Knowledge Formation and Learning in the Management of Projects: A Problem Solving Perspective

ABSTRACT

In contrast to traditional projects, which are assumed to be fully specified and then executed with little learning anticipated, complex projects cannot be *fully* specified at the outset and require continuous learning over their life cycles. Nevertheless, the key role of knowledge formation and learning in managing complex projects is under-developed for expanding project capability boundaries to include knowledge uncertainty and indeterminacy.

Drawing inspiration from Karl Weick's enactivist ideas and an empirical study of two organizations that developed project capability for complex projects, the paper develops an integrated view of projects and project management that is grounded in problem solving learning and organizing. More specifically, a project is reconceptualised as 'a mode of organizing to accomplish a temporary undertaking' with intrinsic learning. This perspective views complex projects under knowledge uncertainty as learning organizations, with implications for project management theory and practice.

1   INTRODUCTION

In traditional project research, even when complex projects cannot be fully specified and planned in advance, such as major infrastructure projects, normative expectations require the appearance of planning and control for these projects through management processes based on instrumental rationality (Sapolsky, 1972). This normative approach treats 'complex' projects, which cannot be *fully* specified in advance, as just 'complicated' projects that can still be managed and planned in the traditional way as "the *application* of knowledge, skills, tools, and techniques ... to meet the project requirements" (PMI, 2013, p. 5, italics added). Not surprisingly, this planning approach privileges static and explicit 'known' knowledge (designs, etc.) over dynamic and experiential 'knowing' knowledge (know-how, etc.), which leads to an expectation of little learning during the execution of project plans as prior knowledge. In this project culture, the role of knowledge formation and learning in project delivery is downplayed, which is to the detriment of enhancing the boundaries of traditional project capability to include project settings characterised by complexity and indeterminacy.

Using the enactivist ideas of Weick (1979, 1995), this paper examines knowledge formation and learning as a key aspect of developing an organizational capability for delivering complex projects, which is based on an empirical study featuring two Irish state-owned organizations in the late 1990s and early 2000s. During this time, each of these organizations was challenged to develop a project capability as a core supporting competence, in order to deliver major infrastructure projects well beyond their project capability up to then (Thompson, 1967). While acknowledging the difficulty of distinguishing between large projects and complex projects, Williams (2002) builds on Baccarini (1996) to highlight the indeterminacy and uncertainty of complex projects, "whose behaviour is *beyond* the sum of their parts and whose reaction to changes in inputs is *difficult* for the human mind to *predict*" (p. 50, italics added). Thus, an important empirical finding in the study is that developing complex project capability can best be understood as a form of complex problem solving (CPS) learning, which does not lend itself to being fully specifiable in advance. In terms of knowledge formation, this means that a central aspect of developing organizational capability in complex settings involves managing intrinsic knowledge uncertainty. In complex projects, this implies the need to generate knowledge continuously over the project life cycle that is not specifiable at the outset (Engwall, 2002).

In the two organizations under study, both were found to have evolved multi-level organizational learning processes over the course of the featured projects that revolved around complex problem solving (CPS) as a mode of organizing and learning. In effect, in order to generate the 'missing' knowledge that was unspecifiable in designs, plans, etc. at the outset of complex projects, the project

team in each case became a community of learners that was *learning the project* over the life cycle though organizational CPS. The full empirical inquiry that led to these findings is reported elsewhere (Author, 2013), which is an exploratory case study investigation of two complex organizations in the government sector that draws on primary data from 51 semi-structured interviews using a contextualist perspective (Pettigrew, 1997, 2013). The primary purpose of this paper is to examine some of the main conceptual and practical implications for the project literature associated with the above two empirical insights found to be characteristic of a complex project context, namely, incomplete pre-given knowledge and emergent knowledge formation. This will be done through conceptual development inspired by the relevant literature and the study data.

Following this introduction, the remainder of the paper is organized as follows. Section 2 reviews the literature on two project knowledge perspectives for complex projects – planned and emergent. Under a knowledge formation approach, Section 3 adopts an integrated view of projects as a process of knowledge formation through problem solving and project management (PM) as an organizational practice to develop the core idea of projects and PM as *modes of organizing and learning* for knowledge uncertainty. In this view, a project is reconceptualised as 'a mode of organizing to accomplish a temporary undertaking' with implicit learning. This perspective synthesises the two main approaches to project knowledge - explicit 'known' knowledge (designs, etc.) and experiential 'knowing' knowledge (know-how, etc.). Finally, the concluding Section 4 outlines the implications of this new 'modes of organizing and learning' perspective for future research and practice.

2   PLANNED AND EMERGENT KNOWLEDGE IN PROJECT DELIVERY

Informed by the empirical insights of incomplete pre-given knowledge and emergent knowledge formation, both found to be inherent characteristics of the delivery of complex projects, this section reviews the literature on complex projects in relation to knowledge formation and learning under traditional PM and practice-oriented approaches. From the perspective of knowledge and learning, traditional PM under PMBOK guidelines assumes knowledge certainty at the start of projects in designs, plans, etc. (APM, 2012; PMI, 2013), whereas practice-oriented approaches accept the need for learning over the life cycle (Cattani et al., 2011). Further, a distinction is made between traditional projects, however complicated, that can be fully specified in advance and complex projects that cannot be fully specified in advance of their delivery. Finally, different modes of problem solving learning are discussed, including complex projects and PM as a form of organizational complex problem solving (CPS), which facilitates the formation of emergent knowledge over the project life cycle. If complex projects are distinguished from traditional projects by unspecifiable pre-given

knowledge, then, the formation of emergent knowledge and its effective coordination become central concerns in their successful delivery.

In traditional project research, which tends to reflect a linear model of input-outcome relationships (March, 2006; Nightingale, 2004), knowledge is seen to revolve around plans, designs, and associated activities, which are implemented by competent project team members to achieve predetermined targets, such as cost, time, and scope. In this approach, project knowledge is assumed to be available up-front as explicit 'known' knowledge (designs, etc.) and, then, assembled like Lego blocks with little learning anticipated beyond the application of prior knowledge. This approach is reflected in its definition of PM by the Project Management Institute (PMI) as "the *application* of knowledge, skills, tools, and techniques to project activities to meet the project requirements" (PMI, 2013, p. 5, italics added). This kind of explicit 'known' knowledge (designs, etc.) is context-independent and can be documented and transferred without difficulty between projects (Popper, 1979). In terms of traditional project research, the project team (subject) endeavours to manage a separate project plan (object) as documented informational knowledge that is fully specified in advance, in order to successfully deliver a project (Leybourne and Sadler-Smith, 2006; Smyth and Morris, 2007).

Over time, however, this traditional linear perspective, which privileges planning over learning in its conceptualisation of project management delivery, came to be seen as increasingly problematic and incomplete. In 2006, in response to growing criticism of the divide between PM theory and practice, the UK government sponsored a multi-disciplinary review entitled *Rethinking Project Management*. The main findings of this two-year research programme are presented by Winter et al. (2006) in terms of five directions aimed at developing project theory and practice. These are categorised in three groups around PM as practice: (1) theory ABOUT practice (project complexity); (2) theory FOR practice (projects as social processes, project value creation, project conceptualisation); and (3) theory IN practice (practitioner development). The findings represent a move to rebalance the traditional monolithic project paradigm of technical rationality with insights from the social sciences to yield a socio-technical framework that is malleable to cope with the exigencies of specific project delivery. They also resonate with the approach of Scandinavian scholars in relation to viewing projects as temporary organizations (Engwall, 2002; Engwall et al., 2003; Lundin and Söderholm, 1995; Packendorff, 1995). Importantly, in a practice-oriented approach, learning is seen as intrinsic, and as Wenger (2001) insightfully observes: "One reason they [practitioners] do not think of their job as learning is that what they learn *is* their practice" (p. 95, original italics). Extending this insight to project settings, it can be said, in paraphrase, that one reason PM practitioners themselves do not tend to think of problem solving as learning is that solving problems '*is*' their job, i.e., their practice.

One of the central insights to emerge from the empirical study on which the paper is based is that complex problem solving (CPS) is seen to be the core process through which new knowledge emerges in the delivery of complex projects. Within the wider literature on problem solving, the level of complexity has long been used to distinguish between different levels of knowledge formation and learning, where recent characterisations of complex problems by Snowden (2002) and Cleden (2009) resonate with the earlier analysis by Swinth (1971) who observes "[t]here is typically a high degree of *interdependence* between parts" and such tasks "are too complex to be readily understood and solved by *one person or group*" (pp. B68-9, italics added). However, such approaches to complex problems highlight a paradox at the heart of complex projects, namely, if complex projects cannot be fully specified, then, how can they be fully planned in advance of their delivery? A tentative resolution of this knowledge paradox, suggested by the empirical insights from the study, is by *learning the project* over the life cycle. This involves the project team generating the missing knowledge through problem solving learning as a community of learners *of projects in projects*. In this knowledge-based view, complex PM is an organizational practice comprised of a community of learners using organizational CPS, where CPS learning '*is*' the practice.

The recent empirical study by Enberg et al. (2010) echoes the conceptual perspective being developed in this paper. In their contribution, they highlight the "unforeseeable … effects of small changes" (p. 762) on knowledge integration in complex projects, which was addressed by adopting a distributed approach to knowledge coordination informed by sensemaking and tacit knowledge (Polanyi, 1967; Weick, 1995). This implicitly acknowledge Hayek's (1945) 'specification problem', which is central to the perspective on knowledge formation in complex projects being advanced by this paper. In his classic paper, Hayek (1945) highlighted the practical difficulty of a central planning approach to the working of markets as complex knowledge phenomena, because the complete data are never given "to a single mind ... and can never be so given" (p. 519). He went on to suggest that any solution to this practical problem needed to harness experiential knowledge, which is dispersed among many people. Similarly, in another recent paper that recognises the limitations of traditional PM, Berggren et al. (2008) advocate a practice-oriented approach for complex projects and organic integration for coordinating the distributed nature of experiential knowledge (know-how, etc.). What both of these PM papers highlight is the need to continuously generate emergent knowledge in complex projects and the need to coordinate this emergent knowledge using a distributed approach.

3 PROJECT MANAGEMENT AS A PROCESS OF DYNAMIC ORGANIZING-LEARNING: A RECONCEPTUALISATION

Based on the two empirical insights highlighted earlier of incomplete pre-given knowledge and emergent knowledge formation in complex projects, the previous section reviewed the project literature in terms of planned and emergent approaches to knowledge and learning for complex projects. In both cases, limitations were identified that revolve around how projects are conceptualised. By viewing projects as tasks under traditional PM, 'hard' explicit knowledge (designs, etc.) is privileged over 'soft' experiential knowledge (know-how, etc.), which is problematic in complex projects with knowledge uncertainty (Williams, 2005). On the other hand, while practice-oriented approaches to project research accept the idea of learning over the project cycle that involves experiential 'knowing' knowledge (know-how, etc.), this approach does not seem to achieve a reconciliation with the strengths of traditional explicit project knowledge (Blomquist et al., 2010; Hällgren and Wilson, 2008; Lalonde et al., 2010, 2012; Sanderson, 2012). Moreover, the issue of continuous knowledge formation as a response to knowledge uncertainty in complex projects is not adequately addressed in the literature, in terms of the implications for how projects are conceptualised and how knowledge can be obtained about them (Thomas, 2000; Winter et al., 2006).

Using the enactivist lens of organizing and sensemaking (Weick, 1979, 1995), the discussion in this section highlights problem solving as a key organizing and learning activity that constitutes a complex project as a knowledge formation process for innovating solutions based on temporary organizing and learning. This 'modes of organizing and learning' approach to complex projects is grounded in a view of knowledge formation as a dialectical interplay between explicit 'known' knowledge and experiential 'knowing' knowledge through problem solving. This approach is informed by Kolb's (1984) 'experiential learning' and Cook and Brown's (1999) idea of organizational learning as an interplay between 'knowledge' and 'knowing'. The paper will argue that this dialectical approach represents a synthesis of the two main knowledge perspectives in project research - explicit 'known' knowledge (designs, etc.) and experiential 'knowing' knowledge (know-how, etc.). Overall, this approach attempts to enhance the strengths of traditional project knowledge with a complementary perspective of experiential project knowledge (Morris, 2002, 2006), rather than suggesting the replacement of the former with the latter or other approaches (Cicmil and Hodgson, 2006).

3.1 Complex Projects - Knowledge Formation Through Problem Solving

Although projects can be characterised in many ways, ranging from their content as specific tasks to their form as temporary organisations, few would disagree that problem solving is an important characteristic of the PM process throughout the project life cycle. What seems taken for granted in the

project research schools of both Söderlund (2002) and Bredillet (2008) is the knowledge formation dynamic that is inherent in collective problem solving, which is pervasive in project settings. In projects, problem solving is often regarded as a heuristic practice, one among many, rather than as a central creative aspect of the overall PM process. In contrast, by viewing means-end problem solving as a knowledge formation process for innovating solutions, this demarcates PM from other management disciplines for conditions of intrinsic knowledge uncertainty (Lenfle and Loch, 2010).

However, the formation of new knowledge is problematic for traditional project research with its Positivist lens, because, under this view, knowledge is largely seen as objective in the form of explicit 'known' knowledge (designs, etc.). Accordingly, the normative role of PM is to apply this pre-existing knowledge for resolving implementation situations rather than to generate new knowledge, i.e., "plan-then-execute" (Leybourne and Sadler-Smith, 2006, p. 485). In effect, traditional project research anticipates little learning beyond the application of prior knowledge. In contrast, using a knowledge-based view, this paper highlights the *absence* of knowledge as an intrinsic characteristic of complex projects, where the role of PM as an organizational practice is to manage the process that facilitates the formation of 'missing' project knowledge through problem solving learning.

If learning is a central element of PM as organizational practice (Wenger, 2001), a better understanding of learning in projects is needed but, in order "to understand learning, we must understand the nature of knowledge and vice versa" (Kolb, 1984, p. 38). This is a serious impediment for traditional project research with a 'one size fits all' approach to knowledge based on technical rationality, which views objective knowledge as detached from the knowing subject and fully specified at the outset (Flyvbjerg et al., 2003; Morris and Hough, 1987; Shenhar, 2001; Smyth and Morris, 2007). A practice-based epistemology with implicit learning is well placed to complement the epistemology of traditional project research based on technical rationality but leaves open the question of how to reconcile explicit 'known' knowledge (designs, etc.) with experiential 'knowing' knowledge (know-how, etc.) (Bragd, 2002; Cicmil and Hodgson, 2006; Newell et al., 2006).

3.2   Complex Problem Solving as a Dynamic Organizing-Learning Interplay

In recent project research, this unresolved knowledge dichotomy is acknowledged by Blomquist et al. (2010), who highlight the advantages of a practice-oriented approach by observing that "a dynamic setting for action is created on the local arena where *knowledge* and *action* come together in practice" (p. 13, italics added). If experiential 'knowing' knowledge is required for action (Cook and Brown, 1999; Schön, 1983), this suggests a convergence in PM practice settings between explicit 'known' knowledge and experiential 'knowing' knowledge. In the same vein, Lalonde et al. (2010) review PM through the lens of practice and also recognise the same knowledge dichotomy *"at the heart of the relationship between theory and practice"* (*ibid.*, p. 33). In a subsequent publication using a

Pragmatist perspective, the same authors view PM practice as a process of inquiry which involves a "to-and-fro" movement between "design" practices that signal intentions for the future and "descriptive" practices that reflect what has already happened (Lalonde et al., 2012, p. 418). This parallels the earlier work of Engwall (2002), who maintains that project learning occurs through an interaction between project goals (design practices, plans, etc.) and the experience of performing concrete actions (descriptive practices, know-how, etc.). Furthermore, Engwall (2002) argues that, because it is "impossible to know everything beforehand" (p. 275), successful PM involves facilitating conditions in which "project execution is seldom a process of implementation; rather *it is a journey of knowledge creation*" (p. 277, italics added). In this practice-oriented approach, project knowledge is not 'out there' and fully specified at the start in project plans but is an emergent knowledge solution to the challenge of delivering a project through its plans and associated artefacts (Kreiner, 2002), which can seldom be fully specified in advance (Hayek, 1945).

The above practice-oriented approaches highlight the limitations of project research that includes experiential 'knowing' knowledge (know-how, etc.), which cannot be adequately resolved without involving explicit 'known' knowledge (designs, etc.), the bedrock of traditional project research. Based on earlier discussion, the same limitations hold in reverse for traditional project research based on explicit 'known' knowledge (designs, etc.), which cannot be adequately resolved without involving experiential 'knowing' knowledge (know-how, etc.), the essential ingredient of a practice-oriented approach. This paper argues that this dichotomy is best resolved by a knowledge formation approach through problem solving that is grounded in a dialectical interplay between these two kinds of knowledge, the static and dynamic. This dialectical approach is informed by Kolb's (1984) experiential learning as an interplay between comprehension (know-that) and apprehension (know-how), and Cook and Brown's (1999) organizational learning as an interplay between 'knowledge' and 'knowing'.

3.3   Projects as Modes of Organizing and Learning for Temporary Undertakings

While the conceptualisation of projects as organizational forms rather than content advances the idea of projects as temporary organizations (Lundin and Söderholm, 1995; Turner and Müller, 2003), it does not fully harness the key insight of Weick (1979, 1995) that organizations, even temporary ones, are essentially about *organizing* and *learning* (sensemaking) rather than form. Using an organizing lens, the emphasis shifts from the social construction of the *form* of the project as a temporary organization to the organizing activities that constitute the project as a *process* of temporary organizing and the drivers of these organizing activities. Organizing is what organizations do, because the business of organizations is to 'organize' and organizing is learning, whether single-loop or double-loop (Argyris, 1977). However, an organizing-learning perspective requires a holistic

approach to knowledge, which must accommodate explicit 'known' knowledge, such as information in books and electronic databases, as well as experiential 'knowing' knowledge. The latter is embedded in the 'know-how' of the organization's personnel, which is on display when they continuously *organize* the organization as a distributed practice by continuously *learning* it afresh (Orlikowski, 2002; Tsoukas, 1996, 2005).

In the spirit of Weick, it seems better to view projects as 'modes of organizing and learning' over the project life cycle rather than temporary organizational forms that are, nevertheless, organizations during their temporary life. For projects, this suggests that organizing and sensemaking over the project life cycle are mutually constituted during project delivery as a synonymous duality of organizing and learning, or 'organizing-learning', where organizing involves learning and learning involves organizing. In this view, projects are processually enacted to 'become' the project (Tsoukas and Chia, 2002; Pettigrew, 1997), where organizing and sensemaking largely revolve around problem solving as tacit learning, which PM practitioners routinely encounter in their professional work. Thus, Lundin and Söderholm's (1995) characterisation of projects as temporary organizations by time, task, team, and transition, along with Bakker's (2010) review of temporary organizations by time, task, team, and context, can be combined by viewing projects as modes of organizing and learning that involve life cycle (time and transition), synonymous organizing and learning (task and context), and team.

Because of their temporary character, projects revolve around accomplishing temporary undertakings. In effect, a project can be viewed as a mode of organizing to accomplish a temporary undertaking. In this view, project management can be seen as an organizational competence in organizing temporary undertakings. Accordingly, the following reconceptualisations of projects and PM are now proposed by this paper around the common theme of modes of organizing and learning, which represents an integrated view of projects as process and PM as practice:

> A project is a mode of organizing to accomplish a temporary undertaking.
>
> Project management is an organizational competence in organizing to accomplish temporary undertakings.

While these reconceptualisations are driven by the need for learning in complex projects, they can also be applied to traditional projects where little learning is anticipated. Further, if PM is a mode of organizing projects as temporary undertakings, this parallels partnering as a mode of organizing collaborative supply-chain activities, both temporary and permanent (Brady and Söderlund, 2008; Bresnen and Marshall, 2000). Using the analogy of a football club as a multi-level organization where every game of football is a different project that can be planned to a greater or lesser degree, a modes of organizing and learning (MOL) approach for projects and PM can be viewed like concentric

circles around the inner circle of football games, or projects, as temporary undertakings. As the second circle, PM is an organizational competence in organizing football games, or projects, termed projectizing, where projectizing is a means-end mode of organizing physical and social resources for delivering projects as temporary undertakings. Project programme management suggests itself as a third circle and so on.

3.4   Understanding Project Knowledge – Traditional and Complex

While the debate in the literature recognises the limitations of traditional project research, there is no consensus on the nature of projects and how we can obtain knowledge about them (Drouin et al., 2013; Söderlund, 2004). As a process perspective, a modes of organizing and learning approach (MOL) offers good prospects as a new perspective, because it anticipates learning activity over the project life cycle rather than knowledge certainty at the outset (Söderlund, 2013). Crucially, by expanding the horizons of existing project knowledge to include knowledge uncertainty, it has the potential for extending the boundaries of linear project capability to non-linear project settings characterised by complexity and indeterminacy (Brady and Hobday, 2011; Cattani et al., 2011; Davies and Hobday, 2005; Kreiner, 1992; Lenfle and Loch, 2010). In the business literature, a process perspective is an older tradition and a broad church that informs a practice-oriented approach to research (Gherardi, 2006; Orlikowski, 2002; Pettigrew, 2013; Schatzki et al., 2001; Schön, 1983; Tsoukas, 2005).
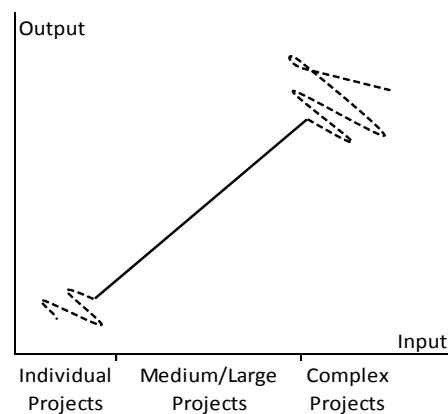

Fig. 1   Project Knowledge Spectrum

A process perspective can accommodate diverse views of projects, from traditional projects as tasks with little learning expected to projects as temporary organizations with some knowledge formation anticipated to complex projects with continuous knowledge formation due to inherent knowledge uncertainty. Under a MOL approach, the project spectrum can be divided into zones of knowledge complexity rather than systems complexity (Cleland and King, 1983). This spectrum has a linear

middle part with a non-linear 'fuzzy' tail at each end, Fig. 1. At the fuzzy lower-end, although little researched, simple projects are performed by individuals acting largely alone with project plans 'in their head', which involves knowledge formation that is more tacit than explicit (Polanyi, 1967). In the middle linear area, medium to large projects are performed under the norms of traditional PM, where organizing and learning involves single-loop and double-loop learning with knowledge that is largely explicit. However, as courts of law bear witness from earliest times, plans and rules can seldom be fully specified in advance, because written laws, contracts, etc. rely on taken-for-granted presuppositions, both tacit and explicit, for their understanding and implementation (Polanyi, 1967; Wittgenstein, 2010).

At the fuzzy upper-end, complex projects and innovation settings are characterised by knowledge uncertainty and indeterminacy, which involves open-loop and complex problem solving over the course of the project life cycle (Midler, 1995). Beyond complex projects, whose end-states can be specified at the outset but not their designs (Pitsis et al., 2003), are found organic projects whose end-states are often aspirational at the outset and can evolve unpredictably over time. For these organic projects, both their end-states and designs need to adapt to ongoing experience, learning, and resource availability, e.g., government programmes (Lindblom, 1979; Lundin and Söderholm, 2013). Thus, by viewing projects holistically as arenas of knowledge formation and learning, as 'rational actors' rather than 'rational objects', PM can ground itself in a model of rationality that is socio-technical, like neo-classical economics, rather than purely rational, like mathematics.

3.5   Bridging Project Management Knowledge Perspectives

Traditional project research adopts a knowledge approach based on instrumental rationality, which is reflected in the 'plan-then-execute' approach in the PMBOKs of the professional bodies (APM, 2012; PMI, 2013). However, this has consequences that limit the investigation of topic areas in project research. Firstly, traditional PM emphasises explicit 'known' knowledge (designs, etc.) that is fully pre-given at the outset and assembled by the PM practitioner as an applied scientist with little learning anticipated. In contrast, a MOL approach anticipates emergent knowledge and a professional commitment to learning, where learning '*is*' the practice (Wenger, 2001) and this is based on a dialectical interplay between explicit 'known' knowledge (designs, etc.) and experiential 'knowing' knowledge (know-how, etc.). In this way, a MOL approach represents a bridging perspective based on knowledge formation that enhances the two main types of knowledge in project research - explicit 'known' knowledge in traditional PM and experiential 'knowing' knowledge in practice-oriented approaches.

Secondly, under traditional PM with pre-given knowledge, problem solving is subsumed as a decision-making heuristic, one among many. Under a MOL approach based on emergent knowledge formation, problem solving is highlighted as a generative process for innovating solutions that is intrinsic to PM as an organizational practice. This demarcates PM from operational management disciplines where little learning is anticipated. Thirdly, by assuming that knowledge is pre-given and static, traditional PM implicitly assumes that PM is a theoretically reversible process and independent of time, where time is passive and symmetrical. In contrast, a MOL approach views PM as an irreversible organizational practice through time with intrinsic knowledge formation that is emergent, dynamic, and time-dependent, where time is an active operator and asymmetrical.

4   IMPLICATIONS FOR PROJECT RESEARCH AND PRACTICE

The reconceptualisation in this paper of projects and project management as modes of organizing and learning (MOL) has implications for the development of project theory, research, and practice, which are now outlined in the following discussion.

Project Theory Development

As a contribution to project theory development, a MOL approach firstly adds support to the view of organizations, including projects, as primarily about organizing, learning, and sensemaking (Ivory et al., 2006; Koskinen, 2012; Lundin and Söderholm, 1995; Thomas, 2000; Weick, 1979, 1995). Secondly, a MOL approach synthesises the static view of a project as an 'object/being' with the dynamic view of a project as an 'actor/becoming' (Chia, 2013; Engwall, 1998; Linehan and Kavanagh, 2006) by highlighting knowledge formation through problem solving as a dialectical interplay between the static and dynamic kinds of project knowledge. Thirdly, a MOL approach is a contribution to the emerging research tradition that views PM as an organizational practice, where project learning is mutually constituted with PM as practice (Wenger, 2001; Winter et al., 2006).

Because of its inheritance from the applied sciences and its traditional normative approach, project theory borrows from other disciplines and is under-developed in its own right, which hinders the development of project research as a separate discipline over the longer term (Bredillet, 2008; Morris, 1997; Packendorff, 1995; Söderlund, 2004). As a contribution to project theory development that also contributes to organization theory, this paper firstly presents organizing and learning as a synonymous duality of knowledge formation through problem solving learning. This complements the structures-dispositions (*habitus*) duality of Bourdieu (2013) and the structure-agency duality of Giddens (2007)

as a combined process perspective that is grounded in knowledge formation for the enactment of social relationships in space and time. Secondly, the combined organizing and learning approach adds theoretical support to Weick and Westley (2002) in affirming the concept of the 'learning organization' against its perception as an oxymoron, because of the association of learning with disorder and organization with order. By viewing organizing and learning as a synonymous duality, both are mutually constituted and are "always both at once" (Wenger, 2001, p. 68). Thirdly, a MOL approach can act as a shared theoretical construct between temporary project organizations and permanent organizations, by viewing an organization as a mode of organizing and learning to accomplish an undertaking, either permanent or temporary (Brady and Söderlund, 2008; Weick, 1979, 1995).

Project Research Development

A MOL approach recognises knowledge formation as a central part of the journey through the project life cycle rather than assuming knowledge certainty at the outset with little learning thereafter (Engwall, 2002; Lundin and Midler, 1998; Schön, 1983). Using a MOL approach, the idea of PM as a 'collectivity of practice' (Lindkvist, 2005) could be further researched to investigate how the formation of project knowledge varies over the project life cycle and the factors that affect the dynamics of this knowledge formation. In addition, future project research might fruitfully investigate knowledge formation involving the three complementary kinds of project knowledge over the life cycle. This includes explicit 'known' knowledge (designs, etc.) and experiential 'knowing' knowledge (know-how, etc.), which were the focus of this paper, and, in addition, the tacit dimension of knowledge as a component of all knowledge (Brown and Duguid, 1991; Cook and Brown, 1999; Lindkvist, 2005; Polanyi, 1967). In relation to knowledge management, as complex projects require continuous learning over the life cycle by the project team as a community of learners, future research could explore how this dispersed emergent knowledge can be coordinated through distributed organizing or other means (e.g., Ahern et al., 2013).

The MOL approach of this paper is grounded in problem solving, which is inherently non-equilibrium. This can vary in degree from single-loop and double-loop learning in delivering small and medium projects to complex problem solving that is far from equilibrium in developing a dynamic organizational capability for delivering complex projects under knowledge uncertainty (e.g., Nightingale and Brady, 2011). Future project capability research could explore the way the dynamics of key organizing and learning activities affect adaptability to environmental change and how the timing of management interventions enhances the outcomes of these knowledge formation activities during periods of organizational change (e.g., Okhuysen and Eisenhardt, 2002).

Project Practice Development

The MOL approach of this paper sheds lights on several areas of perennial concern in project practice that can be reviewed with a fresh perspective. Firstly, a process perspective for projects with intrinsic learning has implications for the education of project practitioners, because 'soft' management skills may be as important as 'hard' systems skills for facilitating the organizing and learning of projects in projects (e.g., Berggren and Söderlund, 2008; Davies and Hobday, 2005). Secondly, with a MOL approach, future research could investigate the kinds of non-hierarchical leadership that are most likely to be effective in PM practice settings, where the limitations of a command and control approach to leadership under traditional PM are well documented (e.g., Hedlund, 1994). In this vein, future research might focus on how organizing and learning processes can be facilitated together for projects as learning organizations rather than managed separately for projects as tasks under traditional assumptions. Thirdly, with a MOL approach, project teams can be viewed as arenas for sharing both explicit project knowledge and experiential project knowledge, where sharing the experience of experiential knowledge is more likely to foster collective action than sharing the detail of explicit knowledge (e.g., Czarniawska-Joerges, 1992). This means that experiential knowledge (know-how, etc.) in project teams may be as important for collective action as the explicit knowledge of project specialists, because explicit knowledge (designs, etc.) is often only accessible through specialised language that is more difficult to communicate within cross-functional teams than experiential knowledge that is on display . Moreover, there is growing evidence in complex projects that much work takes place by individuals working alone (e.g., Enberg et al., 2006). This implies that many non-linear individual projects may be taking place within a complex project, Fig. 1, which is an area that is under-researched with implications for leadership and teams in the management of complex projects.

Fourthly, with a MOL approach, the key process of knowledge integration in complex projects can be approached as the distributed management of emergent knowledge formation through complex problem solving rather than the centralised management of knowledge as a commodity (e.g., APM, 2012; PMI, 2013). This involves a dialectical interplay between explicit 'known' knowledge (designs, etc.) and experiential 'knowing' knowledge (know-how, etc.) at many levels of the project team ecology. This also means that training for the operation and maintenance of such complex projects after handover needs to include the elaboration of explicit project knowledge in the form of 'as built' drawings, etc. as well as insights relating to experiential project knowledge, which is more difficult to access (e.g., Engwall, 2003).

Finally, by reconceptualising a project as a process of organizing with intrinsic learning, the difficulty of transferring project expertise relating to the content of projects can be reconsidered in terms of

transferring expertise that is based on the synonymous organizing and learning *of projects in projects*. This is a transferrable competence that is applicable in diverse project settings, which requires a shift in emphasis from what was learned in previous projects as something static to also include the dynamic organizing activities that accompanied this learning. This suggests that only by facilitating the appropriate organizing and learning activities *together* can project knowledge be successfully transferred as a synthesis of experiential knowledge and explicit knowledge rather than either on its own. Building on and developing Mintzberg's (2004, p. 10) practice insight, this paper argues that this knowledge synthesis involves a dialectical interplay between "doing in order to think" (know-how, etc.) and "thinking in order to do" (designs, etc.).

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