

Rethinking project reliability using the ambidexterity and mindfulness perspectives.

Purpose

This paper brings together two seemingly disparate bodies of literature – *ambidexterity* (the ability both to exploit and explore) and *mindfulness* – to take a fresh perspective on the management of uncertainty. The authors differentiate between ‘rule-based’ and ‘mindfulness-based’ reliability and explore project risk responses in environments characterised by varying degrees of uncertainty.

Design/methodology/approach

Five case organisations across a range of industries are used to illustrate how uncertainty may be prepared for and suitable responses activated. This also adds to our understanding of the nature of ambidexterity, which has previously been characterised primarily at the organisational level with relatively few studies looking at managerial actions and ‘switches’ between modes. The data consist of initial survey responses to indicate the level of mindfulness under conditions of normality, followed by interviews studying particular incidents and the nature of the responses.

Findings

Key practices are identified that support high-reliability in complex projects, with four managerial modes (‘Traditional’, ‘Just-in-time’, ‘Infusion’, and ‘Entrepreneurial’) that emerged from the data.

Practical implications

The findings offer managers a practical framework to choose between different modes of reliable performance by considering the uncertainty of the environment and whether the primary driver of the work is efficiency or effectiveness. This allows managers to reflect on their own organisations and practices and identify whether their current approach is suitable.

Originality/value

This work offers new insight into risk responses in complex environments and shows how the mindfulness and ambidexterity literatures may be used as beneficial lenses to increase our understanding. Blending these two schools also offers opportunities for future research.

Keywords: Ambidexterity, Mindfulness, Projects, Reliability, Risk, Uncertainty.

Introduction

It is now ten years since the EPSRC-funded *Rethinking Project Management* (RePM) drew to a close. The fifth workshop within RePM specifically considered issues surrounding actuality and uncertainty in projects, and more recent output has also attempted to unravel and inform the areas surrounding uncertainty, ambiguity, and complexity in projects (Cooke-Davies *et al.*, 2007; Geraldi *et al.*, 2011b; Leybourne and Sainter, 2012; Maylor, *et al.*, 2013).

Projects today operate in a world of unprecedented uncertainty and complexity (Benjamin and Levinson 1993; Besner and Hobbs, 2012; Cavaleri *et al.*, 2012; Davies and Mackenzie, 2014; Galbraith and Merrill 1996; Piperca and Floricel, 2012, Pitsis *et al.*, 2014; Williams *et al.*, 2012), meaning that generic approaches are not always suitable (Cicmil and Hodgson, 2006; Crawford and Pollack, 2007), and understanding and improving performance is challenging (Sage *et al.*, 2014; Williams, 2008). RePM identified this a decade ago, with two of the papers in the IJPM ‘special issue’ on the outputs of RePM building on these themes. Cicmil *et al* (2006) considered the actuality of projects, recognising the need for praxis and context-dependent judgement, and Atkinson, Crawford and Ward (2006) looked at fundamental uncertainties in projects, positing that “project management practice does not address many fundamental sources of uncertainty in projects, particularly in ‘soft’ projects where flexibility and tolerance of vagueness are necessary” (p. 687). As a consequence of these issues, many project organisations struggle to provide reliable performance, i.e. adherence to their originally-intended plans.

In this paper we present a comparative study of five organisations encountering varying levels of uncertainty, and investigate how they respond in complex, evolving, environments. We first summarise the ambidexterity literature, whereby organisations can both exploit existing experience and explore new solutions, and show how this is a valuable conception in

the project context. We then introduce the ideas of ‘rule-based’ and ‘mindfulness-based’ ways of working, to identify managerial practices that go beyond a ‘mechanistic’, ‘process’, view of organisational responses to deal with the consequences of uncertainty. As we uncover in the literature review, exploitation is akin to a more rule-based approach, and exploration has strong parallels with mindfulness in its search for new solutions, but these two bodies of work have evolved separately and do not appear have been considered in terms of their similarities. The former has grown originally from the learning literature, although now is associated more with organisational strategy, whereas the latter is derived from social psychology. We bring these two literatures together to offer both scholars and managers a different method to conceptualise risk and uncertainty, and potential ways with which to respond. Our research was intended to identify whether ambidexterity and mindfulness can be combined meaningfully to understand better the managerial responses to uncertainties in projects.

Our case research uncovered four archetypal modes of operating, each suited to different levels of uncertainty. There is no ‘one-best-way’ but we offer a framework for managers to identify which mode may best suit their particular context, and which meets some of the ideals of the ‘Research in Practice’ and the ‘Research for Practice’ outcomes of RePM.

In order to deal with uncertainty and complexity, a significant body of work has been built to enable risks to be identified and managed. This includes the output of professional bodies, as well as organisation-specific rules and procedures. Both the academic and practitioner risk literature is voluminous, and few would argue against its value. However, the continuing regularity of projects failing to meet their objectives (e.g. the CHAOS reports from The Standish Group) would indicate that there is still much to be done to improve project performance.

The relevance of ambidexterity to projects

March (1991) identified the distinction between exploitation (using, refining and building on existing expertise) and exploration (innovation and problem-solving to create new solutions), and suggested that these two activities competed for finite resources, thereby setting up an important organisational challenge. However, a sizeable body of work on *ambidexterity* has arisen to understand how these can in fact be reconciled in practical organisations. The ability to manage both successfully is associated with financial and other performance benefits (see Birkinshaw and Gupta, 2013; Junni, *et al.*, 2013; Turner *et al.*, 2013b; and O'Reilly and Tushman, 2013, for reviews). The benefits of ambidexterity are broadly accepted, yet despite the burgeoning number of studies, there is only limited explanatory empirical evidence showing the managerial activities that may bring it about.

The detailed mechanisms by which ambidexterity may be achieved are still far from clear. There are three high-level approaches (Turner *et al.*, 2013b). In temporal ambidexterity (Tushman and O'Reilly, 1996), exploitation and exploration are sequential modes, i.e. the organisation alternates between them according to market requirements. For example, the actions of a new competitor may cause a stable organisational form to change rapidly. In structural ambidexterity (O'Reilly and Tushman, 2004), however, the organisation is configured for both exploitation and exploration via the separation of these processes into different departments or groups. For example, manufacturing might be separated from the research and development (R&D) activities, since these require quite different operational procedures. The conflicting requirements are reconciled by integration at the senior management level (Raisch and Birkinshaw, 2008), where organisational strategy is set and resources can be allocated most effectively. The third model is that of contextual ambidexterity (Gibson and Birkinshaw, 2004), which is “the behavioral capacity to simultaneously demonstrate alignment [exploitation - meeting predefined goals] and

adaptability [exploration - flexibility as required by the situation] across an entire business unit.” (p. 209). This is based on the premise that individuals will make sensible judgements in the moment as to how best to spend their time in complex work environments. There are strong links with organisational improvisation here, which is increasingly becoming recognised as a contributor to effective delivery and learning within projects (Leybourne and Kennedy, 2012).

The literature on ambidexterity is characterised by theoretical work and empirical studies undertaken primarily at the organisational level (Turner *et al.*, 2013b). Although the role of the individual manager is acknowledged as important (e.g. Birkinshaw and Gupta, 2013; Lubatkin, *et al.*, 2006; Mom, *et al.*, 2009; Nemanich and Vera, 2009), there is only limited work on the managerial actions in day-to-day operations that enable this important organisational capability. Consequently, O'Reilly and Tushman (2011) call for greater insight into the managerial micro-mechanisms that enable ambidexterity, and Turner *et al.* (2013, p. 329) suggest studies that help us “comprehend better how ambidexterity ‘works in practice’”.

In this paper we consider ambidexterity in organisational projects. The logic of using projects as a context is that they require the existing organisational expertise and systems (exploitation) yet necessarily involve some degree of uniqueness, novelty and knowledge-generation (exploration) (Gerald *et al.*, 2011a). There is a growing body of research on projects as appropriate units of analysis to study complex interactions (Davies and Hobday, 2005; Maylor *et al.*, 2006; Söderlund, 2011), including the consideration of exploitative and exploratory aspects in these temporary organisations. Brady and Davies (2004) for example show how organisations can learn through ‘vanguard’ projects (exploration), then refine this knowledge over time and exploit it systematically in future projects. It is also apparent that a more exploratory approach may be more advantageous in highly uncertain environments (e.g. Brady *et al.*, 2012; Klein and Meckling, 1958; Lenfle and Loch, 2010) where there may be a

lack of clarity with regards to both goals and methods at the outset (Turner and Cochrane, 1993). Interestingly, many of these researchers were involved in the activities of RePM.

Projects are complex environments (Geraldi *et al.*, 2011b) in which contextual ambidexterity would be expected (e.g. Turner and Lee-Kelley, 2013). This is in contrast to many of the studies in which the suitability of the environment for ambidextrous working is not clear. Ambidexterity at the individual (Turner *et al.*, 2013a) and project team level (Liu and Leitner, 2012) has also been shown to be significant for project performance. Recent research has also studied this at the programme level (Pellegrinelli *et al.*, 2015). Some have looked at the corresponding micro-level processes (Tiwana, 2008; Turner *et al.*, 2015), yet this has not been a major focus and our understanding is still relatively limited. There is as yet only limited investigation of the detailed managerial actions by which ambidexterity can be implemented within projects, and the fine-grained contextual ambidexterity view that we sought to investigate is comparatively under-researched.

Rule- and mindfulness-based reliability

Organisations increasingly rely on a mix of rule- and mindfulness-based reliability (Andersen and Hanstad, 2013; Butler and Gray 2006). Rule-based reliability has developed as organisations implement processes and compliance systems to achieve greater control and repeatability in their operations. The premise of rule-based reliability is that rules – informed by past events – can be applied consistently to reduce human cognition as a source of error. In contrast, the mindfulness approach to reliability allows human cognition to flourish. Mindfulness is a well-established construct in social psychology literature and has led to a discrete body of research on High Reliability Organisations (HROs), which emerged in the 1980s when the ‘Berkeley Group’ became concerned with organisations that repeatedly

perform activities with ‘high hazard’ technologies but experience very few errors and incidents (Roberts and Libuser, 1993; Rochlin 1993, 1996).

Drawing on this body of literature, five organisational characteristics have been established as reliability-enhancing (e.g. Coutu 2003; Weick 1987; Weick and Roberts 1993; Weick, *et al.*, 2000; Weick and Sutcliffe 2007). Weick’s work on organisational sense-making also formed the basis for our current understanding of organisational improvisation. The five organisational characteristics referred to above are: *preoccupation with failure*; *reluctance to simplify*; *sensitivity to operations*; *commitment to resilience*; and *deference to expertise*.

Preoccupation with Failure is characterised by a constant ‘chronic unease’ (Reason 1990) about potential (small) errors. It draws attention (partially away from ‘blinding’ successes) towards the potential of catastrophic failure. People are continuously looking out for ‘weak signals’ (Weick and Roberts, 1993) – signs of failure or deviations from a planned change that may cascade into a crisis. Reporting of weak signals is encouraged and incentivised; near-misses and errors are used as learning opportunities and shared freely.

This is complemented by second characteristic – *Reluctance to Simplify*. It counters people’s tendency to normalise and ignore weak signals. It assumes that failure is not the result of a single, simple cause. Weak signals are not seen as isolated, controllable, risks but as systemic failures that require a strong response, and a nuanced appreciation of such systemic risk is required. People are encouraged not to jump to conclusions, to be sceptical, and to show a constant doubt about simple explanations. Assumptions are challenged by evaluation from a variety of (cross-functional) perspectives, with the aim of fostering a more detailed interpretation of failure.

Sensitivity to Operations relates to an organisational ability to remain close to where failure happens. ‘Real-time’ information exchange about failure and the ability of people to integrate

pieces of information to understand the ‘big picture’ of an operation (or project) is paramount. ‘Knowing’ how a situation unfolds requires fast and un-bureaucratic communication and the imagination to look beyond weak signals in isolation.

Whereas these first three characterise an increased awareness and appreciation of failure (indeed, an anticipation of failure), the other two principles allow responses to uncertainty. The ability to cope with, and successfully bounce back from, failure is associated with *Commitment to Resilience*. Those who are close to the problem and can enact a first-response to contain failure need to be encouraged and motivated to do so swiftly and competently. An increased ‘response repertoire’ through training and investment in skills, enabled by widened responsibility and accountability, are at the forefront of establishing resilience. Nevertheless, mindful organising needs to be exercised by those closest and most knowledgeable about the problem and its solution(s). Expertise needs to be drawn upon irrespective of organisational prestige, silo mentality, ego, or hierarchical divisions. *Deference to Expertise* implies that this expertise is valued more than hierarchy. Rank and status are subordinated to pertinent knowledge and experience.

Despite the ever-increasing understanding of what *rule-* and *mindfulness-based* reliability imply, there is surprisingly little attention paid to whether, and how, organisations activate both – at times conflicting - modes of management or move between one and the other. Such a practical ‘switch’ is of great importance to organisations if they are to manage uncertainty successfully. This is especially important in environments such as research and development (R&D) and new product development (NPD). This logic also corresponds to a similar lack of understanding within the ambidexterity literature of how a shift between, for example, an exploitative or an exploratory mode to the other can be triggered and then controlled. Our research was intended to give insight into this issue and to ascertain how a combination of these lenses could be used to gain a greater understanding of practical risk responses.

Method

We investigated five UK-based organisations with varying levels of uncertainty in their work. These were organisations whose senior management expressed interest in understanding better the nature of operational resilience. A prerequisite to the study was that each organisation had to demonstrate a successful track record of performance in its own industry compared to its competitors using key, appropriate, metrics. Three were predominantly ongoing operations (although incorporating projects as part of this), while the other two were based around a model of project delivery.

Two of the organisations were major worldwide insurance companies ('Insure-Alpha' and 'Insure-Beta'), whose work was characterised mostly by structural and emergent complexity (in the classification by Maylor, *et al.*, 2013). One was a large power station ('Power-Co'), primarily dealing with structural complexities and some emergent ones. Another case was that of a major new power system product development group with worldwide customers ('Engine-NPD'), principally faced with structural issues although also with socio-political and emergent ones. The final case was a research company executing a set of high-tech R&D projects for clients across multiple industrial sectors ('Inno-R&D'), whose business relies upon the ability to manage structural, emergent, and to a certain extent, socio-political complexities due to the nature of their work. The first four case organisations aimed (broadly) to minimise uncertainty and uniqueness in their work, whereas Inno-R&D explicitly chooses to undertake novel high-technology work for its customers.

Within these cases we applied a two-step approach to gather data. The first was to survey how these organisations operate under 'normal' conditions of (relatively) low uncertainty. This allowed us to understand the participants' perceptions of their 'typical' operating environment. The second involved interviews to obtain rich insight into how they deal with

specific project issues (abnormalities), characterised by uncertainty in the problem and/or response to it. For this we used the critical incident technique (Flanagan, 1954), as discussed below, to gain multiple perspectives on key events that occurred, together with the accompanying decisions and actions that were taken. These could therefore be contrasted with ‘normality’. Table 1 provides an overview of the data gathered.

*** INSERT TABLE 1 ABOUT HERE ***

To establish how an organisation operates under ‘normal’ conditions, the survey measured perceptions of the extent of rule-based and/or mindfulness-based management. Our questionnaire was developed in accordance with Weick’s self-assessment tool (Weick and Sutcliffe 2001) and refined based on pertinent literature (e.g. Vogus and Sutcliffe 2007). However, instead of replicating a 5 point Likert Scale that measures purely the perceived existence of mindful practices, we provided extreme ‘poles’ of *rule-based* (i.e. more exploitative) versus *mindfulness-based* (akin to more exploratory) reliability. An example question asked whether people had discretion to resolve unexpected problems as they arose, with answers ranging from ‘People have little discretion’ – indicative of rule-based (exploitative) practices - to ‘a lot’ – associated with mindfulness-based (exploratory) ways of working.

In order to understand each organisation’s response to abnormalities, we then carried out a critical incident analysis (Flanagan, 1954), interviewing decision-makers throughout the hierarchy in each organisation (including board members, directors, senior and middle managers, and technical staff). At the centre of these interviews were challenging events – characterised by uncertainty in the problem - which the organisation faced, through which we analysed response practices. The use of respondents throughout the hierarchy allowed us to obtain multiple accounts of the incidents from different roles, rather than relying only on a

single account. Interviews were recorded and transcribed so that incidents and responses could be examined and compared.

These interviews were intended to unravel how an organisation prepares for and activates rule-/mindfulness-based management to deal with uncertainty. This two-step approach allowed us to establish a pre-incident state of rule-/ mindfulness-based preparedness and in-depth insight into the activation of responses. By considering this in terms of ambidexterity – how do managers balance exploitation and exploration, or switch between them, under difficult conditions? – we also add to our understanding of the practicalities of this subject.

Results

The pursuit of reliability under conditions of normality

Figure 1 shows each organisation's average tendency towards rule-based or mindfulness-based reliability under conditions of normality, divided into each of the 5 principles. Tending towards 1 implies that the respondents, on average, perceived their state of preparedness to be rule-based; 5 indicates a propensity towards mindfulness.

*** INSERT FIGURE 1 ABOUT HERE ***

The organisations provided a wide range of responses. In ascending order, Engine-NPD demonstrated a significant tendency towards rule-based management (a strong reliance on exploitation). Both Insure-Alpha and Insure-Beta, on average, tended to be rule-driven, although the aspect of Deference to Expertise stands out in both organisations. Power-Co and Inno-R&D both provide mindful capabilities in times of normality.

Preparedness and activation of reliable performance under conditions of abnormality

Abnormal incidents are characterised by uncertainty in the problem and/or response to it, and the potential for complexity rapidly to affect performance to the extent that a crisis may be imminent. From analysing transcript data and comparing the issues within each of the cases, together with in-company accounts of the same incident from multiple perspectives, we found the organisations' activation of capabilities able to deal with uncertainty unfolded in four distinct modes, which we now describe as 'Traditional', 'Just-in time', 'Infusion', and 'Entrepreneurial'.

The 'Traditional' – we labelled it Traditional because this remains process-based, primarily exploitative – approach to managing critical incidents is to absorb uncertainty with a pre-defined framework of actions. The underlying premise is that pre-loaded plans and principles can accommodate any form of adversity. Management by exception, by relying on situated human cognition, is discouraged.

In the case of Engine-NPD, major incidents included the release of new computer-aided design software from a supplier that unexpectedly could not cope with the amount of traffic generated by its extensive internal user base. Without intervention, this could have led to the shut-down of a production line. Engine-NPD attempted to absorb the incident using their normal rules and procedures, namely escalation, change requests and rolling-back the software after identifying the problem. However, their control systems were unwieldy and resolution took several weeks, leading to tense periods in which parties allocated the costs and accountability to each other. Solutions to deal with these novel problems required an 'unfreezing' of standards and frameworks, a time-consuming challenge.

*** INSERT FIGURE 2 ABOUT HERE ***

This approach to critical incidents offers a stable, transparent, environment, in which external resources can be integrated relatively easily, as they only have to adhere to a limited set of rules and procedures. This is a benefit of such an exploitative system that seeks efficiency. Such preparedness was, however, challenged by the lack of readiness to deal with problems that were not pre-planned. The inability to solve the problem with the response repository at hand (e.g. from engineering and project management) led to delays and lengthy arguments about the root-cause of incidents. As shown in Figure 1, Engine-NPD had a predominantly rule-based approach, and this may not be the most effective for an NPD environment. An ‘exploitation-based’ approach, through relying on previous experience to design an appropriate control system, may thus be insufficient to deal with practical, complex, project environments with emergent problems.

In both Insure-Alpha and Insure-Beta, the ‘Just-in-time’ mode involved the creation of temporary mindful capabilities to deal with events until they were resolved. These included disasters such as the US Hurricanes, which were unpredicted and at a magnitude that was, to some extent, unplanned for. Responses can be viewed as specific, time-bound projects initiated as a result of the emergency events. The financial impact to the organisation was significant and needed careful coordination, yet dealing with the disasters also needed to be balanced with supporting ‘business-as-usual’. Here there was a more clear-cut implementation of both exploitative and exploratory actions. The response was the ad-hoc formation of ‘Tiger Teams’, consisting of cross-functional experts. These teams comprised seasoned managers, emotionally and structurally detached from the context in which the incident happened. They aimed to resolve these major incidents, including working with other insurers to ensure an appropriate financial response and dealing with the immediate

litigation issues. This allowed others to remain focused on contributing to normal operations. Thus we observed the companies moving from a more exploitative ‘day-to-day’ mode to creating a classically structurally ambidextrous project team to accommodate both ongoing work (exploitative) yet also being able to incorporate novel and responsive solutions to emerging difficulties (exploration). This is indicated in Figure 3, which also shows the demarcation between rule-based and mindfulness-based reliability.

*** INSERT FIGURE 3 ABOUT HERE ***

The deployment of parallel but separated rule-based and mindfulness-based capabilities does, though, have its limitations. Resource-based boundaries between normal operations and critical incidents become blurred. We found that key decision-makers, preoccupied with maintaining day-to-day operations, were reluctant to allow others to deal with those aspects of abnormality that were intrinsically related to their own work unit. Arguments about who was responsible for what at times slowed down timely intervention, indicating the practical challenges associated with this response. This is the difficulty with attempting to integrate a structurally ambidextrous approach into a single response, since the solutions required under complex conditions may not readily fall into either of the two camps. The necessarily blurred boundaries between exploitative and exploratory requirements (Turner and Lee-Kelley, 2013) means that such a clear-cut distinction is unrealistic and will inevitably lead to some level of confusion.

An alternative approach to dealing with critical incidents is to ‘infuse’ additional capabilities (although not extra capacity) to deal with incidents characterised by uncertainty (Figure 4). This is more akin to the concept of contextual ambidexterity, although with a nuanced movement to a more exploratory mode under conditions of difficulty. Power-Co had established a relatively high degree of mindful practice during times of normality (Figure 1).

Key decision-makers were empowered to go beyond their normal routines and when faced with abnormality could absorb these alongside their normal operations by deploying appropriate, flexible, responses. Such incidents included the breakdown of vital machinery, essential to energy production, and this could have led to the shutdown of the power plant – a major crisis.

*** INSERT FIGURE 4 ABOUT HERE ***

Decision-makers are compliant with rules and procedures, as would be expected in such an environment. Nevertheless, they are also explicitly empowered, authorised and skilled to deal with situations that go beyond normality. The activation of these capabilities, though, was challenged by the unwillingness and limited capacity of the decision-makers to deal with both normality and abnormality simultaneously. In most of the researched incidents, managers paid attention primarily to the unfolding events, focusing their attention on the exploration and largely ignoring the unaffected systems that still had to be monitored and managed. Others, however, could not let go of the expectation of normality. Although an appropriate flexible response was implemented to deal with the incidents quickly, the balancing of both mindful and rule-based responses simultaneously is demanding. Ambidexterity with high levels of both exploitative and exploratory activity can therefore be perceived as an excessive challenge. Managers can experience overload from trying to deal with both aspects simultaneously, which can reduce the effectiveness of the solutions being attempted, or one being completed at the expense of the other.

The final alternative to deal with uncertainty, the ‘Entrepreneurial’ approach, is to create and maintain permanent mindful capabilities. This represents an effective state of contextual ambidexterity, with, in this case, a consistent emphasis on more exploratory operations. Here

there is limited preloading of rules and procedures. Decision-makers are relatively ‘free’ to develop their own way of working in contextually separated operations and projects.

This mode was prevalent in Inno-R&D, which undertakes cutting-edge research for customers in fields such as medical devices, communications systems and sensor technologies. The work is characterised by a permanent build-up and maintenance of mindful practices. Once a critical incident – such as a major setback in a test environment - or situation had been identified and shared, it was accepted that no standard operating procedure may be suitable for dealing with it. Compliance to protocol was replaced by project managers engaging with stakeholders in a discourse of what the problem constituted and how to solve it (an exploratory approach). A visible, tangible, ‘switch’ from one mode to another could not be observed. However, in contrast to the previous cases, uncertainty was not seen as something to be avoided under all circumstances but as an opportunity for innovation. Hence, critical incidents were genuinely perceived as opportunities to learn and improve, unlike those in the other organisations.

*** INSERT FIGURE 5 ABOUT HERE ***

Uncertainty is here associated with (relatively) little governance and compliance to project management frameworks, with each project given the freedom to define their own ways of working. We now elaborate on the five mindful practices that we observed in this case, contrasted with those within Engine-NPD (also heavily project-based), then conclude with the implications for ambidexterity.

Contrasting two reliability-seeking project-based organisations

At Inno-R&D, initial project plans are perceived to be ‘just’ estimates, and ongoing reviews are necessary based on the continuous and evolving understanding of problems and their

solutions. The delivery of functional reliability is perceived as being more important than meeting (arbitrary) deadlines and budget obligations if/when trade-offs have to be made. This is in contrast to the approach of Engine-NPD, where plans are defined in detail and must be met, otherwise penalties are imposed. A set of rules and processes are implemented and consistency in applying this rule-set is emphasised, with more of a focus on meeting deadlines rather than necessarily the quality outcomes.

Preoccupation with failure

Inno-R&D - Trial by error

In order to be sensitive to what works and what does not, Inno-R&D embarks on extensive testing. Detailed simulations, together with functional and performance testing of prototypes, are at the heart of R&D projects, often with the involvement of the client and suppliers. Testing and (re)design often occur in parallel, sometimes discovering solutions that had not been planned, sometimes testing multiple options to find the best resolution. It needs a delicate approach to allow failure to happen (indeed, to seek it) yet to learn effectively when developing new products. This cyclical willingness to allow exploration and then to exploit the findings, then to seek further improvement is valuable under such conditions of uncertainty. Although schedules are of great importance, deadlines can be shifted. There is a general acknowledgement that testing is central to any form of learning.

Engine-NPD – Negative connotation of failure

In Engine-NPD, testing is also important as a means to understand failure. However, failure to meet deadlines is viewed as strongly negative. *“Because they have political dates to hit. We must hit it or we’ll go into the change freeze, we’ll lose the benefits case. I mean, as I say, I actually wrote five or six paragraphs on it, a saga, and the Chief of [Client] just ignored it, as did my counterpart, the programme manager that I faced off to. He just [said] ‘thanks very much, we’re buying off the risk’, their decision.”* The preoccupation with deadlines appears to

supersede that of designing a quality output, in this case a system that runs reliably, when choices have to be made about priorities.

Reluctance to simplify + Sensitivity to operations

Inno-R&D - Surfacing and sharing failure

The learning approach in complex R&D projects acknowledges that outcomes cannot be approached in a purely linear fashion through scheduling and forecasting. Reality cannot be fully planned for, but needs to unfold. Failure cannot be designed out of the system, but it can be seen as an opportunity to prevent weak signals cascading into something bigger – a crisis.

At Inno-R&D, such acknowledgement that failure is not an indicator of bad planning but represents ‘normal’ R&D drives a reporting culture in which openness is paramount. Managers emphasise that any planning of R&D activities is a set of estimates, not certainties. These often include numbers with ranges and tolerances to acknowledge the uncertainty, and stakeholders are sensitised that estimates are likely to change. Project phases are defined to allow these estimates to be updated.

Creating a mindset around potential failure goes hand-in-hand with sharing and reporting actual weak signals (e.g. deviations from estimates). People take small mistakes seriously and are open to communicating them. Staff are thus wary of ‘simple’ solutions. The support of contextual ambidexterity is therefore both a personal aspect of individual behaviour, but must also be supported by the organisation’s management and culture. This openness and flexibility (i.e. acceptance and promotion of exploration) is hard to cultivate, yet easy to stifle. Blame or punishment for incorrectly forecasting the unknown would most likely result in a more exploitative, rule-focused, approach being adopted. This is what Inno-R&D are attempting to avoid, and so significant effort is expended in attempting to support a form of ambidexterity that is appropriate and valuable in this organisation.

Engine-NPD – Limited Knowledge Integration

Whereas at Inno-R&D, failure was openly shared internally and between developers, subcontractors, and clients, a lack of communication between such parties could be identified at Engine-NPD. The initial planning stages with all parties involved were extensive, and subcontractors were given a plethora of instructions: “*I assumed that [sub-contractor] knew what they were doing.*” These instructions were neither questioned nor validated. Only when the system components were brought together were incompatibilities seen in the testing environment. This was exacerbated by the testing times being reduced to remain within the set deadlines. A ‘learning’ perspective was not so evident, likely causing reduced performance under complex conditions.

Sensitivity to operations + Deference to expertise - Knowledge-sharing and peer reviews

Inno-R&D – Inquisition through Expertise

The responsibility of project managers to explore beyond the ‘known expertise’ through extensive empowerment only works if access to additional knowledge is provided. Managers can pull in particular expertise from anywhere in the company, as necessary.

All of this is in the interest of making fewer assumptions, noticing more, and ignoring less. ‘Risk blindness’ is addressed with extensive peer-reviews, using independent expertise - someone not involved directly on the project can often spot things that those close to the work cannot see. This is a practical manifestation of the requirement to exploit previous knowledge effectively and to ensure that earlier experiences are used in current work. However, the formal and informal meetings can also be used to synthesise new knowledge, so exploration of new solutions in a ‘safe’ environment is an additional benefit.

These peer-reviews are not destined to ‘check’ (audit) whether project managers are compliant with the organisation’s rules and procedures. Instead, they make project managers

reflect on what they are doing, and why: *“They will ask you difficult questions and spot things that you might not have thought of yourself.”*, *“You start to recognise some early signs [of failure].”*

As practiced, the peer-reviewing system acknowledges the ‘folly of imposed solutions’ and offers support to help a project manager reflect and be creative in his or her solutions. In comparison, many other organisations we have seen use ‘auditing’ to constrain managers in a supposedly self-evidently correct management framework. Not so at Inno-R&D, which uses expertise ‘just’ to inform. It therefore also incorporates a strong focus on exploration in what might otherwise be seen as an exploitative process.

Engine-NPD – Unwarranted Optimism together with Internalisation

The communication at Engine-NPD remained within the boundaries of those parties involved that were so keen to meet the initially-set deadlines. Internal expertise, such as from systems engineers, was not necessarily acted upon

“I think the way it was, when we did the new plan to get the [product] into production we raised a load of planning assumptions and risks around that schedule and they were bought off by [client]. Because the blind optimism of the [client] programme was that this will work... it was not ready to go live and it was lucky it only picked up five reds [at the review] because it could have picked up six or seven if there’d have been less political sensitivity because it’s a joint gate between [client] and [provider]”. Yet, these internal experts, mostly those from the testing environment, can be seen by the client and subcontractors as having a political agenda to slow down the project progress whereas their motivation is centred more on delivering a high-quality product, albeit potentially at the expense of the original schedule.

Commitment to resilience – Empowerment

Inno-R&D – Empowerment beyond expertise

Uncertainty and its resulting potential to trigger failure is brought to the surface at Inno-R&D. Potential failure in the form of weak signals, however, needs to be acted upon by providing people with an extensive action repertoire and the empowerment to activate that repertoire when necessary. Project managers are required to make decisions regarding all aspects of product development or customer service. The remit of their responsibility and authority is extensive: *“We are all expected to do everything.”* From the cradle to the grave of a project, managers are not simply executors of project management activities but additionally take on commercial and legal roles and ‘own’ their project, regardless of their specialism. Such empowerment is by no means comfortable: *“Oh it is very scary, even now, even today.”*

The benefits of this are manifold. Project managers have a greater sense of purpose due to their extensive responsibility to look at a project from perspectives they may not be familiar with. This unfamiliarity, despite being uncomfortable, increases their alertness and attention to problems that otherwise might remain hidden. Managers who extend their repertoire instead of delegating it to ‘experts’ view a situation with fresh eyes. They can ‘see’ more and are thus better positioned to notice and contain issues before they cascade into a crisis.

Being able to put together the big picture helps to maintain oversight of project performance. It helps to ameliorate the issue of blindness to uncertainty that is often a problem in centralised and ‘specialist’ organisations. Going hand-in-hand with greater alertness and vigilance towards the unexpected, project managers at Inno-R&D feel strongly attached to their projects and their organisation. Not only is their expertise valued, but also their skills to go beyond their natural comfort zone. This exemplifies contextual ambidexterity, where managers can use their judgement to make choices as to how to spend their time. Previous

literature on contextual ambidexterity has struggled to articulate this in clear language, but this example illustrates what it can mean in practical terms. This does not mean that it is straightforward – it is not – but it can aid our understanding.

Engine-NPD – Escalations

The ones closest to the problem – most often system engineers at Engine-NPD – raised risks and issues that contradicted the initially planned state of project progress. However, their authority to deal with these problems was limited. Any resolution of a problem that required additional or different resources needed to be authorised by a higher level within the hierarchy. Obtaining this authorisation took time and often triggered a discussion of who was to be compensated for the costs incurred. In both cases – at Inno R&D and Engine-NPD – costs are shared among stakeholders. Nevertheless, at Inno R&D, people close to the problem are empowered enough to enact a timely solution. At Engine-NPD, escalations took at times up to four weeks, increasing the stress in an environment with high pressure to remain within rigid timelines.

Discussion and implications

Literature often focusses either on the hard facts of rule-based risk management (Case, 2010; Keizer and Halman, 2007) or on the soft factors associated with mindfulness (e.g. Kutsch *et al.*, 2014). There is, though, little understanding of how organisations prepare, activate, or balance these archetypes. We investigated five organisational entities, explained their capabilities and also explored how their rule-/mindfulness-based capacities are activated to deal with abnormal (critical) incidents. In so doing, we also incorporated the ambidexterity literature, as this has valuable parallels with that of mindfulness. To date, however, little has been written regarding the detailed managerial practices that support ambidexterity.

Additionally, there has been minimal work on ‘switching’ between modes of ambidexterity, so the critical incident technique used offered insight into this aspect.

We identified four distinct modes of management, each with their own benefits and limitations. Mode 1 is arguably the most efficient mode of managing certainty, with Mode 4 the most effective to deal with high uncertainty. Figure 6 indicates how these can be understood in terms of the efficiency-effectiveness perspective, and also the dimension of uncertainty.

Mode 1 – Traditional – characterised by the adherence to a *rule-based* approach (i.e. an exploitative style), does indeed provide reliable performance, yet only for problems for which appropriate rules have been designed. Speed of activation to deal with incidents of abnormality can be compromised by the necessity of escalations and resulting changes to embedded frameworks of rules, accompanied by sometimes lengthy discussions of accountability. The Engine-NPD case that was characterised by this could be argued to be ineffective since NPD is by its nature an uncertain environment and attempting to constrain the variety of responses may be counterproductive.

Modes 2 (Just-in-time) and 3 (Infusion) involve some preparation to deal with abnormal incidents, either by permanently equipping decision-makers with mindful capabilities or temporarily deploying additional resources. Just-in time provides greater efficiency to deal with abnormality, yet may be compromised by overlapping and sometimes conflicting competences between the embedded decision-makers and the external ‘parachuted-in’ mindful capabilities. Infusion potentially incurs greater waste as, in the absence of uncertainty, mindful capabilities remain idle and underutilised. When activated, the issue of excessive workload to balance both the management of normality and abnormality might prove detrimental to the management of normal operations. From an ambidexterity

perspective both these exhibit temporal ambidexterity (a shift in the predominant response over time) yet also reflect structural and contextual (albeit with a changing emphasis) ambidexterity respectively. The nuances of the responses highlight the difficulty of categorising these complex environments as solely temporal, structural or contextual ambidexterity, emphasising the constraints of the high-level categories theorised to date.

Mode 4 (Entrepreneurial) is the most resource-intensive, establishing a constant state of alertness and flexibility. This corresponds to contextual ambidexterity with an emphasis on exploratory approaches over the re-use of existing solutions, but the exploitative aspect is important to provide stability in the particular project domain. The range and speed of activation is not so much compromised by lack of capacity or overlapping competences to deal with abnormalities, but more with a risk of the erosion of capabilities, in which case there is the potential to ‘drift’ to a more exploitative approach over time due to a lack of exploratory stimuli.

*** INSERT FIGURE 6 ABOUT HERE ***

What does this imply for organisations? The temptation to use a predominately *rule-based*, exploitative, approach (Mode 1) given its premise of efficiency may be inadequate for work characterised by complexity and uncertainty. If the project is expected to be a straightforward ‘repeater’ (for example, a low-risk desktop roll-out of a software upgrade) it may be perfectly sensible, but this will not always be the case. Mode 2 is appropriate for environments where abnormality may strike only occasionally and where the short-term addition of staff to overcome an unexpected issue is feasible. A temporary deployment of external resources (a structurally ambidextrous approach) might, though, only increase the sense of ‘somebody else’ taking over the management of uncertainty, so this may not be suitable if it needs to be deployed regularly. Mode 3 provides a permanent provision of mindful capabilities to

repeatedly deal with abnormalities – a manifestation of contextual ambidexterity - yet this mode only works if the decision-makers are able to cope with the additional pressure to maintain normal operations and at the same time deal with the materialisation of uncertainty. Examples would be in a new product environment, or where the organisation is seeking new markets whereby knowledge is necessarily limited at first. The pure mindfulness approach seems to be the most effective approach in R&D and NPD, but its effect is potentially jeopardised by the onset of complacency and consequently routinisation - the temptation to ‘automate’ successful practices in an exploitative manner irrespective of the uncertainty at hand. Hence, this requires a constant refreshing of situated cognition that allows the flexibility to manage novel situations. The ambidexterity here has a tendency towards exploration as central to mindfulness is flexible thinking. This requires a structure that challenges individuals’ assumptions and breaks the temptation to ‘simply’ follow past practices, in the way that project managers were ‘understood’ to approach project-based work prior to the RePM activity.

Conclusion

Complex projects are not amenable to simple solutions. This was a major outcome of the REPM activity, and is evident in the results of this study. Processes and procedures within organisations are necessary to make projects function effectively, yet mindful capabilities are required when rules find their limits. Exploratory solutions need to be blended with rule-based exploitation. Nevertheless, little is known about how organisations balance the use of rule- and mindfulness-based ways of working, or what triggers an effective switch between emphasising exploitation or exploration in an ambidextrous environment. From our case-based data we established four modes of management, which we labelled ‘Traditional’, ‘Just-in-time’, ‘Infusion’, and ‘Entrepreneurial’.

We began with a discussion of the ambidexterity and mindfulness literatures, and suggested an overlap between them that had not been explored, likely due to the dissimilar fields in which they have been researched. We believe we have contributed to both literatures. With ambidexterity, the more nuanced understanding of the switching and balancing between exploitation and exploration shows a much finer level of granularity than the three high-level concepts of temporal (Tushman and O'Reilly, 1996), structural (O'Reilly and Tushman, 2004) and contextual (Gibson and Birkinshaw, 2004) ambidexterity would imply. Indeed, these elements can each be identified, yet can appear as interwoven aspects rather than conceptually separate. This additional level of complexity with its requirement to improvise under conditions of uncertainty (Leybourne and Kennedy, 2012; Maylor *et al.*, 2013) is an addition to our knowledge of the subject. The findings aid in answering the call from O'Reilly and Tushman (2011) for greater insight, and that of Turner *et al.* (2013, p. 329) to “comprehend better how ambidexterity ‘works in practice’”. In terms of mindfulness, and the co-existence of both rule- and mindfulness-based reliability (Anderson and Hansard, 2013; Butler and Gray, 2006), we have shown a dynamic aspect in responding to issues, with four different types of response identified from the case organisations.

Although not being prescriptive, we offer a framework for managers to evaluate their own context in terms of uncertainty and provide suitable response options. It is tempting to argue for ‘more rules’ in the face of uncertainty, but our research offers insights into more nuanced, thoughtful, and flexible approaches to managing. The rule-based approach is undoubtedly powerful, yet balancing this with mindfulness in times of uncertainty may increase both the efficiency and effectiveness of an organisation. Attempts to be overly rule-based in an uncertain environment, as with the first case, can have a detrimental effect on performance. With regards to Figure 6, attempting to run projects in an inappropriate manner (for example, a strongly mindful and flexible approach to projects with a high degree of certainty, or,

perhaps worse, a rigid approach to those with a great deal of uncertainty) will most likely cause the perceived complexity to increase markedly, which is to be avoided if possible. However, as we have indicated, each mode of reliable performance has its distinct challenges to overcome and these must be carefully evaluated.

We believe this is an important area for project managers to consider, especially those in the fields of NPD and R&D, since their projects inherently need to balance existing knowledge with innovation and problem-solving (Turner *et al.*, 2015). We hope that this sparks debate within organisations as to the limits of prescriptive rules and the steps that can be taken to act more flexibly and mindfully, and how considering the implications of ambidexterity may be beneficial for managers and project teams. We advocate further research in this area, including using further cases in different contexts, to generate more insight for managers as to how they can best generate increased reliability in their organisations.

References

Andersen, S. and Hanstad, D.V. (2013), "Knowledge development and transfer in a mindful project-organization", *International Journal of Managing Projects in Business*, Vol. 6 No. 2, pp. 236-250.

Atkinson, R., Crawford, L. and Ward, S. (2006), "Fundamental Uncertainties in Projects and the Scope of Project Management" *International Journal of Project Management*, Vol. 24, No. 8, pp. 687-698.

Benjamin, R. I. and E. Levinson (1993). "A Framework for Managing IT-Enabled Change." *Sloan Management Review*, Vol. 34 No. 4, pp. 23-33.

Besner, C. and Hobbs, B. (2012) "The paradox of risk management; a project management practice perspective", *International Journal of Managing Projects in Business*, Vol. 5 No. 2, pp. 230-247.

Birkinshaw J. and Gupta K. (2013). "Clarifying the Distinctive Contribution of Ambidexterity to the Field of Organization Studies" *Academy of Management Perspectives*, Vol. 27 No. 4, pp. 287-298.

Brady, T. and Davies, A. (2004), "Building Project Capabilities: From Exploratory to Exploitative Learning", *Organization Studies*, Vol. 25 No. 9, pp. 1601-1621.

Brady, T., Davies, A. and Nightingale, P. (2012) "Dealing with uncertainty in complex projects: revisiting Klein and Meckling" *International Journal of Managing Projects in Business*, Vol. 5, No. 4, pp 661-679.

Butler, B. S. and P. H. Gray (2006). "Reliability, Mindfulness, and Information Systems." *MIS Quarterly* Vol. 30 No. 2, pp. 211-224.

Cavaleri, S., Firestone, J. and Reed, F. (2012) "Managing project problem-solving patterns", *International Journal of Managing Projects in Business*, Vol. 5 No. 1, pp. 125-145.

Case, R. H. (2010), "Managing risk in Pharmaceutical R&D." *Research Technology Management*, Vol. 53 No. 2, pp. 24-32.

Cicmil and Hodgson, (2006) "Making Projects Critical", Basingstoke: Palgrave Macmillan.

Cicmil, S., Williams, T., Thomas, J. and Hodgson, D. (2006), "Rethinking Project Management: Researching the Actuality of Projects" *International Journal of Project Management*, Vol. 24, pp. 677 – 686

Cooke-Davies, T., Cicmil, S., Crawford, L. and Richardson, K. (2007) "We're not in Kansas Anymore, Toto: Mapping the Strange Landscape of Complexity Theory, and its Relationship to Project Management" *Project Management Journal*, Vol. 38 No. 2, pp. 50-61.

Coutu, D. L. (2003). Sense and Reliability. *Harvard Business Review*, Vol. 81, pp. 84-90.

Crawford, L. and Pollack, J. (2007) "How Generic Are Project Management Knowledge And Practice?" *Project Management Journal*. Vol.8 No. 1, pp87-96.

Davies, A. and Mackenzie, I. (2014) "Project complexity and systems integration: Constructing the London 2012 Olympics and Paralympics Games", *International Journal of Project Management*. Vol. 32 No. 5, pp773-790.

Galbraith, C. S. and G. B. Merrill (1996). "The politics of forecasting: Managing the truth." *California Management Review*, Vol. 38 No. 2, pp. 29-42.

Geraldi J., Kutsch E. and Turner N. (2011a) 'Towards a conceptualisation of quality in information technology projects' *International Journal of Project Management*, Vol. 29 No. 5, pp. 557-567

Geraldi, J., Maylor, H., and Williams, T. (2011b). "Now let's make it really complex (complicated): A systematic review of the complexities of projects." *International Journal of Operations and Production Management*, Vol. 31 No. 9, pp. 966–990.

Gibson, C. B. and Birkinshaw, J. (2004), "The Antecedents, Consequences, and Mediating Role of Organizational Ambidexterity", *Academy of Management Journal*, Vol. 47 No. 2, pp. 209-226.

Junni, P., Sarala, R.M. Taras, V., Tarba, S.Y. (2013). Organizational Ambidexterity and Performance: a Meta-Analysis. *Academy of Management Perspectives*, Vol. 27 No. 4, pp. 299-312.

Keizer, J. A. and Halman J. I. M. (2007). "Diagnosing risk and radical innovation projects." *Research Technology Management*, Vol. 50 No. 5, pp. 30-36.

Klein, B. and Meckling, W. (1958) "Application of Operations Research to Development Decisions" *Operations Research*, Vol. 6 No. 3, pp 352-363.

Kutsch, E., Browning T. R. and Hall M. (2014). "Bridging the risk gap: The failure of risk management in innovative IS projects." *Research Technology Management*, Vol. 57 No. 2, pp. 26-32.

Lenfle, S. and Loch, C. (2010) "Lost Roots: How Project Management Came to Emphasise Control over Flexibility and Novelty" *California Management Review*, Vol. 53 No. 1, pp. 32-55.

Leybourne S.A. and Kennedy M. (2015), "Learning to Improvise, or Improvising to Learn: Knowledge Generation and 'Innovative Practice' in Project Environments" *Knowledge and Process Management*, Vol. 22 No. 1, pp. 1-10

Leybourne S.A. and Sainter P. (2012) "Advancing Project Management: Authenticating the Shift from Process to "Nuanced" Project-based Management in the Ambidextrous Organization" *Project Management Journal* Vol. 43 No. 6, pp 5-15,

Liu L. and Leitner D. (2012). "Simultaneous Pursuit of Innovation and Efficiency in Complex Engineering Projects-A Study of the Antecedents and Impacts of Ambidexterity in Project Teams." *Project Management Journal*, Vol. 43 No. 6, pp. 97-110.

- Lubatkin, M. H., Simsek, Z., Ling, Y. and Veiga, J. F. (2006), "Ambidexterity and Performance in Small- to Medium-Sized Firms: The Pivotal Role of Top Management Team Behavioral Integration" *Journal of Management*, Vol. 32 No. 5, pp. 646-672.
- March, J. G. (1991) "Exploration and Exploitation in Organizational Learning" *Organization Science*, Vol. 2 No. 1, pp. 71-87.
- Maylor, H., Brady, T., Cooke-Davies, T. and Hodgson, D. (2006), "From projectification to programmification", *International Journal of Project Management*, Vol. 24 No. 8, pp. 663-674.
- Maylor H., Turner N., and Murray-Webster R. (2013) "How Hard Can It Be? Actively Managing Complexity in Technology Projects" *Research Technology Management*, Vol. 56 No. 4, pp. 45-51.
- Mom, T. J. M., Van den Bosch, F. and Volberda, H. W. (2009), "Understanding Variation in Managers' Ambidexterity: Investigating Direct and Interaction Effects of Formal Structural and Personal Coordination Mechanisms" *Organization Science*, Vol. 20 No. 4, pp. 812-828.
- Nemanich, L. A. and Vera, D. (2009). "Transformational leadership and ambidexterity in the context of an acquisition", *Leadership Quarterly*, Vol. 20 No 1, pp. 19-33.
- O'Reilly, C. A. and Tushman, M. L. (2004), "The Ambidextrous Organization", *Harvard Business Review*, Vol. 82 No. 4, pp. 74-81.
- O Reilly, C.A.; Tushman, M.L. (2013) "Organizational Ambidexterity: Past, Present, and Future", *Academy of Management Perspectives*, Vol. 27 No. 4, pp. 324-338.
- O'Reilly, C.A., Tushman, M.L., (2011) "Organizational ambidexterity in action: how managers explore and exploit", *California Management Review*. Vol. 53 No. 4, pp.5-22.

Pellegrinelli S., Murray-Webster R. and Turner N. (2015) "Facilitating Organizational Ambidexterity through the Complementary Use of Projects and Programs" *International Journal of Project Management*, Vol. 33 No. 1, pp. 153-164.

Piperca, S. and Floricel, S. (2012) "A typology of unexpected events in complex projects", *International Journal of Managing Projects in Business*, Vol. 5 No. 2, pp. 248-265.

Pitsis, T. S., Sankaran, S., Gudergan, S., Clegg, S. R. (2014) "Governing projects under complexity: theory and practice in project management", *International Journal of Project Management*, Vol. 32, No. 8, pp1285-1290.

Raisch, S. and Birkinshaw, J. (2008), "Organizational Ambidexterity: Antecedents, Outcomes, and Moderators", *Journal of Management*, Vol. 34 No. 3, pp. 375-409.

Reason, J. (1990). *Human error*. Cambridge, Cambridge University Press.

Roberts, K. H. and C. Libuser (1993). "From Bhopal to banking: Organizational design can mitigate risk." *Organizational Dynamics*, Vol. 21 No. 4, pp 2-17.

Rochlin, G. I., Ed. (1993). "Defining "High Reliability" Organisations in Practice: A Taxonomic Prologue", *New Challenges in Understanding Organisations*. New York, Macmillan.

Rochlin, G. I. (1996). "Reliable Organisations: Present Research and Future Directions." *Journal of Contingencies and Crisis Management*, Vol. 4 No. 2, pp. 55-59.

Sage, D., Dainty, A. and Brookes, N. (2014) "A critical argument in favor of theoretical pluralism: Project failure and the many and varied limitations of project management", *International Journal of Project Management*, Vol. 32 No. 4, pp544-555.

Tiwana, A. (2008), "Do bridging ties complement strong ties? An empirical examination of alliance ambidexterity", *Strategic Management Journal*, Vol. 29 No. 3, pp. 251-272.

Turner, J.R. and Cochrane, R.A. (1993), "Goals-and-methods matrix: Coping with projects with ill defined goals and/or methods of achieving them", *International Journal of Project Management*, Vol. 11 No. 2, pp. 93-102.

Turner, N., and Lee-Kelley, L. (2013), "Unpacking the theory on ambidexterity: An illustrative case on the managerial architectures, mechanisms and dynamics", *Management Learning*, Vol. 44 No. 2, pp. 179-196.

Turner N., Maylor H. and Swart J. (2013a) "Ambidexterity in Managing Business Projects - An Intellectual Capital Perspective" *International Journal of Managing Projects in Business*, Vol. 6 No. 2, pp. 379-389.

Turner, N., Maylor, H. and Swart, J. (2015) "Ambidexterity in Projects: an Intellectual Capital Perspective", *International Journal of Project Management*, Vol. 33, No.1, pp. 177-188.

Turner, N., Swart, J., and Maylor, H. (2013b), "Mechanisms for managing ambidexterity: a review and research agenda", *International Journal of Management Reviews*, Vol. 15 No. 3, pp. 317-332.

Tushman, M. L. and O'Reilly, C. A. (1996), "Ambidextrous Organizations: Managing Evolutionary and Revolutionary Change", *California Management Review*, Vol. 38 No. 4, pp. 8-30.

Vogus, T. J. and Sutcliffe K. (2007), "The Impact of Safety Organizing, Trusted Leadership and Care Pathways on Reported Medication Errors in Hospital Nursing Unites." *Medical Care*, Vol. 45, pp. 1-6.

Weick, K. and Sutcliffe K. (2001), *Managing the unexpected: Assuring high performance in an age of complexity*. San Francisco, Jossey Bass.

Weick, K. and Sutcliffe K. (2007). *Managing the unexpected: Resilient performance in an age of uncertainty*. San Francisco, Jossey-Bass.

Weick, K., Sutcliffe K. and Obstfeld D. (2000), "High Reliability: The Power of Mindfulness", *Leader to Leader*, Vol. 17, pp.33-38.

Weick, K. (1987), "Organisational Culture as a Source of High Reliability" *California Management Review*, Vol. 29 No. 2, pp. 112-127.

Weick, K. and Roberts K. H. (1993). "Collective Mind in Organisations: Heedful Interrelating on Flight Decks." *Administrative Science Quarterly*, Vo.l. 38 No. 3, pp. 357-381.

Williams, T. (2008) "How Do Organizations Learn Lessons From Projects - And Do They?" *IEEE Transactions on Engineering Management*, Vol. 55 No. 2, pp248-266.

Williams, T., Klakegg, O. J., Walker, D. H. T., Andersen, B. and Magnussen, O. M. (2012) "Identifying and Acting on Early Warning Signs in Complex Projects", *Project Management Journal*, Vol. 43 No. 2, pp37-53.

FIGURES

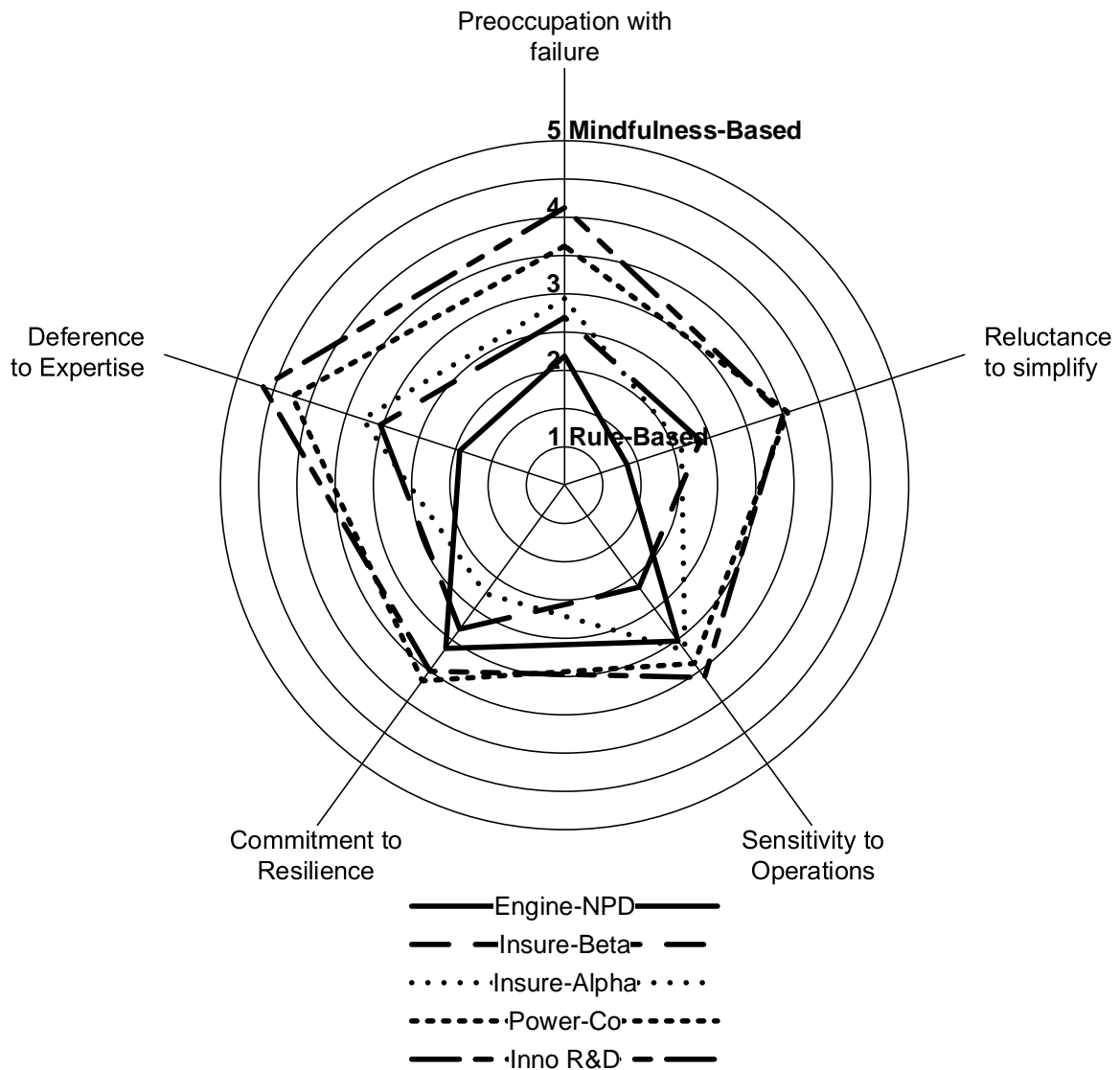


Figure 1: Collective Mindfulness – 5 principles of HRO (averages). 1=rule-based, 5=mindfulness-based.

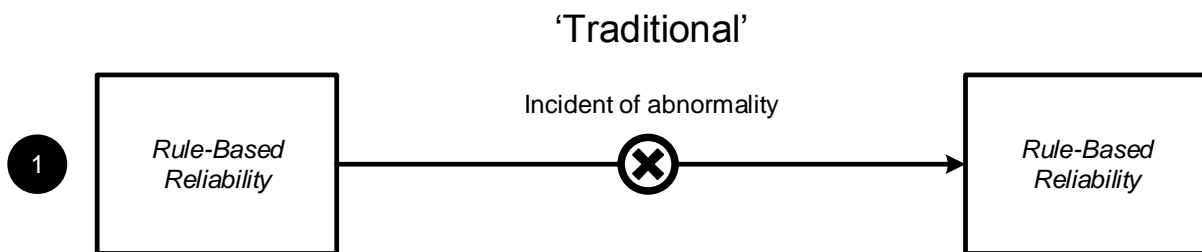


Figure 2: 'Traditional' mode of management

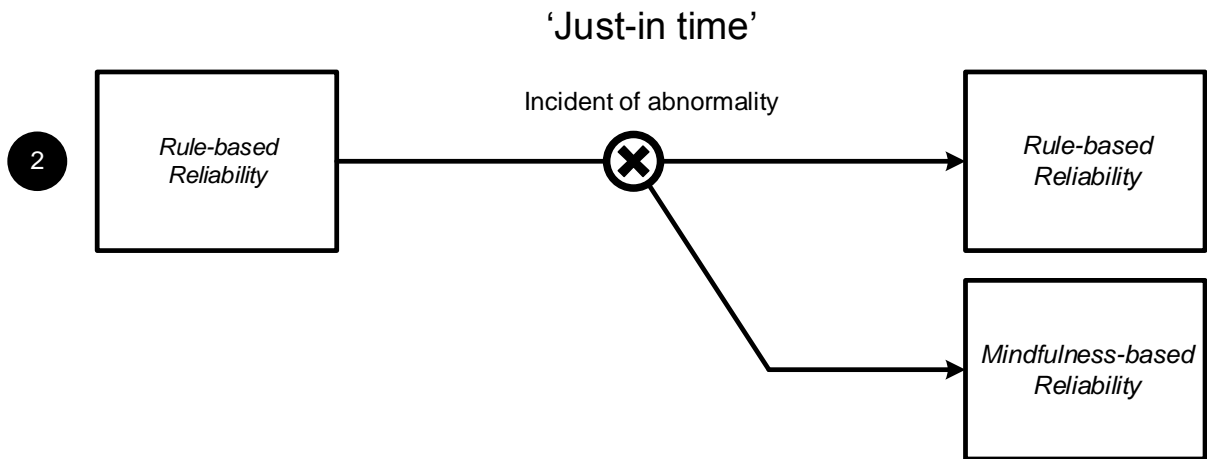


Figure 3: 'Just-in-time' mode of management

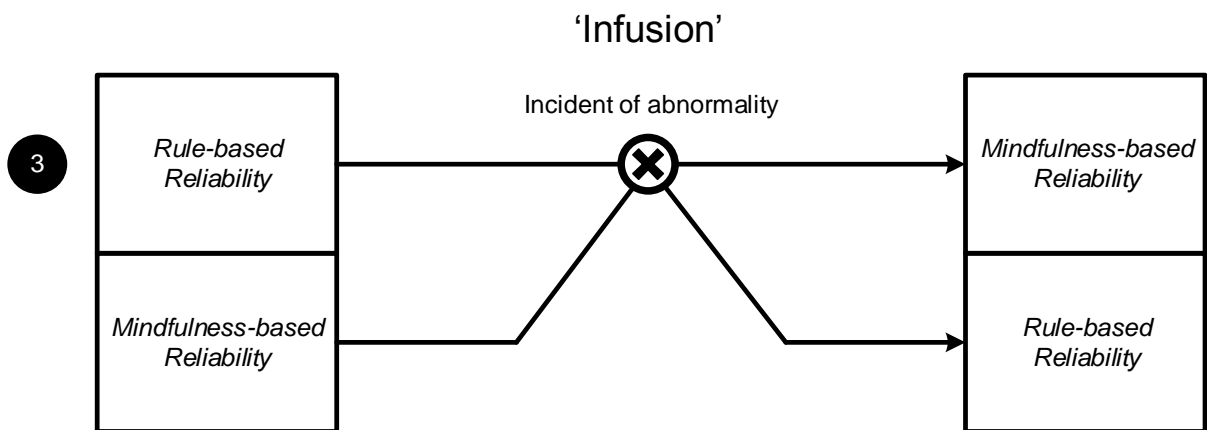


Figure 4: 'Infusion' mode of management

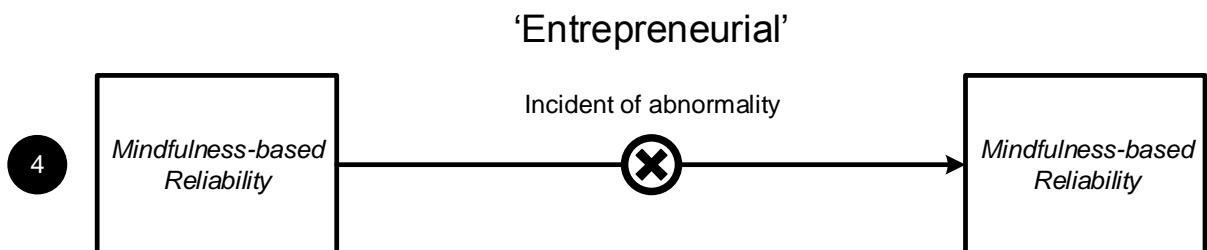


Figure 5: 'Entrepreneurial' mode of management

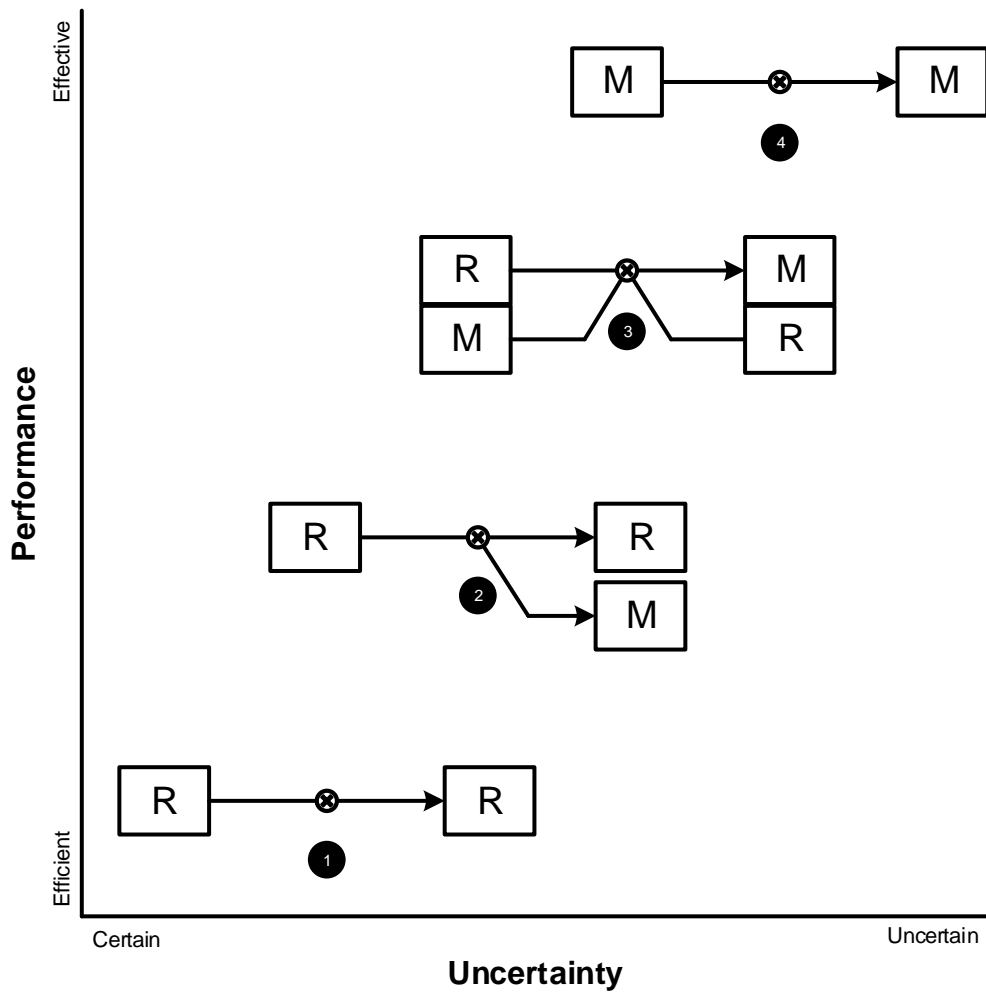


Figure 6: Conceptualisation of each mode of management

TABLES

Firm	Category	Number of survey responses	Percentage of work unit	Number of interviews	Separate incidents in work unit
Engine-NPD	NPD	32	92%	32	6
Insure-Alpha	Operational projects	82	63%	15	5
Insure-Beta	Operational projects	75	54%	16	4

Power-Co	Operational projects	84	62%	11	7
Inno-R&D	R&D project	116	86%	14	4

Table 1: Profile of survey and interview data