Managing through Projects in Knowledge-based Environments

Special Issue Introduction by the Guest Editors

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Knowledge-based competitive advantage erodes if it is not continually refreshed. Organisations increasingly rely on projects to enhance their knowledge-base through specific project deliverables such as new products and technologies. But, to do this, projects must go beyond the specific deliverables for which they are designed, and also become sites and opportunities for the creation, mobilisation and integration of knowledge. In this article we argue that projects interact with the organisation's knowledge base primarily through three key activities: (a) by mobilising knowledge that is needed to meet project objectives; (b) by creating knowledge within and through the project; and (c) by integrating knowledge during the project. We further argue that these knowledge-related activities take place at multiple levels of the organisation. Specifically, they occur at the interorganisational level when multiple organisations work together, at the intraorganisational level where different functions and business units are called to support and collaborate on projects, at the interproject level where populations of projects share and exchange knowledge, and at the intraproject level where knowledge is bound up with team and leadership dynamics. We use examples from the Special Issue to illustrate different project-related knowledge activities and different organisational levels at which these activities take place. This analysis helps to illuminate the wider range of roles which projects may play in exploiting knowledge within and between firms. A number of practical implications flow from this analysis. We conclude with reflections on the evolution of projects as key sites for improving the competitive performance of the organisation.
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More than ever before, strategic advantage across a range of industries depends on how organisations mobilise, combine and create knowledge.[1] In advanced industrial economies, this is not only a matter of transforming knowledge into high value-added products, but of seeing knowledge as key to almost every activity of the firm. This has long been self-evident in nascent industries such as biotechnology, nanotechnology or robotics where knowledge fuels innovation. It is an accepted reality in established industries such as construction or aerospace where upgrading knowledge of design and production is essential for continuous improvement. And it is even in evidence in the increasing reliance on mathematicians in financial services and computer programmers in the film and entertainment industries.

Technologies, economic trends and regulatory regimes can quickly shift, leaving organisations stranded on competitive positions that are no longer sustainable. It is often at this point that managers come face-to-face with the paradox that is at the heart of the knowledge-based economy: organisations are becoming increasingly reliant on knowledge at a time when knowledge-based advantage is eroding more rapidly than ever.[2] To paraphrase the Red Queen in *Alice in Wonderland*: "When it comes to knowledge, organisations have to run faster to remain in the same place."

Tackling this paradox has led many organisations to put renewed emphasis on projects as a vehicle for gaining strategic advantage.[3] Managing through projects has the advantage of speed and focus: projects can be used to concentrate resources, compress development time and prepare new business platforms much more rapidly than routine operations.[4] They are not only capable of addressing discontinuities more rapidly than most organisational processes, but they can also be set up to create products and market discontinuities that are favourable to the firm.

In knowledge-based environments these strategic advantages revolve around the role that projects play in exploiting and enhancing the knowledge base of the firm.[5] But to do so effectively, projects must go beyond the specific deliverables for which they are designed. In effect, they must also become sites and opportunities for the creation, mobilisation and integration of knowledge. The question that inevitably arises is: how can projects perform this additional task? And how they can do so in such a manner as to resolve the paradox identified above?

These questions were the impetus behind this Special Issue. They are not easy to answer because they span multiple fields of research, including the fields of knowledge management, organisational learning and project management.

With this in mind, we decided to take an approach to the Special Issue that is more likely to attract submissions from scholars who are interested in projects, but who work in a variety of disciplinary orientations. Our initial call did not ask for complete papers, but for abstracts and research proposals. We received 32 abstracts, out of which we asked for a full version for 11 papers. Of these, 10 were presented in a workshop that we organised at Cass Business School on March 27, 2007. The workshop served two basic purposes. First, it allowed authors to get feedback on their work prior to formally submitting their paper for review. Second, it encouraged authors to converge on a common set of issues, thereby increasing the thematic unity of the Special Issue.

Following the workshop, the authors had the opportunity to revise their papers. These were sent to reviewers. Two rounds of reviewing winnowed down the submission to five papers. These, plus an invited paper by Angus Finney, are the Special Issue. The following overview of the papers provides an appreciation of the range of issues and industries that this Special Issue covers.

Overview of special issue

The opening article by Ordanini, Rubera and Sala, "Integrating Functional Knowledge and Embedding Learning in New Product Launch: How Projects Helped EMI Music", looks at how EMI Music group, which is headquartered in London, uses projects to distribute and promote music in local markets. As is often the case in the creative industries, artistic and managerial communities of

knowledge find it difficult to communicate and work together. Ordanini et al. show that projects can become a key approach to establishing communication and joint decision rules, which not only improves effectiveness, but also produces knowledge that can be used in future projects.

In the next paper, "Managing Interdependencies in Complex Project Ecologies: The Case of Biomedical Innovation", Newell, Goussevskaia, Swan, Bresnen and Obembe examine the challenge of managing multiple projects in the biomedical sector. In their study of three biomedical projects, the authors focus on the interdependencies that exist among the different projects. These interdependencies hold out the promise of improving the innovation process, but inevitably competition for resources, expertise and personnel, not to mention problems of co-ordination, will often have the opposite effect.

Burgers, Van Den Bosch and Volberda's "Why New Business Development Projects Fail: Coping with the Differences of Technological versus Market Knowledge" tackles the advantages and disadvantages of project autonomy. The conventional view is that allowing projects greater autonomy increases their ability to innovate. But at the same time, there is also the recognition that allowing projects greater autonomy increases their isolation from other parts of the organisation which are indispensable to successful commercialisation. Burgers et al. examine eight new business development projects in a large electronics company. Their key finding is that organisations must avoid a standardised approach to project autonomy. Projects have different requirements, especially when it comes to sales support. It is important for organisations to take note of the distance between innovative technology and market introduction when projects are in the planning phase.

Whyte, Ewenstein, Hales and Tidd's paper is an exploration of how knowledge in projects evolves through the use of visual representations. Closely observing managers and design practitioners in a manufacturer of capital goods and an architectural design firm, the researchers show how a wide variety of representations are used to move the projects along. Indeed, visual representations serve a dual purpose as devices that focus thinking and as objects that mediate discussion and debate. For scholars who associate the production of knowledge primarily with goal-driven learning, the role of visual representations as carriers, codifiers and stimulators of knowledge creation is a startling departure from traditional epistemologies. More to the point, the authors' study suggests that future research on knowledge in projects, and elsewhere for that matter, would do well to look at what hitherto have been seen as ephemeral and marginal representations.

The study by Ivory and Vaughn focuses on the Pendolino tilting train project which was conceived by Virgin Trains for its UK West Coast route between London and Glasgow. Ivory and Vaughan examine the project's evolution against the background of the relationship between the supplier, Alstom, and the customer, Virgin Trains. They argue that key to the relationship was a reframing of the traditional approach to designing and delivering major train projects. Whereas in the past, contracts specified design characteristics, a new approach, or frame, was adopted by Virgin which stipulated "passenger experience" as the overarching deliverable.

Finally, the closing article, "Learning from sharks: Lessons on managing projects in the independent film industry" by Angus Finney, addresses one of the intriguing paradoxes of managing projects in the film industry: films must be developed, financed and produced while at the same time contending with the recognition that knowledge about what makes for successful movies is highly uncertain. Finney shows that this paradox can only be resolved by accepting high market uncertainty, while at the same time developing knowledge about how to avoid the pitfalls of film projects. In a sense, the knowledge that emerges from film projects is negative rather than positive. It is more about what film makers must avoid doing if they want to bring films to market on time and on budget, rather than specifying steps that are more likely to increase box office success.

A Special Issue is not only an opportunity for a group of authors to present their ideas about a set topic, it is also a mandate for the editors to provide an overarching structure for what we hope is an emerging research program.

In what follows we argue that a framework for organising our thinking about the relationship between knowledge and projects consists of two dimensions. The first is the relationship between projects and knowledge at the activity level, and the second is the structural relationship between

projects and knowledge. After presenting this framework, we shall use it to organise and comment on the papers in the Special Issue.

Projects and knowledge: activities and structures

As the summary description of the papers in this special issue indicates, a project creates a portal through which the knowledge of the organisation or multiple organisations can be more readily accessed and transformed. This is one of its major advantages over bureaucracy as a form of organising; bureaucracies lock up different types of knowledge in functional silos, making it easier to accumulate but harder to connect. Reflecting on the papers presented here suggests that projects interact with the knowledge base of the firm in three principal ways.

1. **Knowledge mobilisation**. Because even the existing knowledge of the firm is not always sufficient to meet project objectives, projects often have to act to mobilise and absorb knowledge from the wider environment. This mobilising activity may be directly related to project requirements: managers engage in a search for crucial knowledge inputs as part of their efforts to meet project goals.[6] Quite often, however, projects also mobilise knowledge indirectly, both in terms of different forms and arenas of knowledge. For example, projects mobilise knowledge through the individuals that become members of the team. Team members may be recruited for recognised skills and identifiable knowledge, but in the process of becoming part of the project they may also demonstrate valuable knowledge and expertise that had not been previously recognised by the organisation. Examples of knowledge mobilisation in this issue include one of the projects studied by Burgers et al. In this project, existing products were modified using licensed technology. In a similar vein, Ordanini et al show how the adoption of projects to launch new music at EMI allowed different parts of the organisation to mobilise useful knowledge. Whereas before the adoption of projects to launch new products the organisation used a sequential approach, with marketing and promotion preceding sales, using projects synchronised activities and thus allowed for exchange of valuable knowledge.

2. **Knowledge creation.** Projects often create new knowledge. This knowledge may take several different forms depending on whether it is embodied in new products and services, designed into new processes or institutionalised as new practices. This new knowledge may be created both directly as one of the deliverables from the project, and indirectly through the learning involved in achieving that deliverable.[7] For example, a new microchip design may sell well in the market, but it may also be a step change in the firm's own technological knowledge. New organisational knowledge can also emerge unexpectedly during a project. Solutions and ideas that teams develop during the project may contribute to developing the routines and processes of the firm. For instance, projects may contribute to the project management expertise embodied in crucial project management competencies, or may improve the organisational co-ordination capabilities with the rest of the organisation. The role of projects in knowledge creation is well demonstrated by papers in this issue. One example is the use of the ''Red Book'' in the Pendolino project. This encouraged design engineers to rethink their approach and focus more on non-engineering criteria. Meanwhile, Ordanini et al. provide an example of organisational knowledge creation by showing how EMI's experience of working on projects in Italy yielded new knowledge on co-ordination between headquarters in London and EMI Italy. This new knowledge was then used to facilitate project planning and implementation in other EMI markets.

3. **Knowledge integration.** Project implementation often requires combining skills and ideas from disparate sources.[8] In many instances, this combination is short-term and project-specific. In other words, knowledge is combined to serve the goals and deliverables of the project, but is thereafter allowed to disperse. In some instances, however, the combination produces a synthesis that is of long-lasting value to the organisation. For organisations this not only results in breaking down boundaries between bodies of expertise that were previously isolated from each other, but also prevents organisations from going through endless cycles of having to learn anew how to combine these bodies of expertise when the need arises. Because the knowledge base of large

organisations is segmented, one role which projects often play is to enable the integration of knowledge between different sub-units. The paper by Burgers et al. provides a useful example of this by highlighting the role of new business projects in integrating market and technological knowledge. The paper by Ivory and Vaughan likewise examines the problems of knowledge integration, but in their case the problems of integration arise because producers and customers often start with different conceptions of product design and performance. Integration therefore has to begin with a clear understanding of how each group ''frames'' the project, and what key knowledge areas require careful management. The paper by Finney deals with a similar problem of knowledge integration, but in the context of film development. Here producers, directors and writers have different conceptions of what the final film script will look like, and their disagreements results in project failure. Finally, the paper by Newell et al. examines some of these problems of knowledge integration at an interorganisational level. They show how regulatory, clinical and commercial knowledge is dispersed across different projects and different organisations in the biomedical sector. Innovation therefore depends on combining and integrating these disparate bodies of knowledge. As the authors describe, this integration effort is inevitably hampered by organisational and disciplinary boundaries.

As these latter examples demonstrate, the role which projects play in accessing knowledge is not confined to activities within the firm alone. Projects are situated within a web of relationships which may extend well beyond functional or organisational boundaries. Some projects do operate entirely within the organisation, but others represent a joint undertaking among organisations. Similarly, projects may be unique or they may have an explicit relationship to past and future projects.

This situated character has an impact on the relationship between projects and knowledge. More specifically, to analyse the relationship we also have to make a distinction between the following levels of project-related knowledge activities:

1. **Interorganisational**. Projects are often an undertaking by multiple organisations and institutions. Because these projects draw on resources and personnel from a multiplicity of organisations, their knowledge activities likewise involve interfacing with diverse organisations.[9] Interorganisational projects give projects access to a wider set of skills and ideas, but they also have to struggle with difficult problems of co-ordination and interfacing. The analysis of knowledge-related activities at the interorganisational level focuses on knowledge flows across organisational boundaries, and the methods used to facilitate the integration of this knowledge. Whyte et al., for example, highlight the way in which the design process becomes a crucial meeting ground for architects and their clients. They suggest that an important part of the process is enabling these two groups to develop a common understanding of the aims and outcomes of the project. Finney persuasively shows that the high degree of decentralisation and fragmentation in the film industry increases the importance of managing interorganisational knowledge activities.

2. **Intraorganisational**. Most routine projects take place within the boundaries of the organisation. Understanding project-related knowledge activities at the intraorganisational level involves analysis of the position of the project within the organisational structure. This often highlights interfunctional and interunit flows of knowledge.[10] For example, Ordanini et al. show how the project-based approach to launching new music CDs, which was first tried in the UK, was then transferred to other markets. In their study of new business ventures in a large electronics firm, Burgers et al., by contrast, suggest that intraorganisational integration of knowledge often suffers from a lack of proper incentives. Specifically, areas such as sales are often not given the incentives to push new products vigorously in spite of their technical promise.

3. **Interproject.** Many organisations manage streams of projects or collections of projects. From this perspective, project-related knowledge activities deal with the interaction among projects. This may involve the use of knowledge from previous projects, the co-ordination of knowledge activities across projects and the deliberate use of knowledge as an output for other projects. For example, in their study, Newell et al. examine how knowledge generated in one biomedical

project impacts on other ongoing projects. Indeed, knowledge generated in each project was crucial to the success of other projects. The challenge facing the organisation is that of integrating the knowledge outputs while at the same time allowing each of the projects sufficient flexibility to pursue its own specialised goal.

4. **Intraproject.** Whatever our level of analysis, every project also represents an organisational microcosm in its own right, involving resource recruitment, team building, strategy and leadership.[11] Project-related knowledge activities at the intraproject level focus on the internal processes that impact the effectiveness of knowledge mobilising, creation and integration of knowledge. The study by Whyte et al. explores in depth the evolution of this knowledge. They focus on the variety of project management tools that are used to understand and control the work flow, showing how their visual representations evolve as the project develops. Finney, likewise, examines at some length the conflicts within film projects that often undermine project objectives.

Projects, of course, often operate across multiple levels of the organisational and interorganisational context, and may trigger more than one knowledge activity. From a knowledge perspective, they can serve multiple purposes, which is one of the reasons that they are assuming a broader strategic role than the one specifically tied to their goals and deliverables. To appreciate the strategic potential of projects, it is useful to combine the relationship between projects and knowledge activities as shown in Table 1. The resulting matrix points to the strategic potential of projects, but also indicates the difficulties of realising this potential. To maximise the strategic potential of projects, organisations have to link coherently multiple levels with different knowledge activities. For example, the intraproject creation of new knowledge often depends on effective intraorganisational mobilising of knowledge. Interproject knowledge integration, in turn, often fails because of high project autonomy which inclines project teams to ignore past knowledge. Likewise, the most frequent cause cited for the failure of projects to have an impact on the rest of the organisation is the intraorganisational boundaries that hamper knowledge integration.

When looking at Table 1 therefore, it is worth bearing in mind that the table not only represents existing relationships and practices which link projects and knowledge, but also suggests future innovations in practice. One can speculate about new organisational forms and new managerial methods which seek to create multiple linkages between interproject and intraorganisational levels of project activity along the entire spectrum of knowledge activity, from mobilising, to creating, to integrating. One may also wonder if in the future, organisations, especially organisations that are project-based or project-led, will accord high status to managers who are specifically delegated the task of increasing the knowledge impact of projects on the organisation.

Discussion

The framework outlined above provides a useful heuristic on the different roles that projects can play in a knowledge-based environment. In distinguishing between these activities, it is important to remember that they are not hard and fast categories. In project settings, knowledge is a dynamic and emergent phenomenon, and the activities of mobilising, creating and integrating often overlap and merge. However, the differing emphasis placed on these activities may also be a better way of identifying the knowledge requirements of a project than the usual distinction between routine and innovative projects. For example, in sectors where projects are effectively a business process for delivering the product or service to the client, we would expect "knowledge mobilisation" to be a central activity in projects, with correspondingly less emphasis on creation and integration.[12] Thus, in construction projects, for example, we see teams of specialists being quickly assembled to work within a standardised division of labour.[13] This maximises efficiency by minimising the need to create or integrate knowledge. In other projects, for example in the film and music industry, the emphasis is less on exploiting the existing knowledge base and more on creating new knowledge through a diversity of viewpoints and creative conflicts.[14] The pursuit of knowledge creation often requires greater autonomy from the wider organisation. In turn, this type of project can be usefully compared with projects

Table 1. Knowledge activities and structure

	Mobilising	Creating	Integrating
Interorganisational	Two-way due diligence process between 'Antibody' and its partners. (Newell et al.)	Project Drink and the development of a new partner-based business model focused on consumables revenue. (Burgers et al.) The role of the ''Red Book'' in stimulating new approaches among design engineers by codifying non-engineering criteria. (Ivory & Vaughan)	Visual practices (e.g. drawings, presentations) as focal points for negotiating common understanding with clients. (Whyte et al.) Virgin's reframing of train design around the 'passenger experience' in the Pendolino project. (Ivory & Vaughan)
Intraorganisational	Use of parallel vs sequential timing of marketing and sales activities to access knowledge more speedily at EMI. (Ordanini et al.)	Development of joint decision-making rules for NPD activities at EMI. (Ordanini et al.)	Integrating the A&R group's knowledge of the music and artists with Marketing's knowledge of the market. (Ordanini et al.)
Interproject	Sharing issues around new album launches — e.g. viral marketing approaches. (Ordanini et al.) Use of IT-based project documentation system at Antibody. (Newell et al.)	Knowledge of market characteristics and artist popularity that is created by one album launch is used in subsequent launches. (Ordanini et al.)	Role of virtual communities in storing the experience from one launch and making it available to others. (Ordanini et al.) Integration of regulatory knowledge, clinical knowledge, commercial and manufacturing knowledge in moving to clinical trials phase of biomedical innovation. (Newell et al.)
Intraproject	Temporal sequencing of technology versus market exploration in NBD projects. (Burgers et al.) The role of charts and diagrams within the company intranet at High Tech as a 'holding ground' to enable collaboration between project members. (Whyte et al.)	Role of project autonomy in NBD technology exploration activities. (Burgers et al.)	Championing of Project Oral over time allows integration of technological and market knowledge. (Burgers et al.) The role of visual representations in creating a shared understanding between architects, engineers and clients in Edward Cullinan architectural projects. (Whyte et al.)

emphasising knowledge integration. The latter type of project places the greatest emphasis on overcoming the boundaries between specialist groups or people working in different organisations.

Viewing projects in this light not only provides a different way of identifying their knowledge requirements, but also highlights one of the major challenges which all projects face: the ''sticky'', or context-dependent character of knowledge.[15] This stickiness varies according to the kind of knowledge involved (''tacit'' knowledge being more difficult to transfer) and the boundaries which

it has to cross. It follows that the ability of a project to draw on existing knowledge is closely linked, first, to the kind of knowledge involved, and second, to its positioning within the web of sub-unit and organisational boundaries.[16]

But the stickiness of knowledge also leads to a paradoxical implication which is about knowledge as an output not an input. When knowledge is created within a project, it becomes linked to that project context. As famous or notorious examples such as the Xerox Parc projects have shown, this means that the more innovative the project, the more difficult it may be to share it with the wider organisation.[17] The new knowledge is seen as too "off the wall". Even when it is embodied in new products and services, it may be less easily passed on to other parts of the organisation as useful learning or best practice. This helps to explain why even organisations that are highly project-based continue to "reinvent the wheel" and fail to transfer learning from one project to another.[18]

Implications for practice

The papers presented here demonstrate the rich interaction between project activities and the knowledge and learning of the organisation. These interactions are not always well addressed by

Table 2. Lessons on the role of projects in knowledge-based environments

	Mobilising	Creating	Integrating
Interorganisational	Identify the capabilities of business partners to ensure that they are effectively exploited in joint projects. (Newell et al.)	Explore the differences in approach between partners as a basis for developing new ideas and understandings in the project (Ivory & Vaughan).	Develop an agreed framing of the project and reinforce this through the circulation of shared objects (powerpoint presentations, key documents, project web-site). (Whyte et al., Ivory & Vaughan)
Intraorganisational	Use the time pacing of projects to drive greater alignment and knowledge sharing across sub-units. (Burgers et al., Ordanini et al.)	Exploit projects as an experimental space for creating new routines and rules to be spread throughout the organisation. (Ordanini et al.)	Develop cross-functional projects which create new links and networks across sub-unit boundaries. (Burgers et al.)
Interproject	Ensure that project teams draw on existing knowledge through 'peer assists' from others with experience of the domain, and access to formal documentation and lessons learned from other projects. (Newell et al.)	Develop new business areas by ensuring that the knowledge created in one projects is made available to others. (Ordanini et al.)	Develop virtual communities of practice that combine, synthesise and build on the different kinds of knowledge generated from projects. (Ordanini et al.)
Intraproject	Exploit the diverse backgrounds of project members to develop different perspectives on the project task. (Ivory & Vaughan)	Give project team members enough autonomy to support creative and original solutions. (Burgers et al.)	Bring together different kinds of knowledge through project team selection, and the use of boundary objects to facilitate communication with other groups. (Whyte et al.)

existing approaches to project management. Although these do give increasing recognition to the need to "capture" the learning from projects, they rarely acknowledge the way that projects define a portal for knowledge flows within and across organisations. Nor do they properly address the effect that operating at different levels of organisational and sub-unit activity has on the conduct of projects. Without greater understanding of these features, however, the risk is that the kind of strategic contribution projects could make to business performance is not fully realised.[19] Instead, organisational barriers, as well as the intense time pressures affecting project work, may mean that they fail to exploit the existing knowledge of the organisation, and/or add little to that knowledge base through their own activities.

Drawing on the insights presented in subsequent papers, as well as on the existing literature, we have outlined below in Table 2 a number of possible lessons — calibrated according to levels of analysis — on improving the role of projects in the creation and exploitation of knowledge.

The papers in this Special Issue illuminate our understanding of how managers work with and through projects. But as Table 2 demonstrates, beyond adding to our understanding of current practice the papers also suggest that projects are capable of taking on new strategic duties. Thus the greater mission of this Special Issue is to draw the attention of practitioners and researchers to the potential of projects in knowledge-based environments. This potential expands in tandem with the new technologies and new organisational forms that enhance organisational flexibility. But transforming this potential into reality ultimately depends on managerial imagination and creativity. We believe that the papers presented in this Special Issue will stimulate thinking and provoke action that makes projects into an increasingly versatile and powerful vehicle for the knowledge.

Acknowledgements

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