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Microfoundations in the strategic management of technology and innovation: Definitions, systematic literature review, integrative framework, and research agenda

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ABSTRACT

While innovations and new technologies are often pivotal to the long-term prosperity of firms, such firm-level outcomes emerge from the actions and interactions of organizational members who develop innovations and use new technologies. The "microfoundations movement" seeks to understand how micro-level (e.g., individual) actions and interactions lead to macro-level (e.g., organizational) outcomes and mediate relations between macro-level variables. Although the movement has grown tremendously over the last decade, it has yet to deeply pervade the domain of strategic technology and innovation management. Due to its tremendous growth, it is quite fragmented and dispersed, which impedes the identification of the most promising opportunities for future research. To overcome this problematic situation, we conduct a systematic literature review of existing research on microfoundations in the strategic management of technology and innovation, synthesize it into an integrative framework, and chart promising paths for future research. Specifically, we apply a multi-coder, multi-step approach, identify 87 relevant articles published in 23 leading academic journals over the period from 2003 to 2022, and propose a research agenda comprising more than 20 promising avenues for future research based on the resulting insights. These findings have important implications for the academic literature and management practice.

1. Introduction

It is widely accepted that individuals play a major role in producing innovations (e.g., Amabile, 1988; Dahlander et al., 2016; Felin & Hesterly, 2007; Simon, 1991). Nevertheless, the familiar image of "the lone inventor working tirelessly until one comes across the grand discovery, which is followed by shouts of *Eureka* and much excitement" (Friedman et al., 2008, p. 18; emphasis in original) is often misleading. Few inventors are actually "lone wolves", but most are embedded in social structures that are key to the development of successful innovations (Dodgson & Gann, 2018; Grigoriou & Rothaermel, 2014). The great majority of successful innovations originate in firms and emerge through the interplay of numerous individuals (Schilling & Shankar, 2019; White & Bruton, 2010). At the same time, innovations are becoming more and more essential for the ongoing competitiveness and long-term prosperity of firms (Audretsch et al., 2014; Foss et al., 2011; Schilling & Shankar, 2019). The same holds true for new technologies, which often only deliver the value added desired by firms if they are well received and adequately put into operation by organizational members (Boothby et al., 2010; Hoppmann et al., 2020; Leonardi & Barley, 2010). Consequently, important interdependencies exist between individuals and organizations. While organizations influence the conditions in which individuals can be innovative and adopt new technologies, individuals affect the prosperity of their firm through their innovation-related actions and their use of new technologies (Felin & Foss, 2005; Grant, 1996; Schilling & Shankar, 2019).[1]

In consequence, firms need answers to two interrelated questions to thrive in today's business landscape: (1) Which actions and interactions

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[1] Dodgson (2021, p. 13) reasons that Peter Drucker's famous aphorism of "culture eats strategy for breakfast" also indicates the crucial role of employee behavior (embedded in culture) in driving organizational outcomes.

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of their employees can improve firm performance and which (inter)actions are detrimental? (2) How can fruitful (inter)actions and their translation into firm performance be encouraged and supported? Unfortunately, answering these questions in the technology and innovation context is not trivial for three reasons: First, innovation success depends on fundamentally different, even opposing behaviors (Klonek et al., 2020; Rosing et al., 2011) – it involves idea creation, championing, and implementation (Badir et al., 2020; van de Ven et al., 1999). Second, technology and innovation often pervade the entire organization – firms typically seek to stimulate innovative behavior across various departments (Yuan & Woodman, 2010) and often possess technologies affecting employees in various functions (Orlikowski & Scott, 2008). Thus, the outcomes of innovation and technology management depend on the (inter)actions of a large number of people. Third, the emerging nature of innovation means that it is hard, if not impossible, to predict all major contingencies (Huikkola et al., 2022; Palmié et al., 2016). While employees need to be able to adapt their behavior[2] situationally, they could try to use this flexibility to their own advantage by engaging in political behaviors and "power plays" (Roeth et al., 2019). Overall, these reasons imply that the behavioral foundations of technology and innovation are complex and hard to understand intuitively, providing a fertile ground for academic research.

Generally speaking, the strategic management literature has recently developed a strong interest in studying how organizations affect individuals and how individuals, in turn, affect organizations. Studies of such interdependencies belong to an emerging field that has been called the "microfoundations movement in strategy and organization theory", which emerged in 2003 and has gained traction since 2010 (Felin et al., 2015; Foss & Pedersen, 2016). The microfoundations movement seeks to understand how human action and interaction lead to organization-level outcomes and mediate relations between organizational variables (Felin et al., 2015; Foss, 2011). While the microfoundations movement has grown tremendously over recent years, it has entered various domains of strategic management research, seeking microfoundations for a large variety of phenomena (Felin et al., 2015; Foss & Pedersen, 2016). Thus, the movement is highly dispersed and fragmented (Felin et al., 2015, p. 618). Given its emerging and dispersed nature, it has typically not yet pervaded each individual domain deeply, offering many more opportunities for additional research (Contractor et al., 2019; Felin et al., 2015; Foss & Pedersen, 2016). However, the fragmented and dispersed nature of previous microfoundations work is currently impeding the identification of the most promising opportunities for such research. Consequently, scholars have demanded a refocusing and synthesis of knowledge (Barney & Felin, 2013; Felin et al., 2015).

The strategic management of technology and innovation is one stream within the microfoundations movement that is in particular need of such refocusing and synthesis. While academics have recently started to consolidate the corresponding literature, they have so far focused on highly specific aspects. For instance, Loon et al. (2020) reviewed the literature on the HR microfoundations of capabilities for business model innovation, while Magistretti et al. (2021) reviewed the literature on the microfoundations of design thinking as a dynamic capability for innovation. Given the pervasiveness of technology and innovation, these literature reviews only cover small fractions of the strategic technology and innovation management (STIM) domain, leaving much of the domain unconsolidated.

The purpose of this paper, therefore, is to conduct a systematic literature review of existing research on the microfoundations in the STIM domain, synthesize it, develop an integrative framework, and chart promising paths for future research. After introducing the terms "microfoundations" and "strategic technology and innovation management", we describe the multi-coder, multi-step approach that we used to identify relevant articles in leading academic journals. We subsequently consolidate the 87 articles published in 23 different journals over the period 2003 to 2022 that were identified in this way, and we propose a research agenda comprising 21 promising avenues for future research based on the resulting insights.

Our synthesis and research agenda can make substantial contributions to the academic literature and management practice. Even though the importance of human action and interaction for strategic technology and innovation management has long been acknowledged (e.g., Leonard-Barton, 1992), it has been pointed out repeatedly that human (inter)action remains an under-researched element of strategic technology and innovation management (Dodgson, 2021; Elsahn et al., 2020; Loon et al., 2020; Raffaelli et al., 2019; Schneckenberg et al., 2015; Teece, 2010). This constellation may explain why research on the strategic management of technology and innovation has produced rather inconsistent findings and frequently failed to produce prescriptive insights (Gupta et al., 2007; Keupp et al., 2012; Tidd, 2001). Studying the behavioral foundations of the strategic management of technology and innovation could strengthen scholars' ability to rule out alternative explanations, understand fundamental causes, increase predictability, and improve managerial intervention (Abell et al., 2008; Coleman, 1990; Foss, 2011). Our research agenda can direct scholarly efforts toward the most promising research opportunities and, thereby, assist the emergence of academic guidance to practicing managers.

2. Terminology

2.1. Evolution and state-of-the-art definition of microfoundations

Lippman and Rumelt, who are credited with being the first to use the term "microfoundations" in a strategic management article (Foss & Pedersen, 2016), introduced the concept to the field by stating: "The micro-foundations of a subject are the definitions of its basic elements and the allowable operations that can be performed using these elements" (Lippman & Rumelt, 2003, p. 903). Subsequently, several authors used the term in a similar manner, associating it with important constituting elements. For instance, Teece (2007) describes "cross-functional R&D teams, new product development routines, quality control routines, and technology transfer and/or knowledge transfer routines, and certain performance measurement systems as important elements (microfoundations) of dynamic capabilities" (p. 1322) and further suggests that the "microfoundations of dynamic capabilities [… comprise] distinct skills, processes, procedures, organizational structures, decision rules, and disciplines" (p. 1319).

The microfoundations movement, however, tends to converge on a narrower understanding of the term in line with methodological individualism and reductionism (Foss, 2011). Most scholars in this movement associate the term with individuals as the elements constituting an organization and focus on individual action and interaction as the foundations of organizational phenomena (Felin et al., 2015; Foss, 2011). The main thrust of the microfoundations movement in the management field can be defined as understanding how individual-level factors impact organizations, how the interaction of individuals leads to emergent, organization-level outcomes, and how relations between organizational variables are mediated by individual actions and interactions (cf. Felin et al., 2015, p. 576). Thus, microfoundations scholars locate the proximate cause of a phenomenon at a level of analysis below the phenomenon itself (Felin & Hesterly, 2007), usually seeking to explain organizational phenomena by treating organizational members as the proximate cause of these phenomena.

This narrower understanding of microfoundations is well illustrated by a figure originally developed by sociologist James S. Coleman (1990) and now commonly called "Coleman's boat" or "Coleman's bathtub". In its basic form, which is depicted in Fig. 1, the model consists of two levels (micro and macro), two nodes on every level, and causal arrows between these nodes, which describe intra- and cross-level relationships. The nodes on the upper level and the arrow linking them (Arrow #4)

[2] This article uses the terms "action" and "behavior" interchangeably.

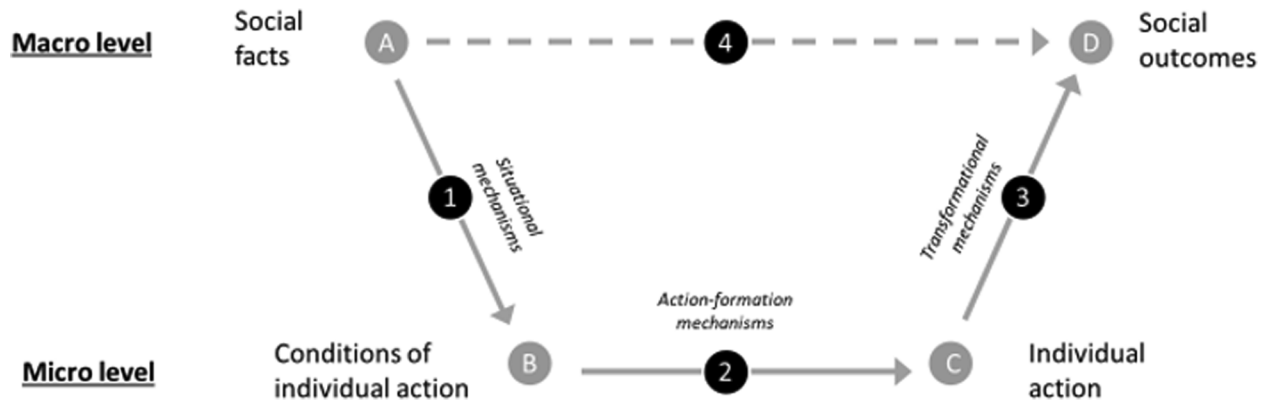

Fig. 1. Coleman's boat: a general model of social science explanation. Note: Based on Coleman (1990), Felin et al. (2015), and Hedström and Swedberg (1998).

represent a simplified view of pure macro scholarship: The "social facts" directly affect the "social outcomes". The nodes on the lower level and the arrow linking them (Arrow #2) represent a simplified view of pure micro scholarship: The "conditions of individual action" lead to "individual action" by means of so-called "action-formation mechanisms". When individuals are placed in varying conditions, their cognition, motivation, opportunities, and other action-relevant factors are likely to vary as well, which in turn influences how they will act (Contractor et al., 2019). The two remaining arrows first connect the macro level to the micro level (Arrow #1) and then the micro level back to the macro level (Arrow #3), thereby allowing for a microfoundational explanation. Arrow #1 acknowledges that macro-level facts influence and shape the conditions of individual action through so-called "situational mechanisms" (Hedström & Swedberg, 1998). For instance, differences in the prevailing institutions across organizations can provide individuals with either incentives or disincentives for certain actions. Arrow #3, in turn, acknowledges that macro-level outcomes emerge from the aggregation of individual actions as a result of so-called "transformational mechanisms" (Hedström & Swedberg, 1998). Microfoundational research can, therefore, account for the influence of macro-level facts on macro-level outcomes, without having to rely on pure macro-level causality. Therefore, microfoundational explanations can replace pure macro-level explanations (Arrow #4 in Fig. 1), which are frequently considered "incomplete", "unsatisfying", or even "shallow" because they do not account for individual agency (Contractor et al., 2019, p. 8). Various research streams including traditionally macro-focused strategy or technology and innovation management have experienced increasing pressures for the reconciliation of micro- and macro-level research in recent years (Barney & Felin, 2013; Felin & Foss, 2006). Consequently, they have seen drastic increases in the adoption of micro-level constructs, contributing to a general microfoundations movement (Felin et al., 2015).

Although most microfoundations scholars in the management field equate individual human beings (e.g., managers, employees) with the micro level and firms with the macro level, it should be noted that the "microfoundations [approach] is fundamentally an analytical levels argument" (Foss & Pedersen, 2016, p. 3). The microfoundations paradigm is not limited to organizational explananda but can, in principle, be used to explain "anything that is supra-individual (e.g., all the way from dyadic relations between individuals to nations)" (Contractor et al., 2019, p. 6). By the same token, the micro level of the microfoundations paradigm need not be restricted to individuals but can embrace collective actors as long as the collective actors are situated at a lower level of analysis than the chosen macro-level entity or are nested within the macro-level entity (Chittoor et al., 2019; Foss & Pedersen, 2016). For instance, business units can be placed on the micro level to study the effect of their actions and interactions on their parent firm at the macro level. Alternatively, interdependent firms can be placed on the micro level to serve as the microfoundations of a business ecosystem at the macro level.[3]

It is therefore possible to generalize the above definition of microfoundations, which is tailored to the dominant usage in the management domain. In general terms, research on microfoundations can be defined as efforts to understand how micro-level factors impact macro-level entities, how the interaction of micro-level actors leads to emergent and collective outcomes, and how relations between macro-level variables are mediated by micro-level actions and interactions.

2.2. *Evolution and definition of strategic technology and innovation management*

The strategic management of technology and innovation – synonymously called strategic technology and innovation management (STIM) – can be understood as the intersection of two management domains:

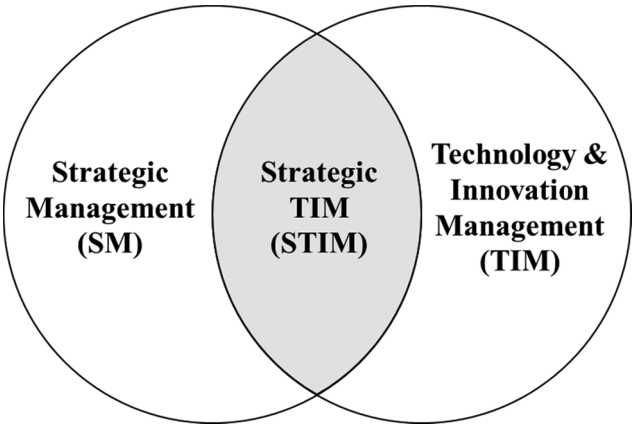

Fig. 2. The domain of strategic technology & innovation management (STIM) as intersection between the strategic management (SM) and technology & innovation management domains.

[3] The basic form of Coleman's boat can be extended by concatenating several "boats" horizontally and/or vertically. With horizontal concatenation of two boats, it is possible to explain the "social facts" of the boat on the right by treating them as the "social outcomes" of the boat on the left. With vertical concatenation (stacking) of two boats, it is possible to consider three levels – the macro level of the upper boat, the micro level of the lower boat, and a *meso* level that simultaneously corresponds to the macro level of the lower boat and the micro level of the upper boat. An example is provided by Bendig et al. (2018).

Strategic Management (SM) and Technology and Innovation Management (TIM) (cf. Fig. 2). Strategic management is essentially concerned with the creation and appropriation of value and the generation of competitive advantage (Durand et al., 2017; Foss & Lindenberg, 2013). Until the early 1990s, strategic management mainly looked at market-/industry-level factors to explain a firm's competitive position (e.g., Porter, 1980). The growing popularity of the resource-based view (Barney, 1991; Peteraf, 1993) subsequently turned the focus to firm-level factors, and the advent of the microfoundations movement then brought individual-level factors to the fore (Foss, 2011; Hoskisson et al., 1999). Thus, the individual level can be considered the endpoint of a continuous move of the strategic management field down the levels of analysis in order to leverage hitherto unobserved heterogeneity in explaining competitive advantage.

As strategic management scholars examined more and more potentially relevant antecedents of value creation, value appropriation, and competitive advantage, it became more and more difficult conceptually to develop a succinct and satisfactory formal definition of strategic management, and the published definitions of the field became "quite varied" (Nag et al., 2007, p. 937). To overcome the divergence of previous definitions and the fragmentation of our understanding, Nag et al. (2007) derived a definition inductively from a large-scale survey of management scholars. According to this consensus definition, "[t]he field of strategic management deals with the major intended and emergent initiatives taken by general managers on behalf of owners, involving utilization of resources, to enhance the performance of firms in their external environments" (Nag et al., 2007, p. 944).

Similarly, concise and ultimate definitions of technology management and innovation management do not exist (Dodgson, 2017; Orlikowski & Scott, 2008). Existing definitions of technology management converge in the notion that technology is a form of implicit or explicit knowledge or a set of skills that allow actors to accomplish something (e.g., transforming inputs into outputs of greater value) and that is typically embodied in material or immaterial objects (e.g., people, processes, tools, and methods) (Burgelman et al., 2008; Schilling & Shankar, 2019; White & Bruton, 2010). Technology management then includes efforts to "plan, develop, implement, monitor, and control technological capabilities" in order to accomplish the objectives of the organization (White & Bruton, 2010, p. 17). Existing definitions of innovation management converge in the notion that innovation management is about managing the complementary facets that constitute the innovation process – the creation of novel and useful ideas as well as their implementation and conversion into new or improved objects (Anderson et al., 2014; Badir et al., 2020). These objects can take various forms – for example, new products or services, new production process technologies, new administrative systems, or new business models (Keupp et al., 2012; Ritala et al., 2020).

In sum, we can define strategic technology and innovation management as follows. STIM consists of the seminal decisions and the major initiatives regarding the acquisition, development, and deployment of technology and innovation for competitive advantage or superior performance (cf. Burgelman et al., 2008; Wheelwright & Clark, 1992; White & Bruton, 2010; Zahra, 1996).

3. Methodology

To examine the state of our knowledge regarding microfoundations in the STIM domain, we conduct an integrative literature review. The integrative literature review is "a form of research that reviews, critiques, and synthesizes representative literature on a topic in an integrated way such that new frameworks and perspectives on the topic are generated" (Torraco, 2005, p. 356). An integrative review is a special kind of systematic literature review that permits the combination and synthesis of findings (Callahan, 2010; Torraco, 2016).

Our study will produce a "*meta*-ethnography" of the microfoundational literature on STIM by conducting a "lines of argument synthesis" (Tranfield et al., 2003). The lines of argument synthesis "can be used if different [… studies] examine different aspects of the same phenomenon" (Tranfield et al., 2003, p. 218). Our study will therefore highlight the diverse thematic foci and constructs within the microfoundational STIM literature and synthesize them into an integrated model (Torraco, 2016).

An integrative literature review begins with the systematic selection of relevant, comprehensive, and representative literature in the chosen field of research (Tranfield et al., 2003). The systematic selection of literature on the micro-foundations of STIM for this paper proceeded along the following steps, which are also summarized in Fig. 3. First, three research assistants perused various search engines (Google Scholar, EBSCOhost, Web of Science) to identify articles that simultaneously contain keywords for both "microfoundations" and "technology/innovation" in the following 30 peer reviewed journals: Academy of Management Annals, Academy of Management Journal, Academy of Management Perspectives, Academy of Management Review, Administrative Science Quarterly, British Journal of Management, Entrepreneurship Theory & Practice, Global Strategy Journal, International Journal of Management Reviews, Journal of Business Research, Journal of Business Venturing, Journal of International Business Studies, Journal of Management, Journal of Management Studies, Journal of Marketing, Journal of Marketing Research, Journal of Product Innovation Management, Journal of the Academy of Marketing Science, Long Range Planning, Management Science, Organization Science, Organization Studies, R&D Management, Research Policy, Small Business Economics, Strategic Entrepreneurship Journal, Strategic Management Journal, Strategic Organization, Strategy Science, and Technological Forecasting & Social Change. The employed keywords, which might occur in either the articles' titles or full texts, are "microfoundations", "multi-level", "cross-level", and "methodological individualism" on the one hand, and "innovation", "technology", "R&D", and "ambidexterity"[4] on the other. Spelling variations of these keywords were also considered (e.g., "multilevel" instead of "multi-level"). In line with the seminal article of Felin et al. (2015) that analyzes the emergence of the microfoundations movement since 2003, the literature search focused on articles published in 2003 or later. The search was last conducted on March 30, 2022 and, thus, contains articles included in the above databases up to this date. The research assistants scrutinized the search results independently of each other in order to exclude search results that are of limited relevance to a literature review on the "microfoundations of technology and innovation management". Combining their independent assessments, 293 articles were considered potentially relevant for our purposes by one or more of the assistants.

Second, each of the 293 articles that emerged from Step 1 was independently rated by two research assistants according to the extent to which it represents microfoundations work and according to the extent to which it represents a technology/innovation topic, based on the understanding of the terms outlined above. These extents were measured by 10-point scales, with 1 indicating a very low extent (not at all) and 10 indicating a very high extent (perfect representation). If an article was rated 7 or higher in both dimensions (microfoundations and innovation/technology) by both research assistants, it was used for the subsequent analysis. If it was rated 6 or lower in at least one dimension by both research assistants, it was not used in the subsequent analysis. If an article was rated 7 or higher by one rater and 6 or below by the other rater in at least one dimension, the article was additionally rated by one of the co-authors. The article was then considered relevant for the

[4] "Ambidexterity" refers to the ability to combine the exploration of novel opportunities (or "exploratory innovation") and the exploitation of existing capabilities (or "exploitative innovation") (Jansen et al., 2009). Since ambidexterity has been at the center of "[o]ne of the most lively organization theory debates in recent years" (Luger et al., 2018, p. 449), it is explicitly considered here.

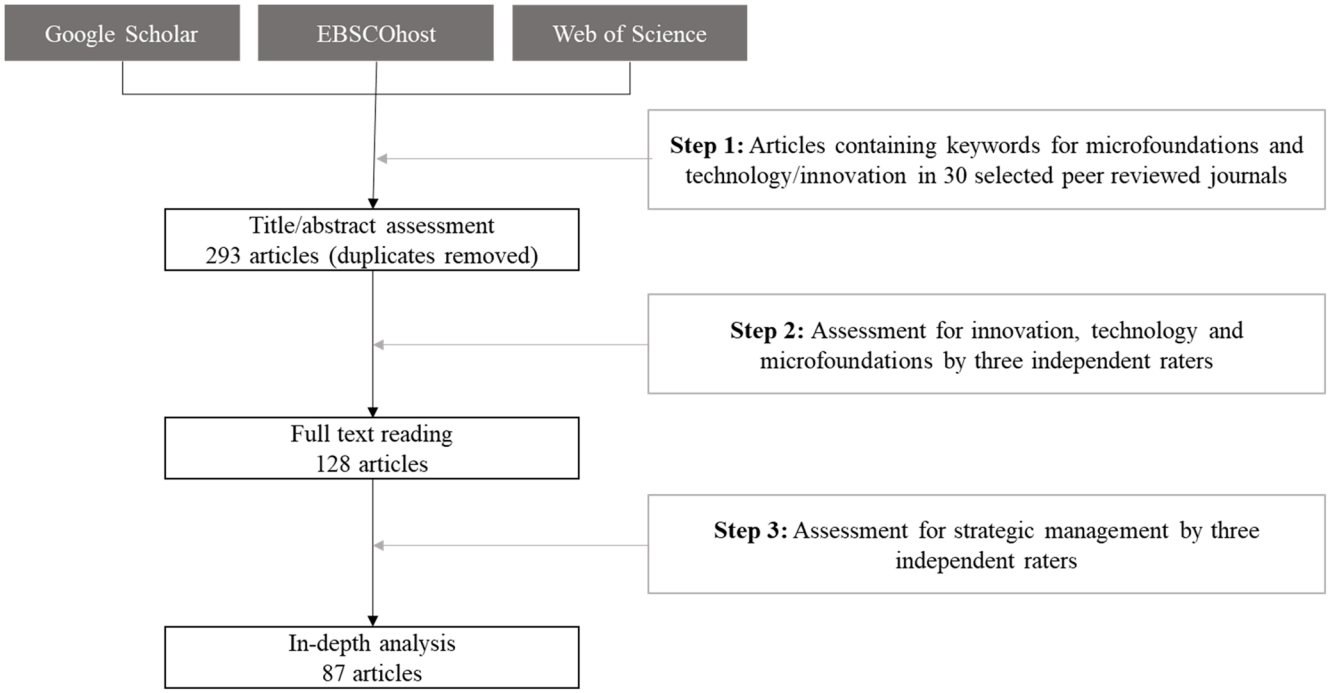

Fig. 3. Process of article selection.

subsequent analyses if it achieved an average rating of 6.5 or higher across the three raters in both dimensions, and irrelevant if its average rating was below 6.5 in at least one dimension. Based on this procedure, a total of 128 articles were considered relevant and retained for the subsequent analysis.

Third, each of the 128 articles resulting from Step 2 was independently rated by one research assistant and one of the co-authors according to the extent to which it can be considered a "strategic management" (SM) article based on the "consensus definition" of SM, which was inductively derived by Nag et al. (2007). Analogous to the procedure of Nag et al. (2007), a four-point scale was used for this purpose, with 1 meaning "clearly not an SM article" and 4 meaning "clearly an SM article". If an article was rated 3 or 4 by both raters, it was used in the subsequent analysis. If it was rated 1 or 2 by both raters, it was not used in the subsequent analysis. If an article was rated 3 or 4 by one rater and 1 or 2 by the other rater, the article was additionally rated by a second co-author. The article was then considered relevant for the subsequent analyses, if it achieved an average rating of 2.5 or higher across the three raters, and irrelevant if its average rating was below 2.5. In total, 87 articles were either unanimously considered SM by the two raters or achieved an average of at least 2.5 across the three coders. These 87 articles are considered as representing the state of the art on "microfoundations in strategic technology and innovation management research" and are analyzed subsequently.

It should be noted that literature reviews conducted in this way will probably not identify every piece of research that is relevant to their respective topic (e.g., Furrer et al., 2008; Hutzschenreuter & Israel, 2008; Keupp et al., 2012; Nielsen, 2010). Relevant studies may have been published in books, book chapters, or journals not included in the journal list, may not contain the specified keywords, or may have been published outside the selected time frame. These literature reviews are not intended to be exhaustive but are designed to draw a representative picture of the respective body of knowledge and the corresponding horizons for inquiry (Furrer et al., 2008; Keupp et al., 2012).[5] This established approach suggests that the identified 87 articles can provide useful information on the state of microfoundations research in the strategic technology and innovation management domain, even though the 87 articles most certainly do not account for all relevant research on this topic. Table 1 provides a list of the 87 articles considered in our literature review, while Table 2 presents a detailed account of where and when these articles were published.

4. Synthesis and paths for future research

Our synthesis and research agenda are structured according to Coleman's boat. We examined the theoretical and empirical models featured in the reviewed articles, extracted the constructs used by these models, situated them in Coleman's boat, and clustered them at multiple levels of granularity. This approach allowed us to identify which constructs and groups of constructs have been studied heavily and which constructs and groups of constructs remain under-researched. Fig. 4 provides an overview of the identified construct clusters. Tables 3 to 7 summarize the results of our review.

4.1. Social facts

Social facts are relevant aspects of the context in which individuals act and are taken as given for the focal explanation (Coleman, 1990). In

[5] Some literature reviews conducted in this way even actively sacrifice exhaustiveness in favor of stronger representativeness by excluding some identified articles (that were hence published in the focal set of journals during the analyzed time frame using the specified keywords) from their subsequent analyses. Specifically, they excluded identified articles that received relatively few citations and were thus not well incorporated into the community's body of knowledge (e.g., Keupp et al., 2012).

Table 1
List of the 87 articles featured in our integrative literature review.

#	Article	Method	Focal Micro & Macro Levels		
			Social Facts	Micro	Social Outcomes
1	Aggarwal et al. 2017 SMJ	Mathematical/ simulation	Org.	Individual	Org.
2	Ahn et al. 2017 RDM	Quantitative empirical		Executives	Org.
3	Albats et al. 2020 TFSC	Qualitative empirical		Individual	Meta Org.
4	Ardito et al. 2019 TFSC	Quantitative empirical	Meta Org.	Individual	Org.
5	Baer et al. 2013 SMJ	Theoretical/ conceptual	Team	Individual	Team
6	Banerjee et al. 2019 SO	Quantitative empirical		Individual	Org.
7	Baron and Tang 2011 JBV	Quantitative empirical		Individual	Org.
8	Bendig et al. 2018 LRP	Quantitative empirical	Org.	Executives	Org.
9	Bjørnskov and Foss 2016 AMP	Literature review			
10	Braun et al. 2018 BJM	Quantitative empirical	Meta Org.	Individual	Org.
11	Carmeli and Dothan 2017 TFSC	Quantitative empirical	Team	Individual	Org.
12	Choudhury and Haas 2018 SMJ	Quantitative empirical	Team	Executives	Org.
13	Christofi et al. 2019 TFSC	Literature review			
14	Coreynen et al. 2020 JBR	Quantitative empirical	Org.	Individual	Org.
15	Dabrowska et al. 2022 RDM	Theoretical/ conceptual			
16	Dai et al. 2016 JMS	Quantitative empirical		Team	Org.
17	Davis and Aggarwal 2019 SMJ	Mathematical/ simulation	Org.	Individual	Org.
18	De Silva et al. 2021 JBR	Qualitative empirical	Meta Org.	Executives	Org.
19	Devarakonda et al. 2022 StS	Quantitative empirical	Meta Org.	Individual	Meta Org.
20	Distel 2019 JM	Quantitative empirical	Org.	Individual	Org.
21	Dixon et al. 2014 LRP	Qualitative empirical		Team	Org.
22	Ebers and Maurer 2014 RP	Quantitative empirical		Team	Org.
23	Felin and Hesterly 2007 AMR	Theoretical/ conceptual			
24	Felin et al. 2017 SO	Editorial/ perspective			
25	Fichter 2009 RDM	Qualitative empirical		Team	Org.
26	Foss et al. 2011 OS	Quantitative empirical	Meta Org.	Individual	Org.
27	Furr et al. 2012 SEJ	Quantitative empirical		Executives	Org.
28	Gao et al. 2021 TFSC	Quantitative empirical		Executives	Org.
29	Garcia Martinez et al. 2019 BJM	Quantitative empirical	Meta Org.	Individual	Org.
30	Glaser et al. 2015 SBE	Quantitative empirical		TMT	Org.
31	Grigoriou and Rothaermel 2014 JM	Quantitative empirical	Team	Individual	Org.
32	Gupta et al. 2007 OS	Editorial/ perspective			
33	Harris and Wood 2020 LRP	Qualitative empirical	Org.	Executives	Org.
34	Helfat and Martin 2015 JM	Literature review			
35	Huang et al. 2021 JBR	Quantitative empirical	Meta Org.	Executives	Org.
36	Hughes et al. 2018 BJM	Quantitative empirical	Team	Individual	Team
37	Hughes et al. 2020 TFSC	Quantitative empirical	Meta Org.	TMT	Org.
38	Jansen et al. 2008 JMS	Quantitative empirical		TMT	Org.
39	Katou et al. 2021 JBR	Quantitative empirical	Meta Org.	Executives	Org.
40	Kazadi et al. 2016 JBR	Qualitative empirical	Meta Org.	Org.	Meta Org.
41	Kemper et al. 2013 JPIM	Quantitative empirical		TMT	Org.
42	Kiss et al. 2020 SMJ	Quantitative empirical		Executives	Org.
43	Lee and Csaszar, 2020 StS	Quantitative empirical	Meta Org.	Individual	Org.
44	Lee et al. 2019 JM	Quantitative empirical	Team	Individual	Team
45	Lehoux et al. 2021 JPIM	Qualitative empirical	Team	Individual	Team
46	Lenka et al. 2018 JBR.pdf	Qualitative empirical	Org.	Individual	Org.
47	Li et al. 2018 AMJ	Quantitative empirical		Team	Org.
48	Lichtenthaler 2011 AMP	Literature review			
49	Lisak et al. 2016 JIBS	Quantitative empirical	Team	Executives	Team
50	Litchfield and Gentry 2010 SO	Theoretical/ conceptual		Individual	Org.
51	Liu et al. 2011 RDM	Quantitative empirical	Team	Individual	Team
52	Liu et al. 2017 JBR	Quantitative empirical	Meta Org.	Team	Org.
53	Loon et al. 2020 JMS	Literature review			
54	Maak et al. 2016 JMS	Theoretical/ conceptual	Meta Org.	Executives	Org.
55	Magistretti et al. 2021 JPIM	Literature review			
56	Martin et al. 2019 SO	Theoretical/ conceptual	Meta Org.	Individual	Org.
57	Marvel et al. 2020 JBV	Quantitative empirical		Executives	Org.
58	Mazzucchelli et al. 2019 TFSC	Quantitative empirical		Individual	Org.
59	Mollick 2012 SMJ	Quantitative empirical		Individual	Org.
60	Mom et al. 2019 JM	Quantitative empirical	Org.	Executives	Org.
61	Nag and Gioia 2012 AMJ	Qualitative empirical		Executives	Org.
62	Nuruzzaman et al. 2019 GSJ	Quantitative empirical		TMT	Org.
63	O'Brien et al. 2019 GSJ	Quantitative empirical	Org.	Executives	Org.
64	Paruchuri and Eisenman 2012 JMS	Quantitative empirical		Individual	Org.
65	Pollok et al. 2019 JPIM	Mixed-method empirical	Team	Individual	Org.
66	Raffaelli et al. 2019 SMJ	Theoretical/ conceptual	Org.	TMT	Org.
67	Remneland Wikhamn 2019 RADM	Qualitative empirical		Team	Org.
68	Rothaermel and Hess 2007 OS	Quantitative empirical	Org.	Individual	Org.
69	Roundy and Lyons 2022 SO	Theoretical/ conceptual			
70			Org.	Individual	Org.

(continued on next page)

Table 1 (*continued*)

#	Article	Method	Focal Micro & Macro Levels		
			Social Facts	Micro	Social Outcomes
	Santoro et al. 2020 TFSC	Qualitative empirical			
71	Scuotto et al. 2020 TFSC	Quantitative empirical		Individual	Meta Org.
72	Scuotto et al. 2022 TFSC	Quantitative empirical	Org.	Executives	Org.
73	Sheehan et al. 2021 BJM	Quantitative empirical	Org.	Team	Org.
74	Siggelkow and Rivkin 2006 AMJ	Mathematical/ simulation		Individual	Org.
75	Simsek 2009 JMS	Literature review			
76	Srivastava et al. 2020 JBV	Quantitative empirical		Executives	Org.
77	Stadler et al. 2022 OS	Quantitative empirical	Org.	Individual	Org.
78	Strutzenberger and Ambos 2014 IJMR	Literature review			
79	Tarba et al. 2020 LRP	Editorial/ perspective			
80	Tuncdogan et al. 2017 LRP	Quantitative empirical		Executives	Org.
81	Un and Cuervo-Cazurra 2004 BJM	Quantitative empirical	Org.	Individual	Org.
82	Venugopol et al. 2020 JBR	Quantitative empirical	Org.	Team	Org.
83	Vuori and Huy 2016 ASQ	Qualitative empirical	Org.	Executives	Org.
84	Yao and Chang 2017 SMJ	Quantitative empirical		Individual	Org.
85	Zahra and Wright 2011 AMP	Editorial/ perspective			
86	Zimmermann et al. 2015 OS	Qualitative empirical	Org.	Team	Org.
87	Zimmermann et al. 2020 LRP	Quantitative empirical	Org.	Executives	Org.

Note to Table 1:
STIM = Strategic technology and innovation management; Org. = Organization; Meta Org. = meta-organization; TMT = Top Management Team.

organization research, this context consists of *meta*-organizational as well as organizational facts (cf. Barney & Felin, 2013).

Meta-organizational facts depict the competitive and institutional landscape in which an organization operates. While it has been observed that individual behavior within organizations may often be driven as much by supra-organizational influences as by the organizational context (Zahra & Wright, 2011), *meta*-organizational facts have so far received moderate attention in the reviewed literature. Some studies feature *meta*-organizational facts that characterize the competitive environment of an organization, such as the focal industry's R&D intensity (e.g., Devarakonda et al., 2022), or the complexity and unpredictability of the firm's opportunity space (e.g., Davis & Aggarwal, 2019; Katou et al., 2021). In contrast to the competitive environment, the socio-political context has scarcely been addressed (a notable exception is Maak et al. (2016) who examine the role of power distance in social innovation). This neglect is detrimental because differences in innovativeness across nations, which have long been acknowledged, highlight the impact of the socio-political context on innovation (e.g., Shane, 1992). For instance, the socio-political context affects how accepting individuals are of risk and how willing they are to deviate from tried-and-true solutions (Kreiser et al., 2010; Mueller et al., 2013). More generally, it seems likely that employees in different socio-political contexts approach innovation differently. Hence, understanding how the socio-political context affects the actions and interactions of

Table 2
Number of articles by journal source and year.

Year	AMJ	AMP	AMR	ASQ	BJM	GSJ	IJMR	JBR	JBV	JIBS	JOM	JMS	JPIM	LRP	OS	RDM	RP	SBE	SEJ	SMJ	SO	StS	TFSC	Total
2004					1																			1
2005																								0
2006	1																							1
2007			1												2									3
2008												1												1
2009												1				1								2
2010																					1			1
2011		2							1						1	1								5
2012	1											1							1	1				4
2013													1							1				2
2014							1				1			1			1							4
2015											1				1			1						3
2016		1		1				1		1		2								2	1			6
2017								1						1		1								6
2018	1				2			1						1						1			1	7
2019					1	2					3		1			1				2	2		3	15
2020								2	2			1		3						1			4	13
2021					1			3					2								1		1	7
2022					5	2	1	8	3	1	5	6	4	6	5	5	1	1	1	8	5	2	10	87
Total	3	3	1	1																				

Note to Table 2:
AMJ = Academy of Management Journal; AMP = Academy of Management Perspectives; AMR = Academy of Management Review; BJM = British Journal of Management; GSJ = Global Strategy Journal; IJMR = International Journal of Management Reviews; JBR = Journal of Business Research; JBV = Journal of Business Venturing; JIBS = Journal of International Business Studies; JOM = Journal of Management; JMS = Journal of Management Studies; JPIM = Journal of Product Innovation Management; LRP = Long Range Planning; OS = Organization Science; RDM = R&D Management; RP = Research Policy; SBE = Small Business Economics; SEJ = Strategic Entrepreneurship Journal; SMJ = Strategic Management Journal; SO = Strategic Organization; StS = Strategy Science; TFSC = Technological Forecasting & Social Change.

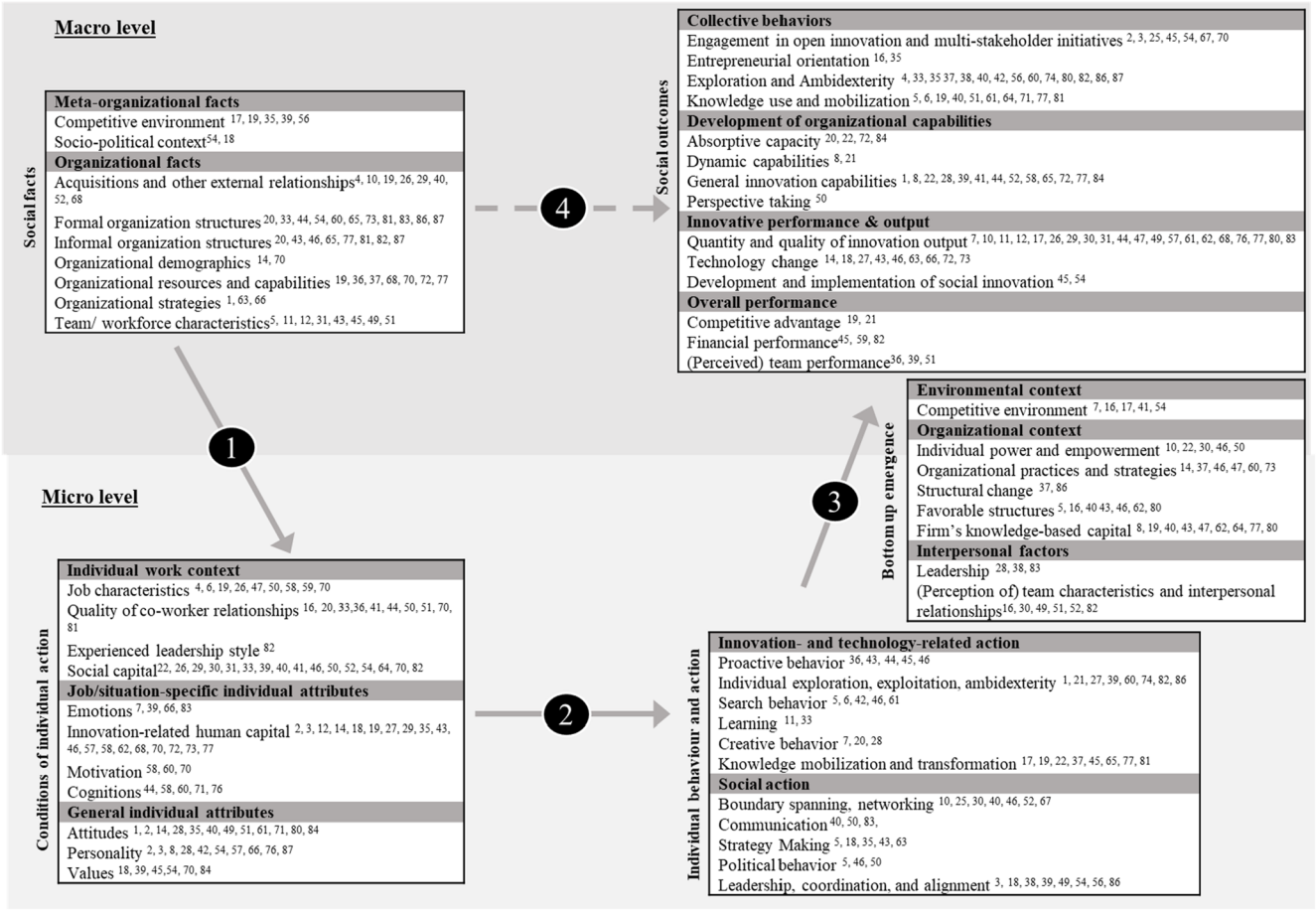

Fig. 4. Clustered overview of identified constructs. Note to Fig. 4: The numbers given in superscript after each construct refer to the Article IDs in Table 1.

employees with respect to innovation and technology is a promising avenue for further research.

Organizational facts comprise attributes of an organization and of its workforce. Several organizational factors have been covered extensively in the reviewed literature – for instance, firms' relationships with external partners (e.g., Bjørnskov & Foss, 2016; Ebers & Maurer, 2014; Garcia Martinez et al., 2019), their informal organization structures (e.g., Un & Cuervo-Cazurra, 2004; Venugopal et al., 2020; Zimmermann et al., 2020), and their formal organization structures (e.g., Mom et al., 2019; Pollok et al., 2019; Sheehan et al., 2021). An important element of formal structures is the centralization of decision making, often referred to by its converse, autonomy (Palmié et al., 2014). Even though autonomy has been quite frequently studied in the microfoundations literature, it offers an intriguing opportunity for future research. The findings regarding the effect of autonomy on innovation have been notoriously mixed (cf. Cardinal, 2001; Palmié et al., 2016). On the one hand, decentralization gives employees the freedom to solve any problems they encounter in innovative ways. On the other hand, the developed solutions may not be compatible with the requirements of other organizational members. Such lack of compatibility reduces the usefulness of these innovations. Based on Amabile (1998), Palmié et al. (2014) advance the distinction between strategic autonomy and operational autonomy. They argue that providing employees with significant leeway in how they can approach the problems they encounter (i.e., much operational autonomy), while limiting their ability to set their own agenda (i.e., little strategic autonomy) can produce innovative solutions that are quite useful for the entire organization. From a microfoundational perspective, it would be interesting to see how various combinations of operational and strategic autonomy affect employees' actions and interactions.

Other relevant organizational facts have been treated erratically in the reviewed literature and, therefore, represent a fruitful avenue for further research. This is the case for organizational resources as well as for organizational strategies. Resources matter because effectuation theory suggests that experimentation with the means at hand can often lead to the identification of innovative solutions and new applications (Palmié et al., 2019; Sarasvathy, 2001). It can therefore be expected that the resources that are available in a firm have an impact on how innovative its employees can be and what the innovative solutions will look like. Strategies matter because they commonly determine what an organization's members are expected and able to do (Finkelstein et al., 2009; Keupp et al., 2012). Since they are usually mandated, approved, and supported by an organization's top management, their relevance for employees is typically high, and their impact on employee actions and interactions is enormous. Nevertheless, strategies have rarely been discussed in the reviewed literature. Moreover, those rare exceptions have focused on innovation strategies. However, recent research indicates that diverse strategies should be studied simultaneously (Schweiger et al., 2019). The effect of a particular innovation strategy can substantially depend on the other strategies of an organization (Haefner et al., 2021; Minoja et al., 2010). Microfoundations research could contribute to this line of work by illuminating how employees react differently to one and the same innovation strategy when it is combined with various other strategies.

4.2. *Conditions of individual action*

Microfoundational research conceptualizes individual behavior and actions in organizations as the outcome of conditions that may be rooted in individuals' specific work context and in individual attributes (Felin

Table 3
Relationships analysed in the reviewed articles.

Subsequent nodes ("To…")	**Conditions of individual action**			**Individual behavior & action**		**Social outcomes**			
Initial node ("From…")	Individual work context	Job-/ situation-specific ind. attributes	General individual attributes	I&*T*-related action	Social action	Collective behaviors	Development of organizational capabilities	Innovative performance & output	Overall performance
Social facts									
Meta-organizational facts	19, 39, 54	18, 19, 35, 39	18, 35, 39, 54	17, 19, 39	18, 35, 39, 54, 56	19, 35, 54, 56	39	17, 18, 54	19, 39
Organizational facts	19, 20, 26, 29, 31, 33, 36, 40, 44, 46, 51, 52, 54, 70, 81, 82	4, 12, 14, 19, 43, 44, 46, 60, 66, 68, 70, 72, 73, 77, 83	1, 14, 40, 45, 49, 51, 54, 66, 70, 87	1, 5, 11, 19, 20, 33, 36, 37, 43, 44, 45, 46, 60, 65, 77, 81, 82	5, 10, 40, 43, 46, 49, 52, 54, 63, 83, 86	4, 5, 19, 33, 37, 40, 45, 51, 54, 60, 70, 77, 81, 82, 86, 87	1, 20, 44, 52, 65, 72, 77	11, 12, 14 10, 26, 29, 31, 43, 44, 45, 46, 49, 54, 63, 66, 68, 72, 73, 83	19, 36, 45, 51, 82
Conditions of individual action									
Ind. work context				6, 22	30, 50	6, 16, 64	22, 41, 50, 58	30, 47	59
Job-/situation-specific individual attributes				7, 27	3	2, 3, 71	58	7, 27, 57, 62, 76	
General individual attributes				28, 42, 61	3	2, 3, 42, 61, 71, 80	28, 84	57, 61, 76, 80	
Individual behavior & action									
Innovation- & technology-(I&T-) related action						74	21		21
Social action						25, 67, 38			

Notes to Table 3:
1. The reported numbers refer to the Article IDs in Table 1.
2. Articles are assigned to a row based on the node in Coleman's boat that they chose as a starting point for their investigation (cf. Fig. 1). For instance, if an article studies the effect of the individual work context (node B) on collective behaviors (node D) via I&*T*-related action (node C), it is listed in the row associated with node B, the column associated with node C, and the column associated with node D. It is not repeated in the row associated with node C, even though it could be argued that an article covering the path B-C-D inherently covers the path C-D as well.

& Foss, 2006; Molina-Azorín, 2014). With respect to individual attributes, it is possible to distinguish between job/situation-specific and general attributes.

Individual work context. Overall, aspects of the individual work context have received substantial attention. Prior studies often adopted a social or interpersonal view in this area. For instance, considerable effort was directed toward network positions (e.g., Kazadi et al., 2016; Kemper et al., 2023; Lenka et al. 2018) and trust (e.g., Hughes et al., 2018; Lee et al., 2019; Santoro et al. 2020). While the reviewed literature covered job characteristics to some extent, some prominent job characteristics are still missing. The job characteristics model (Hackman & Oldham, 1976) may be considered the most influential model of work design by far (cf. Parker et al., 2017). The work design dimensions it highlights have been found to be powerful predictors of a variety of attitudinal and behavioral outcomes (Humphrey et al., 2007). Scholars recently proposed to extend the job characteristics model with further outcomes that are relevant to organizational innovation, such as learning (Parker et al., 2017). The sparse attention that the reviewed literature has so far devoted to the work design dimensions of the job characteristics model therefore represents a crucial limitation. Future research examining such factors as skill variety, task significance, and task identity as conditions of individual action with respect to innovation could advance not only microfoundations research but also work design theory.

Job/situation-specific individual attributes have been studied extensively. Common examples include innovation-related skills (e.g., Marvel et al., 2020; Mazzucchelli et al., 2019), education (Ahn et al., 2017; Albats et al., 2020; Marvel et al., 2020), and relevant previous experience (e.g., Albats et al., 2020; Furr et al., 2012; Nuruzzaman et al., 2019). The second cluster focuses on organizational members' more general attributes that are not (only) directly related to their tasks and jobs or to a specific situation. Prime examples are personality characteristics such as the extent of an individual's extroversion (Albats et al., 2020) or personal values and orientations (Martin et al., 2019; Yao & Chang, 2017). However, two important job/situation-specific attributes remain under-represented to date: motivation and emotions. Motivation – especially, intrinsic motivation – is commonly considered a key ingredient for innovation-related individual action (Amabile, 1998; Anderson et al., 2014). Various types of actions are necessary for successful innovation – for instance, coming up with new ideas, finding organizational support for these ideas, and implementing them, (de Jong & den Hartog, 2010). The cognitive demands and processes differ considerably – at times, even directly conflict – across actions. Certainly, employees are unlikely to have similar levels of motivation for all these kinds of actions. Such intra-individual differences in motivation entail several opportunities for insightful microfoundations research. Research could investigate which organizational facts stimulate motivation for which kind of action or how organizations can stimulate the motivation of their employees regarding more than one kind of action. As motivation has received scant attention in microfoundations research thus far, it represents a promising path for a significant body of additional work.

Emotions affect the breadth of cognitive categories that individuals consider, the ease with which individuals can switch between alternative cognitive sets, and their situational ability to make unusual and

Table 4
Summary for social facts.

Synopsis: Microfoundational studies featuring social facts use micro-level behavior as a link between the focal social fact and the macro-level explanandum. Hence, they describe process models rather than investigate single-stage influences. The most-commonly studied types of social facts are organizational facts (firm- and team-level variables), whereas *meta*-organizational facts (especially, socio-political facts) have been under-researched.

Most-commonly studied explananda:

- For meta-organizational facts: Collective behaviors
- For organizational facts: Innovative performance and output

Indicative questions for future research:

- How does the socio-political context affect innovation performance by influencing individual behavior?
- How do combinations of operational and strategic autonomy affect employees' actions and interactions and, consequently, firms' innovation performance?
- How do available resources affect innovation performance by influencing employees' actions and interactions?
- How does combining a focal innovation strategy with other strategies affect innovation performance by altering how employees react to the innovation strategy?

Exemplar articles:

- Bendig, D., Strese, S., Flatten, T. C., da Costa, M. E. S., & Brettel, M. (2018). On micro-foundations of dynamic capabilities: A multi-level perspective based on CEO personality and knowledge-based capital. *Long Range Planning, 51*(6), 797–814.
- Coreynen, W., Vanderstraeten, J., van Witteloostuijn, A., Cannaerts, N., Loots, E., & Slabbinck, H. (2020). What drives product-service integration? An abductive study of decision-makers' motives and value strategies. *Journal of Business Research, 117*, 189–200.

Table 5
Summary for conditions of individual action.

Synopsis: Articles dealing with the conditions of individual actions focus on the specific situation of individual actors. The conditions may comprise attributes of a situation that these actors encounter, situation-specific attributes of these actors (e.g., their emotions), or general attributes of these actors that are independent of a single situation (e.g., their personality). Microfoundations research acknowledges that these conditions of individual action, which are said to affect individual behavior, and thereby social outcomes, may themselves by influenced by social facts. Several conditions of individual action are studied quite frequently in the reviewed literature. Notable exceptions are supervisor-related conditions, emotions, and motivation.

Most-commonly studied explananda:

- For individual work context: Collective behaviors, but relatively high shares of development of organizational capabilities and overall performance, respectively
- For job-/situation-specific individual attributes: Innovative performance and output
- For general individual attributes: Collective behaviors

Indicative questions for future research:

- How do job characteristics proposed by the job characteristics model affect firms' innovation performance by influencing the innovation-related behavior of employees?
- How can organizations enhance their innovation performance by enhancing the motivation of their employees for multiple innovation-related behaviors?
- How do employees' emotions affect the innovation performance of firms?
- How do employees' personal values affect the innovation performance of firms?

Exemplar articles:

- Distel, A. P. (2019). Unveiling the microfoundations of absorptive capacity: A study of Coleman's bathtub model. *Journal of Management, 45*(5), 2014–2044.
- Foss, N. J., Laursen, K., & Pedersen, T. (2011). Linking customer interaction and innovation: The mediating role of new organizational practices. *Organization Science, 22*(4), 980–999.

Table 6
Summary for individual behavior & action.

Synopsis: Individual behavior and action are at the core of the microfoundational paradigm with their focus on individual agency. In general, both innovation-/technology-related action and social action have been studied quite extensively (a notable exception being political behavior). However, it is somewhat surprising that the conditions of individual action have received even more attention in the reviewed literature than individual behavior and action as such. Notably, empirical research can be said to adopt a simplified version of Coleman's boat, frequently focusing on either one of the nodes on the micro level and sidestepping the other.

Most-commonly studied explananda:

- For innovation- and technology-related action: Collective behavior
- For social action: Innovative performance and output

Indicative questions for future research:

- How do individual actions related to idea implementation contribute to firms' innovation performance?
- What are functional political behaviors in the innovation and technology context and what are dysfunctional ones? How can functional political behaviors be stimulated and dysfunctional ones inhibited?

Exemplar articles:

- Hughes, M., Coen Rigtering, J. P., Covin, J. G., Bouncken, R. B., & Kraus, S. (2018). Innovative Behavior, trust, and perceived workplace performance. *British Journal of Management, 29*, 750–768.
- Katou, A. A., Budhwar, P. S., & Patel, C. (2021). A trilogy of organizational ambidexterity: Leader's social intelligence, employee work engagement and environmental changes. *Journal of Business Research, 128*, 688–700.

Table 7
Summary for social outcomes.

Synopsis: Microfoundations research, by definition, uses a macro-level outcome as its explanandum. Correspondingly, all articles in our sample feature at least one social outcome. Microfoundations research may either exclusively focus on micro-level factors affecting these macro-level outcomes or it may additionally include macro-level facts affecting these micro-level factors. Moreover, we observed that many articles focused on similar social outcomes leaving room for further studies.

Most-commonly studied social facts:

- For collective behaviors: Organizational facts
- For development of organizational capabilities: Organizational facts
- For innovative performance & output: Organizational facts, and the lowest share of meta-organizational facts
- For overall performance: Organizational facts, but the highest share of meta-organizational facts

Most-commonly studied conditions of individual action:

- For collective behaviors: General individual attributes
- For development of organizational capabilities: Individual work context
- For innovative performance & output: Job-/situation-specific individual attributes
- For overall performance: Individual work context

Most-commonly studied individual action & behavior:

- For collective behaviors: Innovation- and technology- (I&T-)related action
- For development of organizational capabilities: I&T-related action, and a relatively low share of social action
- For innovative performance & output: I&T-related action and social action equally pronounced
- For overall performance: I&T-related action, and the lowest share of social action

Exemplar articles:

- Marvel, M. R., Wolfe, M. T. & Kuratko, D. F. (2020). Escaping the knowledge corridor: How founder human capital and founder coachability impacts product innovation in new ventures. *Journal of Business Venturing, 35*(6), 1–16.
- Mazzucchelli, A., Chierici, R., Abbate, T. & Fontana, S. (2019). Exploring the microfoundations of innovation capabilities. Evidence from a cross-border R&D partnership. *Technological Forecasting & Social Change, 146*, 242–252.

remote connections (Baron & Tang, 2011). Moreover, emotions affect how employees interact with their colleagues (e.g., Sy et al., 2006). For such reasons, emotions play a significant role in the successful performance of innovative behavior (Baas et al., 2008; Baron & Tang, 2011). Since the reviewed literature paid scant attention to this topic, we encourage microfoundations scholars to conduct further research on emotions and innovation.

General individual attributes comprise individual characteristics

whose influence extends beyond a single situation or life domain (e.g., the job). Personality traits, such as cognitive flexibility, have been examined from time to time (e.g., Kiss et al., 2020; Raffaelli et al., 2019). In contrast, personal values – which are a central determinant of individual action (Gallego & Oberski, 2012) – have been rarely addressed (a partial exception is social-welfare orientation, which was studied by De Silva et al. (2021), Katou et al. (2021), and Maak et al. (2016)). Personal values determine what employees pay attention to and what they find acceptable or what they consider problematic. Hence, values influence where employees hope for stability, where they see a need for change, how they interpret situations, and how they interact with other people. It therefore seems likely that many values – not only innovation-specific values – may have an impact on how employees approach innovation (cf. Palmié et al., 2023). A stronger focus on values would resonate well with the microfoundations tradition, which embraces heterogeneity among actors and organizations (Felin et al., 2015). Consequently, we call for more research on personal values and their role in innovation.

4.3. Individual action

Microfoundational research subscribes to methodological individualism (Foss, 2011), which assigns the power to act to individuals, whereas collectives do not have the power to act on their own. Consequently, collectives "must be understood on the basis of individual behavior" (Weber as cited in Agassi, 1975, p. 145).[6] Thus, microfoundational research gives primacy to individual actions as key determinants of organizational and other macro-level outcomes (Felin et al., 2015; Molina-Azorín, 2014). Particularly important for the strategic management of technology and innovation are technology- and innovation-related actions and social actions.

Technology- and innovation-related actions. Innovation involves both the creation of new ideas as well as their implementation (Badir et al., 2020). These two aspects are associated with fundamentally different, if not opposing activities (Klonek et al., 2020; Rosing et al., 2011). While creativity – the generation of new ideas – involves variance-increasing experimentation and divergent thinking, the implementation of ideas involves the variance-decreasing establishment of routines and convergent thinking (Rosing et al., 2011). Even though the activities associated with both aspects are fundamentally different, they are still complementary, and both sets of activities are required for successful innovation. The articles in our sample studied creative behavior repeatedly (e.g., Baron and Tang, 2011; Distel, 2019). They have also devoted significant attention to ambidexterity (e.g., Katou et al, 2021; Mom et al., 2019), which denotes the capability "to deal with tensions between the different conflicting activities associated with exploration and exploitation" (Luger et al., 2018, p. 450). In contrast, the reviewed literature has paid little attention to actions primarily directed at idea implementation.[7] Given its pivotal role in innovation success, this neglect seems unfortunate. We therefore call for further research on these actions from a microfoundations perspective.

Social action. In contrast to the "lone inventor" trope, most innovations result from the interactions of multiple individuals (Friedman et al., 2008). Therefore, social actions are essential for successful innovation. The reviewed literature accounts for their relevance by studying some social actions extensively – notably, leadership behaviors (e.g., Da Silva et al., 2021; Mom et al., 2019) and coordination behaviors (e.g., Katou et al., 2021; O'Brien et al., 2019). However, the analyzed articles rarely acknowledge the importance of political behavior, understood as "activities [to] use power and other resources to obtain one's preferred outcomes in a situation in which there is uncertainty or disagreement about choice" (Pfeffer, 1981, p. 7; Roeth et al., 2019, p. 536). Whereas political behavior traditionally possessed a negative connotation, scholars lately started to emphasize its functional impact on innovation success (e.g., Bunduchi, 2017; Radaelli et al., 2017). Thus, political behavior allows individuals to increase the legitimacy of the innovation, decrease resistance to it, overcome barriers to collaboration, forge coalitions, and reduce misinterpretations, leading to a fast and agile innovation process (Roeth et al., 2019). It therefore seems desirable to develop a more nuanced understanding of political behavior in the technology and innovation process, its functional and dysfunctional forms, the organizational facts encouraging or discouraging certain forms of political behavior, and the implications for the focal organization. In other words, we call for more microfoundations research on political behavior.

Occasional neglect of individual agency. Following Max Weber's dictum that collectives "must be understood on the basis of individual behavior" (Agassi, 1975, p. 145), microfoundations scholars usually subscribe to the primacy of individual agency (Contractor et al., 2019). Nevertheless, we observed that a considerable portion of the empirical microfoundations literature adopts a simplified version of Coleman's boat, focusing on one of the nodes on the micro level and sidestepping the other. Such simplification explains why conditions of individual action and individual behavior itself need not be studied to the same extent. Indeed, the reviewed literature did not cover both micro-level nodes equally. Counterintuitively, however, it has paid greater attention to the conditions of individual action than to individual action itself (cf. Fig. 4). Thus, some articles link conditions of individual action directly to social outcomes, without considering individual action and behavior in between (cf. Table 3). Given the variety of different behaviors required for successful innovation (e.g., Badir et al., 2020; Rosing et al., 2011), this approach is unfortunate. By going directly from conditions of individual action to social outcomes, it remains unclear how the conditions of individual action affect the diverse behaviors. Not knowing the impact of a given condition of action on any of these required behaviors makes it hard to combine multiple conditions of action in the most fruitful way. Therefore, we call for more microfoundational innovation management research that simultaneously considers conditions of individual action and individual action itself.

4.4. Bottom-up emergence

Bottom-up emergence – which means the transformation of individual (micro-level) action into collective (macro-level) outcomes – lies at the core of the microfoundational paradigm (Felin et al., 2015; Tang & Marinova, 2020). Several of the reviewed articles included constructs that intervene in the relationship between some kind of individual action and collective outcome without being either a kind of individual action or a collective outcome itself. These constructs – typically moderators or mediators – are presented in this section. They may stem from the realm of the environmental context, the organizational context, or they may be interpersonal factors.

Environmental context. Articles in our sample dealing with bottom-up emergence commonly studied factors pertaining to the competitive environment – such as environmental dynamism or technological turbulence (e.g., Dai et al., 2016; Davis and Aggarwal, 2019) –, but neglected socio-cultural factors. Socio-cultural factors, such as power distance or collectivism, are likely to influence how employees interact with their colleagues and supervisors (Hofstede et al., 2005). These socio-cultural factors may, therefore, affect how innovative efforts of

[6] Nevertheless, Max Weber and other methodological individualists – especially those representing "structural individualism" or "institutional individualism" (Agassi, 1975; Udehn, 2002) – acknowledge that collective-level influences affect how individuals act and interact. This influence is captured by Arrow #1 in Coleman's boat.

[7] Idea development can be understood as a form of exploration and idea implementation as a form of exploitation (e.g., Rosing et al., 2011). However, ambidexterity research tends to adopt a broader perspective on the exploration–exploitation duality that comprises adaptation vs alignment, incremental vs radical innovation, product development vs product commercialization, and local vs distant search (Luger et al., 2018).

employees are received and transformed into innovative outcomes at the organizational level. Their impact should be studied in greater detail.

Organizational context. Some firms have repeatedly proven very receptive to innovative initiatives of their employees, repeatedly turning the emergent solutions into successful businesses, whereas other firms regularly stifle employee-led innovation initiatives (Paul & Fenlason, 2014). The reviewed articles usually attribute successful bottom-up emergence to the individual power of the employees involved (e.g., their hierarchical position; Braun et al., 2018; Glaser et al., 2015) or to an adequate knowledge base in the organization (e.g., Nuruzzaman et al., 2019; Paruchuri & Eisenman, 2012). However, the aforementioned inter-organizational heterogeneity suggests that firms can develop structured processes to facilitate the transformation of individual innovative efforts into successful firm-level innovation. However, very few studies have analyzed such processes to date, implying that much remains to be learned about the defining characteristics of these processes.

Interpersonal factors. When the reviewed literature analyzed the role of interpersonal factors in bottom-up emergence, it mostly looked at team characteristics, such as trust within a team or team diversity (e.g., Lisak et al., 2016; Liu et al., 2017). In contrast, it rarely addressed explicit activities of organizational leaders and other organizational members that could support the transformation of individual innovation-related efforts into organizational outcomes. Van de Ven and colleagues observed that innovative initiatives are more likely to be successful if managers act as mentors, sponsors, critics, or mediators vis-à-vis the innovative employees and their initiatives, respectively (e.g., van de Ven et al., 1999). We believe that there is ample room for additional research on how such activities affect the bottom-up emergence of innovation efforts.

4.5. Social outcomes

Microfoundational approaches aim to explain a macro-level (social) outcome. While the north-eastern node (node D) in Fig. 1 depicts the explanandum, the remaining nodes and arrows form the explanans (Contractor et al., 2019). The phenomenon to be explained may be a collective behavior, the development of organizational capabilities, innovative performance and output, or overall performance. While our text has so far mostly focused on organizations at the macro level, the microfoundational paradigm can in principle accommodate other collective entities (e.g., teams, ecosystems, industries, nations) (Contractor et al., 2019). However, Table 1 illustrates that the overwhelming majority of the reviewed articles utilize the microfoundations paradigm to explain social outcomes at the organizational level.

Collective behaviors have been studied frequently. Prime examples are collaborative undertakings with external partners (e.g., Ahn et al., 2017; Fichter, 2009), engaging in organizational ambidexterity (e.g., Harris & Wood, 2020; Huang et al., 2021), and knowledge mobilization (e.g., knowledge transfer; Davis & Aggarwal, 2019; Devarakonda et al., 2022; Kazadi et al., 2016). Notably absent from this list are non-market behaviors. Many technological innovations require fundamental changes in their institutional environment to unfold their full potential (Schweitzer et al., 2021). Hence, innovative firms increasingly need to deal with their institutional environment by adapting to some institutional structures, adding to existing institutional structures, or transforming them (Dorobantu et al., 2017; Schweitzer et al., 2021). A firm's "concerted pattern of actions to improve its performance by managing the institutional or societal context of economic competition" is called the firm's non-market strategy (Mellahi et al., 2016, p. 144). Even though the relevance of non-market strategies for firms' innovation performance is continuously growing, the reviewed literature has not yet studied the microfoundations of the underlying collective behaviors – the concerted patterns of action. This seems to be a very promising avenue for further research.

Development of organizational capabilities. The reviewed literature has paid substantial attention to the microfoundations of rather general innovation capabilities (e.g., Aggarwal et al., 2017; Bendig et al., 2018; Grigoriou & Rothaermel, 2014). However, the innovation process consists of very diverse, even opposing aspects, with some requiring variance-increasing approaches and divergent thinking and others variance-decreasing approaches and convergent thinking (e.g., Klonek et al., 2022; Rosing et al., 2011). Given its multi-faceted nature, the innovation process is likely to involve very different capabilities. The microfoundations of these capabilities, in turn, may differ from each other. However, only a single article in our sample has so far used a very specific innovation-related capability (namely, perspective taking) as its explanandum (Litchfield & Gentry, 2010). We therefore encourage scholars to study the emergence of further specific capabilities.

Innovative performance and output are the cornerstones of the strategic management of technology and innovation (Keupp et al., 2012). Many of the reviewed articles explored the microfoundations of such outcomes as the number of new products (e.g., Srivastava et al., 2020) or the revenues made with new products (e.g., Mollick, 2012). Nevertheless, the investigation of innovative performance and output in a microfoundations perspective exhibits three shortcomings. These shortcomings concern social and environmental innovation, administrative innovation, and business model innovation.

Reflecting a growing awareness of environmental and social challenges among its stakeholders, numerous profit-seeking and non-profit organizations wish to develop and scale innovations that do not maximize economic profits, but that create social and/or environmental benefits (Lehoux et al., 2021; Maak et al., 2016). However, this trend is not reflected in the reviewed literature. Only very few articles explicitly addressed social or environmental innovations. Consequently, we do not yet know if the microfoundations of these innovations differ from the microfoundations of "conventional" innovations.

Another type of innovation that is neglected in the analyzed articles is administrative innovation. This neglect is neither new nor germane to the microfoundations literature. Ten years ago, a systematic literature review on the strategic management of innovation in general (as opposed to its microfoundations in particular) bemoaned that most studies dealt with product and process innovations, whereas hardly any were concerned with administrative innovation (Keupp et al., 2012). At the same time, the antecedents of administrative innovations are commonly expected to differ fundamentally from the antecedents of product and process innovations, resulting in decades-old calls for a better understanding of administrative innovations (see Keupp et al. (2012) for an overview). Since none of the articles in our sample has explicitly concerned itself with administrative innovations, we can only echo these calls for the case of microfoundations.

Finally, business models have become a widely accepted source of competitive advantage (Foss & Saebi, 2017; Zott et al., 2011). However, business model innovation (BMI) – a "new subject of innovation, which complements the traditional subjects of process, product, and organizational innovation" (Zott et al., 2011, p. 1032) – is still rather poorly understood (Foss & Saebi, 2017). Our study confirms that business model innovation is under-represented in the microfoundations literature. According to Foss and Saebi's (2017) review of the BMI literature, one of the unresolved questions in this domain pertains to the question whether business model innovation originates in the lower levels of the organization (p. 201). Microfoundations research is in a good position to answer this question by illuminating not only whether business model innovation emerges from the actions and interactions of organizational members but also how it emerges (if at all).

Overall performance. Some articles in our sample did not use innovation performance as their organizational outcome of interest, but an overall indicator of firm performance (e.g., Lehoux et al., 2021; Mollick, 2012; VenugopAl et al., 2020). Unfortunately, the analyzed articles again replicate a shortcoming of the broader strategic management literature by focusing on indicators of economic performance, which may not be "desirable and/or inevitable" (Nag et al., 2007, p. 951;

also see Keupp et al. (2012) for a similar argument regarding the literature on the strategic management of innovation). More and more stakeholders care about not only a firm's economic performance but also its social impact and its environmental impact – that is, the firm's "triple bottom line" (Bansal, 2005; Elkington, 2018). Dodgson (2021, p. 16) even argues that environmental and social issues will provide "the greatest challenges" to the future of strategic technology and innovation management. It is therefore highly problematic that the reviewed literature has paid very little attention to firms' environmental and social impact (a notable exception is Maak et al. (2016)). Micro-level actions and interactions usually do not yield macro-level effects in either the economic dimension, the social dimension, or the environmental dimension, but the microlevel antecedents typically have economic, social, and environmental implications at the same time. The outcomes across the three dimensions are often moderately correlated at best (Margolis et al., 2007; Ones & Dilchert, 2013; Orlitzky et al., 2003). Hence, actions and interactions, which are beneficial for one or two dimensions, may have adverse effects in the other dimension(s). We therefore call for much more microfoundational research on the social and environmental implications of innovative efforts and technology adoption in firms.

Other collective entities than organizations. Sixty-two of the seventy-two theoretical or empirical articles in our sample focus on *organizational* outcomes at the macro level (Table 1). In contrast, only six articles consider infra-organizational entities (e.g., teams) and only four articles consider *meta*-organizational entities (e.g., alliances) as the focal collective at the macro level. The reviewed articles resemble the broader strategic management literature in this regard (cf. Foss, 2011). However, the microfoundations paradigm "is fundamentally an analytical levels argument" (Foss & Pedersen, 2016, p. 3) and is not inherently limited to individual human beings on the micro level and organizations on the macro level (cf. the section where we define microfoundations). From a conceptual standpoint, the microfoundations movement has enormous potential to study the characteristics, decisions, and actions of organizations and other collective actors as microfoundations of supra-organizational phenomena. We encourage scholars to examine the microfoundations of ecosystems and other *meta*-organizations.

5. Conclusion

The recent growth in microfoundational research demonstrates the enormous potential of the microfoundations paradigm to advance our understanding of important phenomena. Current calls for further microfoundational work indicate that the microfoundations movement will likely continue to grow in the future (Elsahn et al., 2020; Loon et al., 2020; Raffaelli et al., 2019). At the same time, its rapid growth has led to a fragmentation that – if it were to remain unaddressed – could impede the identification of the most promising opportunities for additional research. A synthesis of existing microfoundational research can address this problem and provide a solid foundation for subsequent efforts (Barney & Felin, 2013; Felin et al., 2015). Our integrative literature review delivered this synthesis for microfoundational research in the STIM domain. We analyzed 87 articles published in 23 peer-reviewed journals over the period from 2003 to 2022. Together, these articles can be considered representative of present microfoundational research in the STIM domain. Our analysis found that some relevant topics have already gained considerable attention, whereas others have been under-researched so far. From these observations, we charted promising opportunities for future research, which may contribute substantially to the development of the field. Specifically, we identified knowledge gaps that future microfoundational research should resolve with regard to the following topics: (1) The influence of the socio-political context on innovation; (2) the influence of organizational resources on innovative behavior and innovation performance; (3) the interplay between strategic and operational autonomy and its effect on innovative behavior and innovation performance; (4) the combined effect of multiple organizational strategies on innovative behavior and innovation performance; (5) the influence of job characteristics from the job characteristics model on innovative behavior and innovation performance; (6) ways to stimulate motivation for various innovation-related behaviors and their effect on innovation performance; (7) the effect of employees' emotions on innovative behavior and innovation performance; (8) the effect of employees' values on innovative behavior and innovation performance; (9) idea implementation behavior and its effect on innovation performance; (10) political behavior and its effect on innovation performance; (11) the association between conditions of individual action and various individual behaviors required for successful innovation; (12) the influence of the socio-cultural context on the bottom-up emergence of innovation-related behavior; (13) structured processes to facilitate the bottom-up emergence of innovation-related behavior; (14) the effect of interpersonal support on the bottom-up emergence of innovation-related behavior; (15) collective non-market behaviors to facilitate institutional change in favor of new technologies; (16) specific innovation capabilities; (17) social and environmental innovation; (18) administrative innovation; (19) business model innovation; (20) the effect of innovation-related behavior on triple-bottom-line performance; (21) innovation-related phenomena of macro-level entities other than organizations. For each of these topics, we provide arguments as to why it is relevant to close the particular knowledge gap. These arguments may facilitate the emergence of research efforts that can make a substantial contribution to the development of the field. Furthermore, we refer to pioneering work that has already addressed a topic in need of further investigation in order to help scholars identify relevant work for their specific research question.

Microfoundations open new avenues for managers to intervene and influence macro-level phenomena (Abell et al., 2008; Coleman, 1990; Foss, 2011). Some macro-level phenomena (e.g., capabilities) cannot be directly influenced by executives, but executives can indirectly influence them through measures directed at the micro level – for example, hiring new employees, training, or changing the reward system (Coff & Kryscynski, 2011; Foss & Pedersen, 2016). Moreover, even if executives can intervene at the macro level (e.g., deciding on changes in the formal organizational architecture; cf. Gulati et al., 2009), the implementation of this intervention typically involves the micro level, which is decisive for the macro-level effect (Coleman, 1990). Hence, a sound understanding of microfoundations can help executives fulfill their mandate to gain and sustain a competitive advantage (Abell et al., 2008; Foss, 2011). By synthesizing existing microfoundational work and proposing a research agenda for future microfoundations research, our integrative literature review not only contributes to the academic literature but also has practical relevance.

Overall, our literature review indicates that despite the enormous growth of the microfoundations movement in the last decade, scholars have only begun to leverage the potential of the microfoundations approach for the strategic management of technology and innovation. A microfoundations lens allows the field to respond to some of the most pressing challenges it faces.

CRediT authorship contribution statement

Maximilian Palmié: Writing – original draft, Supervision, Project administration, Investigation, Conceptualization. **Stephanie Rüegger:** Writing – original draft, Resources, Data curation, Conceptualization. **Vinit Parida:** Writing – original draft, Supervision, Conceptualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The authors are unable or have chosen not to specify which data has been used.

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