

THE MANAGEMENT OF INNOVATION IN PROJECT BASED FIRMS
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The Management of Innovation in Project Based Firms

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Abstract

Innovation is an important area of management theory, but there is a paucity of research on innovation in project based firms. Project based firms are simultaneously becoming a more vital and important organisational context, exemplifying many current managerial challenges. In this paper we research innovation in twenty project based firms. We identify three key areas of innovation from the theoretical literature and conduct empirical research, discovering (1) whether project based firms provide an organisational context supportive of innovation, (2) how project based firms address the question of innovation and slack resources, and finally (3) whether project based firms view innovation as universally desirable, or adopt a more cautious approach to developing and driving their innovation strategies. Our findings add to current theorising on innovation in organisations, expanding our knowledge of project based firms and innovation strategies.

Key words: Innovation, project-based firms, organic management, organizational support, slack resources, desirability of innovation

Introduction

Innovation is a well developed and extensively reviewed area of management theory^{1, 2}. There remains however a dearth of studies on innovation in project based firms. Project based firms are an important and interesting context in the study of innovation in light of the new management paradigm facing organisations^{3, 4}. This paradigm brings to prominence a number of organisational features including:

- An increase in multi-disciplinary teamwork
- Continuous and discontinuous change
- Enhanced networking with customers and suppliers
- An increase in customer orientation
- An increase in multi-disciplinary and cross functional cooperation

Although many traditional firms have begun to experiment with elements of this new management paradigm, project based firms exemplify these trends. Project based firms are engaged in unique, novel and transient work, delivering bespoke outputs to clients and working to customised specifications in both capital and new product development projects. All project based firms use teams, usually multi-disciplinary, to achieve their goals. Because no two projects are the same, project based firms deal with change as a matter of their daily commercial reality. Further, because they produce once-off offerings rather than commodities (project based firms do not mass produce and stockpile bridges, advertisements or hospitals), customer orientation is always a strategic concern. What better context in which to examine innovation?

Why then is there a dearth of literature on innovation in the project based firm context? The main reason is project management is a relatively new area. It first came to attract increasing attention in the 1950's as a result of:

- development by governments of infrastructure and weapons systems as a result of the Marshall plan and Cold War respectively
- the space race
- technological developments in the infant computer industry
- fragmentation of mass markets

Project management research has focussed largely on practical issues pertaining to 'getting projects done' rather than on strategic or conceptual issues where reasons for success in a certain fields, like innovation, are abstracted from specific contexts and developed theoretically through grounded theory, hypothesis generation from empirical data, or other inductive means. A review of articles published in the main project management journals including PMJ (Project Management Journal), the IJPM (International Journal of Project Management) and PM Network, and between 1990 and 1999, reveals that the most popular topics for project management research are those relating directly to practical issues of initiating, conducting and concluding projects⁵. There is far less emphasis on issues such as organisation structure (14 papers from a total of 663) and no mention of innovation as an important topic. Furthermore, with some notable exceptions^{6, 7} there is relatively little treatment of project based firms as a specific organisational context – within which issues such as innovation management are explored - in mainstream management theorising.

In this paper, we begin to address the paucity of research in this area by describing an empirical study on innovation in project based firms. We ground our paper in theoretical issues raised by the broader innovation literature. We explore these issues through in depth semi-structured interviews with the managers, project leaders and other members of project based firms. In presenting our findings, we reveal:

- What managers of project based firms are saying about innovation?
- How are they managing innovation?
- What are the really important debates for them?

A Review of Innovation Theory

The study of innovation has produced a vast amount of research covering such topics as the impact on innovation of managerial careers, organisational size, slack resources, industry sector, functional differentiation, and culture not to mention power and politics^{8,9}. Without doubt however, some topics have become central to our understanding of organisations and innovation.

One such topic, and a major focus for innovation research, has been the *organisational contexts that support or work against innovation*¹. Burns and Stalker¹⁰ established the importance of organisational context to innovation with their seminal study, a theme reinforced by later studies^{11,12}.

It is now well accepted that certain organisational contexts provide support for innovation and they include the so-called innovative organisation⁹, the organically managed organisation¹⁰ and the holographic organisation¹³. The existence of these forms of organising, and their validity in certain contexts, has been studied for many years. This leads to our first research question: is there evidence that project based firms provide a supportive context for innovation?

A second major theme in the innovation literature is *whether slack resources promote or hinder innovation*. This is one of the most controversial aspects of innovation research¹⁴. Advocates of slack resources¹⁵ argue that it facilitates innovation by permitting firms to experiment with innovative projects that might not attract sufficient support in a more resource-constrained environment. Opponents of slack^{16, 17} claim that it promotes undisciplined investment in new developments and new products and services that show poor potential to generate economic benefits.

Theorists on both sides of this debate agree that slack promotes experimentation, essential in the development of innovative projects, by allowing uncertainty to be absorbed. Innovation projects are intrinsically uncertain making it difficult to gauge ex ante the net present value of

such projects. Slack resources also free managerial attention that in the event of no slack will be focused on short-term performance issues rather than uncertain innovative projects.

Notwithstanding these debates, considerable evidence has been amassed that redundancy and slack are important in fostering innovation. Morgan regards redundancy as so important in flexible, innovative organisations he goes as far as to call it Principle 2 in the design of the holographic organisation¹³. The holographic style is very much a self-organising, emergent phenomenon. Its capacity to aid innovation comes from the design quality that:

[It] has an ability to self-organise and regenerate itself on a continuous basis p100

The purpose of redundancy in this flexible organisation design is to:

Create room for innovation and development to occur. Without redundancy, systems are fixed and completely static p110

This leads to our second research question: how do project based firms view slack resources and their impact on innovation?

A third important theme to emerge is the idea that innovation is *a universally useful thing*.

Many studies adopt this perspective, as Drazin & Schoonhoven¹ explain:

Innovation theory has been dominated by normative explanations of how to achieve an outcome seen as central to the interests of managers: increasing the number of innovations generated p1066

More recently, the universal usefulness of innovation have been challenged by theorists who promote a combined emphasis on both innovation and value in order to ensure that companies can pursue sustained high growth and profits through innovation strategy¹⁸. This leads to our

third research question: do project managers and senior management in project based firms see innovation as universally useful or not?

Methodology

We have identified three important issues raised by this literature review which we examine in the context of project based firms. The basis for our study is interviews with 45 members of twenty project based companies.

Insert exhibit 1 here

We proceeded on the basis of 'theoretical sampling'¹⁹ choosing firms that could illuminate the theoretical issues we identified from the literature. Where necessary, we returned to companies and individual interviewees to expand on important emerging themes. As part of our sample, we interviewed project managers, department/function managers, human resources specialists, senior executives, and others.

Boundaries of the term 'project based firm'

Following Archibald²⁰ we conceptualise project based firms in two ways: firstly as firms whose work consists primarily of projects (Type 1 firms) and secondly as firms who although are mainly operationally oriented, undertake projects as an important part of their overall activities (Type 2 firms). Firms from the EPC (Engineering, Procurement and Construction) industry we studied are all Type 1 firms: all of their work is oriented towards projects. Two quotes from respondents illustrate this:

Projects are the key factor for [our company].....the company and its success depends on all projects, not just one.

Projects are the centre of gravity....the value added for [our company] is in managing projects. Increasingly, it is also more than that. It is managing projects so that clients get quicker completion, more creative processes, better managed projects.

In Type 2 firms, projects are vital to the successful management of ongoing operations and more standard forms of work organisation. Examples of Type 2 firms we have studied include the project office of a large bank, as well as the project division of a major telecommunications firm. In the telecommunications firm, projects are achieving a higher than ever profile. The company has recently undergone a major reorganisation, dubbed 'reorganisation by project'. Projects are the vehicle the company used to attack new market spaces, realign the companies offerings with emerging customer demands, and pursue technological innovations. Although routine operations are a vital part of this company, so too are projects.

However, we need to make a further distinction in this paper. Innovation projects form a subset of other projects undertaken in these twenty firms. In writing this paper, we concentrate on data from our study on innovation in project based firms.

Potential generalisability

Our choice of methodology and aims in conducting the study mean that we cannot be certain how generalisable these data are to other project-based firms. Our goal is theory development through inductive methods and we chose our research partners because they could illuminate aspects of the theoretical framework and research questions. To ensure inter-rater reliability in terms of coding the data, finding themes, and assessing prevalence of practices and interpretation of themes, both researchers analysed the interview notes and field notes separately coming together regularly during the development of the study to compare themes and interpretation of the data.

Analysis and interpretation

Each new interview yielded research materials such as interview notes and secondary source material that we independently, and then later together, analysed. During these phases we brought order to the data, organising it into categories, themes and basic units of description²¹. During periods of joint analysis, and as a process of moving between the data and theoretical issues we also began to attach meanings and significance to the analysis, explaining descriptive patterns and looking for relationships and linkages among the descriptive dimensions. Gradually, we organised all of the data into categories and descriptive units. A number of broad trends and patterns emerged during the interviews and appeared to effect all the firms. However, to ensure thoroughness in reporting the data, we have also included idiosyncratic stories and accounts of innovation strategies practices to show the variation that exists between companies of different size and in different industries.

An innovative context?

The first research question we explored deals with the context within which innovation occurs in project based firms. We explored this issue by asking respondents to discuss a number of themes derived from the innovation literature including, amongst others

- The type of structure used to manage innovation projects
- The level of formality in that structure
- Patterns of authority
- Communication patterns
- Organisation of work
- Evaluation of outcomes

Many of the findings support prior work in innovation theory. Project based firms make extensive use of matrix structures of organising. Boundary spanners are prevalent, bridging

the gap between projects and functional areas which house technical experts that contribute to multi-disciplinary project teams. In only one division of one company we studied, the functional structure has been eliminated and replaced by a fully project based organising system. At the time of the study, a second company was about to experiment with a similar structure, eliminating functional departments in favor of management by projects. However, these two cases are the exception, and some problems were already emerging despite the recency of the developments. In the former case, the division was already experiencing difficulties in that staff complained of the stress associated with having no 'functional home', no sense of permanence in a rapidly changing project environment, a kind of 'no-home syndrome' ²². A more serious problem emerging from this division was the erosion of knowledge within the division. Functions have long served the vital task of acting as repositories for organisational knowledge. When eliminated, the temporary projects replacing them cannot fulfil this function as effectively. To address this, the division was actively considering a range of knowledge management interventions including regular knowledge transfer meetings, databases and lessons learned archives.

Communication patterns within the firms we studied conform to innovation management theories in that they are free flowing and informal. Although there are clear hierarchies within project based firms – and organisational titles are commonplace – the data also suggests that during the project, knowledge flows from member to member according to expertise rather than formal authority vested in hierarchical position. Organisation within projects is by mutual adjustment ⁹. The claims made by respondents to our questions about communication patterns were reinforced by our visits to each company. There we witnessed open doors, frequent movement of people in and out of offices and common spaces, many interruptions during meetings with ad hoc questions posed to those we were interviewing, and a general atmosphere that can be described as relaxed and informal. This atmosphere of informal communication encourages innovation through the creation of random encounters and chance meetings.

According to leading commentators in the field, a pre-condition of an innovation inducing context is the assessment and evaluation of projects in a manner that does not prematurely stifle the emergence of new ideas. Nonaka & Takeuchi ²³ argue that in the 'hyper-text organisation' which is a knowledge creating organisation design, the emphasis on producing large quantities of information from multiple points of view helps to counteract premature convergence on solutions, and groupthink tendencies, and allows many ideas at different levels and in different forms to develop.

This is one area of findings from our study that suggests a gap between innovation theory and practice in project based firms. The companies taking part in our study fall short of creating the ideal conditions to foster innovation through the premature application of traditional evaluation techniques to innovation projects, and a linear approach to managing projects encapsulated by stage gate models ^{24,7}.

Illustration 1: Evaluation of Projects

We visited the headquarters of one company with a global presence and interviewed managers about processes for managing innovation projects. It emerged that a recent reorganisation and change of CEO had resulted in a 'tightening up' of the procedure by which all project bids, including innovation project bids, would be evaluated. Previously, project personnel had been evaluated, in terms of their time, on the basis of end of project outcomes. It was broadly recognised that many project might be necessary to achieve successful outcomes for the company overall, even though individual projects might fail to produce the desired results. In evaluating projects therefore, the company took a broad view of multiple innovation efforts and avoided tight control according to predetermined evaluation criteria. Project personnel worked in multi-disciplinary groups, many such groups existing within the global network. Innovation projects could thus be initiated in many ways, and in many locations.

From this pattern of project evaluation had come many of the companies breakthroughs, including a famous case within the publishing software division which had revolutionised the

sector. Things have however recently changed. The company now operates under a system of Ultimate Rate Realisation (URR) which impacts profoundly on the evaluation of projects. The efficient use of personnel time has become the critical criteria against which all projects are judged and the measurement system focuses all efforts on making people 'accountable' for their time. Innovation efforts have been centralised in departments that monitor and assess innovation and decide what projects will continue, and what will be closed down. Such centralisation facilitates closer control of the time allocated to innovation projects. The decision to centralise innovation efforts invited this response from one interviewee:

We have lost access to people's creativity, which was stimulated by project needs and user needs and also by simple interaction between people in different parts of the world working with different but overlapping knowledge bases. Now everyone is watching their backs all the time, trying to justify their time use and too frightened to undertake anything new and different in case the short-term payoff is negative.

From this illustration we see aspects of the management of innovation projects and innovation efforts that run counter to organisation theory for supporting innovation. We are reminded of one of Kanter's²⁵ golden rules for stifling innovation:

- Rule 6

Control everything carefully. Make sure people count anything that can be counted, frequently

URR as a method of project evaluation relies heavily on the constant counting of people's time. One might argue that careful allocation of time can benefit innovation, as for example in the case of 3M's much lauded 15% rule. However, in the case described above, the centralisation of authority over innovation precludes allocation of time in a general dispersed

way to promote innovation efforts throughout the entire company. Which reminds us also of Kanter's 10th rule for stifling innovation ²⁵:

- Rule 10

And above all, never forget, that you, the higher-ups, already know everything about this business.

We conclude from this illustration that some firms stifle innovation by evaluating projects according to predetermined efficiency criteria and inhibit the emergence of new ideas that can occur when teams of specialists assemble, share knowledge, and are free to develop insights into new products and processes. We are skeptical that this managerial initiative will foster an environment in which 'a thousand flowers bloom'.

Illustration 2: The Organic Management of Innovation by Stealth

We carried out interviews in a financial services firm to investigate the management of innovation projects and the context within which they are carried out. This illustration also points to attempts to control the innovation process by imposing linear and mechanical evaluation mechanisms, but one that has proven less successful resulting in *the organic management of innovation by stealth*.

The firm has grown from a cottage industry, to a company with a turnover of billions in just twenty years. During interviews with the director of process improvement, a senior project manager and the director for human resources, the importance of innovation to the success of the company was a prominent theme. The company operates in a complex, changing market. Indeed, one respondent told us that the market changes so rapidly that the company is forced to reorganise itself once every two years. The company went through its most significant reorganisation ever during 1998.

The process of managing innovation projects in this company was described by respondents using the metaphor of the blending of whiskey. The innovators – experts in financial

products - maintain a number of 'boiling pots', from which they sample to create blends. They cannot know they have the right blend until they hit on it, although they converge on it by a process of trial and error. However, so successful have they been in the past, that the blenders have managed to manoeuvre themselves into positions of power, and command significant resources as well as autonomy to conduct the innovation process in a self managed way. The way they manage innovation projects departs radically from the methodologies preferred in other parts of the company for project management. One respondent described the innovation process as:

... a little bit of this and a little bit of that. The pot-boilers know when they have the right blend. They may not know in advance, but they know when it is perfect. We trust them, and they trust their noses, and that is the key to successful innovation.

The company responds to the complexity of its market by employing experts in financial information systems technology, and allowing them to nurture embryonic ideas. However, many of the development efforts started do not deliver results. The experts are allowed to begin many new projects, and are given the resources to continue working on them free from strict evaluation at regular intervals. Hitting on the right combination of information, service and technology is the key to success, and the strategy pursued is the simultaneous development of many potential solutions. At the time of the interviews, *multiple innovative projects were started by the 'pot boilers' and allowed to continue without interference from managers* even when no obvious successes or results were forthcoming.

The interface between the innovative projects developed in this company, and the ongoing operations of the company, are a site of political battles and resource wars. One respondent was openly hostile to what he saw as the inefficiency of the innovative project management process, and sought to 'systematise' innovation by applying principles and models of classical project management. He, and the other two interviewees, also revealed that all efforts to

systematise the process, and there had been some in the past, met with successful resistance by the innovators. However, owing to the continuing debate about resources within the company, they expected this tug of war to continue for some time.

The survival of organic management in innovation in this company appears to be something that has occurred more by luck than by design. According to the managers we interviewed, efforts to systematise innovation projects, and apply traditional tools of evaluation, particularly stage-gate models²⁵ with strict criteria for 'passing' and 'failing' innovation projects at specific stages are always under consideration. One such tool is the funnel of Wheelwright & Clark²⁴ which emphasises closing projects that are failing to meet predetermined criteria at the toll-gates. In the company in illustration 2, it was essential to keep projects going because the final products generally resulted from blends of different projects, and it was not known in advance which projects would contribute to the final blends. Therefore, although traditional stage gate models of evaluation may work for projects with clear goals and methods²⁶, others would argue that they are unsuitable for innovation projects or for fostering a context in which innovation projects will thrive.

According to Mills et al²⁷, several features of innovation projects make the use of traditional tools of project evaluation impractical. These include: the self managing nature of those involved in the innovation process, and the need these people have for high levels of self directed responsibility and freedom; the evolving nature not only of new products and processes, but also of relationships between different organisational stakeholders as the innovation process unfolds in an uncertain way; and the capacity of new technology and market information to change things radically right up to the launch date. These are all features of the innovation process described in this firm, and the lack of application of traditional stage-gate models is in line with innovation theory. The lesson, in terms of developing a context of supporting innovation, is to evaluate the potential business benefits of projects bearing in mind that innovation efforts are always by definition uncertain and prone to change as events unfold and achieving new things yields new challenges. After all, as Kanter²⁵ points out:

everything can look like a failure in the middle p11

We have presented two cases to illustrate that project based firms continue to apply inappropriate methods to evaluating projects. These methods emphasise linearity, efficiency and control even though all evidence points to the successful management of innovation resulting in a loosening up of evaluation criteria and a focus on broad, global outcomes supported by a strong business vision but avoiding micro-management. Our respondents, it would seem, are still unfamiliar with the need for a different approach to managing innovation projects, and perhaps uncomfortable with the reality of innovation-inducing contexts, which produce, as described by Mintzberg ²⁸

A good deal of disruption, if not chaos and wasted resources....this type achieves its effectiveness by being inefficient p196

Slack Resources and Innovation in Project Based Firms

The debate about slack resources at a theoretical level finds resonance in the firms in our study. In every firm we found some consideration of whether slack resources help or hinder in the management of innovation, and what level is appropriate. It was also common to find oscillation on this issue. According to descriptions of respondents, it seems that following a period of poor innovative outcomes, slack resources are considered as potentially important for innovation and more resources subsequently made available under that category. On the other hand, when positive results are slow to emerge, the mood changes, and slack is seen as negative and inefficient use of resources. This produces an accordion effect, and slack resources are tolerated far more in some periods than in others.

Traditional project management tools emphasise the importance of efficiency in managing projects. When applied to innovation projects, pressure is laid on bringing in projects within predetermined criteria for time, cost and quality. The pressure to manage costs leads to a corresponding pressure to reduce redundancy. Locked within a paradigm that emphasises efficiency over effectiveness, traditional project management needs to evolve in order to embrace the different requirements for informal, organic management of innovation projects. In particular, this seems to require a higher tolerance for slack resources and greater levels of redundancy in order to create the time, space and creativity needed for pursuing new products, services and customer requirements. Are companies taking this on board? Some are, as we will now see.

Illustration 3: Sometimes effectiveness precedes efficiency

One long established project based firm from the EPC industry has taken these lessons to heart in undertaking a project using innovative methods to complete the building of an oil refinery with a time schedule of 33% less than anything that has ever been achieved before. Working closely with the client, who is described as 'our company's future', traditional constraints in terms of financial and intellectual resources were dramatically reduced, leaving engineers free to work on finding innovative ways to reduce time to completion. Ample

people, equipment and money were made available to ensure that all attention could be focussed on new solutions that if successful will revolutionise the industry. The main point from this illustration is the importance of creating redundancy to allow new ideas to develop, blend, proliferate and mutate before pressure to home in on one solution is created. However, even within this firm, this liberal approach to redundant resources, and embracing of the need for ample time and resources to be made available to achieve new outcomes, is *the clear exception* to the rule which generally is tight control over projects, including innovation projects, in terms of time, cost and quality.

Illustration 4: Necessity is the mother of conditions that foster innovation

We also find limited evidence of the use of slack resources to aid innovation in the computer industry. We interviewed respondents from one company working with novel technologies. Project managers reported that one method they use to ensure that new technologies are not only mastered but also successfully applied to projects is to appoint more than one specialist to projects. These can then learn from each other, sharing tacit knowledge and developing tacit knowledge in tandem. Because the technologies are so new, there are few masters from which to learn. They must be developed. The respondents admit that *the novelty of the technologies forced this level of redundancy within team composition*, but has subsequently come to be viewed favorably as knowledge transfer is facilitated and projects run more smoothly because of the presence of multiple partners who can replace each other in times of crisis.

Our data overall lead us to conclude that slack resources are still seen as the enemy in project based firms. Only when faced with huge challenges, such as those illustrated in these cases, are project based firms yielding to the need to loosen up on resources and allow creativity and innovation the space, time and expertise needed to flourish. Perhaps the publicising of these cases, and the study of other cases where innovative successes have emerged from a more liberal approach to resource allocation of innovation, might make a change in mindset more likely in the general project based firm community.

Innovation as universally desirable

Our third research question was aimed at finding out how respondents view innovation generally. In addressing this, we also uncovered evidence of the strategies that are in place in project based firms to manage innovation at a company-wide level, and the forces that impact on firms in developing these strategies. We opted to explore this because the innovation literature has been characterised by a number of tendencies, one of which according to Drazin & Schoonhoven ¹ is the tendency to assume that

Innovation is universally desirable for organisations p1066

We found that respondents look not at the desirability of innovation per se, but at how innovation can make their companies more competitive and better able to survive the rigors of international competitive and the global marketplace.

Illustration 5: Steering Innovation in the right direction

Respondents from one computer consulting company shared their view that innovation is something that must be very carefully managed. Innovation is not without its costs, and these costs are not equally acceptable to all resource providers in project based firms. It can absorb enormous resources, and needs to be handled carefully at the strategic level to prevent widespread wastage of valuable resources. To this end they have a steering group that monitors all proposals for innovation projects. Innovation projects are divided between (1) pure innovation/creation and (2) revamp/renew projects. Most projects fall into the latter category. The same steering group evaluates both types of proposals.

We don't have a very specific set of criteria for evaluating innovation projects. But it has to be relevant for the organisation. There has to be a clear business case.....In the past there was too much innovation, which we

couldn't sell. There is too much of an academic approach to innovation and not enough of a business case. We need innovation, [we] want to be an opinion leader, but perhaps not too much... ...In our reorganisation, we are trying to solve the problem of too much science and not enough application. We are trying to instill more business sense, making people more responsible for their utilization and less just for innovation

Respondents claim not to micro-manage innovation projects. The aim of the group is to monitor the overall portfolio of projects in terms of directions in the marketplace, new technologies, and what clients are telling them they want.

Illustration 6: Innovation is not universally useful, but can be dangerous

Respondents from another company, a well known EPC firm, do not describe innovation as universally desirable. On the contrary, innovation is described as a very difficult business issue. In this company, which has several business areas, innovation can affect a business area negatively. Those proposing innovations that will damage business areas encounter resistance. Our respondents gave us the example of the power reformer. A power reformer combines the functions of previously separate power generators and power transformers thus dramatically impacting on those business areas. When it comes to introducing innovations and setting up projects with negative consequences for established business areas, the strategy the firm adopts is to go outside all business areas and set up independent projects. This entails having a superstructure for innovation with experts from different specialist areas who can spot trends that may impact on one or more business areas, and which establish projects that might not prosper or be initiated within those areas for political and territorial reasons. Corporate funding for innovation reflects this reality, with funding reserved for innovation projects at a central level as well as funding at the business area level.

Our findings from this company specifically and the study in general support a view of innovation – not as universally desirable – but rather a view that recognizes that innovation is

often blocked, impeded and thwarted due to entrenched interests. In turn, a corporate commitment to monitoring innovation projects and needs for new developments, without passively waiting for them to emerge from current programs, divisions or business areas, seems to be commended.

On the issue of whether or innovation is universally desirable, another interesting point to emerge was the impact of the external environment on how companies manage their innovation strategy. Although innovation theory tends to concentrate on the impact of the internal context, our data suggests that the external context can play an important role in how firms view innovation, as the following illustration from the EPC industry shows.

Illustration 7: Innovation driven by external environment

Among the most prominent and longstanding project-based organisations are those that deliver power, oil, gas and petrochemical infrastructure, buildings, railways and defence equipment. Our data reveals that one characteristic all of the firms share in common is that rapid changes in the external environment have prompted innovation, often in administrative terms, and specifically in terms of how projects are carried out. Data gathered from these firms confirms the importance of innovation research that emphasises the importance of the external environmental context on organisations ¹. Deregulation of the industries in which EPC firms operate in recent years has resulted in a dramatic shift in terms of the kinds of clients that commission projects and the competencies these clients bring to such projects with a shift away from governments and government agencies as clients, who had large numbers of in house engineers, and towards financial institutions. Clients are now selling more and more risks to project based firms. As client engineering expertise declines, project based firms are handling more and more complexity and selling more and more specialised engineering knowledge as their key value added. A quote from a respondent in the EPC industry helps to illustrate the trend towards far more involvement of the project based firm in not only delivering, but also in defining, project needs:

We get closer to the client, get a better understanding, support them and help them find alternatives early in the process, and provide a full service front end, back end, and even with equity support

The challenges and risks for the project-based firm escalate as clients pull away from specifying what they want in detail. But the opportunities also rise dramatically, and especially in terms of how innovative these firms can be. To meet these changing environmental conditions project based firms in our study report the need for high levels of innovation in how projects are managed. With increasing complexity to manage, project managers need to be more experienced and project teams need to work more effectively in terms of concurrent design and collaboration over the entire course of projects.

However, the impact of the environment on innovation is not a simple and one-directional effect. The environment also effects orientation towards innovation in other ways. Many EPC firms still work for the government, or through agencies that are spending considerable public money. Safety and health procedures, and strict budgetary controls, all play a role in how project based firms orient themselves towards innovation as a respondent from a large engineering firm explains:

This industry [engineering and construction] is very conservative. We work within so many safety standards and we do not innovate unless a client specifically asks us to. This is not very often. We have lots of reasons. We blame the client, the public sector, public opinion. Our expertise and culture are not for taking risks.

The rules and regulations governing the process and outcomes from project based work can act as a barrier to innovation. Clegg ⁸ argues:

Explicitness about rules may restrict organisational practices, in the familiar punitive sense of rule-implementation as a way of preventing people from doing things they might otherwise do...[S]tructure strives to overwhelm novelty rather than to feel the shock of the new p261/262

As this illustration shows, these rules can emanate from both within and outside a project-based firm. When focusing on firm orientation to innovation, we should therefore consider not only internal organisational context, but also those external factors, within which firms are embedded, as constituting a relevant input to understanding how firms formulate their innovation strategy. Recognising this is one step in the direction advocated by Drazin & Schoonhoven¹ that:

Researchers should consider all organisations as embedded in networks of other organisational actors that influence how and when they engage in innovation activities p1075

Conclusions

We have examined three research questions derived from the theoretical innovation literature within the relatively unexplored empirical context of project based firms. Our main findings from this study are as follows:

1. The firm's in our study adopt organic approaches to innovation management in terms of fostering informal communications; allowing the free flow of knowledge within projects; organisation by mutual adjustment; establishing loose authority relations; making extensive use of matrix structures and boundary spanners to organise specialists from multiple disciplines who come together on projects. However, when it comes to evaluating projects, many firms stick to traditional linear methods of evaluation that involve judging projects at regular stages according to predetermined criteria. There are some exceptions to this

tendency. Some firms in our study 'sample' from different projects until they find a combination with strong business potential. This requires endurance, patience and support in the early stages. Innovators in these firms can face resistance to this open, fluid organic way of managing projects from those advocating stricter accountability and the imposition of stage gate models that apply predetermined criteria and lead to the early shutting down of projects. We advocate more research, based on these initial findings, to success rates of the organic approach to project evaluation. Viewed longitudinally, these approaches may gain greater acceptance and be integrated in mainstream project based methods and project management literature as legitimate methods of managing innovation projects.

2. The firm's in our study are influenced by conventional notions that proper project management requires adherence to control of time, cost and quality even though redundancy and slack are arguably important resources for fostering innovation. Despite continuing debates in the theoretical literature, there is widespread evidence that redundancy facilitates innovation, while pressures on time can damage innovation, lead to short-term orientation and orientation towards less risky projects. We recommend approaches, such as those found at 3M, that build in time, for personnel at all levels in the firm, to engage in innovative activities and undertake novel projects with the flexibility of time and expertise to foster innovative outcomes. We caution against efficiency driven management of innovation that deprives companies of the benefit of diffuse creative talents and the opportunities that arise when multi-disciplinary teams have slack resources with which to work to generate novel and often groundbreaking results.

3. And finally, the firms in our study do not view innovation as universally useful. They view it as at times dangerous, often costly, and a business issue requiring careful attention from senior management. To manage this at a strategic level, many firms have central bodies for studying innovation proposals and monitoring the pros and cons for the organisation as a whole. Furthermore, some firms are involved in so many diverse business areas it is

necessary to set up independent innovation committees who can identify future technological and market developments and respond by promoting innovations that may damage or threaten one or more exiting business areas.

The environment surrounding firms can also act in contradictory ways on orientation to innovation. Changes in the global business domain act in one way, increasing pressures for novelty and innovativeness, while conservatism borne of strict standards and traditions of strict adherence to government and public sector guidelines act to restrict risk taking and thus innovation. More studies that embrace not only the internal context, but also the external context, in project based business, are needed to understand the dynamics of pressure to innovate, dynamics that apparently work both for and against innovation. Top management can play an important role in directing resources and attention to innovation by focussing on areas of innovation required for the future of the firm, but unlikely to emerge from the grassroots because of fears for current careers and skill bases. At the same time, the centralisation of innovation can run the risk that people at all levels of the organisation, and involved in all kinds of projects, relinquish responsibility for being innovative, making suggestions and combining surreptitious insights in the pursuit of innovation because that is someone else's clearly defined task. We need more studies to examine what the role of corporate governance is in innovation, and how can corporate attention be directed towards allowing innovation to occur without overly controlling and stifling innovation at a central level.

<i>Company Name</i>	<i>Country</i>	<i>Company Type</i>
Ericsson	Sweden	Central project management resource in a supplier of telephone networks and exchanges and manufacturer of mobile telephones
Ericsson	Malaysia	Supplier of bespoke intelligent networks to the telecommunications industry, and of telephone exchanges to organisations
Ericsson	Netherlands	Supplier of bespoke intelligent networks to the telecommunications industry, design and installation
STS	Netherlands	Research company developing novel equipment for the computer industry
Pink Elephant	Netherlands	Information systems consultants
ABN Amro IS Division	Netherlands	Internal department delivering information systems solutions to a bank
Arcadis Bouw/Infra	Netherlands	Engineering procurement and construction contractor in the building, railway and infrastructure industries
Raytheon Engineers and Constructors	Netherlands	Engineering procurement and construction contractor in the oil, gas and petrochemical industry.
Fluor Daniel BV	Netherlands	Engineering procurement and construction contractor in the oil, gas and petrochemical industry.
ABB Lummus Global	Netherlands	Engineering procurement and construction contractor in the oil, gas and petrochemical industry.
ABB	Austria	Engineering procurement and construction contractor in the power generation industry, (combined cycle power station)
ABB	Sweden	Central project management resource in a manufacturing and contracting company in the electrical engineering industry
Unisys	Austria	Supplier of computer equipment and bespoke information systems solutions
Unisys	UK	Supplier of computer equipment and bespoke information systems solutions
British Aerospace Defence Systems	UK	Supplier of bespoke electronic systems to the defence and other industries
Reuters	UK	Supplier of business and financial data products
British Telecom	UK	Communications and data network operator
Posten State Data Centre	Norway	Supplier of bespoke information systems solutions to the public sector
Virtual Factory Initiative (University of St Galen)	Switzerland	Established the virtual factory, comprising 30 companies from Germany, Austria and Switzerland around Lake Constance
EDS	New Zealand	Developer of bespoke information systems; contractor providing outsourced service to the national telephone operator

Exhibit 1: Organisations interviewed

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