Are James March's 'Exploration' and 'Exploitation' Separable? Revisiting the Dichotomy in the Context of Innovation Management

Qijun Zhou (corresponding author)
Greenwich Business School, University of Greenwich, Old Royal Naval College, Park Row, Greenwich SE10 9LS, United Kingdom
e-mail: q.zhou@greenwich.ac.uk

Rob Dekkers
Adam Smith Business School, University of Glasgow, Glasgow G12 8QQ, United Kingdom
e-mail: rob.dekkers@glasgow.ac.uk, ph. + 44 (0)141 330 4670

Robert Chia
Adam Smith Business School, University of Glasgow, Glasgow G12 8QQ, United Kingdom
e-mail: robert.chia@glasgow.ac.uk

Are James March's 'Exploration' and 'Exploitation' Separable? Revisiting the Dichotomy in the Context of Innovation Management

Abstract

The conceptual dichotomy between exploration and exploitation has gained much academic attention in innovation management studies ever since March (1991) identified and examined the importance of this distinction and its consequences for organisations. A systematic literature review surrounding this dichotomy, perusing its postulations, was conducted and our findings indicate that the rationale for separating exploration and exploitation is questionable and not really grounded in the extant empirical evidence. Exploration and exploitation, either as theoretical concepts or managerial activities, may, in fact, be inextricable from one another within the context of managing innovation related activities. This view challenges the status of the assumed dichotomy and suggests that this notional separation may be unhelpful in guiding practices and conceptualisation in innovation management. Accordingly, accepting exploration and exploitation to be essentially intertwined and inseparable can lead to the development of a more comprehensive and inclusive framework for understanding how processes of innovation may be better managed. Our intention is to spark the search for further empirical evidence on the actual practical implementation of exploration and exploitation, looking into alternative explanations, including the use of the dichotomy as end outcomes rather than formative activities, and what this means for reconceptualising innovation management processes.

Keywords: exploration; exploitation; ambidexterity; innovation management

Are James March's 'Exploration' and 'Exploitation' Separable? Revisiting the Dichotomy in the Context of Innovation Management

1. Introduction

In academic research specific to managing innovation in organisations, one of the highly-cited conceptual distinctions employed in the extant literature is the exploration/exploitation dichotomy proposed by March (1991). Pursuant to this vastly influential conceptual distinction (March, 1991, p. 71), exploration is associated with terms such as "*search, variation, risk-taking, experimentation, play, flexibility, discovery and innovation*", whilst exploitation is described in terms of "*refinement, choice, production, efficiency, selection, implementation and execution.*" March (ibid.) has postulated that both concepts are vital to an organisation's survival even though they inevitably compete for scarce organisational resources. Consequently, difficult organisational decisions regarding the prioritising of exploration or exploitation have always to be made in relation to the management of innovation.

Despite this dichotomy being widely accepted and used in business and management studies, and especially in the innovation management literature, existing reviews (Almahendra and Ambos, 2015; Lavie et al., 2010; Gupta et al., 2006) have pointed out ambiguities associated with this dichotomy and the mechanisms, antecedents and consequences of treating exploration and exploitation as distinct organisational activities. Additionally, besides the problematic nature of this distinction between exploration and exploitation, findings from studies in innovation management are not easily translatable into managerial practices in conjunction with theoretical constructs from other disciplines (Tidd, 2001). Given the widespread adoption of this dichotomy in innovation management, a critical appraisal of the ambiguities associated with its conceptual application can help shed some light on whether such a distinction is justifiable, and how it might possibly relate to managerial practices as well as the research

opportunities it offers. Specifically, problems associated with viewing exploration and exploitation as two separate and distinct constructs are related to the difficulties of identifying specific organisational activities as 'purely' attributable to either of these concepts and how the two co-exist in innovation processes. We note that such much-needed appraisal is currently missing in innovation management studies.

To provide further clarification on these points, this paper systematically reviews current studies on exploration and exploitation in the context of innovation management, paying close attention to the theoretical foundation and the quality of empirical evidence supporting the validity of this dichotomous distinction. Innovation management was selected as the research context for the dichotomy because exploration and exploitation appear to be more 'tangible' constructs in the extant literature. Compared to disciplines such as organisational learning or strategic management, innovation outcomes are usually easier to identify as they often manifest themselves in the form of new (or improved) products, processes, or services.

Specifically, the contention of this paper is that if the distinction between exploration and exploitation as opposing constructs is not adequately validated by empirical data (i.e., no clear distinction found in managerial practices), the well-accepted dichotomy should be considered questionable even though it may serve as a theoretically convenient one, and not a material fact. In this sense, it is not always appreciated that most theories and conceptualisations, particularly in social sciences, are underpinned by philosophical assumptions that remain unexamined; a situation that has prompted Sandberg and Alvesson (2011, p. 35) to urge the need for more critical examination of such underlying assumptions in management science. While there are some existing critical reviews of theories and conceptualisations in, for example, the theory of agency (e.g., Hunt III and Hogler, 1990; Worsham et al., 1997) and the resource-based view (for example, Kraaijenbrink et al., 2010; Priem and Butler, 2001), it is surprising that March's (1991) proposition regarding the dichotomy between exploration and exploitation has not been

subjected to similar scrutiny. This review, therefore, attempts to provide a critical assessment of the validity of the exploration/exploitation dichotomy by examining the assumptions underlying these constructs and attempting to establish whether the assumed dichotomy is sustainable with tangible empirical evidence or is something merely taken for granted in the context of innovation management. Consequently, the paper will address three review questions:

- Review question 1: How has the dichotomy between exploration and exploitation, and its underlying assumptions, manifested itself in studies into innovation management as a theoretical construct?
- Review question 2: What are the main perspectives of exploration and exploitation in innovation management studies, and do any of these perspectives question the separation of these concepts?
- Review question 3: Do studies into innovation management provide any tangible evidence that justifies the dichotomy between exploration and exploitation as distinct and separate organisational activities specific to the managing of innovation?

By seeking answers to these questions through a systematic literature review, this paper makes a two-fold contribution to scholarly knowledge. First, it takes the dichotomy as an assumption and examines its validity. This departs from its dominant usage and provides a critical assessment of the original proposition made by March (1991). It contributes to the academic debate by helping to clarify the validity of the distinction and hence its ramifications for managing exploration and exploitation. Second, this review contributes to studies into innovation management, especially to theoretical frameworks that rely on this dichotomy. It provides an overview of the studies in innovation management that have used the dichotomy to inform their empirical study and, consequently, outlines which extensions have been put

forward by such studies. This will support researchers in making an informed decision about using the dichotomy or related conceptualisations for empirical studies. Thus, this review will not only add a comprehensive appraisal of the dichotomy between exploration and exploitation in the context of innovation management but also contributes to theory building in the domain of innovation management.

The paper proceeds as follows. In the next section, a description of the origins for exploration and exploitation will be discussed, beginning with March's (1991) seminal paper and its subsequent usage in management literature. This is followed by an examination of assumptions underlying the two concepts. The methodology for the review will then be presented, with details about the search and selection of papers. We then present the findings of our appraisal, with a discussion related to the research questions. The paper ends with some remarks about the validity of the dichotomy, a substantive agenda for further research and implications for practice.

2. Revisiting the Dichotomy of Exploration and Exploitation

The idea that exploration and exploitation could be understood as distinct, separate and purposeful organisational activities did not draw much attention until March explicitly made this distinction in his paper (Schulze, 2009, p. 5). Since then, the conceptualisation of this dichotomy has been widely used as a theoretical foundation for organisational studies, not limited to organisational learning, where the notion was first proposed. Hence, before proceeding with discussions based on the review questions, the conceptualisation of exploration and exploitation in the seminal paper of March (1992) is first looked at, including critical notes by others and assumptions related to the dichotomy that further justifies the stance of this review.

2.1 Conceptualisation from March (1991)

Referring to adaptive processes, March (1991, p. 71) pointed out that organisations make implicit and explicit choices between exploration and exploitation due to distinctive returns these activities bring and processes for allocating required resources. To further justify his conceptualisation, March (1991, p. 72) referred to four different strands of study, namely 1) rational models of choice, 2) theories of limited rationality, 3) generic approaches to organisational learning, and 4) evolutionary models of organisations. He pointed out that choices between these two opposing activities are exhibited in the refinement of extant technologies and forming new ones that align with organisational learning outcomes. By linking exploration and exploitation to these theories, March (1991) conceptually demonstrated that a trade-off was necessary because of the inevitable tension between these activities. This thinking is then demonstrated based on two models building on organisational adaptation. The first is a model of mutual learning, in which short- versus long-term consideration as well as individual and collective knowledge development was examined. The second model looks at competitive ecologies and summarised the actions individual companies may take to achieve different competitive positions. Correspondingly March's (1991) work focuses primarily on the inevitable trade-off between exploration and exploitation rather than justifying their segregation.

Note that the approach March (1991) adopted was theoretical modelling and simulation, which was not underpinned by empirical data of any kind. Exploration and exploitation can be regarded as learning activities or processes if the analysis is internal to an organisation, as captured in his first model. In his second model, the focus is on external influences on an organisation that may involve environmental changes and competition; this appears more appropriate for setting strategic goals. According to Almahendra and Ambos (2015, p. 24), successive studies also failed to provide empirical support for his two simulation models.

Furthermore, the differences in definition for exploration and exploitation are also related to the level of analysis in his models, i.e., internally-oriented processes for exploitation and externally-oriented processes for exploration. In this respect, Schulze (2009, p. 10) remarks that different models for managing exploration and exploitation in innovation have been proposed for the distinct levels of study, though empirical outcomes still seem somewhat conflicting. The distinct levels of analysis in March's (1991) original proposition, the noted lack of empirical support and the conflicting nature of evidence by others may lead to confusion and ambiguity in understanding and conceptualising exploration and exploitation as different activities if employed differently in empirical studies.

2.2 Some Notes on March (1991)

To understand better the theoretical foundations for exploration and exploitation as different activities for the first review question that will be examined in the systematic review, a closer examination of references that March (1991) relied upon to develop his dichotomy shows that the separation between exploration and exploitation seems to emerge from several disciplines, including economics, sociology, adaptive processes, business change and computing science. A case in point is a study by Kuran (1988) on conservatism in sociology that points to the need to balance protecting expectations and adapting to new environmental conditions, similar to exploiting current knowledge or searching for new alternatives. In March's (1991) list of references, there are also studies on managers' behaviour in making choices (e.g., Kahneman and Tersky, 1979; Radner and Rothschild, 1975); the conflict that exists for decisions here is between certainty and uncertainty, which, according to March (1991, p. 85) is the basis for differences regarding outcomes of exploitation and exploration respectively. Consequently, the notion of exploration and exploitation has been discussed implicitly in different domains until March made the conceptualisation more explicit in the context of management studies; also, it

implies that March's distinction between exploration and exploitation was not entirely new or unique.

In addition to thoughts embedded in the theoretical foundations of March (1991), the idea also is not entirely new in studies related to innovation. For example, some studies have conceptualised exploration and exploitation as related phases of the same process. In the model from Johnson and Jones (1957, p. 55), exploration appears as the first phase of new product development, whereas exploitation is mentioned in the test-marketing phase. Differently, Tatum's (1987) study on innovation in construction firms suggests that exploration and exploitation occur within the same stage; the activities of experimentation and refinement are deemed to happen simultaneously. These two papers provide some additional ways of looking at exploration and exploitation that are different from March's (1991) interpretation; they also support the notion that March's distinction between exploration and exploitation was not entirely new or unique.

2.3 Alternative Views on March (1991)

To address the second review question, alternative views on the dichotomy could be sourced from evolutionary models for organisations that are later proposed. Some wording for how the activities associated with are defined by March (1991, p. 71), particularly the terms ‘search’, ‘variation’ and ‘selection’ suggest an influence of the simplified Darwinian model by Campbell (1969), used in business and management studies. Based on the discussion of adaptation in evolutionary theories, Dekkers (2005, pp. 154–155) offers a different view on the dichotomy. He argues that the current conceptualisation of exploration and exploitation differs from an evolutionary model for organisations in three ways. First, he considers exploration and exploitation as an expression of evolvability and sustained fitness (see Kauffman [1993, p. 95] for further description), which are exerted simultaneously, rather than as distinct internal processes. Second, even though exploration and evolvability improve organisations' fitness,

they are not exactly similar in the evolutionary process. Last, exploitation can be considered a more limited concept for selection processes when interpreted simply as organisational input and output. Therefore, a more precise conceptualisation of exploration and exploitation may be needed to be consistent with generic evolutionary models for organisations, thus posing a challenge to the dichotomy as response to the second review question.

Furthermore, in the vein of managing innovation, the original definition of exploration and exploitation could be regarded as problematic. For example, Drucker (1985, p. 67) pointed out the constant tension between the need for certainty in decision making and the inevitable uncertainty of outcomes concerning innovation. This means that managing innovation related activities would always be associated with uncertainty. According to March (1991, p. 85), exploration is associated with uncertain outcomes, while exploitation is more likely to produce more precisely-defined results. In addressing this matter, Drucker (1985, p. 72) argues that successful innovation results from an accumulation of simple and focused experimental activities guided by a systematic management discipline. This implies that although an activity may seem to be exploration, it could still incorporate (sequences of) activities that are considered exploitation, blurring the distinction between the two, again challenging the dichotomy.

Consequently, considering limitations of the ‘trade-off’ stated in March (1991), studies have introduced the idea of ambidexterity in searching for a new way to manage exploration and exploitation, which is another alternative view on the dichotomy. In the context of business and management studies, the term ambidexterity generally refers to organisations that can do two things simultaneously but without losing the quality of each one. Linking this definition with how organisations could survive in the increasingly intensive competition, Duncan (1976, p. 180) made the first attempt to introduce the concept of 'ambidextrous organisations' into business and management studies. However, it was not until March's (1991) contribution on

the topic of exploration and exploitation that any serious effort was made to investigate the concept of ambidexterity; Tushman and O'Reilly (1996) is one of the first attempts to link exploring and exploiting with ambidextrous organisations. In their later works (O'Reilly and Tushman, 2004, 2011, 2013) an explicit link was made between the dichotomy and ambidexterity. Following these thoughts, organisational ambidexterity has been widely studied, calling for organisations to be ambidextrous through appropriately managing the tension between exploration and exploitation. This also inspired this study to further examine the use of ambidexterity in the context of innovation management, according to our second review question.

[Insert Figure 1 about here]

2.4 Examining Key Assumptions

Furthermore, it appears that the assumptions underlying the two constructs have been rarely examined. In this respect, the critical sociologist Alvin Gouldner (1971), in what is now considered a classic, already stated that social science could never achieve complete objectivity in its analyses. In this vein, there is a pressing need for social scientists to strive to understand the social and psychological sources of their own biases, including premises. For Gouldner (ibid., p. 29), theoretical conceptualisation often entails two sets of assumptions: (i) postulations, which are explicitly formulated, and (ii) background assumptions that are embedded in postulations and thus usually receive less research attention. Based on the definition of background assumptions, domain assumptions are defined as those applied in a specific context of a study that is narrower in scope. In the context of forming theory, postulations, background and domain assumptions are an additional cycle of study; in Figure 1, this is depicted as an adaptation to the revised empirical cycle of de Groot by Wagenmakers et al. (2018, p. 423). In this adapted cycle, literature reviews, particularly protocol-driven ones, evaluate evidence and findings from empirical studies, following the thoughts of Steenhuis et

al. (2022, p. 82). Examples of protocol-driven literature reviews are the systematic reviews with the meta-analysis by Fourné et al. (2019), Shi et al. (2020) and Wenke et al. (2021), albeit they restrict themselves to evaluating aggregated evidence for estimating correlations and do not challenge the dichotomy. Both empirical studies and literature reviews may lead to extensions and propositions as a creative process that informs tentative theories that can be tested.

In addition, postulations and assumptions have informed tentative theory. In our case, the dichotomy of exploration and exploitation posited by March (1991) is the tentative theory, informed by postulations in his writing; we will come back to these postulations in the next paragraph. It also is possible to review evidence collected by literature reviews to appraise how postulations and assumptions have been used. Figure 1 shows that postulations and assumptions can be extracted during literature reviews and serve as input for studies investigating under which conditions postulations and assumptions hold (arrow representing this relationship between 'postulations and assumptions' and 'predictions and hypotheses'). Such investigations complement studies that build on hypotheses derived from tentative theories. Furthermore, the figure positions the purpose of this paper — examining the postulations and assumptions for the dichotomy through a systematic literature review, i.e., the arrow between 'aggregation through literature reviews' and 'postulations and assumptions.'

As starting point for the literature review, an examination of March (1991) in detail reveals that six key statements can be extracted and recognised as postulations because these are explicitly formulated. These are: P1) keywords that are associated with exploration and exploitation, P2) maintaining an appropriate balance between exploration and exploitation is a primary factor in a system's survival and prosperity, P3) exploration and exploitation will compete for resources, P4) organisations will make choices, either explicitly or implicitly, about exploration and exploitation, P5) the essence and returns of exploration and exploitation are different, and P6)

increasing exploitation and reducing exploration make adaptive process potentially self-destructive; these postulations are shown in Table 1.

[*Insert Table 1 about here*]

For background assumptions, this study discerned one being that 'exploration and exploitation are purposefully separated activities.' This background assumption is identified based on arguments such as that these two concepts are assumed to be distinct in terms of process or strategy and essentially to be presenting conflicting priorities for firms. Since March did not delve into why this distinction between exploration and exploitation was necessary and inevitable, there is a need to ask whether this presumed dichotomy holds sufficient validity for advancing scholarly knowledge for innovation management. Accordingly, central to our aim in this study is challenging this domain assumption for innovation management, with the intention to see whether there is any evidence, theoretically or empirically, that exploration and exploitation are purposefully separated innovation activities in practice. This aim is motivated by the fact that though alternative thinking exists beyond the 'classic paper' of March (1991) there still lack critical studies that examine exploration and exploitation in its roots, i.e., the assumptions sustaining the dichotomy.

3. Design of Review Methodology

Since the purpose is to study the dichotomy of exploration and exploitation in the context of innovation management, the meaning of innovation management is clarified first. Innovation management is defined here following Trott's (2005, p. 15) and OECD's (2018, p. 20) definitions:

> *'Innovation is the management of all the activities involved in the process of idea generation, technology development, manufacturing and marketing of a new or improved product, service or process (or a combination thereof) that differs from*

the unit's previous products or processes and that has been made available to potential users (product or service) or brought into use by the unit (process).'

This definition reflects that marketing of products or services, strategic management and human resource management may all be affecting the outcome of innovation in terms of product, process or service.

To question the validity of the dichotomy exploration and exploitation, this paper adopts a systematic approach to appraising literature that includes replicable, scientific and transparent processes, providing as a complete list as possible of all studies relevant to addressing specific questions in a balanced and unbiased manner (Cronin et al., 2008; Nightingale, 2009; Tranfield et al., 2003). After setting the scope and context of this review, appropriate keywords and search terms were determined. A Boolean expression for retrieving relevant papers was formulated: {["exploration and exploitation" OR "exploration vs exploitation" OR "exploration versus exploitation" OR "exploration-exploitation" OR "exploration/exploration] AND ["innovation" OR "new product development" OR "new service development" OR "product design" OR "product engineering" OR "R&D" OR "research and development"]}. This expression was applied to three databases: Google Scholar, EBSCOhost and Scopus sequentially, based on the consideration that the combination of the three is comprehensive enough and that they are generic, and thus, not tied to any specific publishers. The initial stage of the search stopped in September 2020, where 277 papers did bear relevance to this study by scanning the title and abstract. After this retrieval, a detailed examination of the full text took place, duplicates were removed, and exclusion criteria were applied; details of all exclusion criteria and examples of papers discarded are found in Table 2. In addition to the search in databases, following guidance from Greenhalgh and Peacock (2005), snowballing was used to retrieve four papers that were not captured by the initial search. As a result, a total of 90 retrieved papers, see Table 3, are taken in for the analysis.

[Insert Table 2 about here]

[Insert Table 3 about here]

4. Results of the Analysis of Retrieval Papers

In general, the retrieved papers show that the discussion on the dichotomy has mainly focused on the need to balance exploration and exploitation, and methods for managing the tension or conflict between them rather than examining the conceptualisation of this dichotomy. Notwithstanding these differences in foci, the majority of papers refer to the work of March (1991), building on his definition or the broad conceptualisation that he proposed.

4.1 Scrutiny of March (1991)

The importance and influence of March's (1991) work has been identified in papers on exploration and exploitation, with 86 out of 90 papers citing it directly. Among the four remaining papers, Chandrasekaran et al. (2015) and O'Cass et al. (2014) mainly relied on the work that followed March such as Atuahene-Gima (2005, and He and Wong (2004). In Cesaroni et al. (2005), the understanding that organisations have scarce resources and decisions should be made between exploration and exploitation is commensurate with March's (1991) postulation. The final of the four papers is O'Reilly and Tushman (2004), which appears to be more about storytelling on how ambidexterity can be achieved in practice; hence it does not pay much attention to the conceptualisation of exploration and exploitation. Thus, all but one of the retrieved studies follow March's (1991) thoughts.

In addition to the seminal paper in 1991, March has further developed his thoughts on the conceptualisation of exploration and exploitation, especially in Levinthal and March (1993) and March (2006); the question arises whether studies into innovation management have also followed the development of thoughts. In the case of Levinthal and March (1993, p. 105) the study by March (1991) is referred to as only introducing two broad kinds of activities, right

away followed by the argument that a balance needs to be maintained. 59 out of the 90 retrieved papers have referred to the work from Levinthal and March (1993), in which a refined definition based on knowledge is provided for exploration and exploitation. Curiously, in March (2006, p. 205) the original dichotomy in 1991 is rephrased as exploration should not be without exploitation as organisational activities, implying that there should not be a case where 'pure' exploration or exploitation exists. However, only 9 out of 69 papers published after 2008 include a citation to March (2006). Referring heavily to the original conceptualisation and without attention paid to the developments made by the original author may cause limitations when setting research objectives in later studies. Thus, it appears that the work of March (1991), with Levinthal and March (1993) merely extending the thoughts, has had a deep and abiding influence on studies on exploration and exploitation in the context of innovation management, particularly for distinguishing exploration and exploitation as set of distinct activities, and the argument these need to be balanced for viability of organisations.

[Insert Table 4 about here]

This pattern is confirmed by how studies have mentioned or used different combinations of March's (1991) postulations in their theory building, see Table 4; first, it appears that P2: 'organisations should have both exploration and exploitation activities' (69 out of 90 papers) and P5: 'the essence and returns of exploration and exploitation are different' are the two most accepted claims (72 out of 90 papers). Whereas 54 papers include both P2 and P5, there are only 15 out of 90 that use P2 and P5, being also the most used combination for postulations. The possible reason behind this is that no matter how studies define and view exploration and exploitation, these two statements provide the theoretical underpinning and related constructs for undertaking empirical studies on the topic. Since both exploration and exploitation are seen as essential for organisational success (e.g., Andriopoulos and Lewis, 2009; Gilsing and Nooteboom, 2006; Greve, 2007) but are different in terms of essence and returns, the reasoning

goes that they require support by different organisational forms and structures as indicated in, for example, Chang and Hughes (2012) and Jansen et al. (2005). However, such studies build on and reinforce the notion that exploration and exploitation are separate sets of activities without extracting this from data and reasoning they provide.

Second, keywords with which March (1991) captured exploration and exploitation —tabulated as P1— are not commonly followed by studies (only 28 out of 90); it is relatively low compared to the most cited postulations P2 and P5. This implies that subsequent studies have developed other conceptualisations, leading to differences in defining exploration and exploitation as constructs for empirical studies. Whereas using keywords March (1991) proposed in defining exploration and exploitation may have limitations, it still forms a point of departure for conceptualising the dichotomy in studies. This is to say that formulating the other postulations may rely on the keywords he proposed and act as outcomes from a logical deduction of statement P1. Given the low usage of P1 and higher for the other postulations, this paper argues that some proposed definitions in studies merely serve the purpose of more accurately aligning with conceptualisations related to the specific research objectives of empirical studies. In this sense, these 'deviant' definitions have limited validity because their conceptualisations only look at matching possible descriptions of exploration and exploitation for use in the retrieved empirical studies.

Third, in terms of patterns of referring to the postulations, there are only two studies (Greve, 2007; Papachroni et al., 2015) that refer to all six. This is understandable since all these statements made by March (1991) mostly suit his paper's purpose. Hence, to construct empirical studies, it is possible that studies chose referral to postulations that fit their research aims. The two most popular patterns are 'P2 and P5' (with 15 papers) and 'P2, P4 and P5' (with 11 papers). As previously discussed, P2, P4 and P5 are the postulations used by others in some form or another, and the combination of P2 and P5 leads to the underpinning logic of

doing research in exploration and exploitation from the perspective of the dichotomy. Studies that include P4 in addition to the combination of P2 and P5 (for instance, Groysberg and Lee, 2009, p. 752; Schamberger et al., 2013, p. 349) elaborate more on how organisations can control or manage an appropriate balance between exploration and exploitation. However, the main arguments made here are still similar to studies with the combination of P2 and P5. Besides, there are, in total, 31 patterns identified in retrieved studies. The number of studies using each pattern is not significantly different, meaning that different studies tend to use different combinations of postulations from March (1991) in constructing their research. Again, this observation may explain differences in conceptualising the dichotomy, perspectives taken towards exploration and exploitation but also shed a light on differences between outcomes of studies.

To sum up, most of the retrieved studies into innovation management have used March's (1991) postulations in some form or another, and thus, this paper is having a significant impact on later studies. However, the analysis of how March's (1991) postulations have been referred to shows that studies have used the dichotomy but not consistently. It appears that challenges have not been raised to the conceptualisation of viewing exploration and exploitation as a dichotomy, and that differences in outcomes across studies can be attributed to differences in combinations of postulations and adopting different definitions for exploration and exploitation.

4.2 Shifting Paradigms of Analysis for the 'Exploration versus Exploitation' Debate?

The previous discussions indicate that, whereas most papers have taken the work of March (1991) as a starting point for their analysis, there are still different interpretations regarding the dichotomy in innovation management. Yet, the common understanding is that exploration and exploitation, regardless of their form, both exist within an organisation and play an important part in innovation processes (Chandrasekaran et al., 2015; Geiger and Makri, 2006). This point has been further discussed in many studies, and attention has mainly been on how exploration

and exploitation should be managed or balanced in the organisation, resulting in different perspectives.

With the premise of having both exploration and exploitation in organisations, this review summarises current perspectives in a framework. For doing so, it builds on the dimensions of ‘orthogonality versus continuity’ proposed by Gupta et al. (2006, p. 693) together with ‘static versus dynamic’ suggested by Raisch et al. (2009, p. 688). A continuity dimension would lead to arguments that exploration and exploitation are mutually exclusive. In contrast, an orthogonal view would be associated with statements that exploration and exploitation interact and, hence, can co-exist within an organisation without necessarily intense competition (Gupta et al., 2006). In addition to 'orthogonality versus continuity', a static dimension implies that the balance needs to be achieved instantly, such as decisions on allocating budget to different projects, whereas a dynamic view would suggest that the balance is gradually achieved over time (Raisch et al., 2009). The two dimensions in the framework allow to evaluate perspectives captured in writings on the implications of the dichotomy for studies into innovation management.

Viewing the implications of these two dimensions on studies into innovation management, there appears to be a gradual shift in perspectives among scholars. Building on the discussion regarding ambidextrous organisations mentioned in Section 2.3, the ‘static versus dynamic’ dimension leads to the idea of temporal ambidexterity, which include considerations on external factors such as environment and competition. These are critical factors in distinguishing between exploration and exploitation according to March (1991). In terms of the dimension 'orthogonality versus continuity', from the ‘classical trade-off’ to the structural and temporal ambidexterity, these more recent perspectives have been increasingly taken the inclusion of both exploration and exploitation in organisations into account. The analysis of studies has revealed a shift attention from choosing either exploration or exploitation, towards

searching for ways to maintain a balance between these two activities, albeit in very different ways; Figure 2 demonstrates this shift.

[*Insert Figure 2 about here]*

Specifically, starting from the perspective closest to March's proposition, the classical trade-off implies that a focus on either exploration or exploitation will likely drive out the other (March, 1991, p. 85). The reasoning here is simple, 'exploration = 1 - exploitation', as exploration and exploitation will compete for organisational resources (Bauer and Leker, 2013, p. 202). This perspective has been adopted by studies (e.g., Kim and Huh, 2015; de Visser and Faems, 2015) predominantly focused on resource allocation with a focus of identifying an appropriate ratio of how organisations should assign budgets. The common understanding here is that organisations can achieve a higher innovation performance by allocating their resources wisely.

Departing from considering the trade-off and based on the idea from Duncan (1976, p. 180) that organisations could design a dual structure that enables a shift in focus to support innovation, ambidexterity-related perspectives have been used in managing exploration and exploitation in relations to innovation. Following Duncan (ibid.), studies with a temporal perspective on ambidexterity (e.g., Mudambi and Swift, 2011; Nemanich et al., 2007) usually emphasise how an organisation can or ought to shift from explorative strategies to more exploitative ones. The core understanding still is that organisations may find it hard to undertake both activities simultaneously, and studies into innovation management (Greve, 2007; Mudambi and Swift, 2011) have proposed that balancing exploration and exploitation through time is beneficial, especially when the business environment is in a volatile state or industrial sectors are changing at a fast pace.

Taking a similar stance, studies with a structural approach to ambidexterity (Benner and Tushman, 2003; Smith and Tushman, 2005) suggested that organisations would form highly

differentiated units to specifically accommodate either exploration or exploitation. It led to the belief that exploitation-focused units are often centralised with tight control from managers, whereas exploration-focused units are often associated with decentralised structures, loose culture, less controls, and flexible processes aiming at enabling creativity and innovation through experiments (Benner and Tushman, 2003, p. 248). Realising these sperate units requires specific management styles. For instance, Smith and Tushman (2005) proposed four factors that allow managers to design and manage this structural separation: 1) distinct roles, goals, and rewards; 2) supportive integrators; 3) extensive leader-member interactions; and 4) leader coaching to focus on the product level and avoid conflict. Similarly, Jansen et al. (2008, p. 999) argued that a senior team shared vision, transformational leadership, and contingency rewards will allow organisations to manage the separate units successfully. Arguably, structural ambidexterity provided a way for organisations to 'avoid' the tension of managing exploration and exploitation.

With less emphasis on tensions between exploration and exploitation, some studies have suggested that organisational contexts such as culture (for example, Wang and Rafiq, 2014), leadership (e.g., Lin and McDonough, 2011) and cognitive style of top managers (for instance, Karhu et al., 2016) enable organisations to conduct exploration and exploitation related activities simultaneously. This perspective can be regarded as contextual ambidexterity, which was first introduced by Gibson and Birkinshaw (2004). In this vein, studies (Karhu et al., 2016; Lin et al., 2013; Marin-Idarraga et al., 2016) suggested that it is easier for individuals than organisations to balance attributes such as creativity, quality and attention. For example, front-line staff, senior managers and top management teams can choose different approaches to a task that allows an emphasis on both creativity and quality. Therefore, studies based on this perspective (Groysberg & Lee, 2009; Lin et al., 2013; UN, 2007) considered individual behaviours in organisations.

In recent developments, the paradoxical perspective is increasingly considered to offer a comprehensive approach for enabling interactions between exploration and exploitation. This perspective, found in the publications by Andriopoulos and Lewis (2010), and Knight and Harvey (2015), focuses on accepting the tension between exploration and exploitation. Viewing exploration and exploitation from a paradoxical view may require managers not to force their organisations to explore or exploit. Instead, it calls for managers to build up capabilities to deal with the competing demands and tensions caused by this dichotomy for achieving innovation (Andriopoulos and Lewis, 2010, p. 709; Papachroni et al., 2015, p. 88). Though the paradoxical perspective has similar thinking as contextual ambidexterity, the emphasis is different; contextual ambidexterity proposes ways to mitigate the tension between exploration and exploitation, whereas taking a paradoxical view requires individuals to accept the tension and being more flexible in their approach to innovation.

To sum up, the existing perspectives captured in Figure 2 and their implications for innovation management are not without their limitations. The perspectives of classic trade-off, temporal ambidexterity and structural ambidexterity are all built on the understanding that exploration and exploitation cannot co-exist naturally, which ignores the ‘joint-effect’ pointed out by different studies (e.g., Li et al., 2014, p. 80; Zacher et al., 2016, p. 38). Contextual ambidexterity has moved away from separating exploration and exploitation activities at the organisational level, meaning that organisations will not have a specific treatment for either. However, it is impossible to know whether contextual ambidexterity is actually working for organisations. Studies could prove that organisations that have applied specific 'contexts' result in innovation performance improvement. However, this does not mean that the intention is contextual ambidexterity, and it is working. Taking the emerging paradoxical perspective will lead to the thinking of not ‘managing' exploration and exploitation, which logically implies the inseparable of the two, though, many studies with this perspective still call for more empirical

evidence, ideally longitudinal, to further validate the usefulness of a paradoxical approach to the dichotomy.

It should be noted that the shifts shown in Figure 2 are not a linear process. Thus, the emergence of the new paradox perspective has not resulted in the extinction of the 'older' trade-off perspective. Arguably, each perspective still receives support from studies taking it as the point of departure. The contextual ambidexterity and paradox perspective have moved beyond some postulations made by March (1991), such as that exploitation and exploration will be exclusive, which implies they cannot co-exist in specific activities. This shift signals further development of perspectives that may reside in moving beyond the paradoxical perspective toward a perspective that is more inclusive for exploration and exploitation in specific activities, or alternatively, exploration and exploitation should be seen as outcomes of innovation processes.

4.3 Empirical Evidence

From the conceptualisation of the exploration and exploitation dichotomy and its theoretical underpinnings to empirical evidence in innovation management, 79 out of 90 papers in this review are empirical studies. Accounting that 62 out of these 79 studies use quantitative approaches, such as surveys with questionnaires (e.g., Brion et al., 2010; Chandrasekaran et al., 2015), surveys using secondary data (for instance, Kim and Huh, 2015) or secondary longitudinal panel data analysis (for example, Geiger and Makri, 2006), studies seem to be in favour of quantitative approaches rather than qualitative ones. As for the 17 qualitative studies, 14 of which are case studies (e.g., Cantarello et al., 2012; Hotho and Champion, 2010), whereas Gilsing and Nooteboom (2006) tested their model on secondary qualitative data from the Dutch pharmaceutical biotechnology sector, Karhu et al. (2016) conducted a series of semi-structured interviews in different organisations, and Marin-Idarraga et al. (2016) used cognitive mapping as the primary research method. Thus, there are plenty of empirical studies on exploration and exploitation in innovation management, with the majority being quantitative.

The findings of the quantitative studies have mainly provided support for three points. The first point concerns the choice between exploration and exploitation associated with resource allocation, and the influence of exploration and exploitation separately on organisational performance. For example, Bauer and Leker (2013, p. 207) find an inverse U-shaped relation on how firms should allocate resources to either activity and that exploration and exploitation should be pursued simultaneously. Second, the influence of other internal or external factors on exploration and exploitation is examined. These factors include technological diversification (Quintana-Garcia and Benavides-Velasso, 2008), organisational size (Chang and Hughes, 2012; Chang et al., 2011), environmental dynamics (Bernal et al., 2019; Jansen et al., 2005), organisational slack (Geiger and Makri, 2006; Voss et al., 2008), corporate culture (Matzler et al., 2013), leadership style (Jansen et al., 2008; Lin and McDonough III, 2011; Zacher et al., 2016) and social capital (Li et al., 2014). Last, the relationship between ambidexterity and organisations' performance is explored. He and Wong (2004, p. 492) claimed that the interactions between exploration and exploitation positively impact organisational sales growth. Therefore, they concluded that ambidexterity positively impacts organisational performance; other studies support this (Lin et al., 2013; Martini et al., 2015; O'Cass et al., 2014; Soto-Acosta et al., 2018; Swift, 2016). Besides, few studies have studied and reported that exploration has an inverse U-shape relationship with organisational performance (Bauer and Leker, 2014; Kim and Huh, 2015, p. 113; Wei et al., 2014, p. 842). This implies that increasing the level of exploration until a certain point will be beneficial to managing innovation. Thus, these quantitative studies have examined the notion of exploration and exploitation being separable, whereas others have looked into their co-existence.

In addition, qualitative studies have lent empirical evidence supporting three considerations. The first is that studies explained tensions between exploration and exploitation. According to Andriopoulos and Lewis (2009, p. 701), the tension of practically managing this dichotomy is

embedded in strategic intention (profit emphasis versus breakthrough emphasis), customer orientation (tight coupling versus loose coupling) and personal drivers (discipline versus passion) in managerial activities, when they undertook a comparative study with five cases that they categorised as 'ambidextrous.' Further studies (Cantarello et al., 2012, pp. 41-44; Knight and Harvey, 2015, p. 816) proposed how managers should respond to these tensions. However, it seems that distinct evidence that attributes these tensions to exploration and exploitation is lacking. Second, studies (e.g., Bento, 2018; Cantarello et al., 2012; Coradi et al., 2015; Marin-Idarraga et al., 2016) described how managers should perceive exploration and exploitation in practice. For example, Cantarello et al. (2012) present how managers should not only consider exploration and exploitation when thinking about innovation or product development processes but also consider these concepts when thinking about marketing and strategy formation. It appears that in the case studies reviewed, exploration and exploitation are defined and identified according to the 'research purpose.' This means that there is a lack of investigation into whether exploration and exploitation actually exist as segregated activities in practice. Last, studies have highlighted different cases of how ambidexterity can or should be achieved. For example, Wang and Jiang (2009) have demonstrated how the development team of a company producing air-conditioners can simultaneously manage exploration and exploitation to achieve ambidexterity. However, a common shortage in the current case studies is that they do not indicate clearly how ambidextrous organisations can be identified. This is because case studies using the concept of ambidexterity have not specified the reason or criteria for case selection in their study from the perspective of the dichotomy. Thus, the relevance of these cases to ambidexterity is questionable; this includes cases from Cantarello et al. (2012), Durisin and Todorova (2012), Hotho & Champion (2010), Kodam and Shibata (2014), Liu and Leitner (2012), and Wikhamn et al. (2016). Therefore, the qualitative studies here take a strategic perspective on the dichotomy, operationalise it for innovation and new product development,

and attempt to demonstrate the relevance of ambidexterity, albeit in an opaque manner, but do not challenge the dichotomy.

The notion of exploration and exploitation being separable is also reflected in the research design of empirical studies. Some theoretical frameworks lack a link between exploration and exploitation with no hypothesis set to test the relationship between these two concepts; an example can be found in the model of Clausen et al. (2013, p. 229). There are also studies (e.g., He and Wong, 2004) touching on the combined effect of exploration and exploitation, which significantly influences organisational performance. However, these studies fail to provide a clear framework to explain how this combined effect could work. In addition to the lack of attention to the relationship, the limited empirical evidence that discerns exploration and exploitation only lead to incompatible conclusions. Chang and Hughes (2012, p. 8) mention that exploration innovation is distinctive from exploitation innovation with confirmatory factor analysis. Taking exploration and exploitation as segregated constructs in such studies will never challenge the foundation of the dichotomy.

Furthermore, Hernandez-Espallardo et al. (2011, p. 210) argue that their results confirm a trade-off between the two types of innovation. However, exploration and exploitation are conceptualised separately in these two studies in the first place; consequently, these statements may be self-evident. In contrast, Greve (2007, pp. 967-968) has found that exploitation and exploration innovation are generated by similar processes within organisations. However, exploitation here does not affect exploration rates, thus implicitly refuting the trade-off. Furthermore, Blindenbach-Driessen and van de Ende (2014, p. 1102) confirm a strong correlation between explorative and exploitative activities, and these activities can enhance each other. They further proposed that a separate organisational unit for exploration is beneficial. Again, the research designs of empirical studies discussed here build on the

dichotomy as separable activities; thus, their findings with regard to the foundations for the dichotomy are similar and do not address critical comments raised before.

To sum up, although differing perspectives are found, the retrieved studies closely follow March's (1991) propositions. The foci of existing quantitative studies have mainly been on the outcome of different methods to balance exploration and exploitation. This is commonly linked to firms' performance. However, the quantitative studies analysed in this review only provide limited support in conceptualising exploration and exploitation because of the design of their research methodologies. In qualitative studies, there is limited empirical evidence sustaining the usefulness of distinguishing exploration and exploitation in practices and identifying organisations as ambidextrous. Consequently, without further evidence, it is still unclear whether exploration and exploitation should be discussed notionally separable in innovation management due to the lack of reconciling empirical evidence and the absence of adequate research designs that support proof the validity of this dichotomy without circular reasoning.

5. Discussion of Findings

What recurs throughout the discourse in this paper is that the dichotomy of exploration and exploitation has served as theoretical lens for studies into organisational activities related to innovation management. As lens, this dichotomy also became an a priori assumption, through which evidence is viewed. However, current empirical evidence presented in the retrieved studies does not support that an organisational activity could be purely classified either as exploration or exploitation; conversely, no study was undertaken without the assumption that they are distinct activities. Consequently, the entanglement of the conceptualisation — exploration and exploitation as distinct organisational activities — and the research designs in studies have not led to challenging the dichotomy for innovation management, though some critical notes were found in few studies.

We argue that even if an organisational activity leads to outcomes that could be defined as exploration or exploitation, or both, the dichotomy should not be regarded as its characterisation for the activity; instead, viewing exploration and exploitation as outcomes or criteria may be more appropriate. From a theoretical viewpoint, this is supported by the thinking in evolutionary models that influenced March's (1991) propositions among other theoretical streams such as organisational learning, implying that exploration and exploitation as outcomes rather than organisational activities. The argument for this stance can also be found in equifinality (e.g., Gresov and Drazin, 1997), derived from systems theories (von Bertalanffy, 1968, p. 46); this concept implies that there are different pathways for firms to achieve a specific state, say innovation performance. Consequently, the notional separation of exploration and exploitation in practice does not hold from the viewpoint of systems theories because there is not necessarily a single, pre-defined process leading to the same outcome for innovation processes and management. Furthermore, equifinality emphasises outcomes rather than processes as unifying and aligned with comments made in this review. In line with these arguments, nomothetic approaches to innovation management using the dichotomy were commonly employed, but they may overlook the fact that similar outcomes could be achieved with different processes, resource allocation and organisational forms. Conversely, similar processes across firms could lead to multifinality (e.g., Dekkers. 2017, p. 57), i.e., different states can be achieved from a similar starting point; this means that separating processes for exploration and exploitation do not lead to the same outcomes for individual firms. Thus, evolutionary perspectives and systems thinking —equifinality and multifinality— lead to view exploration and exploitation as outcomes of (or criteria for) adaptive processes, the starting point for March's (1991) deliberation rather than organisational activities, whilst noting that some insight appeared after his writing.

These arguments lead to further questioning that if the dichotomy on a conceptual level is problematic, its applications in innovation management would be questionable, which is a finding for our first review question. Whereas the influence of March (1991) is undoubtable, a scrutiny of existing works based on its postulations revealed that how his works has been followed differs. In terms of postulations, P1 (see Table 1) seems to be the foundation of exploration and exploitation being distinctive, as they are categorised by different keywords; even, the protocol-driven literature review by Wilden et al. (2018, pp. 358–359), covering more domains than innovation management, also exclusively uses these keywords. However, in an innovation related activity, these 'keywords' are apparently not regarded exclusive given the numerous works using different definitions, surprisingly not noted by Wilden et al. (ibid.). Furthermore, due to the different foci and how studies use the postulations from March (1991), see Table 4, there is inconsistency on what can be defined as exploration and exploitation in innovation management. For example, this inconsistency is reflected in the distinction between exploration and exploitation, and radical and incremental innovation. Moreover, we noted that the dichotomy was developed with different purposes in mind, i.e., exploration as applied to internally-oriented activities and exploitation to externally-oriented activities. Consequently, this dichotomy does not add to a more comprehensive understanding of managing innovation, rather, it creates more confusion in relation to established notions in the domain of innovation management.

The difficulties of identifying exploration and exploitation in practice also has an impact on perspectives such as different forms of ambidexterity, which our second review question examined. Although there are attempts to refine the original notion from March (1991), no direct challenges to the dichotomy and the domain assumption that exploration and exploitation as intentionally separated activities in the context of innovation management lead to the question how organisations can determine whether they are or have become ambidextrous.

Because ambidexterity is defined as organisations capable of managing both exploration and exploitation, it is impossible to know whether an organisation is ambidextrous until the outcomes of exploration and exploitation are known. Even the possibilities to create separate units in organisations for achieving structural ambidexterity or change management styles to achieve contextual ambidexterity do not necessarily mean that these organisations become ambidextrous. Based on current perspectives discussed in Section 4.2, we further argue that all organisations can be viewed as having a degree of ambidexterity, though some may be effective at managing different outcomes. If not (i.e., converging towards one extreme), according to March (1991), it will lead to organisational failure. Then, if exploitation always exists alongside exploration, there can be no extremes, meaning there is always interaction between the two; thus, invalidating the dichotomy because it becomes difficult to discern what leads to what. Therefore, the ubiquitous link between exploration and exploitation hampers identifying whether organisations are ambidextrous or which degree of ambidexterity they have in the context of innovation management. This further supports our argument that exploration and exploitation are more useful as outcome criteria than innovation activities.

The lack of theoretical clarity was not compensated by availability of empirical evidence that justified the dichotomy, which was investigated through our third review question. It appears that even though the notion has been drawing ample attention from researchers into innovation management, no studies have directly examined the relationship between exploration and exploitation. A popular research focus is to explore the consequences of sustaining a trade-off or balancing exploration and exploitation on organisational performance. With survey-based studies dominating, the number of explorative studies into the dichotomy itself is limited, which does not help bringing clarity to identifying activities that are exploration or exploitation in practice; even these explorative studies have used the dichotomy as theoretical lens. Where exploration and exploitation were discerned, only few studies have looked at joint effects, but

again placing emphasis on outcomes, with no study considering the 'interaction' between them. Similarly, this leads to testing the dichotomy as criteria for outcomes should be considered, together with explorative studies that aim to capture what actually do exploration and exploitation mean in practices for innovation management.

Based on the retrieved studies, we found it difficult to justify using exploration and exploitation for conceptualising and segregating innovation related activities, after considering their evidence, use of postulations and interpretation of theoretical foundations. Consequently, exploration and exploitation can be difficultly seen as orthogonal constructs because at least some overlap or intersection must exist. This leads to questioning which overlaps exists and to what extent contingencies influence them without the prejudice of the dichotomy. No evidence was found in this matter. This point sustained the stance of this study that the domain assumption, which views exploration and exploitation as purposefully separate activities in managing innovation, is not yet validated. Hence, this may be up to further studies to provide direct, theoretical and empirical evidence, supporting or rebutting this domain assumption.

6. Concluding Remarks

Drawing on the findings and discussions in this paper, there are two contributions to knowledge. The first one is that we point to doubts about the validity of viewing exploration and exploitation as distinct activities in innovation management based on the theoretical foundations, postulations and domain assumption of the dichotomy in March's (1991) work, including the different levels of analysis for exploration and exploitation in his original writing; no empirical studies have yet taken this route. After a systematic literature review, this paper has put forward questions regarding the current state of scholarly knowledge on this dichotomy, particularly by not finding a justification for P1 (see Table 1) beyond March (1991). The second contribution to knowledge is that this review shows there are differing views on the dichotomy

and ambidexterity, leading to variety in how the dichotomy is operationalised and resulting in heterogeneity for outcomes of studies; this diversity should lead to awareness by researchers how they build on the distinction between exploration and exploitation, and how they establish its (external) validity. These two contributions to knowledge have implications for further studies and practice.

[Insert Figure 3 about here]

6.1 Implications for Research

This review has challenged the domain assumption in March (1991) on the separation of exploration and exploitation as activities in innovation management and calls for research to justify the conceptualisation. Figure 3 shows that the only extension to the dichotomy is the conceptualisation of ambidexterity, albeit implicitly implied in March (1991) and more explicitly present in his later writing (March, 2006). In addition, Figure 3 demonstrates that his core conceptualisation — exploration and exploitation constitute distinct activities (postulation P1) — is not challenged, nor has evidence been provided to justify this thought for studies into innovation management. Contrarily, the dominantly-quantitative nature of studies on innovation management implies that the dichotomy, particularly postulations P1, has been taken as a starting point for the classification of activities, thus not leaving any possibility for questioning its validity; in terms of Zahra and Newey (2009, pp. 1066–7), such studies are limited to borrowing and replicating theoretical foundations (which they call Mode 1). This means that March's (1991) has not been tested on its external validity or transferability in terms of Spencer's (2003, p. 40) generic quality criteria for research. As indicated in Figure 3, postulations and assumptions have been left largely untouched, with the extension of ambidexterity being at best considered as Mode 2 (borrowing and extending) in Zahra and Newey's (2009, pp. 1067–8); the term 'largely untouched' refers to the conceptualisation of ambidexterity for the dichotomy being Mode 2 from the perspective of exploration and

exploitation as a theory, but from the perspective of postulations and assumptions being merely borrowing and replicating (Mode 1) the canonical interpretation of this notional separation. A final point is the lack of studies building on challenging this dichotomy directly; this is indicated by the dashed lines in the figure. With no observation of the occurrence of Mode 3 (transforming the core), which should have occurred through challenging it, all these points leave the conceptualisation on 'shaky grounds', where studies may show a high degree of internal validity or credibility but have been unable to confirm whether actual practices, not one as measured in quantitative studies, reflect the notional separation of exploration and exploitation.

This inference implies that further research should then proof whether the conceptualisation is justified; such research can take five forms using the depiction in Figure 3. The first possibility for such research is to undertake scale-free studies, i.e., the dichotomy is not used in any way to avoid initial analysis of data to be based by P1 (Table 1) or likewise definitions. This includes direct empirical evidence on the domain assumption examining whether this notional separation exists in managerial practices or not. Especially suitable for this exercise are case studies and investigations using grounded theory; this notion is supported by the reasoning of Woodside (2016, pp. 6–7) that these should precede quantitative studies. They are positioned in the trajectory of 'creative context of discovery' in Figure 3, since studies based on an inductive research methodology aim at discovering theoretical foundations using empirical data. Perhaps this is a somewhat unconventional interpretation of de Groot's empirical cycle to make our point here. Ironically, March (1991) used two simulation models with hypothetical data to put forward his proposition. Moreover, these models were not confirmed by other studies nor did further studies fully embrace that they were designed for different purposes, i.e., exploitation as internally-oriented and exploration as externally-oriented. Such also implies that studies that seek to justify the dichotomy should first reconcile the orientation of both

exploration and exploitation, otherwise they represent different levels (or orientation) of organisational activity. Particularly, research could look at what triggers for innovation and new product development are to later reflect whether organisational activities that follow can be classified as either exploration or exploitation. As a second approach to further research, the intertwined relationship between activities associated with exploration and exploitation should lead to studies that look at how similar outcomes concerning innovation management can be achieved rather than focusing on taking the notion of separation as the starting point. This goes further than studying the interaction, such as the systematic review with meta-analysis by Shi et al. (2020) that considers the joint effect of exploration and exploitation; curiously, they define exploration and exploitation as knowledge activities (ibid., p. 98) without checking which definitions have been used in the retrieved studies, while a between-study heterogeneity index (I^2) of 97% (its maximum being 100%) (ibid, p. 104) can be derived from their tabulation. In this vein, further research should look at whether firms that have separated these activities to some extent may have different innovation performances. A third take on further studies is to compare the accuracy of models based on exploitation or exploration as activities versus outcomes. This will shed light on what use of the dichotomy is most appropriate for studies into innovation management. As a fourth strand of research following from this study, one could suggest meta-synthesis of any kind to evaluate the validity of specific aspects of the dichotomy, for example, as undertaken by Fourné et al. (2019) and Wenke et al. (2021). However, this is hampered by the variety in definitions for exploration and exploitation in studies on innovation management. Dekkers et al. (2022, p. 242) indicate that when there is diversity across studies, only qualitative synthesis is possible, ruling out meta-analysis and similar methods. In this sense, the character of our review here brings this diversity to the fore. This is also confirmed by the two aforementioned systematic reviews with meta-analysis. Fourné et al. (2019, p. 570) report for the indicator of statistical between-study heterogeneity

I^2 97%, and Wenke et al. (2021, p. 659) 74%, 84% and 82% for respectively exploration, exploitation and ambidexterity; Fourne et al. (2019) do not comment in their text on the extremely high value of this indicator (with a maximum value less than 100%), which should have warned them about methodological variance, and Wenke et al. (2021, p. 659) go on with an analysis into moderating variables, ignoring that methodological variance, including how variables such as exploration and exploitation are defined, is a very likely explanation. Finally, protocol-driven literature reviews allowing the context of this paper to be extended to other management domains, such as marketing, strategic management and organisational learning, will yield insight into whether the background assumption of the dichotomy has been challenged in any form and domains in business and management studies. Thus, further studies are needed that are either scale-free or comparative in nature, complemented with reviews on the dichotomy in other domains.

Some discussion in our paper places the onus on innovation performance, i.e., exploration and exploitation are better defined as 'outcomes' in studies using the conceptualisation rather than as activities. However, even as criteria for outcomes of innovation processes, there is also a need to discover how this dichotomy impacts the ongoing decisions managers make in managing innovation. Such evidence should be considered supplementary to the justification of the dichotomy. The view of exploration and exploitation being outcomes also allows a better alignment with meta-theories. Notably, it features in evolutionary theories for organisations with Dekkers (2005, pp. 154–155), mentioned in Section 2.2, offering a point of departure based on the analogy with organisms. Another meta-theoretical perspective could be the connection of exploration and exploitation to technology cycles; in technology cycles, there are four distinct phases: technological discontinuities (variation), eras of ferment, dominant designs, and eras of incremental change (e.g., Anderson & Tushman, 1990; 1991). The distinction of these phases to exploration and exploitation could lead to better insight,

particularly for temporal and paradoxical ambidexterity. There are few studies on this matter in innovation management, with Lin (2012) focusing on the role of acquisitions being a case in point. As for developing conceptualisations, Garud et al. (2013) connect technology cycles to evolutionary models, albeit they seem to use the simplified Darwinian model of Campbell (1969) rather than more recent evolutionary models, such as Dekkers' (2005, p. 150) reference model that is more commensurate with current insight from theoretical evolutionary biology. A point raised earlier in this review is that the consideration of exploration and exploitation as outcomes needs to be interpreted and related to concepts of evolutionary models of organisations, notably the criteria of evolvability and sustained fitness. All this means that the concepts of exploration and exploitation could find their way into empirical research using evolutionary models as meta-theory at a sectoral level, albeit defined as outcomes.

Notwithstanding these points for further research, this paper expects to generate a ‘what if’ and ‘what if not’ discussion based on the problematisation methodology for future studies. It is necessary for studies, both theoretical and empirical, to focus exclusively on the justification of the notion or other questionable concepts that might fall in the same category as the exploration and exploitation dichotomy; an example may be considered 'open innovation' as 'old wine in new bottles' (Trott and Hartmann, 2009). Therefore, this reminds management studies of the necessity of consulting other theories and being open to alternatives in dealing with phenomena that occur in research and practice. Consequently, this review pleas for academics to scrutinise concepts more rather than ‘blindly’ building on them.

6.2 Implications for Practice

This review suggests that managers should be aware that exploration- and exploitation-based activities can both contribute to innovation and may as well be co-determined. Hence, this should not be ignored in strategic planning and decision making. The inseparable view of exploration and exploitation is expected to reduce organisational conflict in team building,

strategy formation and managerial decision making to some extent; moreover, it can also apply to other aspects of (organisational) management. The inseparable notion advocated in this review would lead to a more inclusive framework for managing innovation practices that can be combined with existing innovation processes in organisations.

6.3 A Final Thought

Following this review, has March's (1991) conceptualisation of exploration and exploitation been in vain? Not necessarily, since it has spurred research into processes and performance related to innovation management for which the dichotomy served as convenient interpretation of constructs. Nevertheless, a shift in thinking by scholars is reflected in the perspectives noted in this paper, evidencing the presence of an ongoing debate, implicitly or explicitly. Based on our view, expressed in the discussion of findings and implications for research, this debate should be complemented with empirical studies that investigate better its foundations, search for alternative explanations and place it in the context of evolutionary approaches, thus offering inspiring avenues for further discourse and research on the conceptualisation of exploration and exploitation.

References

Almahendra, R., & Ambos, B. (2015). Exploration and Exploitation: A 20-year Review of Evolution and Reconceptualisation. *International Journal of Innovation Management, 19*(1), 1–31.

Alvesson, M., & Sandberg, J. (2011). Generating Research Questions through Problematization. *Academy of Management Review, 36*(2), 247–271.

Amponsah, C. T., & Adams, S. (2017). Open Innovation: Systematization of Knowledge Exploration and Exploitation for Commercialization. *International Journal of Innovation and Technology Management, 21*(3), 1–26.

Anderson, P., & Tushman, M. L. (1990). Technological Discontinuities and Dominant Designs: A Cyclical Model of Technological Change. *Administrative Science Quarterly, 35*(4), 604–633.

Anderson, P., & Tushman, M. L. (1991). Managing Through Cycles of Technological Change. *Research-Technology Management, 34*(3), 26–31.

Andriopoulos, C., & Lewis, M. W. (2009). Exploitation-Exploration Tensions and Organizational Ambidexterity: Managing Paradoxes of Innovation. *Organization Science*, *20*(4), 696–717.

Andriopoulos, C., & Lewis, M. W. (2010). Managing Innovation Paradoxes: Ambidexterity Lessons from Leading Product Design Companies. *Long Range Planning*, *43*(1), 104–122.

Arvanitis, S., & Woerter, M. (2014). Exploration or Exploitation of Knowledge from Universities: Does It Make a Difference? *Economics of Innovation and New Technology*, *24*(6), 596–623.

Atuahene-Gima, K. (2005). Resolving the Capability–Rigidity Paradox in New Product Innovation. *Journal of Marketing*, *69*, 61–83.

Bauer, M., & Leker, J. (2013). Exploration and Exploitation in Product and Process Innovation in the Chemical Industry. *R&D Management*, *43*(3), 196–212.

Benner, M. J., & Tushman, M. L. (2015). Reflections on the 2013 Decade Award - "Exploitation, Exploration, and Process Management: The Productivity Dilemma Revisited" ten years later. *Academy of Management Review*, *40*(4), 497–514.

Benner, M. J., & Tushman, M. L. (2003). Exploitation, Exploration, and Process Management: The Productivity Dilemma Revisited. *Academy of Management Review*, *28*(2), 238–256.

Benner, M. J., & Tushman, M. L. (2002). Process Management and Technological Innovation : A Longitudinal Study of the Photography and Paint Industries. *Administrative Science Quarterly*, *47*(4), 676–706.

Bento, F. (2018). Complexity in the oil and gas industry: A study into exploration and exploitation in integrated operations. *Journal of Open Innovation: Technology, Market, and Complexity*, *4*(11).

Bernal, P., Maicas, J. P., & Vargas, P. (2019). Exploration, exploitation and innovation performance: disentangling the evolution of industry. *Industry and Innovation*, *26*(3), 295–320.

Bertalanffy, L. v. (1968). *General System Theory*. New York: George Braziller.

Bierly, P. E., Damanpour, F., & Santoro, M. D. (2009). The application of external knowledge: Organizational conditions for exploration and exploitation. *Journal of Management Studies*, *46*(3), 481–509.

Blank, T. H., & Naveh, E. (2019). Competition and Complementation of Exploration and Exploitation and the Achievement of Radical Innovation: The Moderating Effect of Learning Behavior and Promotion Focus. *IEEE Transactions on Engineering Management*, *66*(4), 598–612.

Blindenbach-Driessen, F., & van den Ende, J. (2014). The Locus of Innovation: The Effect of a Separate Innovation Unit on Exploration, Exploitation, and Ambidexterity in Manufacturing and Service Firms. *Journal of Product Innovation Management*, *31*(5), 1089–1105.

Brion, S., Mothe, C., & Sabatier, M. (2010). The Impact of Organisational Context and Competences on Innovation Ambidexterity. *International Journal of Innovation Management*, *14*(2), 151–178.

Camisón, C., Boronat-Navarro, M., & Forés, B. (2018). The interplay between firms' internal and external capabilities in exploration and exploitation. *Management Decision*, *56*(7), 1559–1580.

Campbell, D. T. (1969). Variation, selection and retention in sociological evolution. *General Systems*, *14*, 69–85.

Cantarello, S., Martini, A., & Nosella, A. (2012). A multi-level model for organizational ambidexterity in the search phase of the innovation process. *Creativity and Innovation Management*, *21*(1), 28–48.

Carlisle, Y., & Mcmillan, E. (2006). Innovation in Organizations from a Complex Adaptive Systems Perspective. *Emergence: Complexity & Organization*, *8*(1), 2–9.

Cesaroni, F., Minin, A. Di, & Piccaluga, A. (2005). Exploration and Exploitation Strategies in Industrial R&D. *Creativity and Innovation Management*, *14*(3), 222–232.

Chandrasekaran, A., Linderman, K., & Schroeder, R. (2015). The Role of Project and Organizational Context in Managing High-tech R&D Projects. *Production and Operations Management*, *24*(4), 560–586.

Chang, Y. Y., & Hughes, M. (2012). Drivers of innovation ambidexterity in small- to medium-sized firms. *European Management Journal*, *30*(1), 1–17.

Chang, Y.-Y., Hughes, M., & Hotho, S. (2011). Internal and external antecedents of SMEs' innovation ambidexterity outcomes. *Management Decision*, *49*(10), 1658–1676.

Choi, Y. R. ., & Phan, P. H. . (2014). Exploration, exploitation, and growth through new product development: The moderating effects of firm age and environmental adversity. *IEEE Transactions on Engineering Management*, *61*(3), 428–437.

Clausen, T. H., Korneliussen, T., & Madsen, E. L. (2013). Modes of innovation, resources and their influence on product innovation: Empirical evidence from R&D active firms in Norway. *Technovation*, *33*(6–7), 225–233.

Coradi, A., Heinzen, M., & Boutellier, R. (2015). A Longitudinal Study of Workspace Design for Knowledge Exploration and Exploitation in the Research and Development Process. *Creativity and Innovation Management*, *24*(1), 55–71.

Cronin, P., Ryan, F., & Coughlan, M. (2008). Undertaking a literature review: a step-by-step approach. *The British Journal of Nursing*, *17*(1), 38–43.

de Visser, M., & Faems, D. (2015). Exploration and Exploitation within Firms: The Impact of CEOs' Cognitive Style on Incremental and Radical Innovation Performance. *Creativity and Innovation Management*, *24*(3), 359–372.

Dekkers, R. (2005). *(R)Evolution: Organizations and the Dynamics of the Environment*. Springer.

Dekkers, R., Lindsey, C., & Langhorne, P. (2022). *Making Literature Reviews Work: A Multidisciplinary Guide to Systematic Approaches.* Springer.

Drucker, P. F. (1985). The discipline of innovation. *Harvard Business Review*, *63*(3), 67–72.

Duncan, R. B. (1976). The ambidextrous organization: Designing dual structures for innovation. In R. H. Kilmann, L. R. Pondy, & D. P. Slevin (Eds.), *The management of organization design - Strategies and Implementation* (pp. 167–189).

Durisin, B., & Todorova, G. (2012). A study of the performativity of the ambidextrous organizations theory: Neither lost in nor lost before translation. *Journal of Product Innovation Management*, *29*, 53–75.

Enkel, E., Heil, S., Hengstler, M., & Wirth, H. (2017). Exploratory and exploitative innovation: To what extent do the dimensions of individual level absorptive capacity contribute? *Technovation*, *60*, 29–38.

Fauchart, E., & Keilbach, M. (2009). Testing a model of exploration and exploitation as innovation strategies. *Small Business Economics*, *33*(3), 257–272.

Fourné, S. P. L., Rosenbusch, N., Heyden, M. L. M., & Jansen, J. J. P. (2019). Structural and contextual approaches to ambidexterity: A meta-analysis of organizational and environmental contingencies. *European Management Journal*, *37*(5), 564–576.

Garcia, R., Calantone, R., & Levine, R. (2003). The Role of Knowledge in Resource Allocation to Exploration versus Exploitation in Technologically Oriented Organizations. *Decision Sciences*, *34*(2), 323–349.

Garud, R., Tuertscher, P., & Van de Ven, A. H. (2013). Perspectives on Innovation Processes. *Academy of Management Annals*, *7*(1), 775–819.

Geiger, S. W., & Makri, M. (2006). Exploration and exploitation innovation processes: The role of organizational slack in R&D intensive firms. *The Journal of High Technology Management Research*, *17*(1), 97–108.

Gibson, C. B., & Birkinshaw, J. (2004). The Antecedents, Consequences, and Mediating Role of Organizational Ambidexterity. *Academy of Management Journal*, *47*(2), 209–226.

Gilsing, V., & Nooteboom, B. (2006). Exploration and exploitation in innovation systems: The case of pharmaceutical biotechnology. *Research Policy*, *35*(1), 1–23.

Gouldner, A, W. (1971). *The Coming Crisis of Western Sociology*. Heinemann.

Greenhalgh, T., & Peacock, R. (2005). Effectiveness and efficiency of search methods in systematic reviews of complex evidence: audit of primary sources. *BMJ*, *331*, 1064–1065.

Gresov, C., & Drazin, R. (1997). Equifinality: Functional Equivalence in Organization Design. *Academy of Management Review*, *22*(2), 403–428.

Greve, H. R. (2007). Exploration and exploitation in product innovation. *Industrial and Corporate Change*, *16*(5), 945–975.

Groysberg, B., & Lee, L.-E. (2009). Hiring Stars and Their Colleagues: Exploration and Exploitation in Professional Service Firms. *Organization Science*, *20*(4), 740–758.

Gupta, A. K., Smith, K. G., & Shalley, C. E. (2006). The interplay between exploration and exploitation. *Academy of Management Journal*, *49*(4), 693–706.

He, Z.-L., & Wong, P.-K. (2004). Exploration vs. Exploitation: An Empirical Test of the Ambidexterity Hypothesis. *Organization Science*, *15*(4), 481–494.

Hernanedez-Espallardo, M., Sanchez-Perez, M., & Segovia-Lopez, C. (2011). Exploitation- and exploration-based innovations: The role of knowledge in inter-firm relationships with distributors. *Technovation*, *31*(5–6), 203–215.

Hong, J., Hou, B., Zhu, K., & Marinova, D. (2018). Exploratory innovation, exploitative innovation and employee creativity: The moderation of collectivism in Chinese context. *Chinese Management Studies*, *12*(2), 268–286.

Hotho, S., & Champion, K. (2010). "We Are Always After That Balance" - Managing Innovation in the New Digital Media Industries. *Journal of Technology Management & Innovation*, *5*(3), 36–50.

Hunt III, H.G., & Hogler, R.L., (1990). Agency theory as ideology: A comparative analysis based on critical legal theory and radical accounting. *Accounting, Organizations and Society*, 15, 437–454.

Hunter, S. T., Cushenbery, L. D., & Jayne, B. (2017). Why dual leaders will drive innovation: Resolving the exploration and exploitation dilemma with a conservation of resources solution. *Journal of Organizational Behavior*, 38, 1183–1195.

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

Jansen, J. J. P., Vera, D., & Crossan, M. (2009). Strategic leadership for exploration and exploitation: The moderating role of environmental dynamism. *Leadership Quarterly*, *20*(1), 5–18.

Jansen, J. J. P., van den Bosch, F. A. J., & Volberda, H. W. (2006). Exploratory Innovation, Exploitative Innovation, and Performance: Effects of Organizational Antecedents and Environmental Moderators. *Management Science*, *52*(11), 1661–1674.

Jansen, J. J. P. P., Bosch, F. A. J. Van den, Volberda, H. W., & Van Den Bosch, F. A. J. (2005). Exploratory Innovation, Exploitative Innovation, and Ambidexterity - The Impact of Environmental Antecedents. *Schmalenbach Business Review*, *57*(4), 351–363.

Johnson, S. C., & Jones, C. (1957). How to Organize for New Products. *Harvard Business Review*, *35*(3), 49–62.

Kahneman, D., & Tversky, A. (1979). Prospect Theory: An Analysis of Decision under Risk. *Econometrica*, *47*(2), 263–292.

Karhu, P., Ritala, P., & Viola, L. (2016). How Do Ambidextrous Teams Create New Products? Cognitive Ambidexterity, Analogies, and New Product Creation. *Knowledge and Process Management*, *23*(1), 3–17.

Kauffman, S. A. (1993). *The Origins of Order : Self-Organization and Selection in Evolution*. Oxford University Press.

Kim, C., Song, J., & Nerkar, A. (2012). Learning and innovation: Exploitation and exploration trade-offs. *Journal of Business Research*, *65*(8), 1189–1194.

Kim, G., & Huh, M.-G. (2015). Innovation and survival in Korean SMEs: the moderating effect of competitive strategy. *Asian Journal of Technology Innovation*, *23*(1), 107–119.

Knight, E., & Harvey, W. (2015). Managing exploration and exploitation paradoxes in creative orgniastions. *Management Decision*, *53*(4).

Kodama, M., & Shibata, T. (2014). Research into ambidextrous R&D in product development - new product development at a precision device maker: A case study. *Technology Analysis and Strategic Management*.

Kraaijenbrink, J., Spender, J.-C., Groen, A.J. (2010). The Resource-Based View: A Review and Assessment of Its Critiques. *Journal of Management*, 36, 349–372.

Kuran, T. (1988). The Tenacious Past: Theories of Personal and Collective Conservatism. *Journal of Economic Behavior and Organization*, *10*(2), 143–171.

Lavie, D., Stettner, U., & Tushman, M. L. (2010). Exploration and Exploitation Within and Across Organizations. *The Academy of Management Annals*, *4*(1), 109–155.

Lee, J., & Ryu, Y. U. (2002). Exploration, exploitation and adaptive rationality: the neo-Schumpeterian perspective. *Simulation Modelling Practice and Theory*, *10*(5–7), 297–320.

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

Li, C.-R., Lin, C.-J., & Huang, H.-C. (2014). Top management team social capital, exploration-based innovation, and exploitation-based innovation in SMEs. *Technology Analysis & Strategic Management*, *26*(1), 69–85.

Lin, H.-E., & McDonough, E. (2011). Investigating the Role of Leadership and Organizational Culture in Fostering Innovation Ambidexterity. *IEEE Transactions on Engineering Management*, *58*(3), 497–509.

Lin, L.-H. (2012). Innovation performance of Taiwanese information firms: An acquisition–learning–innovation framework. *Total Quality Management & Business Excellence*, *23*(9–10), 1135–1151.

Maier, J. (2015). *The Ambidextrous Organization*. Palgrave Macmillan.

March, J. G. (2006). Rationality, Foolishness, and Adaptive Intelligence. In *Strategic Management Journal*.

March, J. G. (1991). Exploration and Exploitation in Organisational learning. *Organization Science*, *2*(1), 71–87.

Marín-Idárraga, D. A., Hurtado González, J. M., & Cabello Medina, C. (2016). The Antecedents of Exploitation-Exploration and Their Relationship with Innovation: A Study of Managers' Cognitive Maps. *Creativity and Innovation Management*, *25*(1), 18–37.

Martini, A., Neirotti, P., & Aloini, D. (2015). Finding the way to ambidexterity: Exploring the relationships among organisational design, knowledge creation and innovation. *International Journal of Innovation Management*, *19*(04), 1550045.

Matzler, K., Abfalter, D. E., Mooradian, T. a., & Bailom, F. (2013). Corporate Culture As an Antecedent of Successful Exploration and Exploitation. *International Journal of Innovation Management*, *17*(05), 1350025.

McMillan, G. S. (2015). Exploration and exploitation in science: Their impact on scientific and technological outcomes. *International Journal of Innovation Management*, *19*(2), 1–11.

McNamara, P., & Baden-Fuller, C. (2007). Shareholder returns and the exploration -exploitation dilemma: R&D announcements by biotechnology firms. *Research Policy*, *36*(4), 548–565.

Mudambi, R., & Swift, T. (2011). Proactive R&D management and firm growth: A punctuated equilibrium model. *Research Policy*, *40*(3), 429–440.

Nemanich, L. A., Keller, R. T., & Vera, D. (2007). Managing the Exploration/Exploitation paradox in new product development: How Top executives define their firm's innovation trajectory. *International Journal of Innovation and Technology Management*, *04*(03), 351–374.

Nightingale, A. (2009). A guide to systematic literature reviews. In *Surgery* (Vol. 27, Issue 9, pp. 381–384).

O'Cass, A., Heirati, N., & Ngo, L. V. (2014). Achieving new product success via the synchronization of exploration and exploitation across multiple levels and functional areas. *Industrial Marketing Management*, *43*(5), 862–872.

OECD Publishing. (2018). Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation. In *Handbook of Innovation Indicators and Measurement* (4th ed.).

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

O'Reilly, C. A., & Tushman, M. L. (2013). Organizational Ambidexterity: Past, Present and Future. *The Academy of Management Perspectives*, *27*(4), 324–338.

O'Reilly, C. a., & Tushman, M. L. (2004). The Ambidextrous Organization. *Harvard Business Review*, *82*(4), 4–9.

Papachroni, A., Heracleous, L., & Paroutis, S. (2015). Organizational Ambidexterity Through the Lens of Paradox Theory: Building a Novel Research Agenda. *The Journal of Applied Behavioral Science*, *51*(1), 71–93.

Priem, R.L., & Butler, J.E., (2001). Is the Resource-Based "View" a Useful Perspective for Strategic Management Research? *Academy of Management Review*, 26, 22–40.

Quintana-García, C., & Benavides-Velasco, C. A. (2008). Innovative competence, exploration and exploitation: The influence of technological diversification. *Research Policy*, *37*(3), 492–507.

Radner, R., & Rothschild, M. (1975). On the Allocation of Effort. *Journal of Economic Theory*, *10*(3), 358–376.

Raisch, S., Birkinshaw, J., Probst, G., & Tushman, M. L. (2009). Organizational Ambidexterity: Balancing Exploitation and Exploration for Sustained Performance. *Organization Science*, *20*(4), 685–695.

Revilla, E., & Rodríguez-Prado, B. (2018). Bulding ambidexterity through creativity mechanisms: Contextual drivers of innovation success. *Research Policy*, *47*, 1611–1625.

Rosing, K., & Zacher, H. (2017). Individual ambidexterity: the duality of exploration and exploitation and its relationship with innovative performance. *European Journal of Work and Organizational Psychology*, *26*(5), 694–709.

Saetre, A. S., & Brun, E. (2012). Strategic management of innovation: managing exploration-exploitation by balancing creativity and constraint. *International Journal of Innovation and Technology Management*, *9*(4), 1250025 (24 pp.).

Schamberger, D. K., Cleven, N. J., & Brettel, M. (2013). Performance Effects of Exploratory and Exploitative Innovation Strategies and the Moderating Role of External Innovation Partners. *Industry and Innovation*, *20*(4), 336–356.

Schulze, P. (2009). *Balancing exploitation and exploration organizational antecedents and performance effects of innovation strategies*. Gabler Verlag/GWV Fachverlage.

Shi, X., Su, L., & Cui, A. P. (2020). A meta-analytic study on exploration and exploitation. *Journal of Business and Industrial Marketing*, *35*(1), 97–115.

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

Sok, P., & O'Cass, A. (2015). Achieving service quality through service innovation exploration - exploitation: the critical role of employee empowerment and slack resources. *Journal of Services Marketing*, *29*(2), 137–149.

Soto-Acosta, P., Popa, S., & Martinez-Conesa, I. (2018). Information technology, knowledge management and environmental dynamism as drivers of innovation ambidexterity: a study in SMEs. *Journal of Knowledge Management*, *22*(4), 931–948.

Steenhuis, H.-J., Dekkers, R., Carey, L., & Langhorne, P. (2022). Quality of Literature Reviews. In R. Dekkers, L. Carey, & P. Langhorne (Eds.), *Making Literature Reviews Work: A Multidisciplinary Guide to Systematic Approaches* (pp. 57–105). Cham: Springer.

Suzuki, O., & Methe, D. (2011). Optimal ambidexterity and exploration valuableness: balancing short-term and long-term trade-off in pharmaceutical products development. *Journal of Business Chemistry*, 49–63.

Swift, T. (2016). The perilous leap between exploration and exploitation. *Strategic Management Journal*, *37*, 1688–1698.

Tatum, C. B. (1987). Process of Innovation in Construction Firm. *Journal of Construction Engineering and Management*, *113*(4), 648–663.

Tidd, J. (2001). Innovation management in context: Environment, organization and performance. *International Journal of Management Reviews*, *3*(3), 169–183.

Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British Journal of Management*, *14*, 207–222.

Trott, P. (2005). *Innovation management and new product development* (3rd ed.). Pearson Education.

Trott, P., & Harmann, D. (2009). Why "open innovation" is new wine in old bottles. *International Journal of Innovation Management*, *13*(04), 715–736.

Tushman, M. L., & O'Reilly, C. A. (1996). Ambidextrous organizations: Managing evolutionary and revolutionary change. *California Management Review*, *38*(4), 8–30.

UN, C. A. (2007). Managing the Innovators for Exploration and Exploitation. *Journal of Technology Management & Innovation*, *2*(3), 4–20.

Voss, G. B., Sirdeshmukh, D., & Voss, Z. G. (2008). The Effects of Slack Resources and Environmental Threat on Product Exploration and Exploitation. *Academy of Management Journal*, *51*(1), 147–164.

Voss, G. B., & Voss, Z. G. (2013). Strategic Ambidexterity in Small and Medium-Sized Enterprises: Implementing Exploration and Exploitation in Product and Market Domains. *Organization Science*, *24*(5), 1459–1477.

Wagenmakers, E. J., Dutilh, G., & Sarafoglou, A. (2018). The Creativity-Verification Cycle in Psychological Science: New Methods to Combat Old Idols. *Perspectives on Psychological Science*, *13*(4), 418–427.

Wang, C. L., & Rafiq, M. (2014). Ambidextrous organizational culture, contextual ambidexterity and new product innovation: A comparative study of UK and Chinese high-tech firms. *British Journal of Management*, *25*(1), 58–76.

Wang, F., & Jiang, H. (2009). Innovation paradox and ambidextrous organization: A case study on development teams of air conditioner in Haier. *Frontiers of Business Research in China*, *3*(2), 271–300.

Wei, Z., Yi, Y., & Guo, H. (2014). Organizational learning ambidexterity, strategic flexibility, and new product development. *Journal of Product Innovation Management*, *31*(4), 832–847.

Wenke, K., Zapkau, F. B., & Schwens, C. (2021). Too small to do it all? A meta-analysis on the relative relationships of exploration, exploitation, and ambidexterity with SME performance. *Journal of Business Research*, *132*, 653–665.

Wikhamn, B. R., Styhre, A., Ljungberg, J., & Szczepanska, A. M. (2016). Exploration vs. exploitation and how video game developers are able to combine the two. *International Journal of Innovation Management*, *20*(6), 1650045.

Wilden, R., Hohberger, J., Devinney, T. M., & Lavie, D. (2018). Revisiting James March (1991): Whither exploration and exploitation? *Strategic Organization*, *16*(3), 352–369.

Woodside, A. G. (n.d.). *Bad to Good: Achieving High Quality and Impact in Your Research*. Emerald Group Publishing.

Worsham, J., Eisner, M.A., Ringquist, E.J. (1997). Assessing the Assumptions: A Critical Analysis of Agency Theory. *Administration & Society*, 28, 419–440.

Yalcinkaya, G., Calantone, R. J., & Griffith, D. a. (2007). An Examination of Exploration and Exploitation Capabilities: Implications for Product Innovation and Market Performance. *Journal of International Marketing*, *15*(4), 63–93.

Yamakawa, Y., Yang, H., & Lin, Z. (John). (2011). Exploration versus exploitation in alliance portfolio: Performance implications of organizational, strategic, and environmental fit. *Research Policy*, *40*(2), 287–296.

Yang, Z., Zhou, X., & Zhang, P. (2015). Discipline versus passion: Collectivism, centralization, and ambidextrous innovation. *Asia Pacific Journal of Management*, *32*(3), 745–769.

Zacher, H., Robinson, A. J., & Rosing, K. (2016). Ambidextrous Leadership and Employees' Self-Reported Innovative Performance: The Role of Exploration and Exploitation Behaviors. *Journal of Creative Behavior*, *50*(1), 24–46.

Zahra, S. A., & Newey, L. R. (2009). Maximizing the Impact of Organization Science: Theory-Building at the Intersection of Disciplines and/or Fields. *Journal of Management Studies*, *46*(6), 1059–1075. doi: 10.1111/j.1467-6486.2009.00848.x

Zhou, K. Z., & Wu, F. (2010). Technological capability, strategic flexibility, and product innovation. *Strategic Management Journal*, *31*(5), 547–561.

List of tables and figures

Table 1 Postulations from March (1991)

Code	Statements from March (1991)	Page
P1	• Exploration: search, variation, risk taking, experimentation, play, flexibility, discovery, innovation. • Exploitation: refinement, choice production, efficiency, selection, implementation, execution.	*p. 71*
P2	• Maintaining an appropriate balance between exploration and exploitation is primary factor in system survival and prosperity.	*p. 71*
P3	• Both exploration and exploitation are essential for organisations, but they compete for scarce resources.	*p. 71*
P4	• Organisations will make choice of exploration and exploitation • Implicit choices are buried in many features of organisational forms and customs. • Explicit choices are found in calculated decisions about alternative investments and competitive strategies.	*p. 71*
P5	• Essence of exploitation is refinement and extension of existing competences, technologies and paradigms. Its returns are positive, proximate and predictable. • Essence of exploration is experimentation with new alternatives. Its returns are uncertain, distant and often negative.	*p. 85*
P6	• Increasing exploitation and reducing exploration make adaptive process potentially self-destructive.	*p. 73*

Table 2 Exclusion criteria with examples of rejected papers

Exclusion Criteria	**Example**
Only marketing-orientated	*Kyriakopoulos and Moorman (2004)*
Only HR-orientated	*Litrico and Lee (2008)*
Only strategic management-orientated	*Ireland and Webb (2009)*
Only learning/knowledge-orientated	*Holmqvist, (2004)*
Conference papers	*de Visser et al. (2011)*
Unpublished working papers	*Masini et al. (2004)*
Literature reviews	*Gupta et al. (2006)*

Table 3 Retrieval Papers for Detailed Analysis

Databases	Paper
Google Scholar [59 papers]	Amponsah and Adams (2017); Andriopoulos and Lewis (2009, 2010); Atuahene-Gima (2005); Bauer and Leker (2013); Benner and Tushman (2002, 2003); Bento (2018); Bernal et al. (2019); Bierly et al. (2009); Blank and Naveh (2018); Brion et al. (2010); Camison et al. (2018); Carlisle and Mcmillan (2006); Cesaroni et al. (2005); Chang and Hughes (2012); Chang et al. (2011); Coradi et al. (2015); de Visser and Faems (2015); Enkel et al. (2017); Fauchart and Keilbach (2009); Geiger and Makri (2006); Gilsing and Nooteboom (2006); Greve (2007); He and Wong (2004); Hernanedez-Espallardo et al. (2011); Hong et al. (2018); Hotho and Champion (2010); Hunter et al. (2017); Jansen et al. (2005); Jansen et al. (2006); Jansen et al. (2009); Kim et al. (2012); Knight and Harvey (2015); Lee and Ryu (2002); Li et al. (2014); Lin and McDonough (2011); Lin et al. (2013); Lisboa et al. (2011); Liu and Leitner (2012); Marin-Idarraga et al. (2016); Matzler et al. (2013); McNamara and Baden-Fuller (2007); Nemanich et al. (2007); O'Reilly and Tushman (2004, 2011); Quintana-García and Benavides-Velasco (2008); Revilla and Rodriguez-Prado (2018); Rosing and Zacher (2017); Saetre and Brun (2012); Smith and Tushman (2005); Soto-Acosta et al. (2018); Swift (2016); UN (2007); Voss and Voss (2013); Wang and Rafiq (2014); Wikhamn et al. (2016); Yalcinkaya et al. (2007); Yang and Li (2011)
EBSCOhost (with duplication removed) [17 papers]	Arvanitis and Woerter (2015); Benner and Tushman (2015); Blindenbach-Driessen and van den Ende (2014); Chandrasekaran et al. (2015); Choi and Phan (2014); Clausen et al. (2013); Garcia et al. (2003); Karhu et al. (2016); Kodama and Shibata (2014); Mudambi and Swift (2011); O'Cass et al. (2014); Suzuki and Methe (2011); Voss et al. (2008); Wang et al. (2015); Wei et al. (2014); Zacher et al. (2016); Zhou and Wu (2010)
Scopus (with duplications removed) [10 papers]	Cantarello et al. (2012); Durisin and Todorova (2012); Groysberg and Lee (2009); Kim and Huh (2015); Martini et al. (2015); Mcmillan (2015); Schamberger et al. (2013); Sok and O'Cass (2015); Wang and Jiang (2009); Yang et al. (2015)
Snowballing [4 papers]	Gibson and Birkinshaw (2004); Jansen et al. (2008); Papachroni et al. (2015); Tushman and O'Reilly (1996)

Table 4. Frequency for combinations of March's (1991) postulations (n=90)

Postulations						
P1	P2	P3	P4	P5	P6	
28	69	34	55	72	19	Frequency
	•			•		15
	•		•	•		11
	•	•	•	•		5
•	•	•	•			4
	•		•			4
	•		•	•	•	4
			•	•		4
Other combinations (24)						43

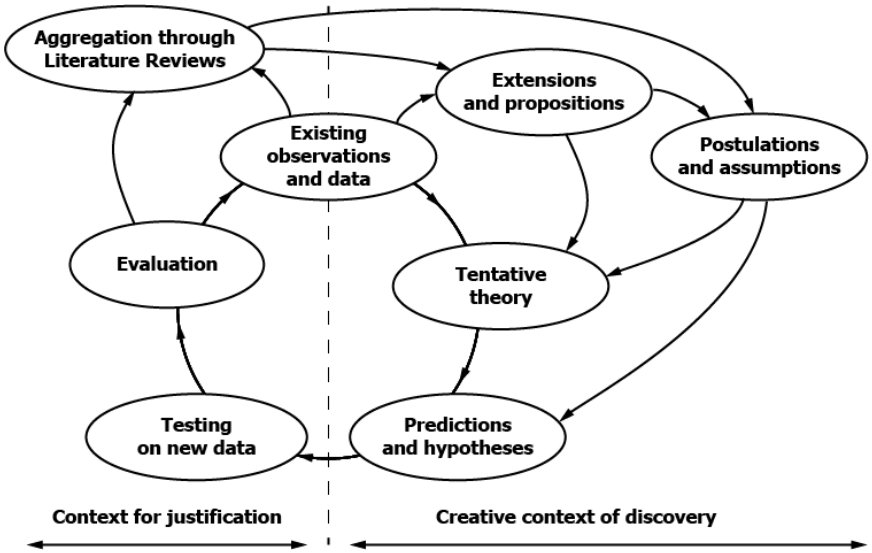

Figure 1 Assumptions and the revised empirical cycle of de Groot

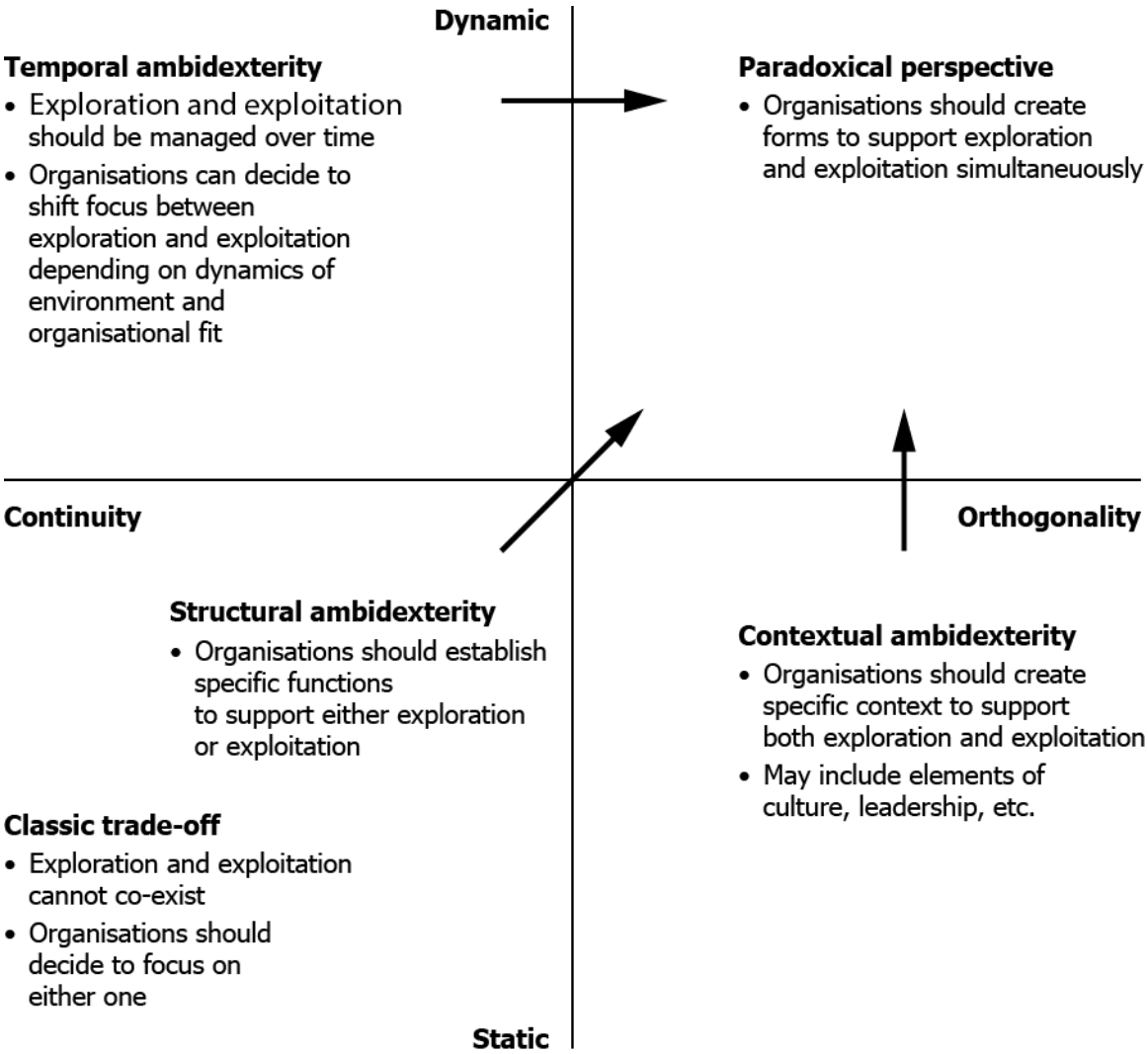

Figure 2 Paradigm shifts for exploration and exploitation

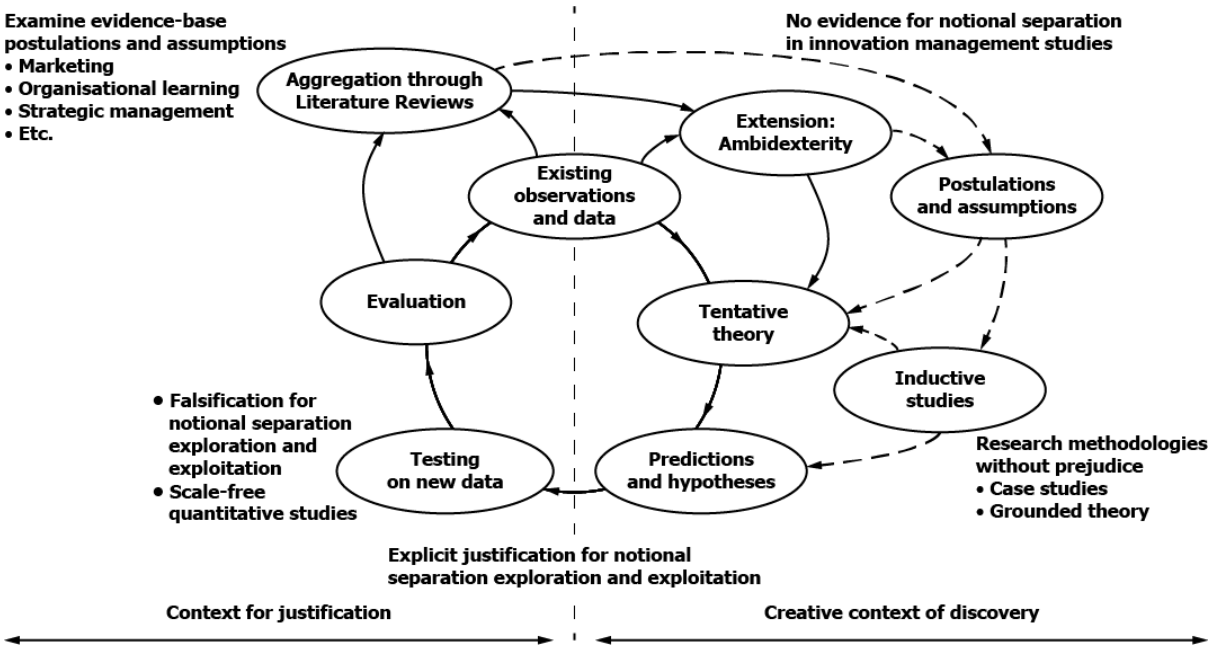

Figure 3 Pathways for research into dichotomy exploration and exploitation