Information & Management 51 (2014) 283–295

Contents lists available at ScienceDirect

Information & Management

journal homepage: www.elsevier.com/locate/im

Coping knowledge boundaries between information system and business disciplines: An intellectual capital perspective

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ARTICLE INFO

Article history:
Received 7 December 2012
Received in revised form 7 October 2013
Accepted 31 December 2013
Available online 9 January 2014

Keywords:
Knowledge boundary
Multidisciplinary collaboration
Intellectual capital
IS development

ABSTRACT

Information system development can be considered a collaboration between users and developers. The inability to leverage the localized knowledge embedded in these two stakeholders hinders software development work to achieve high performance. Exploring the ways to counter this difficulty is then critical. This study applies an intellectual capital perspective to address the issues around spanning the knowledge boundary between developers and users. Our findings highlighted how important effective knowledge boundary spanning is to both product and project quality. Furthermore, three dimensions of intellectual capital increased the degree to which knowledge boundary spanning was effective.

1. Introduction

Multidisciplinary collaboration, such as cross-functional teams within an organization [11], or collaboration among organizations with different expertise [49], has become common in organizations for leveraging multiple knowledge bases to create innovations. Benefits are expected from multidisciplinary collaboration, including addressing the complexity of current phenomena [45], extending the solution space by bringing multiple perspectives [35], generating a wide variety of ideas and producing more creative designs [72,40]. However, challenges appear, especially when such collaborations cross the boundaries between specializations. For example, conflicts arise and collaboration may be dysfunctional when goal and value diversity are driven by professional differences [27], and communication can be ineffective as it always involves a long process of term definition negotiation in multidisciplinary collaboration [59]. These examples collectively highlight the not-to-be-ignored effect of the "knowledge boundary" in multidisciplinary collaboration [11,12]. *Knowledge boundary* refers to the knowledge delivery problems in which the tacit and sticky nature of localized knowledge may actually hinder problem solving and knowledge creation across functions [57,9]. In practice, this specialization of knowledge increases the difficulty of collaborating across functional boundaries and accommodating knowledge developed in other practices [11].

In the information system (IS) area, a typical example of multidisciplinary collaboration is the IS development (ISD) process in which users and IS developers work together to counter requirements risks and generate better outcomes [38]. *Requirements risk* is the possibility that the elicited requirements will be of low quality, such as incorrect or invalid requirements [84,70]. Failing to elicit correct requirements in the design stage could increase the difficulty in the late stages of IS development [28,56]. Project teams may need extra resources and time to achieve predefined goals, and the developed system may not fully support users' daily work [64]. Studies have proposed ways to improve the quality of requirements elicitation, including development methodologies, tools and design paradigms [61,31]. In addition, empirical studies also emphasized the importance of including users in the requirements elicitation process to ensure success [36].

However, simply involving users in the system development process is far from sufficient. After decades of studying, academic researchers show inconsistent results on the effect of user participation [36,42]. Project performance may still be low even when users are included [47]. Even though contingency theory is widely adopted to explain the inconsistent findings [39], few studies attempt to answer this question from the process of or

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http://dx.doi.org/10.1016/j.im.2013.12.005

activities in user participation. This suggests the need to investigate this issue from a different perspective. For example, from a boundary spanning perspective, to obtain higher quality requirements, developers have to understand users' needs, translate user requirements into system features, and even negotiate with users about what the system should be and how processes could be improved. Since users and IS developers have different expertise and interests in their working domains, quality requirements can be created only when the knowledge boundary is successfully overcome.

Information system development is a knowledge intensive process in which business knowledge from users and technical knowledge from developers are considered the most critical resources. By viewing the elicited requirements as new knowledge jointly created by users and developers, the interaction process between these two parties for requirement elicitation can then be regarded as a knowledge boundary spanning process. Ineffective knowledge boundary spanning between users and developers may result in inadequate requirements and hinder final performance. This also highlights the importance of identifying what must be available within the organization or project team for effective knowledge boundary spanning. Since an ISD project is a knowledge intensive process and knowledge is counted as the most critical resource, intellectual capital serves as a good starting point for investigating this issue. Current research suggests that user–IS interactions can be better achieved with mutually shared knowledge, a smooth relationship and appropriate mechanisms for collaboration [78,86]. These concepts are aligned with the intellectual capital theory which suggests that the intellectual materials (e.g., knowledge, information, intellectual property, and experience) allows the organization to produce a higher-valued asset [74]. Distinguishing human, relational and structural types of capital [8], the intellectual capital theory has been adopted to understand knowledge contribution [87] and the quality of knowledge sharing [82,81].

Applying the intellectual capital perspective, this study examines how the various types of intellectual capital between users and IS developers contribute to overcoming knowledge boundaries. The research questions include: (1) "Can effective knowledge boundary spanning between users and IS developers help improve ISD performance?" and (2) "Can intellectual capital facilitate effective knowledge boundary spanning between users and IS developers?" By answering the above questions, this study contributes to the ISD project management area by showing the importance of knowledge boundary spanning. Past studies largely adopted the participation concept and examined the positive and negative effects of user engagement on project performance. We introduce the knowledge boundary concept into this research stream and argue that, in order to better utilize expertise, both developers and users need to cross the knowledge boundary between them. In addition, we also identify possible approaches that can be used to facilitate knowledge boundary spanning. Those identified approaches may serve as guidance for managers to overcome knowledge boundaries in practice.

The rest of this paper is organized as follows. In the next section, related literature is reviewed and hypotheses are provided. The research method is introduced in Section 3. Data analysis and discussion are then followed by the conclusion.

2. Literature

2.1. Knowledge boundaries and boundary spanning

A knowledge boundary is a kind of barrier or gap that prohibits effective knowledge delivery across functions and among experts [9,10]. In contrast to current research, which suggests such factors as motivation [88,2,32], cultural issues [51], transfer channels [2,32] and absorptive capacity [32,14], studies of knowledge boundaries are specifically concerned with the barriers caused by local knowledge itself in the process of knowledge delivery and sharing [11,12]. Past literature addresses knowledge boundaries from three main perspectives. The first stream of research regards knowledge as something to be captured, stored and retrieved [11,24]. This stream takes an *information processing perspective* (*or engineering approach* [24]) and puts emphasis on developing a common lexicon for effective knowledge delivery [24,44,26]. The second stream of research concerns the tacit, sticky and situated nature of knowledge. Therefore, this stream stands on the *interpretive perspective* and focuses on common meanings to share knowledge between actors [83,43]. The third stream of research stresses the *social perspective* and acknowledges how different interests impede knowledge sharing and, therefore, emphasizes the importance of goal consensus building to facilitate knowledge delivery [24,50,29].

Carlile integrated these three streams and developed a comprehensive framework to manage knowledge boundaries [11,12]. The basic argument of this framework is that knowledge within a function actually hinders problem solving across functions because knowledge is localized, embedded and invested in practice [11], as well as socially constructed among professionals [21]. The specialized, socially constructed and embedded nature of knowledge increases the difficulty of working across functional boundaries and accommodating knowledge developed in another practice [21].

Carlile further suggests that knowledge boundaries can arise in different degrees of novelty, specialization and dependence. *Novelty* refers to the degree to which the circumstances are unusual [12]. *Specialization* is the difference of the amount and type of domain-specific knowledge. It determines the amount of effort needed to adequately share and assess each other's knowledge [12]. *Dependence* refers to "a condition in which two entities must take each other into account if they are to meet their goals" [12]. Carlile [11,12] also identified three knowledge boundaries: syntactic, semantic and pragmatic, as shown in Fig. 1.

First, a *syntactic knowledge boundary* occurs when knowledge is low in novelty, specialization and dependence. This knowledge boundary refers to the lack of a shared syntax and creates the concern that information may not be processed properly across a given boundary. This boundary highlights the need for actors to establish a shared and stable syntax to ensure accurate communication across a boundary and to solve challenging communication and information processing problems [11,71]. *Knowledge transfer* is the major purpose of syntactic boundary spanning. A common lexicon created by the storage and retrieval of knowledge can facilitate knowledge transfer across the syntactic boundary [16]. When the created common lexicon sufficiently specifies the differences and dependencies of consequence at the boundary, it can function as a boundary object to facilitate knowledge transfer

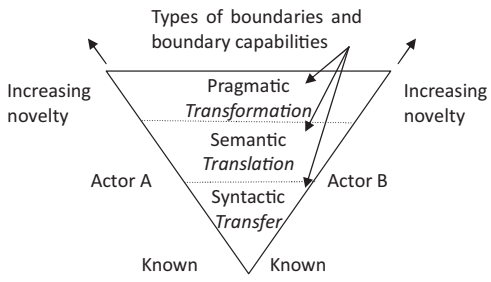

Fig. 1. Framework of knowledge boundaries.
Adapted from [12].