

Organizational ambidexterity: a critical review and development of a project *focused* definition

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Abstract

The objective of this paper is to explore a *project-focused* understanding of contemporary organisational ambidexterity literature. As part of this process, a taxonomical analysis of the elements and components of the concept of organisational ambidexterity is undertaken. Findings suggest that a project-focused notion of organisational ambidexterity involves different levels, dimensions and mechanisms. The predominant contribution of this paper resides within the taxonomy study, which provides a platform for a more holistic understanding of organisational ambidexterity as a multifaceted concept applicable to the project management discipline.

Introduction

What is organisational ambidexterity?

The notion of organisational ambidexterity generally refers to a variety of organization competencies which allows the organisation in question to undertake two contradictory activities simultaneously. Organisational ambidexterity however differs from the notion of dynamic capabilities or organizational

flexibility which has been discussed extensively within the “management in engineering” domain (see for example, Lim et al., 2011; Ansari et al., 2014). Organizational ambidexterity focuses on “...the ability to simultaneously pursue both incremental and discontinuous innovation and change [which] results from hosting multiple contradictory structures, processes, and cultures within the same firm” (Tushman and O'Reilly, 1996; p. 24). On the other hand ‘dynamic capabilities’ refers to key competitive attributes that manifest in an organisation’s ability to remain competitive in high velocity markets through its ability to sense, seize and reconfigure its processes (Choi et al., 2018a). The implications are that organizational ambidexterity represents a mediating factor in the link between the dynamic capabilities of an organisation and its competitiveness (Wei et al., 2014; Jurksiene and Pundziene, 2016).

Over the years, a number of different scholars have advanced varying definitions of organisational ambidexterity. Simsek (2009) provides a comprehensive review of these various literatures which suggests that at the core of the notion of organisational ambidexterity resides the tensions experienced by organisations simultaneously seeking to maintain a balance between two contradictory analytical constructs, namely *exploitation* and *exploration*. The literature has been quite clear that both analytical constructs of organisational ambidexterity require distinct (different) organizational routines and competencies. In the case of exploitation, this will be internal consistency and control (Benner and Tushman, 2003). On the other hand, in the case of exploration, the focus is likely to be on risk-taking and flexibility (McGrath, 2001). Studies have found that an emphasis by an organization on one can degrade the other (Jansen et al., 2009), so ambidexterity emphasises a trade-off balance between these two constructs (Adler et al., 1999). It is noted that while the paper focuses on ‘organisational ambidexterity’, for brevity, we however utilize ‘organisational ambidexterity’ and ‘ambidexterity’ interchangeably.

Articulation and placement

As an emergent research concept (Raisch and Birkinshaw, 2008; Simsek, 2009), *organisational ambidexterity* has increasingly attracted the attention of academic scholarship in various disciplines. This has ranged from operations (Chandrasekaran et al., 2012) and project management (Aubry and Lièvre, 2010; Leybourne and Sainter, 2012; Eriksson, 2013; Pellegrinelli et al., 2015; Turner and Lee-Kelley, 2013; Turner et al., 2013a, 2013b, 2014, 2015, 2016), to technology innovation and engineering management studies (Lin and McDonough, 2011; Liu and Leitner, 2012; Liu et al., 2012). In addition, there has also been studies exploring the impact of ambidexterity on specific organizational attributes such as dynamic capabilities (O'Reilly and Tushman, 2013), knowledge management (Im and Rai, 2008)

and leadership (Nemanich and Vera, 2009). Other studies have also explored the relationship between ambidexterity and organizational change (Tushman and O'Reilly, 1996) and ambidexterity and firm performance (Kristal et al., 2010). Thus, it is reasonable to suggest that the concept of ambidexterity is pervasive, a point reiterated by Birkinshaw and Gupta (2013) and Turner et al. (2013a) in their etiolation of the versatility (and appeal) of ambidexterity among scholars. Although being the case, there appears to be sparse research on ambidexterity situated firmly within the “management in engineering” domain. For example, no publications on ambidexterity were found in well-respected engineering management journals such as ASCE Journal of Management in Engineering, ASCE Journal of Construction Engineering and Management, Engineering Project Organization Journal and Engineering Management Journal. Six such research papers have been published on ambidexterity in IEEE Transactions on Engineering Management and one published in Construction Management and Economics. Furthermore, studies (Lynn, 2002; Shaw, 2002; Picon, 2004; Sousa-Poza and Kovacic, 2008) that have examined the agenda for engineering management research appear not to have expressed substantial interest on the topic, thus the intended contribution of our study.

Our contributions and research question

Our study intends to make distinct contributions to project and engineering management scholarship. The literature suggests that the transient nature (Turner et al., 2015) and the mutual interdependence of the process elements within projects (Turner and Lee-Kelley, 2013) makes them ideal for the duality associated with ambidexterity. Three reasons have been advanced in the literature. Firstly, projects are primarily focused on long-term transformation of scarce resources. This transformation process is however constantly experiencing tensions emanating from a desire for instrumentality (processes and methodologies) on one hand as against a need for flexibility required which reinforces our notion of doing routine versus non-routine projects. Secondly, projects are characterised by their transient nature. Thirdly, the process elements within projects are characterised by mutual interdependence. It is therefore within this context that we explored a much needed specific definition of ambidexterity that was contextualised within projects. The basis of such a study involved a systematic literature review, which allowed a taxonomical analysis of the elements and components of a project-focused notion of ambidexterity to be undertaken. This is the main contribution of this study to the “management in engineering” body of knowledge. However, when projects focus almost exclusively on the *exploration* of new innovative solutions, the potential for overruns (leading to failure) become more likely (Liu et al., 2012), requiring for its mitigation engagement with risk forecasting and *intelligence* (Marshall et al.,

2018). Conversely, projects that focus almost exclusively on *exploiting* existing capabilities through exemplifying efficiencies in their routines and minimising risks are likely to become unable to support *non-routine* project work which is characteristic of the current global engineering environment. A further challenge associated with a focus on exploitation is that the classical control notion of project instrumentality is unlikely to sustain high levels of learning (Lee et al., 2013), task uncertainty and leadership (Lin and McDonough, 2011) and the demand for innovation associated with most complex engineering projects (Lin and McDonough, 2011; Liu and Leitner, 2012; Liu et al., 2012; Chiu, 2014; Choi and Phan, 2014; Chen and Liu, 2018; Choi et al., 2018b). The need to simultaneously balance *exploration* (of innovation) and *exploitation* (of current and existing capabilities) is a typical challenge faced by most engineering endeavours and projects (Liu et al., 2012; Du et al., 2013) and this challenge creates the need for the project and engineering management community to understanding contemporary organisational ambidexterity literature. This is because any focus of such projects predominantly on *exploitation* is likely to lead to “success trap” (Levinthal and March, 1993, p.106) while on the other hand, an over-emphasis on *exploration* will likely to lead to an ever ending “cycle of failure” (Levinthal and March, 1993, p.105); in effect, a failure trap. Thus, in light of ideas relating to ‘project studies’ and the need for “fostering vibrant dialogue and debate” (Gerald and Soderlund, 2018; p. 55) among project and engineering management scholars and practitioners, this paper endeavours to engage in discourse likely to facilitate (i) greater understanding of organisational ambidexterity applicable to projects and by implication contribute to the management in engineering discourse (Evans and Bredin, 1987; Kotnour and Farr, 2005; Omurtag, 2009; Cerchione et al., 2016) and (ii) design transient organisational and learning networks, structures and processes that are capable of effectively supporting organisational ambidexterity in their project environments.

We posit that organisational ambidexterity is largely theoretically constructed and therefore may be perceived by the project management discipline which is increasingly highly institutionalized and driven by practice (Lenfle and Loch, 2010) as of little or no relevance. As Birkinshaw and Gupta (2013) point out, organisational ambidexterity is not a term used by practicing managers. Neither do we contend that it is a term used in project management practice. Certainly, it is not a term that appears in either the 2012 APM Body of Knowledge (6th edition) or the 2017 Project Management Institute (PMI) Body of Knowledge (6th edition). It also does not appear in the 2012 Definitions handbook for the 2012 Association for Project Management (APM) Body of Knowledge (6th Edition).

Recent studies on ambidexterity within the context of project management suggests the widely accepted importance in the use of projects to contextualise ambidexterity (Turner et al., 2013a, 2013b,

2014, 2015, 2016; Pellegrinelli et al., 2015; Bednarek et al., 2016; Petro, 2017). Drawing from earlier works of Birkinshaw and Gupta (2013) who had argued that organisations were more efficient than markets in long-term transformation of scarce resources, we posit that projects encompass the very essence of this transformation process and associated tensions which exist between the misguided desire for instrumentality (Lenfle and Loch, 2010) and the flexibility required to deal with the uncertainties which prevail in projects due to their novelty (Prado and Sapsed, 2016). From Andriopoulos and Lewis (2009) therefore, we argue that project represent the most efficient approach to balance competing short (exploitation) and long term (exploration) demands that organisations face. While the majority of engineering endeavours are increasingly being organized and implemented as projects (Kuprenas et al., 1999), there is a view in the literature that the temporary nature of projects may hinder not only their efficiencies, but also the achievement of strategic business imperatives driving these projects (Bakker et al., 2016; Ligthart et al., 2016).

In effect, since project-based working is the dominant form of organising in contemporary organisations which rely heavily on exploitation and exploration (Liu and Leitner 2012), it will be expected that both exploitation and exploration would be readily identifiable within a project context and projects therefore remain a viable way to contextualise ambidexterity. However, this perspective does not necessarily appear to be widely shared. In fact Aubry and Lièvre (2010) claims that the challenges of project-laden context of ambidexterity is that while projects tend to reflect exploration, project management (in effect, the process of project delivery, which is increasingly standardized) emphasises more of exploitation mode. This is demonstrated by the emphasis of project management frameworks and standards on risk minimization (Pellegrinelli et al., 2015; Turner et al., 2015). In effect, both Pellegrinelli et al. (2015) and Turner et al. (2015) align with espoused duality debates in ambidexterity literature between *efficiency versus flexibility* and *adaptability versus alignment*. It is perhaps for this reason that the ambidexterity challenge has been predominantly articulated at the business and organisational level (Markides, 2013).

The context and project managements view of ambidexterity

We had argued that prior works of scholarship have not provided a comprehensive and cohesive review of literature on ambidexterity that is explicitly contextualised within the context of project management. We briefly review the literature that points to the unfocused nature of work on ambidexterity in project management. We claim that the less than eloquent development of organisational ambidexterity literature

contextualised within project management presents a considerable opportunity for multilevel exploration and review of the literature to be brought to the attention of project management scholars.

Lee et al. (2006) examined ambidextrous coping strategies in projects finding a more positive impact of such strategies on larger and globally distributed projects than smaller sized projects. Of particular relevance is that their findings focused on extending agile approaches to project delivery to emphasise the duality of ambidexterity. In Aubry and Lièvre (2010) and also later Lin and McDonough (2011), the role of leadership in fostering ambidexterity was examined with Aubry and Lièvre (2010) drawing from exploitation which focuses on existing leadership competences and exploration learning modes to examine the tensions between different forms of action that can be adopted by project managers. Hoang and Rothaermel (2010) examined the impact of external exploration and exploitation on project performance from an alliance activity perspective, finding that alliance exploitation positively influenced project performance, while alliance exploration impacted negatively on project performance. Using an in-depth case study, Liu and Leitner (2012) emphasised the need for a balanced countenance of ambidexterity's two contradictory analytical constructs if projects were to succeed. Most importantly, they found that structural separation was generally ineffective because of the constant cycling between exploration and exploitation in projects. Liu et al. (2012) examined ambidexterity in complex construction engineering projects construction projects finding evidence of considerable challenges due to the need for a variety of organizational-level support required for its two analytical constructs. Citing the fragmented nature of construction projects (and ensuring structural separation), they suggested the need to create two distinct operational units - each focused on an individual construct of ambidexterity as the most efficient way of managing ambidexterity in construction projects.

Eriksson (2013) suggested that their temporary and short-term nature made projects more attune to exploitation than to exploration. He however pointed out that due to the limitations of sequential and structural separation of its two constructs, ambidexterity should be managed differently at the project, project portfolio and business unit level. Pellegrinelli et al. (2015) however addressing similar questions as Liu et al. (2012) thought it best to facilitate ambidexterity through the flexible but complementary use of projects and programs.

Other recent studies on project-contextualised ambidexterity includes that of Leybourne and Sainter (2012). In their study, they recommended the need for more robust exploration of ambidexterity in light of tensions that exist when considering on one hand, the desire for novelty and improvisation as against on the other hand, the desire for projects to be controlled. In efforts to enhance the use of project-portfolio management (PPM) as a “specific managerial actions that facilitate the simultaneous pursuit of

exploitation and exploration” (O’Reilly and Tushman 2011, p. 8), Turner et al. (2013a) undertook a systematic review of literature focused on understanding ambidexterity mechanisms. This study was slightly extended in Turner et al. (2013b) with the focus on understanding how ambidexterity could be enacted at the individual level, in other words, the level of the implementing project manager. The main findings of this study were that critical resources of ambidexterity resources were connected in a manner that suggests that a project-focused form of ambidexterity was perhaps more complex than is being acknowledged in project management works of scholarship. Turner et al. (2013a, b) were further extended in Turner et al. (2014), where a practical analytical framework for project-based ambidexterity was developed to facilitate multi-level understanding of how ambidexterity may be operationalized. In Turner et al (2015), an empirical (qualitative) study was employed in an attempt to articulate how ambidexterity may best be delivered in project settings. Five different managerial actions characteristic of the individual level of the implementing project manager were found. While contributing to the emerging literature on ambidexterity, our study seeks to organize the different scholarly contributions on this subject in order to undertake a taxonomical analysis of the elements and components of the concept. Turner et al (2015) was extended in Turner et al. (2016) where two distinct project-based forms that led to the enactment of organisational ambidexterity were identified.

Although the study by Turner et al (2013a) produced mechanisms for achieving ambidexterity in organizations, they indicated that there still remains a lack of understanding as to their applicability. Managers on the other hand may not be able to “orchestrate” exploitation and exploration without a proper understanding for all the underlying constituents of ambidexterity, its applications, and its mechanisms. From this review, it is safe to suggest that detailed understanding of how ambidexterity can be contextualised within projects remain far from clear. However, we deduce from temporality project literature (Prado and Sapsed, 2016) and much wider temporality literature in organisation studies (Bakker et al., 2016) that the enactment of organisational ambidexterity within a project context may encompass the need for project teams to temporally switch between exploitation and exploration, an idea derived from temporal switching capabilities first discussed in Gupta et al. (2006).

To sum up, the main challenge in exploring a project-driven notion of ambidexterity relates to the question of the dominance of standards and bodies of knowledge in projects (Morris et al., 2006). This we argue from an overview of the literature will support the exploitation analytical construct of ambidexterity. However, the dominance of standards and bodies of knowledge in projects is much criticised. Projects also involve an element of uniqueness and novelty which suggests a simultaneous emphasis on the exploration analytical construct of ambidexterity. In effect, both analytical constructs of

ambidexterity, namely exploitation and exploration, are arguably likely to present in most projects (Liu and Leitner, 2012). In sum, projects are also seen in the literature as an appropriate means of managing the associated tensions within the ambidexterity constructs of exploitation and exploration.

Taking all the above into consideration, this study is particularly interested in exploring the contemporary elements and components underpinning a project-focused perspective of organisational ambidexterity literature. Thus, we present our research question as:

What is a project management focused definition of ambidexterity taking note of the evolution of organizational ambidexterity literature?

Since we intend to advance a more specified definition of ambidexterity which is contextualised within projects and their managing organizations, associated taxonomical analysis of the elements and components of the concept will be undertaken from a predominantly project perspective (Stingl and Geraldi, 2017). Undertaking such a review of literature reflects our acknowledgement that such reviews serve as an effective means of capturing different and emerging considerations in theoretical concepts. Rowe (2014) claims that this enables the development of new ideas within different disciplines and subjects. At this junction, the authors acknowledge that seeking answers to this research question exposes the project management discipline to a lack of definitional consistencies. It is within this context that our study seeks to develop a more holistic understanding of what remains arguably multifaceted and complex concept within project management scholarship.

To attain this objective, we synthesize the diverse literature in a rigorous and systematic manner, but in marked contrast to similar studies by Turner et al. (2013a), our study however does not solely focus on ambidexterity mechanisms.

Literature reviews as methods

Literature reviews as creative enquiries

Fink (2010) defines a literature review as "...a systematic, explicit and reproducible method for identifying, evaluating and synthesizing the existing body of completed and recorded work produced by researchers, scholars, and practitioners" (p. 3). The review of literature according to Montuori (2005) represents a means of undertaking creative inquiry and dialogue within a community of scholars. The importance of the review of literature as the foundation of any attempt to understand existing theory is well recognized in the literature (Rowley and Slack, 2004; Montuori, 2005). It is thus a crucial initial

step in any research endeavour encompassing the presentation, classification, comparison and evaluation in an organized manner of prior written information on the subject of interest (Bolderston, 2008). Schwarz et al. (2006) identifies the goals of a literature review as primarily (i) to provide a summary of previous research (ii) to undertake a critical examination of such previous research (iii) to provide an explanation of the results of such prior research and finally (iv) to provide clarifications on alternative perspectives of such research. In other words, for literature to be comprehensive, it has to be critical in that it must be able to consolidate knowledge on a subject matter in a manner which is evaluative.

Systematic reviews

In recent years, one of the popular approaches scholars have adopted to undertake a review of literature is the systematic approach (Xiao and Watson, 2017). The popularity of this review approach has extended to a range of disciplines including software engineering (Kitchenham et al., 2009), information systems (Rowe, 2014), organizational (Birkinshaw and Gupta, 2013), and general management studies (Crossan and Apaydin, 2010). More recently, systematic reviews have become popular in not only operations management (Thome et al., 2016; Maestrini et al., 2017), but also project management (Xue et al., 2010; Stingl and Geraldi, 2017; Lee et al., 2018). Systematic reviews of literature are defined by Rowe (2014), drawn from Kitchenham et al. (2009) as "...a form of secondary study that uses a well defined methodology to identify, analyse and interpret all available evidence related to a specific research question in a way that is unbiased and (to a degree) repeatable" (p. 246). Thus, the main ethos of the systematic review is that it emphasizes some form of precise and structured organization in its search, identification and selection of materials to be included in the review (Xiao and Watson, 2017).

The study

The search

The study was conducted in a manner consistent with systematic reviews of literature. One primary driver for this choice is that systematic literature reviews as highlighted by Thomé et al. (2016), emphasize rigour. In particular, unlike the traditional narrative approach to literature review, systematic reviews involves a process-driven collection and synthesis of material. Systematic reviews are also arguably transparent and reproducible (Tranfield, et al. 2003, p. 220). A much more detailed overview of the use of systematic literature reviews in the operations management context (and by implication, project management) is provided by Thomé et al. (2016).

In line with specific guidelines on the use of systematic literature review (Tranfield et al., 2003; Thomé et al., 2016), the starting point of the literature search process was the selection of journals and databases to support the review. Two library and academic search databases (EBSCO and JSTOR) were chosen. The search in databases was also supported by specific searches in journals that appeared to have consistently published papers on the topic of interest, which is ‘ambidexterity’. Here, we specifically identified three journals, Organization Science (OS), Journal of Management (JOM) and the Academy of Management Journals (AOM) - encompassing Academy of Management Review, Academy of Management Journal and the Academy of Management Perspectives. Other journals were also identified at a later stage with a particular focus on project management such as the International Journal of Project Management. We employed three keyword strings “*ambidexterity*”, “*ambidextrous*” and “*ambidex**” and varied their inclusion in the search functionality of the database with the alternate use of “AND” and “OR”. The objective here was to ensure that the widest body of available literature was captured.

The first of the research articles found was published in 1991 while the last was published in 2016. Books, ‘In Press’ and unpublished articles were excluded from the selected sample. The initial sample was refined through a combination of steps that were based on guidance provided by Tranfield et al. (2003) and Thomé et al. (2016). The detailed guidance provided by Thomé et al. (2016) was deemed of particular relevance because their work is specific to operations management (within which project management as a discipline falls within). We slightly adjusted the various recommended processes to take into account the journal rankings and the number of times the article was cited in comparison with the year of publication. Each search and the number of used and analyzed publications is summarised in Table 1.

INSERT Table 1 ABOUT HERE

Literature selection

We developed six steps to guide our filtering of the initially identified publications. Although slightly adjusted in this study, these steps are consistent with earlier highlighted guidance on the conduct of systematic reviews articulated in Tranfield et al. (2003) and Thomé et al. (2016).

- *Step 1:* We sought to first identify publications to be incorporated within the study. This phase involved utilizing the keyword “*ambidex**” as a key word during searches in the EBSCO and JSTOR database and other identified journals.

- *Step 2:* Involved removing all identified duplication between databases and journal search results and then exporting the outcomes to a Microsoft Excel spreadsheet. During this step, we also ensured that all ‘In Press’, non-peer-reviewed and unpublished works were removed from the search results.
- *Step 3:* Involved reviewing the titles, abstracts and conclusions of the remaining articles in order to further refine the sample. This meant that articles which had been captured as part of the duplication rationalization, but which inevitably were not focused on ambidexterity were removed.
- *Step 4:* A check for completeness was undertaken with cited references in the remaining articles ascertained relevance. From this process, we identified 28 articles which had not been captured in our earlier search.
- *Step 5:* This step focused on quality checking. First, we reviewed the quality of the identified articles, discounting articles that were not ranked on the ABS Journal Quality List. In this step, the number of studies were filtered/reduced down to 45. Those 45 articles are listed in Table 2.
- *Step 6:* This final step involved a final check with focus on “ambidexterity” in the relevant context of projects. Most of the theoretical papers and sole literature reviews were dropped, but only after considering their list of references per Step 4. The taxonomical levels of ambidexterity were then constructed based on this final step. However, some of the papers which were discounted in Step 5 were considered in the study to identify indicators and attributes used to support how we conceptualized the study. In Table 3 and Table 4 shows the Analysis for the attributes and identifiers used to define “Dimensions” and “mechanisms” respectively. In sum, while the identified levels were derived from 36 reviewed articles, the final count of papers were in fact only 21 (as shown in Table 5), reflecting that in some instances, more than one level had been accounted for within a single publication.

INSERT Table 2 ABOUT HERE

INSERT Table 3 ABOUT HERE

INSERT Table 4 ABOUT HERE

The review suggests considerable scholarly interest in ambidexterity commenced in approximately 2004, occurring again in 2010 and again in 2015, publications selected for use in the review were those published 2004 and 2016, during the peak of research which is shown in Table 1. From Step 6, nine papers were qualitative and twelve quantitative; five came from 2004-2007, four from 2008-2011, eleven from 2012-2015 and one from 2016-2017. In terms of industry, those papers covered a wide range of industry such as: Financial services/banking, Manufacturing and technology, Construction and engineering, Telecommunications, Research and Development (R&D) projects and Management consulting.

Analysis of the literature

Thomé et al. (2016) suggests that in terms of systematic reviews of literature, "...there is no universal recipe for the analysis stage" (p.412). Thus, we drew upon Geraldi et al. (2011) for guidance on analysis. Our decision was based on this work being published within an operations and project context. Geraldi et al. (2011) had proposed five steps for analysing literature in systematic reviews. Thus, we adopted the following steps in our analysis.

The first step of our analysis focused primarily on extracting definitions and attributes that support conceptualization of levels of ambidexterity. In the second step, we undertook a grouping and meta-grouping of identified definitions and attributes. This facilitated the recognition of the different levels within project organisations where ambidexterity could be applied. We then inserted the year of publication into the resulting grouping of the literature. What this step suggested is that initial literature on ambidexterity appeared predominantly focused on its individual level (see for example Swart et al. 2016), although some literatures such as Jansen et al. (2005) did explore its operational level application. As indicated, the second step of analysis involved grouping and meta-grouping which led to the recognition of the different levels within project organisations where ambidexterity could be applied. The analysis which was undertaken at this step used articles with empirical background as identified in step 6 of the systematic review of the literature (i.e. it used the 21 articles of step 6 of the systematic review) - this is mostly presented in Table 3, 4 and 5. The analysis carried out in the second step generated two further attributes of ambidexterity, those are identified as (i) the *dimensions* and the *mechanisms* of ambidexterity.

INSERT Table 5 ABOUT HERE

The third step of the analysis focused on re-validating the notion of levels by revisiting the most relevant articles, and this triggered the fourth step of the analysis. The fourth step focused on re-validating dimensions and mechanisms of ambidexterity using articles from step 5 of the systematic review (i.e. using the larger pool of the 45 articles as listed in Table 3). The intention behind this exercise was to gather a greater pool of the identified literature to explore all possible mechanisms of ambidexterity and categorize them for ease of use and identification. The fifth (and final step) involved analysing dimensions of ambidexterity against levels of ambidexterity as represented in Table 6. In other words, we have looked into more details of what dimensions can be found in each of the levels identified. This final step serves as means of understanding what dimensions of ambidexterity are expected at each level of the organization. An additional and similar type of analysis was also undertaken against dimensions of ambidexterity and its mechanisms. This is presented in Table 7.

INSERT Table 6 ABOUT HERE

INSERT Table 7 ABOUT HERE

In light of the above discussion, we have summarized the notion of levels, dimensions and mechanisms in Figure 1 for ease of reference.

INSERT Figure 1 ABOUT HERE

Finally, the literature suggests a number of the influencers, which could have an effect on the levels, dimensions and mechanisms of ambidexterity. These influencers consist of external environmental factors (Lavie et al. 2010), and other parameters such as resource availability, firm size (Choi and Phan, 2014) and dynamic capabilities (Rothaermel and Alexandre 2009).

The findings

Levels, dimensions and mechanisms of ambidexterity

Four levels of ambidexterity which we termed ‘strategic’, ‘project’, ‘operations’ and ‘individual’ were identified in our study, resonating with ongoing multi-level (Costa et al., 2013) and diversity (Harrison and Klein, 2007) perspectives within organisation studies. We draw upon Rousseau (1985) to define levels as ‘the hierarchical relationship and attributes of the constituent elements of an organisation’ (p. 3

and 4). According to Gibson and Birkinshaw (2004), managing ambidexterity requires connections to be made between various levels of ambidexterity in order to facilitate their alignment. We are interested in these levels as Chandrasekaran et al. (2012) suggests that tensions occur at multiple levels of an organization and that an organisation's inability to manage the tensions associated with ambidexterity at both its strategic and project levels can create substantial difficulties.

Levels of ambidexterity

The literature suggests that it is at the strategic level that exploration and exploitation decisions are made within an organization (Chandrasekaran et al., 2012). It is also at this level that decisions are made on how the organization will be designed and structured in order to support exploitative or exploratory opportunities are made (Bednarek et al., 2016). To resolve the tensions associated with ambidexterity, senior managers will usually draw upon their knowledge about the external market and their understanding of the organisations competencies and capabilities (Wei et al., 2014).

While the literature suggests that decisions relating to managing opportunities emanating from exploitative or exploratory opportunities takes place at the strategic level of organisations, these opportunities can only be made ready for use at the project level supported by specific project architectures or project management processes. In fact, it is at the project level that organisations align and adapt to changes in the market associated with exploitative or exploratory.

In terms of specific project architectures to support ambidexterity, a number of different architectures can be adopted. For example, the organisation can choose to adopt dual architectures to manage its exploitative and exploratory opportunities. Such approach implies physically separating between exploitative and exploratory-related activities. Organisation can also choose to adopt dual methods of project delivery, with loosely 'coupled' project mechanism (in effect, loose abidance to specifications and client requirements) focusing on exploitation while tightly coupled delivery mechanism which emphasis rigid controls and tight abidance to client needs being utilized to deliver exploitative focused opportunities. The challenge of project team architecture specificity under ambidexterity is that project environments are particularly dynamic and complex while in a number of cases, project teams are structured in a less than agile manner (Mishra and Sinha, 2016), that may be unable to support the demand for almost immediate agility. The literature suggests that how projects are structured may actually influence how individual projects behave. Certain project architectures appear more suitable for projects that are routine and focus on efficiencies, while some other architectures,

usually those that tend to be more organic, are more suitable to projects, particularly those with high pace and complexity that emphasize adaptability and flexibility.

On the question of project management processes, concerned about potential limitations of control-dominant philosophies, scholars such as Leybourne and Sainter (2012) have emphasised an ongoing shift in project and team outlook to an emphasis on improvisation. However, we posit that such approaches face a number of boundary integration challenges as the operational level provides the necessary platform for resources common to the strategic and project level to be shared. It is important to highlight that a focus on improving ambidexterity at a strategic level with no or slight consideration for the operational aspects reduces prospects of the organization developing, deploying, and leveraging flexibility.

As the lowest level of ambidexterity is the ‘individual’ level. Mom et al. (2007, 2009) focus on how individuals within an organization can actually organize, mobilise and manage exploitation and exploration. Jørgensen and Becker (2017) suggests that maintaining either a relationship-centric or expert-centric team design can promote ambidextrous capacities in teams. The same will arguably apply to project teams where behavioural response to the daily tensions associated with the need to balance opportunity exploitation against its exploration by individual project managers (Turner et al., 2013b) and project team members (Liu and Leitner, 2012) is expected to contribute to project success. The literature also suggests that the set of characteristics of individual project managers is a contributing factor to the success of projects (Chipulu et al., 2013; Petro & Gardiner, 2015). Similarly, project stakeholder theory suggests that individual stakeholders contribute significantly to project success (Ojiako et al., 2015).

Dimensions of ambidexterity

We identified four ambidexterity dimensions which included ‘knowledge’, ‘technology’, ‘process’ and ‘behaviour’. Here, by ‘dimensions’, we are referring to specific organizational features which could create paradox(es) amongst themselves and which could lead to a contagious effect on the host organization. It is contended in this research that a resolution of such paradox(es), whether this resolution takes place within one or a group of dimensions, should see enhanced performance and business sustainability throughout.

A frequently discussed theme in ambidexterity-related research is the paradox in managing the contradiction between a short-term focus on exploiting repetitive and well-defined *knowledge* and the need for organisations to balance this against the need to expand the organisation’s knowledge of new ideas (Raisch et al., 2009). Since both elements are critical for sustainable competitive advantage, firms

need to explicitly manage both exploration and exploitation (Gupta et al., 2006). Thus, organisations that are ambidextrous are those that show a capability to develop and at the same time, seek (and also) manage knowledge which may be unfamiliar (exploration).

The literature, for example Chandrasekaran et al. (2012) and Voss and Voss (2013), suggests that *technology*, that is the practical application of knowledge of a scientific nature, can serve as an aid to manage ambidexterity and exploit its opportunities through its ability to enable firms to fully exploit their resource base, develop novel products and enter new markets. For these reasons, organisations with a lower level of technological capability tend to focus more on exploiting opportunities while organisations with higher level of technology competency tend to focus more on exploring opportunities (Zang and Li, 2017).

Process refers to a series of carefully crafted multi-level routines and actions that the organization will engage with in order to achieve a desired balance between exploitation and exploration (Zimmermann et al., 2015). The *process* dimension is particularly interested in resolving trade-offs arising from for example process variations (Matthews et al., 2015) and trade-off between operational efficiencies and strategic flexibilities (Kortmann et al., 2014). The literature suggests that organisations have the ability to build "...a set of processes or systems that enable and encourage individuals to make their own judgments about how to divide their time between conflicting demands for alignment and adaptability" (Gibson and Birkinshaw, 2004, 211). Zimmermann et al. (2015) found for example that although members of the top management team in an organisation at a specific point will (i) highlight a need for the organisation to adopt ambidexterity, (ii) follow this up by designing organizational structures which will support such ambidexterity, in reality, organisations also do depend on this process being complemented by an emergent form of ambidexterity which is driven from the bottom by project-level managers responding to changes in competitive realities which sometimes the top management team is unaware of.

A *behavioural* perspective of ambidexterity also exists in the literature (see Patel et al., 2012). Here, the emphasis is on resolving the tension between 'hard elements' of behaviour such as discipline and 'soft elements' such as support and trust. The literature suggests that in order to effectively manage prevalent tensions associated with ambidexterity, an organization need to demonstrate behavioural capabilities that suggests an ability to simultaneously exploit and explore (Jansen et al., 2009). Thus, the behavioural perspective focuses on the way organisations (and its individual managers) responds to ambidextrous stimuli. The attributes of such behaviour are generally according to Ghoshal and Bartlet (1994) manifested at the level of the operational unit.

Mechanisms of ambidexterity

We also identified *mechanisms of ambidexterity*. By mechanism, we suggest by referring to the works of both Jansen et al. (2009) and Turner et al. (2013a), the specific established means by which organization's manage the contradictions and tensions associated with ambidexterity. Against this attribute, we identified from the analysis, four sets of mechanisms for resolving the tensions we had identified in this attribute: (i) structural mechanisms, (ii) learning mechanisms, (iii) selection/allocation mechanisms – which encompassed for example the allocation of resources to meet market demands and the balancing of resources to equalize between codified knowledge and new knowledge (Matthews et al. 2015) - and (iv) communication mechanisms – which dealt with for example formalization and communication of rules (Mom et al. 2009).

We observed that *structural mechanisms* were the most mentioned in the literature. In terms of the *learning mechanisms* for example, at the individual level, ambidextrous individuals have the ability to learn from previous events to enhance application for future circumstances. Also, they have the ability to learn as they go-about adapting to evolving circumstances (Aubry and Lievre, 2010). On the other hand, in terms of *communication mechanisms*, the literature alludes to knowledge sharing and communication being one of the key attributes to achieving ambidexterity (Jansen et al., 2005; Mom et al., 2007). An improved level of communication allows integration at all levels of the organization. Integration at the knowledge workers' level can be achieved by the organisation focusing on creating an environment conducive to “trust and reciprocity” (Turner et al., 2015).

We note that the mechanisms defined here may resemble in one way or another Turner et al's (2013a) mechanisms, where he used the organization's Intellectual Capital for this purpose. Our definition and the detailed analysis we provided for mechanisms however delves into the 'micro-level' for those compared to Turner et al's (2013a) general definition and approach. We also believe that our definition, with its 'micro- level' approach, provides a platform for their 'applicability' – which is an area of a great concern per Turner et al (2013a).

Discussion

The concept of ambidexterity is increasingly important within organisations. This interest has been supported by extensive research mainly in general management and organisation studies literature. However, although strategic initiatives within organisations are in most cases realised through the structure provided by projects, there is a paucity of research on ambidexterity set *explicitly* within the

context of project management. This is however set to change following growing interest in the topic among project and engineering management scholars. This suggests an increasing realisation among project management practitioners and scholars that projects represent perhaps the best means of contextualising ambidexterity.

In view of the research question presented at the start of the paper, “*What is a project management focused definition of ambidexterity taking note of the evolution of organizational ambidexterity literature?*”, ambidexterity is the ability of the organization to employ a range of techniques to resolve paradoxical challenges within all levels of the organization (separate and interwoven) to overcome external competition and dynamics, taking into account internal limiting factors, such as size, resource availability, and absorptive capacity of the organization.

The implementation of these as a strategy is realised through projects requires looking at governance of projects in a new light, bearing in mind ambidexterity, whose definition we here expand to:

Ambidexterity is the ability of the organization to employ structural, learning, selection, and communication techniques to resolve paradoxical challenges within intellectual, behavioural, technological, and processual dimensions in the various levels of the organization—these levels (strategic, projects, operations, and individual) can be separate or interwoven—to overcome situations of external dynamicity and competitive environments, considering internal limiting factors such as size, resources availability, and absorptive capacity of the organization.

At this point, we reiterate that the objective of our study is to contribute to scholarship by advancing an understanding of the ambidexterity concept that is set within the context of project management. As such, the intention of this paper holds as far as it provides a more specific and by implication, informative definition for ambidexterity that is more readily applicable, beneficial and meaningful to project management scholars and practitioners. It is not the intention of this study that this project-contextualised definition for ambidexterity replaces well recognised definitions of ambidexterity that have so far been articulated in the literature.

The study contributes to project management theory and practice in three ways which are distinct. The first contribution of the paper is that it sets the scene for vibrant dialogue and debate in relation to project-contextualised ambidexterity. In doing this, while taking into consideration the evolution of project-contextualised ambidexterity literature such as that of Turner et al. (2013a, 2013b, 2014, 2015,

2016) and Bednarek et al. (2016), this is the first study that explores the potential for an expanded project management focused definition of ambidexterity.

Second, our findings suggests that ambidexterity can be viewed from different levels, dimensions and mechanisms. We identified four such levels consisting of the strategic level, the project level, the operational level and finally, the ‘individual’ level. In terms of dimensions, we identified four consisting of ‘knowledge’, ‘technology’, ‘process’ and ‘behaviour’. We also identified four sets of mechanisms of ambidexterity, namely structural mechanisms, learning mechanisms, selection/allocation mechanisms and communication mechanisms. Each of the different levels, dimensions and mechanisms of ambidexterity were associated with attributes and/or identifiers. Analysis appears to suggest not only that each level, dimension and mechanism of ambidexterity are able to support both exploitation and exploration, but also that these attributes are interconnected. As we examine each of these different levels, dimensions and mechanisms, we suggests that they represent specific aspects of project-based organising. The consideration of levels, including the project level, is important to understand the ambidextrous nature. It is at this level that organisations can align and adapt to approach exploitative or exploratory opportunities. In developing project management structures, it is important to recognise the different requirements of exploitative and exploratory opportunities. Some structures and project-management philosophies will be more suited to the different demands of each. Similarly, when exploring project management processes, it will appear that ambidexterity requires a strong connection between the strategic and operational level which seems to be often lacking in practice. These findings are also indicative of the complexity of the relationships between the different levels, dimensions and mechanisms of ambidexterity.

Third, our study findings offer project management scholars and practitioners a point of reference for further research into the different levels, dimensions and mechanisms of project-contextualised ambidexterity. In effect, our findings serves as a foundation for building much more understanding of the levels, dimensions and mechanisms of project-contextualised ambidexterity in other organisational forms which may be emerging. These may include autonomous -managed networks. Our findings would arguably equally apply to other disciplines which are aligned to project management. One such discipline could be programme management.

Bartolucci et al. (2010) had suggested that a concern with systematic reviews often relates to questions as to whether the eligibility criteria of the identified literature reviewed were consistent and well established. Noting this, further studies may choose to undertake exploratory meta-analysis in order to further ensure consistency in literature selection. However, despite this limitation, engaging in the

literature using a systematic review allowed for a detailed understanding of the broad range of perspectives held by scholars and practitioners on the different levels, dimensions and mechanisms of a project-contextualised form of ambidexterity. Thus, future studies, as well as meta-analysis, may also choose to undertake critically scrutinise the different levels, dimensions and mechanisms of any such project-contextualised form of ambidexterity. There are two ways this can be done. Firstly, it may be through quantitative research which will focus on understanding the relationship between these the different levels, dimensions and mechanisms. Secondly, it may be done through qualitative studies, in this instance, through case study research. The obvious benefit of case study research will be that through intimate engagement with practitioners, we will be able to develop a project-contextualised form of ambidexterity that is relevant to project management practice. This will overcome our earlier observation that ambidexterity is seen as being of little or no relevance to practice since it remains largely theoretically constructed. Future studies can look at different practices which could be customized within the organization to serve achieving ambidexterity, one of such practices could be those of the project portfolio management. Project portfolio management practices in this case can be looked at closely along with those mechanisms of ambidexterity as generated in this study to identify similarities for ease of application and practicality in use.

Finally, there is ample opportunity in terms of future studies focused on testing not only the validity of our conclusions – which proposed that that a project-focused notion of organisational ambidexterity involved different levels, dimensions and mechanisms - but also testing how the interface between these different levels, dimensions and mechanisms do specifically impact upon a project-focused notion of organisational ambidexterity. What we have been able to demonstrate in this paper is that a project-focused notion of organisational ambidexterity involves different levels, dimensions and mechanisms and that this taxonomy is useful in terms of both understanding and analysing organisational ambidexterity. Each of the propositions presents opportunities for distinct further studies that will be enhanced through empirical works. Noting that while prior empirical studies on ambidexterity exist, the majority have focused on the organisational level (Kassotaki et al., 2018; Zimmermann et al., 2018), future studies emanating from our study can proceed in a number of directions. For example, cognizant of recent studies by Kassotaki et al. (2018), future research could seek to examine not only (i) how ambidexterity is manifested across these different levels, dimensions and mechanisms of ambidexterity, but also (ii) how ambidexterity is managed across different organisational levels, cognizant of its varying dimensions and mechanisms. Such studies, for example when undertaken from the lens of project readiness (see Jones et al., 2005; Ahmadi et al., 2015; Ram and Corkindale, 2015; Shokri et al., 2016)

will serve as a means of gaining more meaningful insight into the interplay between the different levels, dimensions and mechanisms of a project-focused notion of organisational ambidexterity. Another direction for future research is to explore the proactive role that project managers play during the initiation of ambidextrous strategies beyond the borders of the projects they manage. For example, while a substantial amount of ambidexterity research appears to point to senior executives serving as the central driving force and key decision originators in the implementation of firm-based solutions for ambidexterity (Tushman and O'Reilly, 1996; Tushman and Euchner, 2015; Birkinshaw and Gibson, 2004; Gibson and Birkinshaw, 2004; Lubatkin et al., 2006; Jansen et al., 2008; Raisch et al., 2009; Simsek, 2009; Mihalache et al., 2014; Jurksiene and Pundziene, 2016), the reality could be otherwise. Zimmermann et al. (2018) for example suggests that 'frontline managers' (known for their autarchic strategic behaviour - see Burgelman, 1983) actually play an active role in shaping the processes and systems organisations require to balance the countenance of ambidexterity's two contradictory analytical constructs. Drawing from Thorpe and Mead (2001), "Frontline supervisors typically include the project managers" (p. 409).

Conclusion

We have established both the importance of the concept of ambidexterity and the lack of its research set explicitly within the context of project management. In the light of this, we have widened the definition of ambidexterity to encompass a project-focused understanding of the concept. We have described a taxonomical analysis of contemporary organisational ambidexterity literature. Our findings suggests that ambidexterity can be viewed from different levels, dimensions and mechanisms, and we specify each of these. Our analysis suggests that each level, dimension and mechanism are able to support both exploitation and exploration, that they represent specific aspects of project-based organising, and that these attributes are interconnected in complex ways. In doing this we also help to set the scene for dialogue around project-contextualised ambidexterity, and provide a point of reference for further research. We have further pointed to further work to strengthen these first steps, suggesting studies relating to specific propositions, exploratory meta-analyses, further quantitative study of the different levels, dimensions and mechanisms and their relationships, contextualised case studies, and on the practical proactive role that project managers play. This paper therefore forms an important step in understanding the concept of ambidexterity within the project context upon which academics and practitioners can build upon.

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Table 1. Number of publications by each refining step

| Search option | Database/journal | Step 1 | Step 2 | Step 3 | Step 4 | Step 5 | Step 6 |
|----------------------|-------------------------|---------------|---------------|---------------|---------------|---------------|---------------|
| "ambidexterity" | EBSCO | 1052 | 700 | 46 | 74 | 45 | 21 |
| "ambidextrous" | JSTOR | 408 | | | | | |
| "ambidex*" and/or | OS, JOM, AOM | 17 | | | | | |

Table 2. Analysis of ambidexterity levels

| <i>Key publications</i> | <i>Motivation of the study</i> | <i>Industry</i> | <i>Method</i> | <i>Strategic level</i> | <i>Project level</i> | <i>Operations level</i> | <i>Individual level</i> |
|-------------------------------------|--|--|---------------|--|--|--|--|
| <i>Matthews et al. (2015)</i> | Explores process improvement through the theoretical lens of organizational ambidexterity. | Building contractor Engineering consultancy Management consultancy Telecom firms. | Qualitative | N/A | N/A | Process control versus process innovation. Operational process improvement. | N/A |
| <i>Jansen et al. (2012)</i> | Examines the effect of unit-level ambidexterity on performance taking decentralization of multi-units, their resource dependence and munificence into account. | Financial services | Quantitative | Organizational/strategic level decentralization of sub-units and their resource dependence fall under strategic decisions of the organization. | N/A | N/A | N/A |
| <i>Chandrasekaran et al. (2012)</i> | Explores ambidexterity as a competence that resides at different organisational levels. | Research and Development (R&D) projects and high tech business. | Quantitative | The initial decision of exploitation or exploration cascades from a strategic decision initiated by senior leadership. | Two types of projects had been explored for fit to ambidexterity; exploratory and exploitative types. Incentives are provided to see balance between these projects through. | N/A | N/A |
| <i>Gibson and Birkinshaw (2004)</i> | Promotes the notion that contextual ambidexterity mediates behavioural elements in the organization | General | Quantitative | N/A | N/A | N/A | Contextual ambidexterity is achieved by building a context that encourages individuals to make their own judgment of how to best divide their time |

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|--------------------------------------|---|---------------------|--------------|--|---|--|--|
| | | | | | | | between conflicting demands. |
| <i>Kortmann et al. (2014)</i> | Explores the balancing between operational efficiency and strategic effectiveness through the use of the mediating role of mass customization (i.e. production) | Manufacturing | Quantitative | Balance between strategic flexibility at a strategic level and operational efficiency at operations level. | N/A | Balance between strategic flexibility at a strategic level and operational efficiency at operations level. | N/A |
| <i>Aubry and Lievre (2010)</i> | Examines the tensions between different modes of action that a project manager uses throughout a project | Expedition projects | Qualitative | N/A | N/A | N/A | A project manager is caught in tension between two modes of actions. |
| <i>Andriopoulos and Lewis (2009)</i> | Examines nested paradoxes of innovation that cover various levels in the organization: strategic, project and individual | Product design | Qualitative | Applies differentiation and integration techniques to profits versus breakthroughs. | Leverages synergies between project constraints and takes emerging possibilities into account | N/A | Passion versus discipline during delivery as exhibited by knowledge workers. |
| | | | | | Loose coupling versus tight coupling with client during project delivery. | | |
| <i>Pellegrinelli et al. (2015)</i> | Explores complementary roles of projects and programs in providing ambidexterity | Retail banking | Qualitative | N/A | The complimentary use of projects and programs produce ambidexterity. | N/A | N/A |
| <i>Jansen et al. (2005)</i> | Undertakes a study environmental and organizational antecedents and their effects on ambidexterity | Financial services | Quantitative | N/A | N/A | Ambidextrous units are characterized with decentralization and formalization of rules. | Ambidextrous units are characterized by individuals' connectedness. |

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|--|--|-----------------------------|--------------|--|--|--|---|
| <i>Cao et al. (2009)</i> | Examines how to operationalize ambidexterious improvements and how they are applied in a balanced or combined mode | High tech | Quantitative | N/A | N/A | The allocation of resources on exploitation or exploration activities is dependent on the way of how ambidexterity is being operationalized. | N/A |
| <i>Turner et al. (2015)</i> | To study the use of intellectual capital and means of achieving ambidexterity | Technology projects | Qualitative | N/A | Project based working is dominant work in contemporary organizations and it relies heavily on exploitation and exploration. | N/A | N/A |
| <i>Bednarek et al. (2016)</i> | To explore the use of dynamic client portfolio as source of ambidexterity | Global reinsurance industry | Qualitative | The selection of clients is a strategic decision and is very relevant to selecting the portfolio of projects for the organization. | The selection of clients is a strategic decision and is very relevant to selecting the portfolio of projects for the organization. | N/A | N/A |
| <i>Voss and Voss (2013)</i> | To examine ambidexterity within and across organizational functions and test the effect on performance | Service sector | Quantitative | N/A | N/A | Ambidexterity is theorized and tested at a functional level: product and market. | N/A |
| <i>Mom et al. (2007)</i> | This study tests the influence of managers' knowledge flow direction on ambidexterity | Electronic industry | Quantitative | N/A | N/A | N/A | Managers' communication means has an effect on ambidexterity. |
| <i>Rothaermel and Alexandre (2009)</i> | To study the effect of internal-external technology sourcing om ambidexterity | Manufacturing | Quantitative | N/A | N/A | Deciding on the source of technology used is a functional/ | N/A |

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|-------------------------------|---|-----------------------------|--------------|--|--|---|--|
| | | | | | | operational decision. | |
| <i>Turner et al. (2014)</i> | To develop a framework to capture knowledge requirements of projects at multiple organizational levels. | Telecomm. | Qualitative | N/A | Capture knowledge at a project level to build exploitation and exploration capabilities. | N/A | N/A |
| <i>Lubatkin et al. (2006)</i> | To study how top management team behavioural integration affects organizational-level ambidexterity. | Small to medium sized firms | Quantitative | N/A | N/A | N/A | The behavioural integration of Top Management Teams (TMT) has a major effect on ambidexterity. |
| <i>He and Wong (2004)</i> | To examine how exploitation and exploration can jointly influence performance in the context of technological innovation. | Manufacturing | Quantitative | N/A | N/A | Exploitation and exploration requires different structures, process, strategies and capabilities. | N/A |
| <i>Wei et al. (2014)</i> | To examine the effect of exploitation and exploration activities on firms with proactive and responsive market orientation. | General | Quantitative | Studies the role of strategic orientation of market approach on ambidexterity. | N/A | N/A | N/A |
| <i>Turner et al. (2013a)</i> | To study the use of intellectual capital and means of achieving ambidexterity | Projects | Qualitative | NA | This study mainly addresses IC in technology projects | NA | NA |

Table 3. Analysis - Attributes and identifiers used to define “Dimensions”

| <i>Dimensions</i> | <i>Attributes and/or identifiers</i> |
|---|---|
| <i>Knowledge</i> | Develop, diffuse, codify, assimilate and share knowledge (Rowley et al., 2000; Jansen et al., 2005; Jansen et al., 2006; Lubatkin et al., 2006; Mom et al., 2007; Im and Rai, 2008; Cao et al., 2009; Jansen et al., 2012; Eriksson, 2013; Turner et al., 2014; Wei et al., 2014; Matthews et al., 2015; Bednarek et al., 2016) |
| | Pursue, obtain and manage innovation (Jansen et al., 2006; Cao et al., 2009; Andriopoulos and Lewis, 2009; Jansen et al., 2012; Matthews et al., 2015) |
| <i>Behaviour</i> | Cognitive use for activity assigning (Kaplan, 2008; Chandrasekaran et al., 2012) |
| | Individual judgement of conflicting demands (Gibson and Birkinshaw, 2004) |
| | Stretch and discipline and support and trust (Gibson and Birkinshaw, 2004) |
| | Alignment and adaptability (Gibson and Birkinshaw, 2004) |
| | Cognitive tension between action modes (Aubry and Lievre, 2010) |
| | Discipline versus passion during delivery (Andriopoulos and Lewis, 2009) |
| | Defenders versus prospectors role (Auh and Menguc, 2005); team composition and company affiliation (Beckman, 2006) |
| | Production of radical innovation (O'Connor and DeMartino, 2006). |
| <i>Technology</i> | R&D and technology projects (Chandrasekaran et al., 2012) |
| | Mass customization and production impact upon efficiency (Kortmann et al., 2014) |
| | Innovation in New Product Designs (Andriopoulos and Lewis, 2009) |
| | Developing new product technologies and capabilities (Voss and Voss, 2013) |
| | Internal versus external technology sourcing (Rothaermel and Alexandre, 2009); and technological innovation (He and Wong, 2004). |
| <i>Process</i> | Process improvement versus process control (Matthews et al., 2015) |
| | Operational efficiency versus strategic flexibility (Kortmann et al., 2014) |
| | Coupling during delivery (Andriopoulos and Lewis, 2009); Process oriented approach to flexibility and change (Pellegrinelli et al., 2015); |
| | Process structures (Rowley et al., 2000; Jansen et al., 2005); |
| | Knowledge attainment through client portfolios (Bednarek et al., 2016); |
| | Process innovation (Zahra and Das, 1993); |
| | Production processes for flexibility and efficiency (Adler et al., 1999) |
| | Autonomous strategic processes (Burgelman, 1991, 2002) |
| Sensing opportunities and routines (O'Reilly and Tushman, 2011,2013). | |

Table 4. Analysis - Attributes and identifiers used to define “Mechanisms”

| <i>Mechanisms</i> | <i>Attributes and/or identifiers</i> |
|--|---|
| <i>Structural</i> | Organizational structure (Jansen et al., 2012) |
| | Resource dependence (Jansen et al., 2012) |
| | Structural separation (Chandrasekaran et al., 2012) |
| | Mass customization (Kortmann et al., 2014) |
| | Innovation partitioning (Kortmann et al., 2014) |
| | Complementary tactics across all structural levels (Andriopoulos and Lewis, 2009) |
| | Structural balancing (Pellegrinelli et al., 2015) |
| | Portfolio management utilisation (Pellegrinelli et al., 2015); |
| | Structural decentralization (Jansen et al., 2005) |
| | Project activity balancing (Cao et al., 2009); |
| | Structure selection (Turner et al., 2015) |
| | Cross functional domain combination (Voss and Voss, 2013) |
| | Organizational design (He and Wong, 2004) |
| | Organizational domain separation (Lavie et al., 2009,2010) |
| | Simultaneous structural utilisation (Bradach, 1997) |
| | Tightly coupled sub-units (Benner and Tushman, 2003) |
| Different operational approaches (Kaplan and Henderson, 2005). | |
| <i>Learning</i> | Exploitative learning and reduction of process variation (Matthews et al., 2015) |
| | Cross-resources learning enabled switching (Kortmann et al., 2014) |
| | Emergent learning through adaptation (Aubry and Lievre, 2010) |
| | Enhancing organizational absorptive capacity (Jansen et al. 2006; Andriopoulos and Lewis, 2009) |
| | Execute projects with learning versus execution with efficiency (Edmonson, 2008; Turner et al., 2014) |
| | Balancing existing versus new competencies (Danneels, 2002) |
| <i>Selection</i> | Procurement methodology selection (Eriksson, 2013) |
| | Project team selection (Eriksson, 2013) |
| | Incentive allocation (Chandrasekaran et al., 2012) |
| | Adaptive allocation of resources to achieve strategic flexibility (Kortmann et al., 2014) |
| | Employees’ “enrichment” as innovation routes (Kortmann et al., 2014) |
| | Resource allocation (Andriopoulos and Lewis, 2009) |
| | Organisational size driven resource allocation (Cao et al., 2009) |
| | Client portfolio selection (Bednarek et al., 2016) |
| | Resources prioritisation (He and Wong, 2004) |
| | Resources allocation through strategic orientation (Wei et al., 2014) |
| | Source selection across organizational boundaries (Rosenkopf and Nerkar, 2001) |
| | Knowledge capturing (Bednarek et al., 2016) |
| | Internal versus external sourcing (Rothaermel and Alexandre, 2009) |
| Re-allocation of resources (O’Reilly and Tushman, 2011,2013) | |
| Project type selection (Pellegrinelli et al., 2015) | |
| <i>Communication</i> | Facilitated communication through structural decentralization/centralization (Eriksson, 2013) |
| | Unit resource dependency (Jansen et al., 2012) |
| | Downward communication (Chandrasekaran et al., 2012) |
| | Adaptation of responsive behaviour (Gibson and Birkinshaw, 2004) |
| | Employee interaction and knowledge flow (Jansen et al., 2005) |
| | Social networks utilisation (Turner et al., 2015) |
| | Communication flow and knowledge (Mom et al., 2007) |
| | Knowledge flow and behaviour (Lubatkin et al., 2006) |
| Diversity (Simsek, 2009) | |

Table 5. Studies/articles used in Steps 5 & 6 of the systematic review

| SN | Key publications | Title of the study | Publishing journal | No. of citations as of June 2018 |
|-----------|---------------------------------------|---|---|---|
| 1 | <i>Matthews et al. (2015)*</i> | Organisational ambidexterity within process improvement: An exploratory study of four project-oriented firms | <i>Journal of Manufacturing Technology Management</i> | 15 |
| 2 | <i>Jansen et al. (2012)*</i> | Ambidexterity and performance in multiunit contexts: Cross-level moderating effects of structural and resource attributes | <i>Strategic Management Journal</i> | 191 |
| 3 | <i>Chandrasekaran et al. (2012)*</i> | Antecedents to ambidexterity competency in high technology organizations | <i>Journal of Operations Management</i> | 94 |
| 4 | <i>Gibson and Birkinshaw (2004)*</i> | The antecedents, consequences, and mediating role of organizational ambidexterity | <i>Academy of Management Journal</i> | 2890 |
| 5 | <i>Kortmann et al. (2014)*</i> | Linking strategic flexibility and operational efficiency: The mediating role of ambidextrous operational capabilities | <i>Journal of Operations Management</i> | 71 |
| 6 | <i>Aubry and Lievre (2010)*</i> | Ambidexterity as a competence of project leaders: A case study from two polar expeditions | <i>Project Management Journal</i> | 36 |
| 7 | <i>Andriopoulos and Lewis (2009)*</i> | Exploitation-exploration tensions and organizational ambidexterity: Managing paradoxes of innovation | <i>Organization Science</i> | 1136 |
| 8 | <i>Pellegrinelli et al. (2015)*</i> | Facilitating organizational ambidexterity through the complementary use of projects and programs | <i>International Journal of Project Management</i> | 29 |
| 9 | <i>Jansen et al. (2005)*</i> | Exploratory innovation, exploitative innovation, and ambidexterity: the impact of environmental and organizational antecedents | <i>Schmalenbach Business Review</i> | 335 |
| 10 | <i>Cao et al. (2009)*</i> | Unpacking organizational ambidexterity: Dimensions, contingencies, and synergistic effects | <i>Organization Science</i> | 756 |
| 11 | <i>Turner et al. (2015)*</i> | Ambidexterity in projects: An intellectual capital perspective | <i>International Journal of Project Management</i> | 29 |
| 12 | <i>Bednarek et al. (2016)*</i> | Dynamic client portfolios as sources of ambidexterity: Exploration and exploitation within and across client relationships | <i>Long Range Planning</i> | 17 |
| 13 | <i>Voss and Voss (2013)*</i> | Strategic ambidexterity in small and medium sized enterprises: Implementing exploration and exploitation in product and market domains | <i>Organization Science</i> | 144 |
| 14 | <i>Mom et al. (2007)*</i> | Investigating managers' exploration and exploitation activities: The influence of top-down, bottom-up, and horizontal knowledge inflows | <i>Journal of Management Studies</i> | 424 |

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|----|---|--|---|------|
| 15 | <i>Rothaermel and Alexandre (2009)*</i> | Ambidexterity in technology sourcing: The moderating role of absorptive capacity | <i>Organization Science</i> | 677 |
| 16 | <i>Turner et al. (2014)*</i> | Ambidexterity and knowledge strategy in major projects: A framework and illustrative case study | <i>Project Management Journal</i> | 18 |
| 17 | <i>Lubatkin et al. (2006)*</i> | Ambidexterity and performance in small- to medium-sized firms: the pivotal role of top management team behavioural integration | <i>Journal of Management</i> | 1359 |
| 18 | <i>He and Wong (2004)*</i> | Exploration vs. exploitation: an empirical test of the ambidexterity hypothesis | <i>Organization Science</i> | 3009 |
| 19 | <i>Wei et al. (2014)*</i> | Organizational ambidexterity, market orientation, and firm performance | <i>Journal of Engineering and Technology Management</i> | 32 |
| 20 | <i>Turner et al. (2013a)*</i> | Mechanisms for managing ambidexterity: A review and research agenda | <i>International Journal of Management Reviews</i> | 214 |
| 21 | <i>Turner et al. (2013b)*</i> | Ambidexterity in managing business projects –an intellectual capital perspective | <i>International Journal of Managing Projects in Business</i> | 8 |
| 22 | <i>Rowley et al. (2000)</i> | Redundant governance structures: An analysis of structural and relational embeddedness in the steel and semiconductor industries | <i>Strategic Management Journal</i> | 2332 |
| 23 | <i>Jansen et al. (2005)</i> | Exploratory innovation, exploitative innovation, and ambidexterity: the impact of environmental and organizational antecedents | <i>Schmalenbach Business Review</i> | 335 |
| 24 | <i>Jansen et al. (2006)</i> | Explorative Innovation, Exploitative Innovation and Performance: Effects of Organizational Antecedents and Environmental Moderators | <i>Management Science</i> | 2260 |
| 25 | <i>Im & Rai (2008)</i> | Knowledge sharing ambidexterity in long-term interorganizational relationships | <i>Management Science</i> | 378 |
| 26 | <i>Eriksson (2013)</i> | Exploration and exploitation in project-based organizations: Development and diffusion of knowledge at different organizational levels in construction companies | <i>International Journal of Project Management</i> | 112 |
| 27 | <i>Kaplan (2008)</i> | Framing contests: Strategy making under uncertainty. | <i>Organization Science</i> | 651 |
| 28 | <i>Auh & Menguc (2005)</i> | Balancing exploration and exploitation: The moderating role of competitive intensity | <i>Journal of Business Research</i> | 608 |
| 29 | <i>Beckman (2006)</i> | The influence of founding team company affiliations on firm behavior | <i>Academy of Management Journal</i> | 666 |
| 30 | <i>O'Connor & DeMartino (2006)</i> | Organizing for radical innovation: an exploratory study of the structural aspects of RI management systems in large established firms | <i>Journal of Product Innovation Management</i> | 322 |

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|----|--------------------------------------|---|--|------|
| 31 | <i>Zahra & Das(1993)</i> | Innovation strategy and financial performance in manufacturing companies: An empirical analysis | <i>Production Operations Management</i> | 192 |
| 32 | <i>Adler et al. (1999)</i> | Flexibility versus efficiency: A case study of model changeovers in the Toyota production systems | <i>Organization Science</i> | 1560 |
| 33 | <i>Burgelman (1991)</i> | Intraorganizational ecology of strategy making and organizational adaptation: Theory and field research | <i>Organization Science</i> | 1735 |
| 34 | <i>Burgelman (2002)</i> | Strategy as vector and the inertia of coevolutionary lock-in | <i>Administrative Science Quarterly</i> | 876 |
| 35 | <i>O'Reilly & Tushman (2011)</i> | Organizational ambidexterity in action: how managers explore and exploit | <i>California Management Review</i> | 334 |
| 36 | <i>O'Reilly & Tushman (2013)</i> | Organizational ambidexterity: Past, present, and future | <i>Academy of Management Perspectives</i> | 697 |
| 37 | <i>Lavie et al. (2009)</i> | The performance effects of balancing exploration and exploitation within and across alliance domains | <i>Paper presented at the Academy of Management Best Paper Proceedings, Chicago, IL.</i> | 21 |
| 38 | <i>Lavie et al. (2010)</i> | Exploration and exploitation within and across organizations | <i>The Academy of Management Annals</i> | 843 |
| 39 | <i>Bradach (1997)</i> | Using the plural form in the management of restaurant chains | <i>Administrative Science Quarterly</i> | 823 |
| 40 | <i>Benner & Tushman (2003)</i> | Exploitation, exploration, and process management: The productivity dilemma revisited | <i>Academy of Management Review</i> | 3857 |
| 41 | <i>Kaplan & Henderson (2005)</i> | Inertia and incentives: Bridging organizational economics and organizational theory | <i>Organization Science</i> | 257 |
| 42 | <i>Edmondson (2008)</i> | The competitive imperative of learning | <i>Harvard Business Review</i> | 313 |
| 43 | <i>Danneels (2002)</i> | The dynamics of product innovation and firm competences | <i>Strategic management journal</i> | 2424 |
| 44 | <i>Rosenkopf & Nerkar(2001)</i> | Beyond local search: Boundary-spanning, exploration, and impact in the optical disk industry | <i>Strategic Management Journal</i> | 2318 |
| 45 | <i>Simsek (2009)</i> | Organizational ambidexterity: towards a multilevel understanding | <i>Journal of Management Studies</i> | 549 |

* Those studies marked with an asterisk (*) were the ones filtered through to step 6 of the systematic analysis

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Table 6. Analysis between levels and dimensions of ambidexterity

| <i>Dimension</i> | <i>Knowledge</i> | <i>Behaviour</i> | <i>Technology</i> | <i>Process</i> |
|-------------------|---|---|---|---|
| <i>Strategic</i> | Sharing across strategic units (Jansen et al. 2012); benefit from strategically selected client portfolios (Bednarek et al. 2016); strategic orientation and market knowledge (Wei et al. 2014) | Cognition helps decide strategies (Chandrasekaran et al. 2012); leadership facilitates managing strategic contradictions (Smith and Tushman 2005) | Decision on technology is strategized at the top level (Chandrasekaran et al. 2012) | Operational efficiency versus strategic flexibility (Kortmann et al. 2014); Organisations exercise simultaneous autonomous strategic processes (Burgelman 2002) |
| <i>Projects</i> | Benefit from knowledge that comes from a strategically selected portfolio of projects and clients (Bednarek et al. 2016); diffusion of knowledge for R&D activities (Eriksson 2013); the use of intellectual capital (IC) to communicate knowledge within projects (Turner et al. 2015); projects are knowledge-based activities (Turner et al. 2014) | Project manager's behaviour in project delivery, the use of rationalization versus efficiency during delivery (Aubry and Lievre 2010) | Exploratory and exploitative technology projects are incentivized for better performance (Chandrasekaran et al. 2012); technological innovation projects (He and Wong 2004) | Projects provide control and serve as a learning platform (Vits and Gelders 2002); coupling delivery processes (Andriopoulos and Lewis 2009); process control and flexibility (Pellegrinelli et al. 2015) |
| <i>Operations</i> | Codification of knowledge provides control – exploitation (Matthews et al. 2015); exploitation and exploration build absorptive capacity to make the organization accept new knowledge (Cao et al. 2009) | N/A | Codify expertise (exploration) and codify knowledge (exploitation) (Matthews et al. 2015); mass customization, operation and technology of production (Kortmann et al. 2014); focus on new product development versus improve current products (Voss and Voss 2013); decide on the source of technology – internal or external (Rothaermel and Alexandre 2009); | Process improvements and control (Matthews et al. 2015); codification of processes (Matthews et al. 2015); decentralization and rule formalisation (Jansen et al. 2005) |
| <i>Individual</i> | Connectedness and social interaction for better knowledge flow (Jansen et al. 2005); flow of knowledge has an effect on ambidexterity (Mom et al. 2007); knowledge sharing and integration between TMTs (Lubatkin et al. 2006) | Individual behavioural activities lead to achieving contextual ambidexterity (Gibson and Birkinshaw 2004); two modes of cognitive actions in tension (Aubry and Lievre 2010); passion versus discipline in delivery (Andriopoulos and Lewis 2009) | N/A | N/A |

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Table 7. Analysis between dimensions and mechanisms of ambidexterity

| | <i>Structural</i> | <i>Learning</i> | <i>Selection</i> | <i>Communication</i> |
|-------------------|---|--|--|---|
| <i>Knowledge</i> | The use of complementary tactics (Andriopoulos and Lewis 2009); the use of various organizational structure such as organic or mechanistic (Turner et al. 2015) | Interplay between exploitation or exploration to build absorptive capacity (Andriopoulos and Lewis 2009); learning from clients: nurturing, investigating, holding and watching (Bednarek et al. 2016); execution as learning (Turner et al. 2014); classify new projects based on existing competencies versus new competencies (Danneels 2002) | Allocation of resources to exploratory and exploitative tasks improves on the absorptive capacity of the organization (Cao et al. 2009); the selection of clients' dynamic portfolios to obtain new sources of knowledge (Bednarek et al. 2016); resource allocation based on knowledge about market and the strategic orientation of the organization (Wei et al. 2014) | Knowledge sharing between TMTs (Lubatkin et al. 2006); flow/communication of knowledge (Mom et al. 2007); decentralize knowledge for diffusion (Eriksson, 2013); resource dependence and sharing knowledge through communication across units (Jansen et al. 2012); connectedness and social interaction to share knowledge (Jansen et al. 2005); the use of heavy social networks (Turner et al. 2015) |
| <i>Behaviour</i> | N/A | Rationalization versus adaptation for the situation in hand (Aubry and Lievre 2010) | Select behaviourally ambidextrous employees during hiring process | Communication from top management that encourages employees' adaptation to contextual ambidexterity (Gibson and Birkinshaw 2004) |
| <i>Technology</i> | Project partitioning or separation according to degree of innovativeness (Kortmann et al. 2014); complementary tactics to gather various technological aspects between projects (Andriopoulos and Lewis 2009); combining exploratory and exploitative product and market development (Voss and Voss 2013); organizational design for ambidexterity (He and Wong 2004) | Resources capabilities of switching between technologies and technological projects (Kortmann et al. 2014); classify new projects based on existing competencies versus new competencies (Danneels 2002) | Select project team to facilitate ambidexterity (Eriksson 2013); select procurement methods to facilitate ambidexterity (Eriksson 2013); incentivize project teams to work on exploratory/exploitative projects (Chandrasekaran et al. 2012); select the source of technology – internal/external (Rothaermel and Alexandre 2009); prioritize resources' allocation to technological innovation (He and Wong 2004); resources allocation to projects portfolio (Andriopoulos and Lewis 2009) | Decisions of exploitation or exploration cascades down and communicated from top management (Chandrasekaran et al. 2012) |
| <i>Process</i> | Complementary tactics (Andriopoulos and Lewis 2009); the application of portfolio management to balance between projects and the overarching program (Pellegrinelli et al. 2015); decentralization of processes (Jansen et al. 2005) | Learning through process innovation versus learning through process control (Matthews et al. 2015); employees learnt capabilities by switching (Kortmann et al. 2014); classify new projects based on existing competencies versus new competencies (Danneels 2002) | Resources allocation to projects portfolio (Andriopoulos and Lewis 2009); employees' enrichment (Kortmann et al. 2014) | Formalization of rules (Jansen et al. 2005); communication processes through decentralized structures (Jansen et al. 2005) |

Figure 1. Levels of ambidexterity, dimensions and mechanisms

