The impact of project portfolio management practices on the relationship between organizational ambidexterity and project performance success

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Abstract

Some studies suggest that organizational ambidexterity is best orchestrated through individual projects. However, stand-alone individual projects are relatively limited in scope, while suffering from susceptibilities to horizontal and vertical segmentation. This may render them poorly suited to serve as conduits for organizational ambidexterity. By contrast, organisations which deliver projects in portfolios, often in order to maximise resource utilisation, may discern that these also provide better conduits for organisational ambidexterity. This study examines not only the extent to which project portfolio management (PPM) practices impact orchestrations of organizational ambidexterity, but also whether these orchestrated PPM practices impact further lead to superior project performance. Data were collected from one hundred and sixty PPM stakeholders spread across eight countries in the Middle East November 2016 to January 2017. The study finds portfolios performance to be strongly and highly correlated with organizational ambidexterity. Furthermore, the more organizations exhibited

efficient project-portfolio-management practice, the more they were found to develop ambidextrous capabilities.
Keywords: Organizational ambidexterity, Project portfolio management (PPM); Projects; Project performance

1. Introduction

1.1 Context

Academic scholarship has traditionally suggested that in globalised operations, independent 'stand-alone' projects are key to orchestrating the strategic visions of the parent organizations (Chipulu et al. 2016; Kopmann et al. 2017; Maylor et al. 2018; Midler et al. 2019). This view recognises that projects involve non-routine, ad-hoc and one-off decisions. These decisions may be further laden with potentially helpful '*paradoxes'*, '*contradictions'* and '*dualities'* that have traditionally spoken to perceived needs for trade-offs between competing strategic expectations and positions (Roscoe and Blome 2019). Generally, '*Organizational ambidexterity*' is an approach that organizations can follow in order to accommodate spontaneous and dynamic tensions arising between management practices by simultaneously engaging in contradictory explorative and exploitative behaviour (Tushman and O'Reilly 1996; O'Reilly and Tushman 2013).

1.2 The problem setting

It is commonly accepted that orchestrations of ambidexterity are challenging because of the distinct structural and competency requirements required to support the multiple distinct and contradictory constructs and related practices at issue (Tushman and O'Reilly 1996; O'Reilly and Tushman 2013; Luger et al. 2018; Martin et al. 2019). These differences mean that finding appropriate organizational conduits for organizational ambidexterity is critical. Often individual projects are viewed as able to provide such conduits (Eriksson 2013; Turner and Lee-Kelley 2013; Turner et al. 2015; Petro et al. 2019). As our literature review will explain, a number of descriptive and normative perspectives underlie this view (e.g. commonplace views of individual projects as seamlessly engaged in continuous iteration and adjustment).

Contrary perspectives express concern that individual projects are susceptible to high fragmentation, and so they look to alternative forms of project orchestration for organizational ambidexterity. One particular form, sometimes preferred, involves combined use of *projects* and

programmes (Pellegrinelli et al. 2015). Midler et al. (2019) prefers *programmes* over *projects*. In this context, drawing from both Stal-Le Cardinal and Marle (2006; p. 226) and Pellegrinelli (2011; p. 236), we define a 'project' as a "…*temporary, but deliberate manifestation of an intent to utilise structured techniques and approaches to efficiently deliver tangible deliverables*". More specifically, the management of programmes is concerned with projects that maintain similar objectives and resources. Programmes also encompass projects that share dependencies. They also generally tend to be commissioned for a specific client, with benefit accrual emanating from projects which are jointly managed (Sohani and Singh 2017).

However, the present research concurs with the view that project '*portfolios'* serve as a much more effective and efficient platform for coordination between projects (Teller et al. 2012; Martinsuo 2013; Patanakul 2015; Kopmann et al. 2017; Petro 2017; Petro et al. 2020). In particular, this is because 'portfolios' which each deal with the "…*coordination and control of multiple projects"* (see Martinson 2013; p. 794), may involve multiple projects pursuing sometimes different and contradictory strategic goals. Thus, in ensuring that diverse priorities are balanced (including the effective and efficient utilization of scarce project resources- see Kock et al. 2020), Project Portfolio Management (PPM) serves as an ideal platform for the management of organizational ambidexterity (see Pellegrinelli et al. 2015; Bresciani et al. 2018). One important consideration driving preferences for *portfolios* as against *programmes* in order to orchestrate organizational ambidexterity is that organizations do not generally practice '*single project management*' (Martinsuo and Lehtonen 2007; Görög 2011). Rather, instead of commissioning and implementing single 'stand-alone' projects (Eriksson 2013), organizations typically tend to commission, implement and manage projects in portfolios (groups) of concurrent and interdependent projects (Archer and Ghasemzadeh 1999).

1.3 The research aim and question

This research therefore sets out to examine the extent to which project portfolio management (PPM) practices impact orchestrations of organizational ambidexterity, and whether these PPM practices further impact the abilities of organizations to channel their ambidextrous capabilities towards superior project performance. At the crux of our enquiry is whether '*Project portfolio management'* enables / increases the effect of '*Organizational ambidexterity'* on '*Project performance successes'*. We therefore present our research question as:

RQ*: To what extent do Project Portfolio Management (PPM) practices impact upon the orchestration of ambidexterity, and do these practices impact upon an organization's ability to channel its ambidextrous capabilities towards superior project performance?*

This research question is framed for consistency with the practice of 'gap spotting' in the formulation of research questions (see Sandberg and Alvesson 2011; Hällgren 2012). Notably, the gap which our research question addresses appears to exist despite literature asserting that PPM is optimal for managing and actualizing projects/programmes (Pellegrinelli et al. 2015), and other literature which has primarily focused on understanding the challenges that organizations face which may be resolvable through PPM (Petro et al. 2020). Recognising that such research is obliquely related to our own, we explore territory (Handfield and Melnyk 1998, p. 324) in the interplay between (i) *Organizational project portfolio management (PPM)*, (ii) *Organizational ambidexterity* and (iii) *Project performance (project success)*; one secondary outcome of exploring such territory will be our extension of the above project-focused ambidexterity literatures.

1.4 Structure of the paper

The next section (section 2) gives an overview of the relevant literature in organizational ambidexterity. This commences with a review of relevant concepts. We also examine Project portfolio management (PPM) literature, and the relationship between PPM and organizational ambidexterity. In section 3, we present the research methodology, which is based on data obtained between November 2016 and January 2017 from one hundred and sixty practitioners. It is explained that the questionnaire was improvised from organizational scale measures developed earlier by Lubatkin et al. (2006). In section 4, we report the results of the data analysis, which was undertaken using *IBM SPSS Statistics software version 22*. Discussions of implications from findings are presented in section 5. The paper concludes in section 6 by attesting to the importance of the portfolio approach while calling attention to its advantages with some critical reservations.

2. Organizational ambidexterity

2.1 What is organizational ambidexterity?

At its very basic form, '*organizational ambidexterity*' is a concept that seeks to explain the competencies and capabilities which organizations need to develop and maintain in order to successfully engage in the *simultaneous* co-existence, trade-off and switching between '*exploration of new possibilities'* and '*exploitation of old certainties'* (March 1991; Tushman and O'Reilly 1996; O'Reilly and Tushman 2013). *'Organizational ambidexterity'* refers to an organization's ability to "…*simultaneously* (i.e., concurrently*) pursue both incremental and discontinuous innovation and change*…" (Tushman and O'Reilly 1996, p. 24). Two relevant terms of action are important here. First, the '*exploration of new possibilities'* focuses on search and discovery actions (March 1991). This construct is both strategic and experimental in character, being focused on 'distant' knowledge (Petro et al. 2019, 2020). Second, the '*exploitation of old certainties'* focuses on deriving advantage from current and evolved management initiatives and other practices, not only recognising but also actively regulating and cultivating the organizational efficiencies and internal organizational consistencies with which these activities are associated (March 1991). Exploitation is therefore more tactical than strategic in character, being associated with 'near' knowledge that is more likely to emerge from existing management information (Petro et al. 2020).

Generally, organizational ambidexterity literature assumes tensions not just between management practices in general, but more specifically, and thinking more reflexively here, it also considers tensions associated with trade-offs which organizational ambidexterity effort generates itself. In effect, it assumes such tensions will be greater where there is more organizational capacity to engage in the necessary structural separation effort (Simsek et al. 2009).

The literature posits that exploration and exploitation requires different but complementary organizational structures and designs. For example, exploration generally thrives under decentralized structures while exploitation requires more centralization. The literature also posits that organizations simultaneously pursuing and switching between exploration and exploitation will outperform those that do not, as they develop complementary competencies (Luger et al. 2018; Wolf et al. 2019). This view of 'complementary' suggests that an organization's ability to pursue exploration is more likely to be successful when undertaken in the presence of a simultaneous pursuit of exploitation and *vice versa* (Levinthal and March 1993).

2.2 Projects as conduits for organizational ambidexterity

Three reasons predominate within literature, for regarding individual projects as the most appropriate conduit for organizational ambidexterity. *First,* operational routines can be implemented and managed (Hayes 2002). *Second,* project management as a discipline is very familiar with demands associated with balancing the need for certainty (via the use of *formalized* project management methods: Milosevic and Patanakul 2005) against the need to create the space for unanticipated challenges (Gross 2014; Klein et al. 2015). Individual project structures also allow for easy switching of project resources between '*exploitation'* and '*exploration'* activities. *Third*, management of individual projects can readily oversee continuous adjustments without major disruptions to team structures, particularly since projects are inherently ephemeral (Söderlund 2013; Tryggestad et al. 2013) and temporal (Söderlund 2013). Furthermore, most project teams are organized for delivering one-off tasks with pre-designated (usually) completion dates. They are also structured amorphously (Scott-Young and Samson 2009), allowing for flexible self-organizing (Manning 2017) and also for professionals to be rotated in and out of the project for designated tasks (Riis and Pedersen 2003) with minimal disruption (Scott-Young and Samson 2009). Furthermore, project teams are usually subjected to flexible role-balancing between 'reserved legitimacy', which comes with appointment to their role, and 'status hierarchy', which comes from participation within project governance (Clegg and Courpasson 2004).

The extent to which individual projects facilitate individual manager adjustment is therefore also key. Lee et al. (2006) found software development project managers engaging in ambidextrous coping strategies. Aubry and Lièvre (2010) examined the experience of duality associated with varying action modes over project lifecycles. Lin and McDonough (2011) found a correlation between project leadership and innovation ambidexterity. Hoang and Rothaermel (2010) looked at organizations (at the strategic and operations level) and their managerial participation in different alliances and external partnerships, suggesting that the '*exploration'* construct of ambidexterity, within this frame, negatively impacted project outcomes, while the '*exploitation'* construct exerted positive impact. In summary, then, the relationship between organizational ambidexterity and project-related performance suggests that stronger manifestations of ambidexterity (i.e. ambidextrous capabilities) in individual project management is likely to lead to stronger project performance (Jansen et al. 2012; Cegarra-Navarro et al. 2019; Dezi et al. 2019).

Reservations expressed, concerning preferences for individual projects as conduits for organizational ambidexterity, include the following. Projects are increasingly complex, particularly by

reliance on distributed and networked teams. This can lead to high levels of both horizontal and vertical fragmentation (Fellows and Liu 2012; Alashwal and Fong 2015). Here, while horizontal fragmentation implies that projects increasingly involve multiple and heterogeneous specialist-functional actors, vertical fragmentation recognises project delivery processes as disruptively phase-managed by actors drawn from multiple levels of organizational hierarchies. Reasons given for high internal fragmentation include heterogeneous stakeholder objectives (Chipulu et al. 2019), diverse cultural perspectives on projects (Chipulu et al. 2014, 2016; Ojiako and Chipulu 2014; Ojiako et al. 2015a, b), functional and role specialisation (Ojiako et al. 2014) and preference for projects to be monitored and controlled within distinct stage or phase boundaries (Parvan et al. 2015). Sometimes such fragmentation has led to projects being characterised by not only poor flow of information, knowledge and learning, but also limited sharing of resources. This has led to calls for more inter-project coordination ("*No project is an island*", Engwall 2003; p. 789) recognising that projects are increasingly interdependent with other projects and are likely to enhance their performance by leveraging this interdependence. Accordingly, in the next section we consider the project portfolio perspective.

2.3 Portfolios as an alternative conduit for organisational ambidexterity

Unlike programmes which are interested in projects that maintain similar objectives and resources, project portfolio management (PPM) is more focused on maintaining a centralised perspective of its constituent projects. The primary aim, here, is to ensure that there is limited or no competition among specific projects for resources (Sohani and Singh 2017). Through portfolios, organizations can provide platforms for resource sharing between projects, leveraging not only information, knowledge and learning, but also competencies and resource expertise from partner projects (Hoang and Rothaermel 2010; Jansen et al. 2012; Stettner and Lavie 2014; Wassmer et al. 2017). In effect, portfolios serve as boundary-spanning platforms that facilitate bridging of sometimes highly diverse projects (Montibeller et al. 2009; Kornfeld and Kara 2011). Portfolios can also provide some level of predictable institutional regulatory and cultural context for managing and coordinating resources across projects, and they can further be used to optimise risk ownership distributions. Using portfolios in this way, an organization can increase the performance of individual projects within the portfolio.

Portfolios vary by type (see Bresciani et al. 2018; Luger et al. 2018; Wolf et al. 2019). One type is where constituent individual projects are relatively dis-similar, perhaps lacking overall networked

coordination. This type may be more suitable in circumstances where the organization is particularly interested in '*explorative'* operations strategies (and individual supporting projects). In such portfolios, there is likely to be a focus on 'upstream' projects requiring new knowledge creation. Examples include New Product Development (NPD) projects. Conversely, an organization that is more interested in '*exploitative'* operations strategies may focus its attention on portfolios comprising projects which are either part of the same coordinating network(s) or which are in varying ways homophilic with each other. Here, the emphasis is likely to be on collaborating for 'downstream' endeavours. Examples include projects focused on product commercialization.

A number of salient factors discussed in alliance theory provide insight into the ambidextrous capabilities of portfolios (Teller et al. 2012; Sun and Lo 2014; Stettner and Lavie 2014; Wassmer et al. 2017; Degener et al. 2018). These factors include portfolio maturity and coordinating experience. Portfolio maturity and co-ordinating experience involve particular aligning mechanistic tendencies. As portfolios become more mature and their constituent projects become embedded within their information and knowledge networks, and also more reliant on complementary resources, they become more likely to emphasise exploitation. Similarly, portfolios with substantial coordinating experience (and associated mature/efficient mechanisms) are more likely to focus towards downstream endeavours, thus also preferring exploitation.

The use of portfolios serves to mitigate against the challenges of dual pulls experienced by single projects seeking to pursue contradictory strategic objectives. In this vein, project portfolios are likely to serve as better conduits of ambidexterity in that they represent a more appropriate platform to deal with the tensions that arise from exploration and exploitation. This is because portfolios allow for the facilitation of permeability across project boundaries, thus leveraging more varied competencies for ambidextrous management practice. It must be noted, drawing from Tiwana (2008), that while project portfolios are associated with various ambidexterity-related and project performance benefits, these can be mediated by the ties (relationships) between the participating projects. Thus, projects exhibiting *strong* inter (homogeneous) portfolio relationships may be much better able to implement exploitative initiatives, while at the same time being *less* able to develop these initiatives. Conversely, projects within the same portfolios which exhibit *strong* heterogeneous portfolio relationships are arguably very often *less* likely able to implement exploitative initiatives, while being *more* likely to develop these initiatives. In effect, then, project portfolios with individual projects that are more able to forge relationships with other projects outside the same portfolio, and which therefore

become connected to other projects with varying skills, expertise and competencies, are more able to generate new ideas. Nonetheless, they are arguably very often less able to successfully implement these initiatives. Hence, our first hypothesis considers that the performance PPM practices impact upon the orchestration of ambidexterity.

H1a. Portfolio performance is correlated with the orchestration of organizational ambidexterity

2.4 Organizational ambidexterity and superior project performance

The literature opines that organizations engaged in exploration-focused projects are likely to end up in endless '*search and innovation*' that remains underexploited (Junni et al. 2015; Petro et al. 2019) unless they develop strategic capabilities that are '*rare'* and '*inimitable'* (Barney 1991, 1996, 2001; Barney et al. 2001). Moreover, investing or promoting projects focused primarily or solely on exploration is an inherently risky strategy. This is because advantages to be gleaned from such projects can take years to be realised, if at all (Lubatkin et al. 2006). In fact, organizations investing or promoting projects predominantly focused on exploitation may become increasingly less willing and able to search for new opportunities; hence, their existing skill base may become obsolete (Levinthal and March 1993). Focusing equally on exploration and exploitation, on the other hand, is likely to place an organization in a position where it both enshrines its *current* core competencies and becomes willing and able to search for and develop *future* capabilities.

Generally, the high rate of uncertainty associated with project environments raises questions relating to how portfolios perform (as ambidexterity conduits) in terms of effectiveness and efficiency (see Lin et al. 2007). Here, we have drawn upon the earlier works of Neely et al. (1995; p. 80) to define '*performance'* as "…*the effectiveness and/or efficiency of action*". From this literature, '*effectiveness'* refers to the degree to which a project meets stakeholder specifications and expectations, while '*efficiency'* refers to resources deployed to meet stakeholder specifications and expectations. Drawing from Cooke-Davies (2002; p. 188), project performance, thus conceived, further predicts project success.

Drawing from the literature, it is widely proposed that when organizations simultaneously engage in both exploration and exploitation, they are likely to outperform organizations that emphasise just one of these (Jansen et al. 2012; Junni et al. 2013; O'Reilly and Tushman 2013; Hughes 2018; Luger et al. 2018). Thus, the literature acknowledges that ambidextrous competencies can

enhance performance across all levels of an organization (Junni et al. 2013). This same view is shared in project management literature where scholars have found that the existence of ambidextrous capabilities within project teams significantly contributes to project performance (De Visser et al. 2010; Liu and Leitner 2012; Turner et al. 2015). More often than not, co-dependency between the iterative clarification of objectives, continuous management review, and continuous striving towards more efficient cycles of feedback, will lead to a key competency whereby the project is better able to avoid various process and learning traps that threaten project performance (Chandrasekaran et al. 2012). Sohani and Singh (2017) note that ambidexterity plays a critical role in achieving project success. Hence, our second hypothesis considers that an organization's ability to channel its ambidextrous capabilities will drive superior project performance.

H2a. Ambidexterity is correlated with superior project performance.

3. The study

3.1 The study and hypotheses

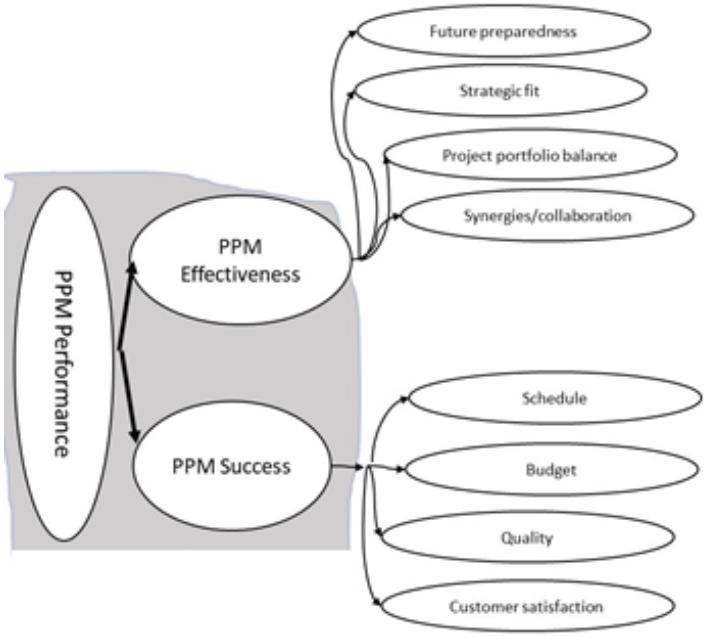
We wish to examine the relationship between Project Portfolio Management (PPM), organizational ambidexterity and (individual) project performance success. Study of the literature aligned to our own experience indicates possible relationships, but clearly a quantitative study was needed. We therefore undertook a survey relating these three areas together. While this raises the possibility of Common Methods bias (Podsakoff et al 2003), it does nonetheless provide an initial study of these relationships.

3.2 Description of the survey instrument

For the study, we employed a questionnaire (Appendix B) consisting of five sections structured as follows. The first section (questions 1 to 5) focused on respondent demographics, while the second section tapped evaluations of overall organizational success relative to competitor organizations. The third section focused on more specific evaluations of project performance, construing '*PPM performance'* in simple terms as a combination of '*PPM effectiveness'* and '*PPM success'*. Here, '*PPM effectiveness'* denotes the degree to which use of PPM is perceived to meet stakeholder specifications or expectations (see Neely et al. 1995). On the other hand, our '*PPM success'* construct denotes perceptions that the intended goals of every project within the portfolio were actually delivered (see

Chipulu et al. 2019; p. 1074). *PPM effectiveness* comprises: (i) '*'Future preparedness'* (Meskendahl, 2010; Petro and Gardiner 2015), (ii) *'Strategic fit'* (Jonas et al. 2010; Petro and Gardiner 2015), (iii) *'Project portfolio balance'* (Jonas et al. 2010; Petro and Gardiner 2015), and (iv) '*Synergies/collaboration'* between business units (Jonas et al. 2010). While *'Future preparedness', 'Strategic fit'* and *'Synergies/collaboration'* employed three measures of assessment, '*Project portfolio balance'* employed five measures. Four measures were used for '*PPM success'* (schedule, budget, quality, and customer satisfaction). These associations are diagrammatically represented in Figure 1 below. The fourth section focused on perceived ambidexterity (see the following section). The fifth (final) section of the questionnaire focused on perceived synergies and collaboration between projects (within a portfolio).

Figure 1: Influence relationships



3.3 Scale measures for ambidexterity

As with Lubatkin et al.'s (2006) study, the twelve ambidexterity items used for the present research were measured by a 5-point Likert scale, ranging from 1 ('*strongly disagree'*) to 5 ('*strongly agree'*). The *scale measures* for '*exploration'* and *'exploitation'* employed in this study are shown in *Appendix A* (adapted from Lubatkin et al. 2006), which was based on earlier measures developed by He and

Wong (2004)). The original He and Wong (2004) scale measured views concerning how well organizations shift their product design attention and resources between explorative and exploitative objectives. The Lubatkin et al. (2006) scale was innovative by employing twelve items balanced evenly between '*exploration'* and '*exploitation'*. These two constructs were included as distinct, but not separate, within one unitary measure designed to recognise their complementary contributions to organizational ambidexterity. This 'additive' measurement approach has also since been followed by other scholars (see Jansen et al. 2012, 2009; Yu et al. 2013).

As the questionnaire (Appendix B) shows, we made the following changes to the original Lubatkin et al. (2006) scale measures. First, on the grounds that project performance success criteria have traditionally involved independent measures of time, cost and quality (e.g. Atkinson 1999; Ojiako et al. 2008; Chipulu et al. 2019), we separated quality and cost (item 7 of Lubatkin et al.). We also dropped item 12 of Lubatkin et al.'s exploitation measure on grounds of its irrelevance to our study. We made no changes to Lubatkin et al.'s exploration items.

3.4 Hypotheses

The hypotheses stated above now become more precisely:

> **H1b**. Portfolio performance (PPM effectiveness and PPM success) is correlated with the organizational ambidexterity (using Lubatikin's measure).
>
> **H2b**. Organizational ambidexterity (using Lubatikin's measure) is correlated with project-management success (schedule/budget/quality/satisfaction)

3.5 Administration of the survey instrument

The survey instrument (in English) was administered online to respondents predominantly based in the Middle East. Each of the researchers approached practitioners within their individual networks on the basis of likely relevant (current or very recent) experience. As Chipulu et al. (2014) noted, although arguably a form of non-probability sampling technique, this means of identifying survey respondents is generally employed in research settings such as our present study, where there is no comprehensive frame for sampling respondents deemed to possess the appropriate experience from which relevant information, knowledge and learning can be gleaned. Data collection was undertaken between November 2016 and January 2017. Of the 248 returned responses, we discarded 88 responses because

they were either (i) incomplete or (ii) there were key critical items relating to ambidexterity which were not answered. This left 160 usable responses.

3.6 Brief descriptive overview of demographics

The overall industry distribution of the respondents suggests a combination of Construction (25.6%), Engineering (16.2%), Allied consultancy (9.4%) and Manufacturing (10%), amounting to 61.2% of the total respondents. 41.9% of the respondents worked for organizations with more than 300 employees, 26.9% worked for organizations employing between 75 and 300 staff. More than 65% of the respondents (107 respondents) were drawn from senior to top management levels of their organizations.

4. Analysis

4.1 Factor analysis

The survey data were analysed using a combination of approaches including (i) Factor, (ii) Correlation and (iii) Regression analysis. Adopting an approach similar to that of Chipulu et al. (2014), we opted to test both hypotheses simultaneously.

Factor analysis was carried out on the selected variables in order to establish the three central constructs comprising the research model: '*PPM effectiveness'*, '*Ambidexterity'* and *'Project performance'.* An exploratory factor analysis (CFA) was conducted using the factor reduction function in *IBM SPSS Statistics software version 22*. To test the factor loadings per construct, a *Varimax* rotation with a minimum of 25 iterations was used. In summary, the four variables used to describe PPM *effectiveness* (*'future preparedness', 'strategic fit', 'project portfolio balance', 'synergies/collaboration'*) loaded successfully on the four different factors, as shown in Table 1 (below). A few items, as shown, were now dropped for not contributing.

Table 1: Factor analysis for '*PPM effectiveness'*

Items	**Factors**			
	1	**2**	**3**	**4**
Future preparedness 1	0.706			
Future preparedness 2	0.806			
Future preparedness 3	0.522			
Strategic fit 1		0.775		
Strategic fit 2		0.746		

Strategic fit 3		0.596		
Portfolio balance 1			*0.376*	
Portfolio balance 2			*0.163*	
Portfolio balance 3			0.614	
Portfolio balance 4			0.778	
Portfolio balance 5			0.792	
Synergies 1				0.627
Synergies 2				0.786
Synergies 3				0.879

The two variables for ambidexterity ('*Exploration'* and '*Exploitation'*) loaded successfully, with their 12 items loading on two corresponding factor domains in line with expectation. This is shown in Table 2. A few items designed to tap ambidexterity were however jettisoned due to their relatively poor contributions. The two variables ('*Performance'* and '*Success'*) used to describe project performance and success also loaded successfully on two different factors as shown in Table 3. All items for this construct loaded successfully and were retained.

Table 2: Factor analysis for '*Ambidexterity'*

Items	**Factors**	
	1	**2**
Exploration 1	0.849	
Exploration 2	0.817	
Exploration 3	0.846	
Exploration 4	0.768	
Exploration 5	0.593	
Exploration 6	*0.499*	
Exploitation 1		*0.444*
Exploitation 2		0.858
Exploitation 3		*0.445*
Exploitation 4		*0.436*
Exploitation 5		0.622
Exploitation 6		0.582

Table 3: Factor analysis for '*PPM performance and success'*

Items	**Factors**	
	1	**2**

Project portfolio performance 1	0.737	
Project portfolio performance 2	0.821	
Project portfolio performance 3	0.854	
Project portfolio performance 4	0.758	
Project portfolio success 1		0.748
Project portfolio success 2		0.647
Project portfolio success 3		0.780
Project portfolio success 4		0.834

The relationship of ambidexterity with both was first of all tested, thereafter testing mediation with project performance separately due to its greater involvement with ambidexterity. All factors were then tested for reliability and internal consistency. These tests used all items that had loaded successfully into their relevant factors by *Cronbach Alpha* (Nunnally 1978). In taking this decision it was noted that while *Cronbach's alpha* has traditionally been used for this purpose, composite reliability tests are becoming more popular; nonetheless, according to Peterson and Kim's (2013) influential study, the differences are 'relatively inconsequential'. The test showed all factors to be reliable. Almost all alphas were 0.7 and above, as Table 4 shows.

Table 4: Reliability test and KMO results for all factors.

Factor	**Number of items**	**Items reduced to**	**Cronbach alpha**	**KMO**
Project portfolio performance	4	NA	0.829	0.750
Average project portfolio' success	4	NA	0.779	0.747
Future preparedness	3	NA	0.754	0.677
Strategic fit	3	NA	0.757	0.693
Portfolio balance	5	3	0.715	0.712
Use of synergies	3	NA	0.757	0.657
Exploration	6	5	0.885	0.864
Exploitation	6	3	0.850	0.852
Global factor: PPM performance and success	*2*	*NA*	*0.620**	*0.500**
Global factor: PPM effectiveness	4	NA	0.791	0.860
Global factor: Ambidexterity	2	NA	0.861	0.912
*Due to lack of reliability combined with a low KMO measure, constituent items were looked at separately in the further analysis.				

Although the '*PPM performance'* items loaded successfully on two separate factors, its two constituent factors, '*Performance'* and '*Success'* exhibited reliabilities below 0.7. The *Kaiser-Meyer-Olkin* (KMO) measure of sampling adequacy was carried out to ascertain the appropriateness of using factor analysis

and to further confirm the reliability of those measures selected for field investigations (Kaiser 1970). This measure represents the ratio between variables' squared correlation and their squared partial correlation. A KMO value closer to 0 represents a diversion between those variables, and hence, factor analysis may not be appropriate for testing. Good KMO results are those with a value that is higher than 0.7 (Hutcheson and Sofroniou 1999). KMO was measured using SPSS and presented in Table 7 (above), along with the reliability results.

4.2 Correlation analysis

A correlation analysis for factors constituting the research model was carried out using the bivariate Pearson correlation test (see Table 5, below). Too enable this, a data normality test was conducted using two methods. *First*, normality was checked visually by inspecting the graphs and figures generated through the descriptive analysis. A normal bell curve was detected for almost all the variables. This was slightly skewed to the right-hand side, indicating some participant optimism in responding to the field questionnaire. *Second*, the Kolmogorov-Smirnov statistical non-parametric test was carried out to confirm the visual findings for normality. A two-tailed correlation test was therefore performed to capture all possibilities of correlation.

Table 5: Correlation analysis.

		Correlation with row number										
Row		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
1	Project portfolio performance	1.000										
2	Average project portfolio success	0.450**										
3	Future preparedness	0.498**	0.575**									
4	Strategic fit	0.333**	0.530**	0.635**								
5	Portfolio balance	0.444**	0.577**	0.476**	0.490**							
6	Use of synergies	0.391**	0.468**	0.497**	0.454**	0.350**						
7	Exploration	0.494**	0.535**	0.691**	0.516**	0.512**	0.549**					
8	Exploitation	0.447**	0.580**	0.619**	0.561**	0.510**	0.555**	0.763**				
9	PPM performance and success	***0.863*****	***0.840*****	0.625**	0.497**	0.593**	0.498**	**0.603****	**0.599****			
10	PPM effectiveness	**0.539****	**0.687****	***0.847*****	***0.821*****	0.728**	0.737**	**0.736****	**0.724****	**0.710****		
11	Ambidexterity	**0.501****	**0.593****	0.699**	0.571**	0.545**	0.586**	***0.947*****	***0.930*****	**0.641****	***0.778*****	1.000

	Bivariate correlation analysis using the Pearson correlation method ** Correlation is significant at the 0.01 level (two-tailed) **Bold font** refers to relationships directly related to the quantitative research model ***Bold italic font*** represents a check for collinearity—that is, a correlation that exceeds 0.8 may trigger a case of collinearity (similar items) as per Field (2009)

The outcome of our study showed support moderately strong and highly significant (r = + 0.501 at sig = 0.01) for the relationship between ambidexterity and project performance, and moderately strong and highly significant (r = + 0.593 at sig = 0.01) for the relationship between ambidexterity and PPM success.

Ambidexterity was found highly correlated with the combined/clustered global factor *'Performance'* and '*Success'* at r = + 0.641 and sig = 0.01 also. Moreover, taking exploration and exploitation factors separately, these correlated with the factors for project performance and project success, both separately and clustered. '*PPM effectiveness'* was found highly correlated with ambidexterity at r = + 0.778 with sig = 0.01, suggesting that the more an organization or its business units exhibit an effective application of its PPM practices (measured through its '*PPM effectiveness'*), the higher the level of ambidexterity, which contributes to the explanation of H1b (Portfolio performance being PPM effectiveness and PPM success together). In particular, the model showed '*PPM effectiveness'* highly and strongly correlated with *'Performance'* at r = + 0.539, average projects '*success* at r = + 0.687, and the cluster of '*Performance'* and '*Success'* at r = + 0.710.

As a number of factors were significantly and highly intercorrelated within the model, a check for collinearity was necessary prior to moving on to regression analysis. Correlation values of 0.8 were taken as the threshold for collinearity (Field 2009). Collinearity here refers to the close dependence, and the exhibition of "non-independence," of the predictor variables (Dormann et al. 2013). This may occur, for example, upon measuring two very similar variables. For instance, one could be the "*age*" of a respondent and another could be their '*year of birth'*. Collinearity, in such cases, can easily inflate regression values (Dormann et al. 2013).

The correlation model shows '*Exploration'*, '*Exploitation'* and '*Ambidexterity'* as highly correlated. This, however, has already been assumed from widespread literature, reviewed earlier, which identified '*Exploration'* and '*Exploitation'* as *the* two ambidexterity constructs. The same applies for the other constructs '*PPM effectiveness*', '*PPM performance' and 'PPM success*'. However, since their correlation was close to 0.8, our study was particularly interested in the relationship between '*PPM effectiveness'* and '*Ambidexterity'*.

Collinearity between those factors was checked using the *Variance Inflation Factor* (VIF) measure (Field 2009). This measure shows whether a variable or a predictor has a strong linear relationship with the other variables(s) or predictor(s). It is based on Myers (1990) (see also Dormann et al. 2013), who suggests that VIF values above 10.0 may be problematic. However, it is worth noting that the guide for *IBM SPSS Statistics software version 22* suggests that any value above 2.0 is of concern. Based on this, several scenarios for the two constructs and their constituent variables were performed. The VIF for all variables can be seen in Table 6 to be less than 2.0, indicating that collinearity or multi-collinearity was not an issue.

4.3 Regression analysis and test for mediation

The previous section presented a correlation analysis between all the model variables. This section takes the analysis one step further using the *Ordinary Least Square (OLS) regression* method. *OLS* regression tends to be used to predict the behaviour of relationships and how they could act in future events (Field 2009). Regression was carried out to explore whether PPM practices mediate the relationship between ambidexterity and an organization's performance (see Table 6).

Table 6: Results of regression analysis for organizations

Table 6a: Results of regression analysis for organizations with 0–20 employees.					
Variable		**Model 1** Dependent variable *Performance*	**Model 2** Dependent variable *Ambidexterity*	**Model 3** Dependent variable *Performance*	**Model 4** Dependent variable *Performance*
(β)	Ambidexterity	0.326			-0.069
	PPM effectiveness		0.687*	0.556	0.604
R^2		0.106	0.472	0.309	0.312
Adjusted R^2		0.017	0.406	0.223	0.115
ANOVA F		1.186	7.157*	3.583	1.586
VIF		1.000	1.000	1.000	1.895 for all
* Significance < 0.05 level				** Significance < 0.01 level	
Table 6b: Results of regression analysis for organizations with 20–75 employees					
Variable		**Model 1** Dependent variable *Performance*	**Model 2** Dependent variable *Ambidexterity*	**Model 3** Dependent variable *Performance*	**Model 4** Dependent variable *Performance*
		0.525**			0.445*
(β)	Ambidexterity		0.674**	0.480*	0.545
	PPM effectiveness				
R^2		0.276	0.454	0.231	0.284
Adjusted R^2		0.254	0.438	0.208	0.239
ANOVA F		12.559**	28.283**	10.186*	6.347*
VIF		1.000	1.000	1.000	1.774 for all
* Significance < 0.05 level				** Significance < 0.01 level	
Table 6c: Results of regression analysis for organizations with 75–150 employees.					
		Model 1 Dependent variable	**Model 2** Dependent variable	**Model 3** Dependent variable	**Model 4** Dependent variable

		Performance	*Ambidexterity*	*Performance*	*Performance*
(β)	Ambidexterity	0.584*			0.016
	PPM effectiveness		0.827**	0.700**	0.687*
R^2		0.341	0.684	0.490	0.490
Adjusted R^2		0.308	0.668	0.466	0.437
ANOVA F		10.361*	43.288**	20.163**	9.140*
VIF		1.000	1.000	1.000	3.164 for all
* Significance < 0.05 level				** Significance < 0.01 level	

Table 6d: Results of regression analysis for organizations with 150–300 employees

		Model 1 Dependent variable *Performance*	**Model 2** Dependent variable *Ambidexterity*	**Model 3** Dependent variable *Performance*	**Model 4** Dependent variable *Performance*
(β)	Ambidexterity	0.146			0.143
	PPM effectiveness		0.588*	0.207	0.124
R^2		0.021	0.345	0.043	0.056
Adjusted R^2		-0.033	0.307	-0.013	-0.062
ANOVA F		0.392	8.964*	0.764	0.478
VIF		1.000	1.000	1.000	1.527 for all
* Significance < 0.05 level				** Significance < 0.01 level	

Table 6e: Results of regression analysis for organizations with 300 and more employees

		Model 1 Dependent variable *Performance*	**Model 2** Dependent variable *Ambidexterity*	**Model 3** Dependent variable *Performance*	**Model 4** Dependent variable *Performance*
(β)	Ambidexterity	0.544**			0.205
	PPM effectiveness		0.820**	0.582**	0.413*
R^2		0.296	0.672	0.339	0.352
Adjusted R^2		0.285	0.667	0.328	0.331
ANOVA F		26.465**	128.962**	33.277**	16.830**
VIF		1.000	1.000	1.000	3.047 for all
* Significance < 0.05 level				** Significance < 0.01 level	

In effect, our findings confirmed the general hypothesis that not only does the existence of ambidextrous capabilities significantly contribute to the performance of projects (***H2b***), but also that PPM capabilities do moderate the relationship between organisational ambidexterity and PPM success. Our findings thus support earlier literature suggesting that more ambidextrous capabilities will lead to higher levels of business and operational performance. As shown in Table 7 (below), the coefficient β (i.e., the slope of the regressed line) for ambidexterity in Model 1 was positive and highly significant ($\beta = 0.525$ at $sig < 0.01$), therefore supporting this finding. Our proposition that the more an organization or its business units exhibit an effective application of project portfolio management practice (measured by PPM effectiveness), the higher the level of ambidexterity (as presented in Model 2), is supported by the highly significant positive β coefficient ($\beta = 0.674$ at $sig < 0.01$) (***H1b***).

Table 7: Results of regression analysis for small and medium enterprises only.

Variable		**Model 1** Dependent variable *Performance*	**Model 2** Dependent variable *Ambidexterity*	**Model 3** Dependent variable *Performance*	**Model 4** Dependent variable *Performance*
(β)	Ambidexterity	0.525**			0.445*
	PPM effectiveness		0.674**	0.480*	0.545
R^2		0.276	0.454	0.231	0.284
Adjusted R^2		0.254	0.438	0.208	0.239
ANOVA F		12.559**	28.283**	10.186*	6.347*
VIF		1.000	1.000	1.000	1.774 for all
* Significance < 0.05 level; ** Significance < 0.01 level; VIF: Variance Inflation Factor					

To further explore whether PPM mediates the relationship between ambidexterity and an organization's performance, three steps were followed. First, we established that the independent variable (i.e., '*PPM effectiveness'*) influences the mediator (i.e., '*Ambidexterity'*). This was established and supported in Model 2, where $\beta = 0.674$ at $sig < 0.01$. Second, we established that the independent variable ('*PPM effectiveness'*) influences the dependent variable (performance). This was established in Model 3 at $\beta = 0.480$ and $sig < 0.05$, as shown in Table 7 (above). In the last step, the challenge was to demonstrate that the mediator (ambidexterity) influences the dependent variable (performance) with the independent variable (*'PPM effectiveness'*) controlled. If, in this last step, the effect of PPM effectiveness on performance is found to be no longer significant when the mediator 'ambidexterity' is in the model, then full mediation can be indicated - depending on how significant the model was.

Recognising the above, and as shown in Model 4 (Table10), a multiple regression analysis was performed using the two variables as independent variables – '*PPM effectiveness'* and '*Ambidexterity'*. The β coefficient for ambidexterity was found to be positive and significant at $\beta = 0.445$ and $sig < 0.05$. The *VIF* for all variables in the four models was measured and found to be less than 2.0, indicating that collinearity or multi-collinearity did not exist in these models, entailing their results are acceptable (Myers 1990; Field 2009).

5. Discussions

The study set out to explore to what extent project portfolio management (PPM) practices impact orchestrations of ambidexterity, and whether these practices further impact the abilities of organizations to channel their ambidextrous capabilities towards superior project performance. Generally speaking, these relationships were found to exist. However, our findings do also bring to the

fore a number of discussion points which we theorise below in the light of concepts drawn from organizational ambidexterity theory.

5.1 PPM practices and the successful orchestration of organizational ambidexterity

As relates to the first part of the research question (*To what extent do PPM practices impact upon the orchestration of ambidexterity*?), we found higher levels of organizational ambidexterity strongly and highly correlated with higher levels of PPM performance (PPM effectiveness and PPM success). Also pertinent here is literature espousing strong ties between collaborating projects within a portfolio and enhanced ambidexterity (Tiwana 2008). On this view, 'portfolios', because of their boundary-spanning leveraging competencies, are more able to cater for those inconsistent routines that are a hallmark of organizational ambidexterity (see Stettner and Lavie 2014). In other words, by using a portfolio of projects, organizations may sidestep tensions which would be harder to overlook should they arise *within* a single project; moreover, portfolios allow for concurrent pursuit of project delivery strategies that employ both exploitative competencies (focused on increasing existing market share) and explorative competencies (focused on new revenue streams). When ambidexterity is orchestrated through portfolios, the organization can better ensure that with each project representing an alternative implementation platform, each project maintains consistent and focused processes.

5.2 PPM's ability to drive project performance through enhanced ambidextrous capabilities

As relates to the second part of the research question (*Do PPM practices impact upon an organization's ability to channel its ambidextrous capabilities towards superior project performance?*), we found that greater (both effective and efficient) use and application of PPM practices led to enhanced orchestration of higher levels of ambidexterity (further entailing that the more an organisation would be able to channel ambidextrous capabilities towards positive project performance). The literature suggests that project portfolios which ensure tight resource-based, contextual and structural synergies between their individual constituent projects are, because of their improved process and practices integration and complementarity (see Sun and Lo 2014), better able to develop expertise for delivering overall PPM effectiveness (Tiwana 2008). This suggests that an 'exploitative' perspective of project portfolio management *may* outperform 'explorative' perspectives. The underlying explanation, here, is that an organization's PPM expertise may become more efficient and effective with iterative use for the same PPM delivery processes. In suggesting this, Bierly and Daly (2007) noted that despite

its relatively low optimal level, exploitation, compared to exploration, tends to be the stronger performance driver.

Furthermore, we also reflect critically on our general finding that ambidextrous competencies and capabilities may increase the performance of an individual operating entity. This may happen, Cao et al. (2009) contend, because at the core of ambidexterity is the capability developed by an operating entity to innovate while retaining long developed efficiency competencies. There is however a weakness to this argument. The weakness stems from our recognition that in seeking to increase performance, projects may draw on complementary benefits from being part of a portfolio, in that they are able to draw upon and develop expertise which is either outside their pre-existing project boundary, or more specifically, outside pre-existing portfolio boundaries (as in the case of organizational participants in strategic alliances). Under such circumstances, project performance (assessed as PPM effectiveness and PPM success) will depend on how well projects balance resource constraints against the ability to draw on complementary strengths from outside traditional portfolio networks. This is because during intense competition within internal environments, it is unlikely that other portfolios will be particularly willing to share scarce resources (Tsai 2002). To conclude, it may be surmised that project portfolios are only able to serve as mechanisms for orchestrating ambidexterity and at the same time, for enhancing performance, when their activities are *robustly* coordinated at project level.

6. Conclusions

The study undertook to ascertain whether effects of organizational ambidexterity on project performance are stronger for orchestration of ambidexterity at portfolio level. Its strong positive finding, specifically that PPM practice does indeed enhance prospects for ambidextrous management practice to contribute to project success, clearly underscores the need for project portfolios to be designed and operated with such enhancement in mind. And yet it also clarifies that future studies require more theoretical nuance to tease out the specific portfolio effects at issue, being mindful in particular to recognise that positive and negative effects may occasionally be bundled together. This further entails, we would suggest, that practitioners conceive of portfolio design with some openness to the possibility that there is always a calculus of positives and negatives to consider for purposes of design optimisation.

In enabling us to conclude with the above recommendation, our research has been deeply concerned with the actuality of practice in both project and operations management. We designed our studies in a manner consistent with quantitative studies, recognising in particular persistent and ongoing calls for more empirical research in operations management (Fisher et al. 2019; Terwiesch 2019; et al. 2019) and project management (Geraldi and Söderlund 2016, 2018). We also acknowledge that there is also, currently, very little empirical research that has so far revealed core project-related interdependencies engaged in orchestrating organizational ambidexterity, or, indeed, processes (mechanisms) by which Project portfolio management (PPM) practices can mediate the relationship between organizational ambidexterity and project performance. Petro et al. (2020) observes that despite the growth in ambidexterity research over the years, a number of practical questions about the precise mechanisms involved remain unanswered. Therefore, our study construed Project Portfolio Management (PPM) as a standalone construct measured against a combination of scales. Ambidexterity was operationalized as a measurable scale construct, although construed as a distinctive variable encompassing the two paradoxical (but not necessarily, polarized) constructs. Our study paid particular attention to foundational characteristics of ambidexterity mechanisms earlier identified as likely to impact orchestrations of ambidexterity through project portfolio management practices, and we recommend that future studies pay more attention to the specifics.

As expected for studies of this nature, ours did have limitations, which provide a platform for future studies. First, despite our recognition in the findings that management of the contradictions associated with ambidexterity could be impacted by salient organizational-wide attributes, our study specifically did not explore these attributes. Our second limitation relates to the recognition within literature that the relationship between organizational ambidexterity and performance may vary not only across levels, but also under different functional, structural and resource conditions. Accordingly, it can be argued that more detailed research is necessary, pertaining to dynamics of inter-project variation and integration and how these may impact upon designing organizations for optimal interaction (between different projects being pursued by the organization), and horizontal and vertical interaction with other areas of the organization. We think this would be a good approach for improving on present research through more granular studies of portfolio effects and optimisation. Understanding the nature of inter-project variation and integration should enable more value creation for the organization through enhanced understanding of how best to combine insights from not only other projects but also the wider organization, as a means to create the conditions for enhanced performance.

References

Abebe, M. and Angriawan, A., 2014. Organizational and competitive influences of exploration and exploitation activities in small firms. *Journal of Business Research* 67(3): 339-345.

Alashwal, A. and Fong, P. 2015. Empirical study to determine fragmentation of construction projects. *ASCE Journal of Construction Engineering and Management* 141(7): p.04015016.

Andriopoulos, C., and Lewis, M. 2009. Exploitation-exploration tensions and organizational ambidexterity: Managing paradoxes of innovation. *Organization Science* 20(4): 696–717.

Antonacopoulou, E. 2001. The paradoxical nature of the relationship between training and learning. *Journal of Management Studies* 38(3): 327-350.

Archer, N., and Ghasemzadeh, F. 1999. An integrated framework for project portfolio selection. *International Journal of Project Management* 17(4): 207-216.

Ardito, L., Peruffo, E. and Natalicchio, A. 2019. The relationships between the internationalization of alliance portfolio diversity, individual incentives, and innovation ambidexterity: A microfoundational approach. *Technological Forecasting and Social Change* 148: p.119714.

Atkinson, R. 1999. Project management: cost, time and quality, two best guesses and a phenomenon, its time to accept other success criteria. *International Journal of Project Management*, 17(6): 337-342.

Association for Operations Management (APICS). 2011. *Operations Management Body of Knowledge Framework*. (APICS OMBOK Framework). Chicago, IL 60631: APICS OMBOK

Aubry, M., and Lièvre, P. 2010. Ambidexterity as a competence of project leaders: A case study from two polar expeditions. *Project Management Journal* 41(3): 32–44.

Aubry, M., Sicotte, H., Drouin, N., Vidot-Delerue, H. and Besner, C. 2012. Organisational project management as a function within the organisation. *International Journal of Managing Projects in Business* 5(2): 180-194.

Bai, L., Chen, H., Gao, Q. and Luo, W. 2018. Project portfolio selection based on synergy degree of composite system. *Soft Computing* 22(16): 5535-5545.

Barney, J. 1991. Firm resources and sustained competitive advantage. *Journal of Management* 17(1): 99-120.

Barney, J. 1996. The resource-based theory of the firm. *Organization Science* 7(5): 469-469.

Barney, J. 2001. Resource-based theories of competitive advantage: A ten-year retrospective on the resource-based view. *Journal of Management* 27(6): 643-650.

Barney, J., Wright, M., & Ketchen, D. 2001. The resource-based view of the firm: Ten years after 1991. *Journal of Management* 27 (6): 625-641.

Bendoly, E., Donohue, K. and Schultz, K. 2006. Behavior in operations management: Assessing recent findings and revisiting old assumptions. *Journal of Operations Management* 24(6): 737-752.

Bendoly, E., Croson, R., Goncalves, P. and Schultz, K. 2010. Bodies of knowledge for research in behavioral operations. *Production and Operations Management* 19(4): 434-452.

Bendoly, E., Swink, M. and Simpson, W. 2014. Prioritizing and monitoring concurrent project work: Effects on switching behavior. *Production and Operations Management* 23(5): 847-860.

Bierly, P. and Daly, P. 2007. Alternative knowledge strategies, competitive environment, and organizational performance in small manufacturing firms. *Entrepreneurship Theory and Practice* 31(4): 493-516.

Bresciani, S., Ferraris, A., and Del Giudice, M. 2018. The management of organizational ambidexterity through alliances in a new context of analysis: Internet of Things (IoT) smart city projects. *Technological Forecasting and Social Change* 136 (2018): 331-338

Cao, Q., Gedajlovic, E. and Zhang, H. 2009. Unpacking organizational ambidexterity: Dimensions, contingencies, and synergistic effects. *Organization Science* 20(4): 781-796.

Cegarra-Navarro, J.G., Jiménez-Jiménez, D. and Garcia-Perez, A., 2019. An integrative view of knowledge processes and a learning culture for ambidexterity: Towards improved organisational performance in the banking sector. *IEEE Transactions on Engineering Management*, DOI: 10.1109/TEM.2019.2917430 (In Press).

Chandrasekaran, A., Linderman, K. and Schroeder, R. 2012. Antecedents to ambidexterity competency in high technology organizations. *Journal of Operations Management* 30(1-2): 134-151.

Chebbi, H., Yahiaoui, D., Vrontis, D. and Thrassou, A. 2015. Building multiunit ambidextrous organizations - A transformative framework. *Human Resource Management* 54(S1): s155-s177.

Chipulu, M., Ojiako, U., Gardiner, P., Williams, T., Mota, C., Maguire, S., Shou, Y., Stamati, T. and Marshall, A. 2014. Exploring the impact of cultural values on project performance: The effects of cultural values, age and gender on the perceived importance of project success/failure factors. *International Journal of Operations & Production Management* 34(3): 364-389.

Chipulu, M., Ojiako, U., Marshall, A., Williams, T., Neoh, J., Mota, C. and Shou, Y. 2016. Building cultural intelligence: insights from project management job advertisements. *Production Planning & Control* 27(3): 133-147.

Chipulu, M., Ojiako, U., Marshall, A., Williams, T., Bititci, U., Mota, C., Shou, Y., Thomas, A., El Dirani, A., Maguire, S., and Stamati, T. 2019. A dimensional analysis of stakeholder assessment of project outcomes, *Production Planning & Control* 30 (13): 1072-1090.

Cho, W. and Shaw, M. 2013. Portfolio selection model for enhancing information technology synergy. *IEEE Transactions on Engineering Management* 60(4): 739-749.

Chou, C., Yang, K. and Chiu, Y. 2018. Managing sequential ambidexterity in the electronics industry: roles of temporal switching capability and contingent factors. *Industry and Innovation* 25(8): 752-777.

Clegg, S. and Courpasson, D., 2004. Political hybrids: Tocquevillean views on project organizations. *Journal of Management Studies* 41(4): 525-547.

Closs, D., Jacobs, M., Swink, M. and Webb, G. 2008. Toward a theory of competencies for the management of product complexity: six case studies. *Journal of Operations Management* 26(5): 590-610.

Cooke-Davies, T. 2002. The "real" success factors on projects. *International Journal of Project Management* 20(3), pp.185-190.

Cooke-Davies, T.J. and Arzymanow, A. 2003. The maturity of project management in different industries: An investigation into variations between project management models. *International Journal of Project Management* 21(6): 471-478.

Croson, R., Schultz, K., Siemsen, E., Yeo, M. 2013. Behavioral operations: The state of the field. *Journal of Operations Management* 31 (1-2): 1-5.

Dameron, S. and Torset, C. 2014. The discursive construction of strategists' subjectivities: Towards a paradox lens on strategy. *Journal of Management Studies* 51(2), 291-319.

De Clercq, D, Thongpapanl, N and Dimov, D. 2013. Contextual ambidexterity in SMEs: The roles of internal and external rivalry. *Small Business Economics* 42(1): 191-205.

De Visser, M., de Weerd-Nederhof, P., Faems, D., Song, M., Van Looy, B. and Visscher, K. 2010. Structural ambidexterity in NPD processes: A firm-level assessment of the impact of differentiated structures on innovation performance. *Technovation* 30(5-6): 291-299.

Degener, P., Maurer, I. and Bort, S. 2018. Alliance portfolio diversity and innovation: The interplay of portfolio coordination capability and proactive partner selection capability. *Journal of Management Studies* 55(8): 1386-1422.

Dezi, L., Ferraris, A., Papa, A. and Vrontis, D. 2019. The role of external embeddedness and knowledge management as antecedents of ambidexterity and performances in Italian SMEs. *IEEE Transactions on Engineering Management*, DOI: 10.1109/TEM.2019.2916378 (In Press).

Dormann, C., Elith, J., Bacher, S., Buchmann, C., Carl, G., Carré, G., Marquéz, J., Gruber, B., Lafourcade, B., Leitão, P. and Münkemüller, T. 2013. Collinearity: a review of methods to deal with it and a simulation study evaluating their performance. *Ecography* 36(1): 27-46.

Englund, R. 2008. *Control or results? How to manage the paradox and achieve greater project results*. Paper presented at PMI Global Congress 2008 - North America, Denver, CO. Newtown Square, PA: Project Management Institute.

Engwall, M. 2003. No project is an island: linking projects to history and context." *Research Policy* 32(5): 789-808.

Eriksson, P., 2013. Exploration and exploitation in project-based organizations: Development and diffusion of knowledge at different organizational levels in construction companies. *International Journal of Project Management* 31(3): 333–341.

Fellows, R. and Liu, A. 2012. Managing organizational interfaces in engineering construction projects: addressing fragmentation and boundary issues across multiple interfaces. *Construction Management and Economics* 30(8): 653-671.

Fernhaber, S. and Patel, P. 2012. How do young firms manage product portfolio complexity? The role of absorptive capacity and ambidexterity. *Strategic Management Journal* 33(13): 1516-1539.

Field, A. 2009. *Discovering statistics using SPSS* (3rd ed.). Thousand Oaks, CA: Sage Publications.

Fisher, M., Olivares, M. and Staats, B., 2019. Why Empirical Research Is Good for Operations Management, and What Is Good Empirical Operations Management? *Manufacturing & Service Operations Management* DOI: https://doi.org/10.1287/msom.2019.0812 (In Press).

Geraldi, J. and Söderlund, J. 2016. Project studies and engaged scholarship: Directions towards contextualized and reflexive research on projects. *International Journal of Managing Projects in Business* 9(4): 767-797.

Geraldi, J., and Söderlund, J., 2018. Project studies: What it is, where it is going. *International Journal of Project Management* 36(1): 55-70.

Geraldi, J., Maylor, H. and Williams, T. 2011. Now, let's make it really complex (complicated) A systematic review of the complexities of projects. *International Journal of Operations & Production Management* 31(9): 966-990.

Gino, F. and Pisano, G., 2008. Toward a theory of behavioral operations. *Manufacturing & Service Operations Management* 10(4): 676-691.

Görög, M., 2011. Translating single project management knowledge to project programs. *Project Management Journal* 42(2), pp.17-31.

Grant, K., and Pennypacker, J. 2006. Project management maturity: an assessment of project management capabilities among and between selected industries." *IEEE Transactions on Engineering Management* 53(1): 59-68.

Gross, U. 2014. Fighting the fire: improvisational behaviour during the production launch of new products. *International Journal of Operations & Production Management* 34(6): 722-749.

Gupta, A., Smith, K., and Shalley, C. 2006. The interplay between exploration and exploitation. *Academy of Management Journal* 49: 693–706.

Güttel, W. and Konlechner, S. 2009. Continuously hanging by a thread: Managing contextually ambidextrous organizations. *Schmalenbach Business Review* 61(2): 150-172.

Hällgren, M. 2012. The construction of research questions in project management. *International Journal of Project Management* 30(7): 804-816.

Handfield, R., and Melnyk, S. 1998. The scientific theory-building process: a primer using the case of TQM. *Journal of Operations Management* 16 (4): 321–339.

Hayes, R. 2002. Challenges posed to operations management by the "new economy. *Production and Operations Management* 11(1): 21-32.

He, Z., and Wong, P. 2004. Exploration and exploitation: An empirical test of the ambidextrous hypothesis. *Organization Science* 15: 481–496.

Hoang, H., and Rothaermel, F. 2010. Leveraging internal and external experience: exploration, exploitation, and R&D project performance. *Strategic Management Journal* 31(7): 734-758.

Hodgson, D., Paton, S. and Cicmil, S. 2011. Great expectations and hard times: The paradoxical experience of the engineer as project manager. *International Journal of Project Management* 29(4), 374-382.

Hoegl, M. and Weinkauf, K. 2005. Managing task interdependencies in Multi‐Team projects: A longitudinal study. *Journal of Management Studies* 42(6): 1287-1308.

Huang, H. and Jong, S. 2019. Public Funding for Science and the Value of Corporate R&D Projects; Evidence from Project Initiation and Termination Decisions in Cell Therapy. *Journal of Management Studies* 56 (5): 1000-10039.

Huq, J., Reay, T. and Chreim, S., 2017. Protecting the paradox of interprofessional collaboration. *Organization Studies* 38(3-4): 513-538.

Hughes, M. 2018. Organisational ambidexterity and firm performance: burning research questions for marketing scholars. *Journal of Marketing Management* 34(1-2): 178-229.

Hughes, M., Filser, M., Harms, R., Kraus, S., Chang, M. and Cheng, C. 2018. Family firm configurations for high performance: The role of entrepreneurship and ambidexterity. *British Journal of Management* 29(4): 595-612.

Hutcheson, G., and Sofroniou, N. 1999. *The multivariate social scientist*. London, England: Sage Publications.

Jansen, J., Van den Bosch, F. and Volberda, H. 2005. Exploratory innovation, exploitative innovation, and ambidexterity: The impact of environmental and organizational antecedents. *Schmalenbach Business Review* 57(4): 351-363.

Jansen, J., George, G., Van den Bosch, F. and Volberda, H. 2008. Senior team attributes and organizational ambidexterity: The moderating role of transformational leadership. *Journal of Management Studies* 45(5): 982-1007.

Jansen, J., Tempelaar, M., Van den Bosch, F., and Volberda, H. 2009. Structural differentiation and ambidexterity: The mediating role of integration mechanisms. *Organization Science* 20(4): 797-811.

Jansen, J., Simsek, Z. and Cao, Q. 2012. Ambidexterity and performance in multiunit contexts: Cross-level moderating effects of structural and resource attributes. *Strategic Management Journal* 33(11): 1286-1303.

Jarzabkowski, P., Lê, J., Van de Ven, A. 2013. Responding to competing strategic demands: How organizing, belonging, and performing paradoxes coevolve. *Strategic Organization* 11: 245–280.

Jonas, D. 2010. Empowering project portfolio managers: How management involvement impacts project portfolio management performance. *International Journal of Project Management* 28(8): 818-831.

Junni, P., Sarala, R. Tarba, S., Liu, Y. and Cooper, C. 2015. The role of human resources and organizational factors in ambidexterity. *Human Resource Management* 54(S1): s1-s28.

Junni, P., Sarala, R., Taras, V. and Tarba, S. Y. 2013. Organizational ambidexterity and performance: A meta-analysis. *Academy of Management Perspectives* 27(4): 299–312.

Kaiser, H. 1970. A second generation little jiffy. *Psychometrika* 35: 401–415.

Kauppila, O. 2010. Creating ambidexterity by integrating and balancing structurally separate interorganizational partnerships. *Strategic Organization* 8(4): 283-312.

Kim, J. and Wilemon, D. 2009. An empirical investigation of complexity and its management in new product development. *Technology Analysis & Strategic Management* 21(4): 547–564.

Klein, L., Biesenthal, C. and Dehlin, E. 2015. Improvisation in project management: A praxeology. *International Journal of Project Management* 33(2): 267-277.

Kock, A., Schulz, B., Kopmann, J. and Gemünden, H.G. 2020. Project portfolio management information systems' positive influence on performance–the importance of process maturity. *International Journal of Project Management* 38(4): 229-241.

Kopmann, J., Kock, A., Killen, C. and Gemünden, H. 2017. The role of project portfolio management in fostering both deliberate and emergent strategy. *International Journal of Project Management* 35(4):557-570.

Kornfeld, B. and Kara, S. 2011. Project portfolio selection in continuous improvement. *International Journal of Operations & Production Management* 31(10): 1071-1088.

Koza, M. and Lewin, A. 1998. The co-evolution of strategic alliances. *Organization Science* 9(3): 255-264.

Le Roy, F. and Fernandez, A. 2015. Managing coopetitive tensions at the working-group level: The rise of the coopetitive project team. *British Journal of Management* 26(4): 671-688.

Lee, G., DeLone, W., and Espinosa, J. 2006. Ambidextrous coping strategies in globally distributed software development projects. *Communications of the ACM* 49(10): 35–40.

Levinthal, D. and J. March. 1993. The myopia of learning. *Strategic Management Journal* 14 (S2): 95–112.

Lewis, M. 2000. Exploring paradox: Toward a more comprehensive guide. *Academy of Management Review* 25: 760–776.

Lin, H and McDonough, E. 2011. Investigating the role of leadership and organizational culture in fostering innovation ambidexterity. *IEEE Transactions on Engineering Management* 58: 497–509.

Lin, Z., Yang, H. and Demirkan, I. 2007. The performance consequences of ambidexterity in strategic alliance formations: Empirical investigation and computational theorizing. *Management Science* 53(10): 1645-1658.

Linhart, A., Röglinger, M. and Stelzl, K. 2019. A Project Portfolio Management Approach to Tackling the Exploration/Exploitation Trade-off. *Business & Information Systems Engineering*, DOI: https://doi.org/10.1007/s12599-018-0564-y, In Press.

Liu, L., and D. Leitner. 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* 43 (6): 97–110.

Liu, L., Wang, X. and Sheng, Z. 2012. Achieving ambidexterity in large, complex engineering projects: a case study of the Sutong Bridge project. *Construction Management and Economics* 30(5):399-409.

Lubatkin, Michael H., Zeki Simsek, Yan Ling, and Veiga, J. 2006. Ambidexterity and Performance in Small-to Medium- Sized Firms: The Pivotal Role of Top Management Team Behavioural Integration. *Journal of Management* 32(5): 646-672.

Luger, J., Raisch, S. and Schimmer, M. 2018. Dynamic balancing of exploration and exploitation: The contingent benefits of ambidexterity. *Organization Science* 29(3): 449-470.

Machado, C., de Lima, E., da Costa, S., Angelis, J. and Mattioda, R. 2017. Framing maturity based on sustainable operations management principles. *International Journal of Production Economics* 190: 3-21.

Mähring, M. and Keil, M. 2008. Information technology project escalation: A process model. *Decision Sciences* 39(2): 239-272.

Manning, S. 2017. The rise of project network organizations: Building core teams and flexible partner pools for interorganizational projects. *Research Policy* 46(8): 1399-1415.

March, J. 1991. Exploration and exploitation in organizational learning. *Organization Science* 2(1): 71–87.

Martin, A., Keller, A. and Fortwengel, J. 2019. Introducing conflict as the microfoundation of organizational ambidexterity. *Strategic Organization* 17(1): 38-61.

Martinsuo, M. and Lehtonen, P. 2007. Role of single-project management in achieving portfolio management efficiency. *International Journal of Project Management* 25(1): 56-65.

Martinsuo, M. 2013. Project Portfolio Management in Practice and in Context. *International Journal of Project Management* 31 (6): 794–803.

Maylor, H., Meredith, J., Söderlund, J. and Browning, T. 2018. Old theories, new contexts: extending operations management theories to projects. *International Journal of Operations & Production Management* 38(6): 1274-1288.

Meskendahl, S. 2010. The influence of business strategy on project portfolio management and its success—a conceptual framework. *International Journal of Project Management* 28(8): 807-817.

Midler, C., Maniak, R. and de Campigneulles, T. 2019. Ambidextrous Program Management: The Case of Autonomous Mobility. *Project Management Journal* p.8756972819869091.

Mihalache, O., Jansen, J., Van den Bosch, F. and Volberda, H. 2014. Top management team shared leadership and organizational ambidexterity: A moderated mediation framework. *Strategic Entrepreneurship Journal* 8(2): 128-148.

Milosevic, D., and Patanakul, P. 2005. Standardized project management may increase development projects success. *International Journal of Project Management* 23(3): 181-192.

Mishra, A. and Sinha, K. 2016. Work design and integration glitches in globally distributed technology projects. *Production and Operations Management* 25(2):347-369.

Montibeller, G., Franco, L., Lord, E. and Iglesias, A. 2009. Structuring resource allocation decisions: A framework for building multi-criteria portfolio models with area-grouped options. *European Journal of Operational Research* 199(3): 846-856.

Müller, R., Martinsuo, M. and Blomquist, T. 2008. Project portfolio control and portfolio management performance in different contexts. *Project Management Journal* 39(3): 28-42.

Myers, R. 1990. *Classical and modern regression with applications* (2nd ed). Boston, MA: Duxbury.

Narayanan, S., Balasubramanian, S. and Swaminathan, J. 2011. Managing outsourced software projects: An analysis of project performance and customer satisfaction. *Production and Operations Management* 20(4): 508-521.

Neely, A., Gregory, M. and Platts, K. 1995. Performance measurement system design: a literature review and research agenda. *International Journal of Operations & Production Management* 15 (4): 80-116.

Nölleke-Przybylski, P., von Rimscha, M., Möller, J., Voci, D., Altmeppen, K. and Karmasin, M. 2019. Patterns of structural and sequential ambidexterity in cross-border media management. *Journal of Media Business Studies* 16 (2): 126-152.

Nunnally, J. 1978. *Psychometric methods*. New York, NY: McGraw-Hill.

O'Reilly, C. and Tushman, M. 2011. Organizational ambidexterity in action: How managers explore and exploit. *California Management Review* 53(4):5-22.

O'Reilly, C. and Tushman, M. 2013. Organizational ambidexterity: Past, present, and future. *Academy of Management Perspectives* 27(4): 324–338.

Ojiako, U., and Maguire, S. 2008. Success criteria for systems led transformation in organisations: Implications for global operations management. *Industrial Management and Data Systems* 108 (7): 887-908.

Ojiako, U., Johansen, E. and Greenwood, D. 2008. A qualitative re-construction of project measurement criteria. *Industrial Management & Data Systems* 108(3): 405-417.

Ojiako, U., Maguire, S., and Chipulu, M. 2013. Thematic elements underlying the delivery of services in high-contact public service encounters. *Production Planning and Control* 24 (6): 532-545.

Ojiako, U., and Chipulu, C. 2014. National culture and success/failure perceptions in projects. *Proceedings of the Institution of Civil Engineers: Management, Procurement and Law* 167 (4): 167-179.

Ojiako, U., Chipulu, M., Gardiner, P., Williams, T., Mota, C., Maguire, S., Shou, Y and Stemanti, T. 2014. Effect of project role, age and gender differences on the formation and revision of project decision judgements. *International Journal of Project Management* 32 (4): 556-567.

Ojiako, U., Chipulu, M., Marshall, A., Ashleigh, M., Maguire, S., Williams, T. and Obokoh, L. 2015a. Heterogeneity and perception congruence of project outcomes. *Production Planning & Control* 26(11):858-873.

Ojiako, U., Papadopoulos, T., Stamati, T., Anagnostopoulos, D. and Marshall, A. 2015b. Collaborative governance in Greek infrastructure projects. *Proceedings of the Institution of Civil Engineers: Management, Procurement and Law* 168 (3): 135-145.

Papachroni, A., Heracleous, L. and Paroutis, S. 2015. Organizational ambidexterity through the lens of paradox theory: Building a novel research agenda. *Journal of Applied Behavioral Science* 51(1): 71-93.

Parvan, K., H. Rahmandad, and A. Haghani. 2015. Inter-Phase Feedbacks in Construction Projects. *Journal of Operations Management* 39: 48–62.

Patanakul, P. 2015. Key attributes of effectiveness in managing project portfolio. *International Journal of Project Management* 33: 1084 - 1097.

Pellegrinelli, S. 2011. What's in a name: Project or programme?. *International Journal of Project Management* 29(2): 232-240.

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* 33(1): 153-164.

Peterson, R. and Kim, Y. 2013. On the relationship between coefficient alpha and composite reliability. *Journal of Applied Psychology* 98(1): 194-198.

Petro, Y. and Gardiner, P. 2015. An investigation of the influence of organizational design on project portfolio success, effectiveness and business efficiency for project-based organizations. *International Journal of Project Management* 33(8): 1717-1729.

Petro, Y. 2017. Ambidexterity through project portfolio management: Resolving paradoxes in organizations. Newtown Square, PA: Project Management Institute.

Petro, Y., Ojiako, U., Williams, T., and Marshall, A. 2019. Organizational ambidexterity: a critical review and development of a project focused definition. *ASCE Journal of Management in Engineering* 35 (3): 03119001.

Petro, Y., Ojiako, U., Williams, T. and Marshall, A. 2020. Organizational ambidexterity: using project portfolio management to support project-level ambidexterity. *Production Planning & Control* 31 (4): 287-307.

Piao, M. and Zajac, E. 2016. How exploitation impedes and impels exploration: Theory and evidence. *Strategic Management Journal* 37(7): 1431-1447.

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: a critical review of the literature and recommended remedies. Journal of Applied Psychology, 88(5), 879.

Raisch, S. and Zimmermann, A. 2017. *Pathways to Ambidexterity: A Process Perspective on the Exploration - Exploitation Paradox*. In Smith, Wendy; Lewis, Marianne; Jarzabkowski, Paula & Langley, Ann (ed.): The Oxford Handbook of Organizational Paradox. Oxford: Oxford University Press, 2017, S. 315-332.

Raisch, S., Birkinshaw, J., Probst, G. and Tushman, M. 2009. Organizational ambidexterity: Balancing exploitation and exploration for sustained performance. *Organization Science* 20(4): 685–695.

Ra Raza-Ullah, T., Bengtsson, M. and Kock, S. 2014. The coopetition paradox and tension in coopetition at multiple levels. *Industrial Marketing Management* 43(2): 189-198.

Riis, J. and Pedersen, F. 2003. Managing organizational development projects by paradoxes. *Production Planning & Control* 14(4): 349-360.

Roscoe, S. and Blome, C. 2019. Understanding the emergence of redistributed manufacturing: an ambidexterity perspective. *Production Planning & Control* 30(7): 496-509.

Rossmannek, O. and Rank, O. 2019. Internationalization of exploitation alliance portfolios and firm performance. *Management Decision* 57(1): 86-99.

Sandberg, J. and Alvesson, M. 2011. Ways of constructing research questions: gap-spotting or problematization?. *Organization* 18(1): 23-44.

Santoro, G., Thrassou, A., Bresciani, S. and Del Giudice, M. 2019. Do Knowledge Management and Dynamic Capabilities Affect Ambidextrous Entrepreneurial Intensity and Firms' Performance?. *IEEE Transactions on Engineering Management*. 10.1109/TEM.2019.2907874 (In Press).

Sauro, J. 2010. *Should you use 5 or 7 point scales?* Retrieved from http://measuringu.com/scale-points

Schad, J., Lewis, M., Raisch, S. and Smith, W. 2016. Paradox Research in Management Science: Looking Back to Move Forward. *Academy of Management Annals*, 10(1): 5-64.

Schoenherr, T., Bendoly, E., Bachrach, D. and Hood, A. 2017. Task interdependence impacts on reciprocity in IT implementation teams: Bringing out the worst in us, or driving responsibility?. *Production and Operations Management* 26(4): 667-685.

Scott-Young, C. and Samson, D. 2009. Team management for fast projects: an empirical study of process industries. *International Journal of Operations & Production Management* 29(6): 612-635.

Simsek, Z. 2009. Organizational ambidexterity: Towards a multilevel understanding. *Journal of Management Studies* 46(4): 597-624.

Sinha, S. 2016. Managing an ambidextrous organization: balancing innovation and efficiency. *Strategic Direction* 32 (10): 35-37.

Smith, W. and Tushman, M. 2005. Managing strategic contradictions: A top management model for managing innovation streams. *Organization Science* 16(5): 522-536.

Smith, W., Erez, M., Jarvenpaa, S., Lewis, M. and Tracey, P. 2017. Adding complexity to theories of paradox, tensions, and dualities of innovation and change. *Organization Studies* 38 (3-4): 303-317.

Söderlund, J. 2013. *Pluralistic and processual understandings of projects and project organizing: towards theories of project temporality. Novel Approaches to Organizational Project Management Research: Translational and Transformational*. Copenhagen Business School Press, Copenhagen, pp.117-135.

Sohani, S. and Singh, M. 2017. Multilevel analysis of ambidexterity and tagging of specialised projects in project-based information technology firms. *International Journal of Operations & Production Management* 37 (9): 1185-1206.

Sørensen, J. and Stuart, T. 2000. Aging, Obsolescence, and Organizational Innovation. *Administrative Science Quarterly* 45 (1): 81–112.

Stadtler, L., Schmitt, A., Klarner, P. and Straub, T. 2010. *More than bricks in the wall: Organizational perspectives for sustainable success*. New York: Springer.

Stal-Le Cardinal, J. and Marle, F. 2006. Project: The just necessary structure to reach your goals. *International Journal of Project Management* 24(3): 226-233.

Stettner, U. and Lavie, D. 2014. Ambidexterity under scrutiny: Exploration and exploitation via internal organization, alliances, and acquisitions. *Strategic Management Journal* 35(13): 1903-1929.

Sun, B. and Lo, Y. 2014. Achieving alliance ambidexterity through managing paradoxes of cooperation: A new theoretical framework. *European Journal of Innovation Management* 17(2): 144-165.

Suzuki, O. 2019. Uncovering moderators of organisational ambidexterity: evidence from the pharmaceutical industry. *Industry and Innovation* 26(4): 391-418.

Tamayo-Torres, J., Roehrich, J. and Lewis, M. 2017. Ambidexterity, performance and environmental dynamism. *International Journal of Operations & Production Management* 37 (3): 282-299.

Taylor, A. and Helfat, C. 2009. Organizational linkages for surviving technological change: Complementary assets, middle management, and ambidexterity. *Organization Science* 20(4): 718-739.

Teller, J., Unger, B., Kock, A. and Gemünden, H. 2012. Formalization of project portfolio management: The moderating role of project portfolio complexity. *International Journal of Project Management* 30(5): 596-607.

Terwiesch, C. 2019. Empirical Research in Operations Management: From Field Studies to Analyzing Digital Exhaust. *Manufacturing & Service Operations Management* 21 (4): 713-722.

Terwiesch, C., Olivares, M., Staats, B. and Gaur, V. 2019. A review of empirical operations management over the last two decades. *Manufacturing & Service Operations Management* DOI: https://doi.org/10.1287/msom.2018.0755 (In Press).

Tiwana, A. 2008. Do bridging ties complement strong ties? An empirical examination of alliance ambidexterity. *Strategic Management Journal* 29(3):251-272.

Tryggestad, K., Justesen, L. and Mouritsen, J. 2013. Project temporalities: how frogs can become stakeholders. *International Journal of Managing Projects in Business* 6(1): 69-87.

Tsai, W. 2002. Social structure of 'coopetition' within a multiunit organization: Coordination, competition, and intraorganizational knowledge sharing. *Organization Science* 13(2): 179-190.

Turner, N. and Lee-Kelley, L. 2013. Unpacking the theory on ambidexterity: An illustrative case on the managerial architectures, mechanisms and dynamics. *Management Learning* 44(2):179-196.

Turner, N., Swart, J. and Maylor, H. 2013a. Mechanisms for managing ambidexterity: A review and research agenda. *International Journal of Management Reviews* 15(3):317-332.

Turner, N., Maylor, H. and Swart, J. 2013b. Ambidexterity in managing business projects –an intellectual capital perspective. *International Journal of Managing Projects in Business* 6(2):379-389.

Turner, N., Maylor, H., Lee-Kelley, L., Brady, T., Kutsch, E., and Carver, S. 2014. Ambidexterity and knowledge strategy in major projects: A framework and illustrative study. *Project Management Journal* 45(5): 44–55.

Turner, N., Maylor, H. and Swart, J. 2015. Ambidexterity in projects: An intellectual capital perspective. *International Journal of Project Management* 33(1): 177-188.

Turner, N., Swart, J., Maylor, H., and Antonacopoulou, E. 2016a. Making it happen: How managerial actions enable project-based ambidexterity. *Management Learning* 47(2): 199-222.

Turner, N., Kutsch, E. and Leybourne, S. 2016b. Rethinking project reliability using the ambidexterity and mindfulness perspectives. *International Journal of Managing Projects in Business* 9(4): 845-864.

Turner, N., Aitken, J. and Bozarth, C. 2018. A framework for understanding managerial responses to supply chain complexity. *International Journal of Operations & Production Management* 38(6): 1433-1466.

Tushman, M. and O'Reilly, C. 1996. Ambidextrous organizations: Managing evolutionary and revolutionary change. *California Management Review* 38: 8–30.

Van Marrewijk, A., Clegg, S., Pitsis, T. and Veenswijk, M. 2008. Managing public–private megaprojects: Paradoxes, complexity, and project design. *International Journal of Project Management* 26(6): 591-600.

Wassmer, U., Li, S., and Madhok, A. 2017. Resource ambidexterity through alliance portfolios and firm performance. *Strategic Management Journal* 38 (2): 384-394.

Wolf, T., Cantner, U., Graf, H. and Rothgang, M. 2019. Cluster ambidexterity towards exploration and exploitation: Strategies and cluster management. *Journal of Technology Transfer* 44(6): 1840-1866.

Wu, Y. and Wu, S. 2016. Managing ambidexterity in creative industries: A survey. *Journal of Business Research* 69(7): 2388-2396.

Yu, T., Patterson, P.G. and de Ruyter, K. 2013. Achieving service-sales ambidexterity. *Journal of Service Research* 16(1): 52-66.

Zang, J., and Li, Y. 2017. Technology capabilities, marketing capabilities and innovation ambidexterity. *Technology Analysis and Strategic Management* 29 (1): 23–37.

Zhang, G., Tang, C. and Qi, Y. 2020. Alliance Network Diversity and Innovation Ambidexterity: The Differential Roles of Industrial Diversity, Geographical Diversity, and Functional Diversity. *Sustainability* 12(3): 1041; doi:10.3390/su12031041.

Zhao, W., Hall, N. and Liu, Z. 2020. Project Evaluation and Selection with Task Failures. *Production and Operations Management* 29 (2): 428-446.

Zimmermann, A., Raisch, S., and Birkinshaw, J. 2015. How is ambidexterity initiated? The emergent charter definition process. *Organization Science* 26(4): 1119-1139.

Appendix A: Scale measures

Item	***Exploration*** **items taken from Lubatkin et al. (2006)**	***Exploration*** **items (amended for our study)**
1	Looks for novel technological ideas by thinking "outside the box".	Look for novel technological ideas by thinking outside boundaries.
2	Bases its success on its ability to explore new technologies.	Base success on its ability to explore new technologies.
3	Creates products or services that are innovative to the firm.	Create products or services that are innovative to the firm.
4	Looks for creative ways to satisfy its customers' needs.	Look for creative ways to satisfy its customers' needs.
5	Aggressively ventures into new market segments.	Aggressively ventures into new market segments.
6	Actively targets new customer groups.	Actively targets new customer groups.
	Exploitation **items taken from Lubatkin et al. (2006)**	***Exploitation*** **items (amended for our study)**
7	Commits to improve quality and lower cost.	Commitment to improve quality.
8	Continuously improves the reliability of its products and services.	Commitment to lower cost.
9	Increases the levels of automation in its operations.	Continuously improves the reliability of its products and services.
10	Constantly surveys existing customers' satisfaction.	Increases the levels of automation in our operations.
11	Fine-tunes what it offers to keep its current customers satisfied.	Constantly survey existing customers for satisfaction.
12	Penetrates more deeply into its existing customer base.	Enhance and improved what we offer to keep its current customers satisfied.
** The changes made were – we separated quality and cost (item 7 of Lubatkin et al) and then dropped item 12 of Lubatkin et al's Exploitation measures. No changes in the Exploration items.*		

Appendix B: The questionnaire

First section: Respondents' Demographic Information

- '*Gender'*; '*Age'*; '*Educational Background'*; '*Professional Background*'; '*Professional Level*'; '*Industry Background*'; '*Number of years' working experience*'; '*Industry sector'*; '*Number of employees in current organisation'*.

Second section: (evaluation of organisational success over past 3 years- 'Very low', 'Low', 'Medium/unsure', 'Moderately high', 'Very high')

1. Compared to competitors regarding the overall project performance?
2. Compared to competitors regarding the market share?
3. Compared to competitors in terms of revenue growth?
4. Compared to competitors regarding profitability?

Third section: (assessment of projects over past 3 years- 'Strongly Disagree', 'Disagree', 'Neutral/Unsure', 'Agree', 'Strongly Agree')

1. Our projects achieve a high schedule adherence
2. Our projects achieve a high budget adherence
3. Our projects achieve a high quality adherence
4. Our projects are completed with a high degree of customer satisfaction
5. We sufficiently develop new technologies and/or competencies in our projects
6. With our projects, we are a step ahead of our competition with new products, technologies, or services
7. The projects enable us to shape the future of our industry
8. Our projects are consistently aligned with the future of the company
9. The corporate strategy is being implemented ideally through our projects
10. Resource allocation to projects reflects our strategic objectives
11. There is a good balance of project focused on new and existing areas of application
12. There is a good balance of project focused on new and existing technologies
13. There is a good management of risks in our projects
14. There is a good balance in our projects as relates to different implementation phases (early/late phases)
15. There is a good balance in our projects to generate a constant cash flow

Fourth section (assessment of ambidexterity over past 3 years- 'Very low', 'Low', 'Medium/unsure', 'Moderately', 'High', 'Very high')

1. Look for novel technological ideas by thinking outside boundaries
2. Base success on its ability to explore new technologies
3. Create products or services that are innovative to the firm
4. Look for creative ways to satisfy its customers' needs
5. Aggressively ventures into new market segments
6. Actively targets new customer groups
7. Commitment to improve quality
8. Commitment to lower cost
9. Continuously improves the reliability of its products and services
10. Increases the levels of automation in our operations

11. Constantly survey existing customers for satisfaction
12. Enhance and improved what we offer to keep its current customers satisfied

Fifth section (assessment of synergies and collaboration between projects within portfolios over past 3 years- 'Strongly disagree', 'Disagree', 'Neutral/unsure', 'Agree', 'Strongly agree')

1. We are able to leverage synergies between projects in our portfolio
2. We consistently make use of synergies (e.g., shared usage of modules, platforms, technologies, etc.) between our projects
3. We consistently make use of synergies (e.g., shared distribution channels, infrastructure, etc.) between our projects