. a focus on plans) were important determinants of project performance. They are complementary and both should be pursued in IT-enabled business projects. At this relatively early stage in the study of knowledge management in projects, it appears that if a choice has to be made, it is better for performance to place the emphasis on people.

In this research we have delved more deeply into the mechanisms of knowledge management and tried to understand from a theoretical and a practical perspective what is important in attaining project success. We hope that this research inspires further effort in this domain.

Conflict of interest

Authors have no conflicts, are not employed by any governments or commercial operations.

Appendix A. Survey questions

A.1. Knowledge management (Likert scale, 1–7)

AvgEnabEnv (enabling environment) — The following items were averaged:

EnabEnv1 — The project team members viewed themselves as having a knowledge and learning orientation within the project.
EnabEnv2 — Members of the IT team and the business team were easily able to meet face-to-face throughout the project.
EnabEnv3 — The project team members had access to a knowledge management system (e.g., project portal, document repository).
EnabEnv4 — Members of the IT team and the business team trusted each other to act professionally and competently.

EnabEnv5 — Members of the project team recognized the potential value of their peers' expertise.

AvgKPrac (knowledge practices) — The following items were averaged:

KPract1 — Business team members shared their knowledge and expertise with IT team members.
KPract2 — Members of the governance team shared their knowledge and expertise with members of the project team.
KPract3 — During the project, the IT team and the business team formally shared information (e.g., meetings, status reports).
KPract4 — During the project, the IT team and the business team informally shared information (e.g., sharing personal stories, social interaction).
KPract5 — Business team members knew which IT team members had knowledge and expertise that was relevant to their work.
KPract6 — IT team members knew which business team members had knowledge and expertise that was relevant to their work.
KPract7 — IT team members shared their knowledge and expertise with business team members.

AvgKStock (knowledge stock) — The following items were averaged:

KStock1 — At the start of the project, the business team had all the knowledge and expertise needed to create the organizational change plan.
KStock2 — At the start of the project, the governance team had all the knowledge and expertise needed to define the desired organizational benefits.
KStock3 — At the start of the project, the IT team had all the knowledge and expertise needed to create the technical design.

A.2. Project documentation (Likert scale, 1–7)

CD1 — A comprehensive organizational change plan was created.
CD2 — A comprehensive statement of desired organizational benefits was created.
CD3 — A comprehensive technical design was created.

A.3. Social alignment (Likert scale 1–7)

SAlign1 — Overall, there was a high level of alignment of knowledge across the IT team, business team and governance team.
SAlign2 — Overall, there was a high level of alignment of knowledge between the project team and the business units.

A.4. Document alignment (Likert scale 1–7)

DAlign1 — The organizational change plan was appropriate to deliver the desired organizational benefits.
DAlign2 — The technical design was appropriate to support the delivery of the organizational change plan.

A.5. Project performance (business value) (one Likert scale 1–7, one variance question)

BusVal1 — Overall, the client organization was satisfied with the benefits received from the project.
BusVal2 — In terms of quality, the project delivered: (check one)
☐ The level initially specified.
☐ A level more than was initially specified by ____ %.
☐ A level less than was initially specified by ____ %.
☐ I am unable to answer this question.

Appendix B. Calculation of the total effect of social and document alignment on project performance

Total effect is calculated by finding the effect of each path involving the independent variable and the dependent variable and summing them. The effect of each path is calculated by multiplying the individual path coefficients.

Social alignment's effect on project performance	
1. Direct effect — path from SA to PP	=.36
2. Path from KM to SA to PP (.61*.36)	=.22
3. Path from KM to PD to SA to PP (.47*.24*.36)	=.04
Total effect	=.62
Document alignment's effect on project performance	
1. Direct effect — path from DA to PP	=.30
2. Path from KM to PD to DA to PP (.47*.69*.30)	=.10
3. Path from KM to DA to PP (.11*30)	=.03
Total effect	=.43

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