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ORIGINAL RESEARCH ARTICLE

Tidying Up the Concept of Grand Challenges: A Bibliometric Analysis

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Abstract

Management scholars increasingly seek to make a contribution to addressing the big issues faced by society (climate change, poverty, migratory crises, etc.), often using the term grand challenges to refer to these. However, after an initial phase of enthusiasm, the lack of coherence and distinctiveness of a relatively new management research concept – typical of an 'umbrella concept' – has been criticized. This article addresses the research question of how grand challenges can pass the tests of validity and rationalization in order to improve the robustness of the concept. To this end, we map out the literature on grand challenges using a mixed methodology of bibliometric analysis, combining co-citation and bibliographic coupling. By identifying the intellectual foundations and research streams, our paper analyzes the different uses of grand challenges in the literature as well as the resulting inconsistencies – thereby tidying up the concept. The current weaknesses of the grand challenges concept call for a clarification of its attributes. We pinpoint the importance of this redefinition and how it can be achieved, and discuss the possibilities for theoretical development of the field.

Keywords: *Bibliometrics; Concept; Grand challenges; SDG*

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The last decade has been marked by a growing collective awareness of the immense challenges facing humanity, such as climate change or the collapse of biodiversity. The declaration of the Sustainable Development Goals (SDGs) by the United Nations in 2015 made a significant contribution to this awareness, specifically identifying the 17 challenges to be addressed by 2030 (United Nations, 2015). One of the novelties of the SDGs is the expected contribution of the private sector, and thus of businesses, to solving these societal problems. Indeed, the joint setting of these goals seems to have accelerated companies' thinking and actions to contribute to them (George et al., 2016; Montiel et al., 2021; Muff et al., 2017). The SDGs are characterized by a powerful social and environmental dimension: eradication of poverty and hunger, access to high quality basic services (healthcare, water, sustainable, and affordable energy), preservation of the oceans, reduction of inequalities (including between genders), climate action, respect for biodiversity. We are also witnessing a growing awareness within management research, which is taking a greater interest in these major issues, partly by adopting a critical stance on the way companies approach them (Banerjee, 2018) or even through 'intellectual activism' (Contu, 2020, p. 737).

Since 2015, the term grand challenges, which refers to 'large, unresolved problems' (Colquitt & George, 2011, p. 432) that have a global impact on human societies (George et al., 2016) and require the involvement of a variety of often heterogeneous actors (Ferraro et al., 2015), has been increasingly employed. The management research community is also increasingly encouraged to embrace the concept (George et al., 2016; Howard-Grenville & Spengler, 2022; Phan, 2019), and the number of publications is going up rapidly, resulting in a growing body of literature.

However, a number of papers have pointed to the conceptual and theoretical problems posed by the growing use of the term grand challenges, some even going so far as to suggest the withdrawal of grand challenges as a concept due to numerous inconsistencies (Seelos et al., 2022). Other contributions have invited the academic community to engage in some form of conceptual and theoretical rationalization of the field (Carton et al., 2023; Dorado et al., 2022). Such debates are characteristic of umbrella concepts that bring together a large number of heterogeneous phenomena

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(Hirsch & Levine, 1999). After the initial enthusiasm for these concepts, their validity has been questioned by a section of the academic community that criticized the excessive diversity of the phenomena they encompassed. In order to establish these concepts in the long term, phases of 'tidying up' and rationalization are necessary (Hirsch & Levine, 1999). The umbrella concept of grand challenges is no exception to these tests of validity and rationalization, and therefore requires a better understanding of its use. The question we pose is: How can grand challenges pass the tests of conceptual validity and rationalization?

To bring new perspectives to this debate, we draw on bibliometric analyses of the academic literature on grand challenges. Bibliometrics is a useful complement to more traditional literature reviews: its quantitative methodology, which exhaustively analyzes the cited references, allows for a certain degree of objectivity (Zupic & Čater, 2015) and the relevant identification of different 'schools'. According to Walsh and Renaud (2017) and Maucuer and Renaud (2019), we employ a mixed methodology combining co-citation and bibliographic coupling. Co-citation analysis allows us to answer the first research sub-question: What are the intellectual foundations of the literature on grand challenges? We then use bibliographic coupling to answer the second research sub-question: how is the concept of grand challenges addressed in different research conversations?

Following a literature review and presentation of the methodology, we break down our findings into four groups of intellectual foundations and seven research conversations. Our analysis of the intellectual roots of the concept highlights the strong influence of neo-institutional theory and the absence of novel theoretical frameworks. To further rationalize the concept of grand challenges, we characterize the dominant attributes of each research conversation and propose a clarification of the concept.

Literature review

The increasing use of the grand challenges concept

The historical origins of the notion of grand challenges can be traced back to the interactions between the scientific community and society in the 20th century (Kaldewey, 2018). At that time, the philosophy of science emphasized the difference between the problems addressed by science and those encountered by society on a daily basis, with science very often powerless in the face of the latter (Kuhn & Hacking, 2012). The emergence of grand challenges as a concept reveals a deep and lasting change in the role that science should play in solving the problems of society. For Kaldewey (2018), the increasing use of the term 'challenges' at the expense of 'problems' within the academic community testifies to the idea that science can provide answers to societal problems. In the late 1980s, the concept of grand challenges first emerged in computer science against the backdrop of the technological rivalry between the United States and Japan (Hicks, 2016). The concept gradually spread to other disciplines, first to the 'hard' sciences, such as biology, physics, and environmental studies, and then to the social sciences. Until 2015, the few studies evoking grand challenges were almost exclusively concerned with science policy issues aimed at facilitating the development of technological innovations (Cagnin et al., 2012; Edquist & Zabala-Iturriagagoitia, 2012; Geels, 2014; Peine et al., 2015). Grand challenges are in turn seen above all as scientific 'locks', as obstacles that can potentially be overcome.

However, the most influential management publications adopt a very different definition of grand challenges as the most important challenges facing humanity, which are so complex and far-reaching that they will probably never be fully overcome. This shift in definition coincides with the launch of the SDGs. And from this point on, the use of the term grand challenges increases dramatically in publications referenced on Web of Science (WoS), from very few annual publications to 14 in 2019 and 49 in 2022.

Grand challenges in management research: A controversial concept

In 2016, the *Academy of Management Journal* dedicated a special issue to grand challenges, and the editorial by George et al. (2016) marked the beginning of a widespread use of the term, while at the same time sowing confusion between it and the SDGs. Indeed, in this exponentially growing field, management researchers are confronted with an abundance of terminology: grand challenges, SDGs, and wicked problems. This confusion has led some to point out the weaknesses of grand challenges as a concept (Seelos et al., 2022) and to call on the community to make an effort to clarify the concept aimed at preventing the risk of 'babelizing' the field (Carton et al., 2023; Dorado et al., 2022). While the use of grand challenges is encouraged by a particularly active part of the community (Gümüsay et al., 2022), it has also been noted that its widespread dissemination has led to a significant number of opportunistic uses as part of a 'strategy' of self-promotion by the authors (Howard-Grenville & Spengler, 2022).

Based on a review of the literature using the term grand challenges, Howard-Grenville and Spengler (2022) argue that it is useful as a concept for management research. Conversely, Seelos et al. (2022) point to the many inconsistencies in the wide variety of uses of the term grand challenges and suggest that the concept be withdrawn in favor of 'research principles'. They show the wide gap between the academic community's references to grand challenges and the empirical work on the

concept. For example, climate change is referred to as a Grand Challenge in some 50 publications but has been studied in only two (Seelos et al., 2022). By encompassing too wide a variety of heterogeneous phenomena, grand challenges lose conceptual clarity and thus prevents theoretical development and practical utility of the work that uses it (Suddaby, 2014). Given the fragmentation of the field, other contributions call for it to be 'tidied up', which would involve mapping grand challenges to each other that share strong ontological affinities (Carton et al., 2023; Dorado et al., 2022), as well as identifying how the theoretical frameworks favored for certain grand challenges can be applied to others (Carton et al., 2023).

These debates reveal the current status of grand challenges as an umbrella concept (Hirsch & Levin, 1999), 'a broad concept or idea used loosely to encompass and account for a set of diverse phenomena' (Acquier, 2016, p. 2). Because of the diversity of phenomena covered by umbrella concepts, they are subject to criticism from a 'validity police' (Hirsch & Levin, 1999, p. 199) that questions the relevance and the coherence of the elements that make up the umbrella concept. Umbrella concepts can go through several life cycles (Alvesson & Blom, 2022): once their validity has been questioned, the community embarks on a conceptual reorganization, which most often results in the production of typologies. This stage of the lifecycle, which we call rationalization and structuring, is crucial. It is from here that the community will orient its conceptual choices, which can range from the complete abandon of the umbrella concept to some form of institutionalization via the status quo. We associate recent debates on grand challenges with this critical stage of the 'validity challenge' (Hirsch & Levin, 1999, p. 201) and rationalization (Suddaby, 2014). This article aims to contribute to this transition.

Methodology: A mixed-method bibliometric analysis

Literature reviews using science mapping have become increasingly popular in recent years, as they provide additional insights to more traditional literature reviews (Walsh & Renaud, 2017). These methods, which rely in particular on bibliometric analysis and a quantitative approach, allow for the creation of 'macro' images of a research field and its sub-fields. Bibliometric methodologies can provide valuable guidance to researchers in their exploration of the literature (Caputo et al., 2018) and introduce more objectivity (Zupic & Čater, 2015).

We conducted a mixed bibliometric analysis, according to the method proposed by Walsh and Renaud (2017), combining co-citation and bibliographic coupling analyses. Both involve establishing links between different scientific publications based on the referencing practices of the authors of the same publications (Vogel & Güttel, 2013). Co-citation can be defined as the frequency with which two 'units' are cited together within the same publication (Small, 1973), where a unit is an article, an author, or a journal. It reveals the 'invisible schools' (Noma, 1984) and thus allows us to understand the intellectual foundations of a field. Bibliographic coupling, which is older than co-citation (Kessler, 1963), aims to establish a greater or lesser proximity between two publications by measuring the degree of similarity of their bibliographies (Zupic & Čater, 2015). Bibliographic coupling is based on the premise that the more common bibliographic references two publications have, the more they address the same topics, perspectives, or approaches. The methodology thus characterizes the 'research front' by distinguishing different 'conversations', that is, the thematic trends of the moment (Jarneving, 2005) or the main research dynamics within the field (Zupic & Čater, 2015). Mixed methodologies combining co-citation and bibliographic coupling are increasingly successful (Maucuer et al., 2022) and are justified by the high degree of complementarity between the two methods (Walsh & Renaud, 2017). Analyses were performed using VOSviewer network analysis software, which provides clustered mappings of publications: the more similar the bibliographies of two publications, the greater their visual proximity; the more influential a publication, the larger its sphere.

Sampling of publications

The sample of academic publications was drawn from the WoS platform. It is the oldest and most comprehensive database in the social sciences (Birkle et al., 2020; Li et al., 2018), with a performance that is superior to Scopus (Zhu & Liu, 2020), especially in terms of the quality of bibliographic data. Of the 15,734 references listed in the various bibliographies in the sample, only 63 could not be identified (i.e., 0.004% of all references cited by the publications).

The bibliographic data were collected in three stages (see Figure 1). First, the 'raw' sample was collected: the WoS query used the term 'Grand Challenge*' in the title, keywords, or abstract. The sample was restricted to journals listed in the ABS 2021 and FNEGE 2022 rankings, and to journal articles and editorials only (conference papers, book chapters, and other publications were excluded). In addition to its position in the management sciences and the academic quality of the journals listed, the choice of the FNEGE ranking is justified by its openness to a diversity of approaches and related disciplines, while excluding others that are too far removed. This request resulted in a sample of 263 publications in November 2022.

The second stage was to eliminate publications whose use of the term grand challenges was too far removed from its meaning in management research, such as a publication in the *Journal of Cleaner Production* that presented the results of physicochemical experiments aimed at addressing the grand challenge of chemical recycling (Li et al., 2022). This selection process resulted in 33 publications being removed from the

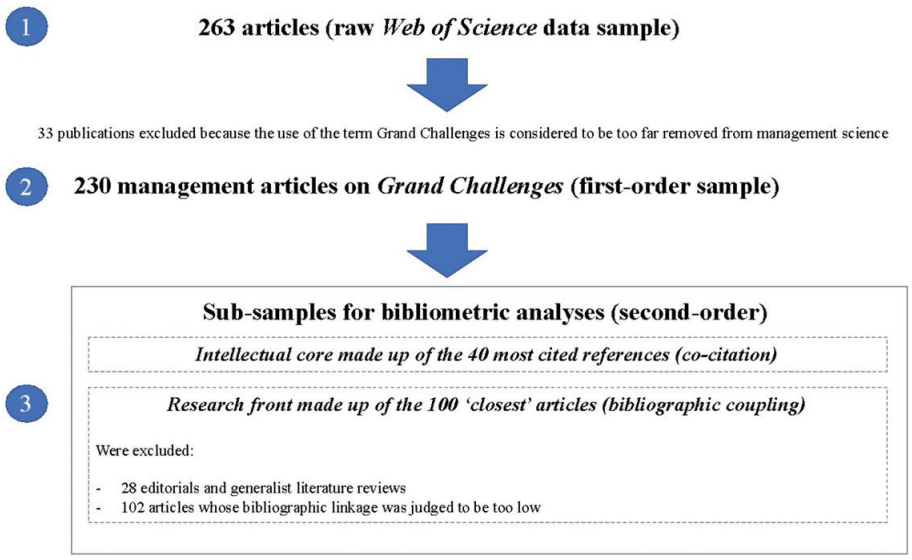

Figure 1. Sampling process.
Source: Own elaboration

sample. Our first-order sample thus consists of 230 publications in management-related fields that use the term grand challenges in their title, abstract, or keywords.

The third stage was to use this first-order sample to develop subsamples adapted to each type of bibliometric analysis. For the subsample of the bibliographic coupling analysis, we excluded 28 editorials and generalist literature reviews (Maucuer et al., 2022). The final second-order sample includes 202 publications.

Data analysis

For co-citation, the full first-order sample was used, but following the established procedure, the visualization and analysis focused on the 40 most cited references, as they reflect the 'intellectual heart' of the sample (Noma, 1984). This sub-sample size complies with recommendations in the literature (Maucuer et al., 2022; Walsh & Renaud, 2017), the challenge being to strike a balance between comprehensiveness and intelligibility. Indeed, we proceeded by 'trial and error' (Maucuer & Renaud, 2019, p. 184) to identify the threshold of citations that would allow us to achieve a minimum degree of coherence within the different intellectual root clusters. After several attempts, we decided on a minimum threshold of nine citations for a single reference.

For the bibliographic coupling, we reduced the analysis to a limited number of articles in order to focus the analysis on the publications that are closest from a bibliographic point of view (Walsh & Renaud, 2017). By carrying out a first analysis of the entire first-order sample removed from editorials and literature reviews, we observed the strong heterogeneity of the different clusters, which proved impossible to report in an understandable and rigorous way. We therefore carried out a second analysis of the 50 publications most closely linked by their bibliographies, the interpretation of which allowed us to identify a much higher degree of coherence within the different clusters. To increase the completeness of our results, a third analysis was carried out with a threshold of 100 publications. The analysis of these publications allowed us to obtain consistent results while limiting the statistical 'noise' resulting from the exhaustiveness requirement. With this second-stage sample of 100 publications, we were able to precisely identify the uses of grand challenges in the different clusters, which we call 'research conversations', and thus characterize their conceptual attributes.

Results: Foundations and trends in management research on grand challenges

We present here the results of our two analyses: the first, the co-citation analysis, aims to identify the intellectual core of the sample or, in other words, its foundations, the literature on which it draws. The second mapping, obtained by the method of bibliographic coupling, presents the 'research front' on grand challenges, that is, the research communities publishing on the topic.

The intellectual foundations of the grand challenges literature

Using co-citation analysis, we identified five clusters among the intellectual foundations of the literature on grand challenges (see Figure 2 and Table 1 in the Appendices). Some clusters

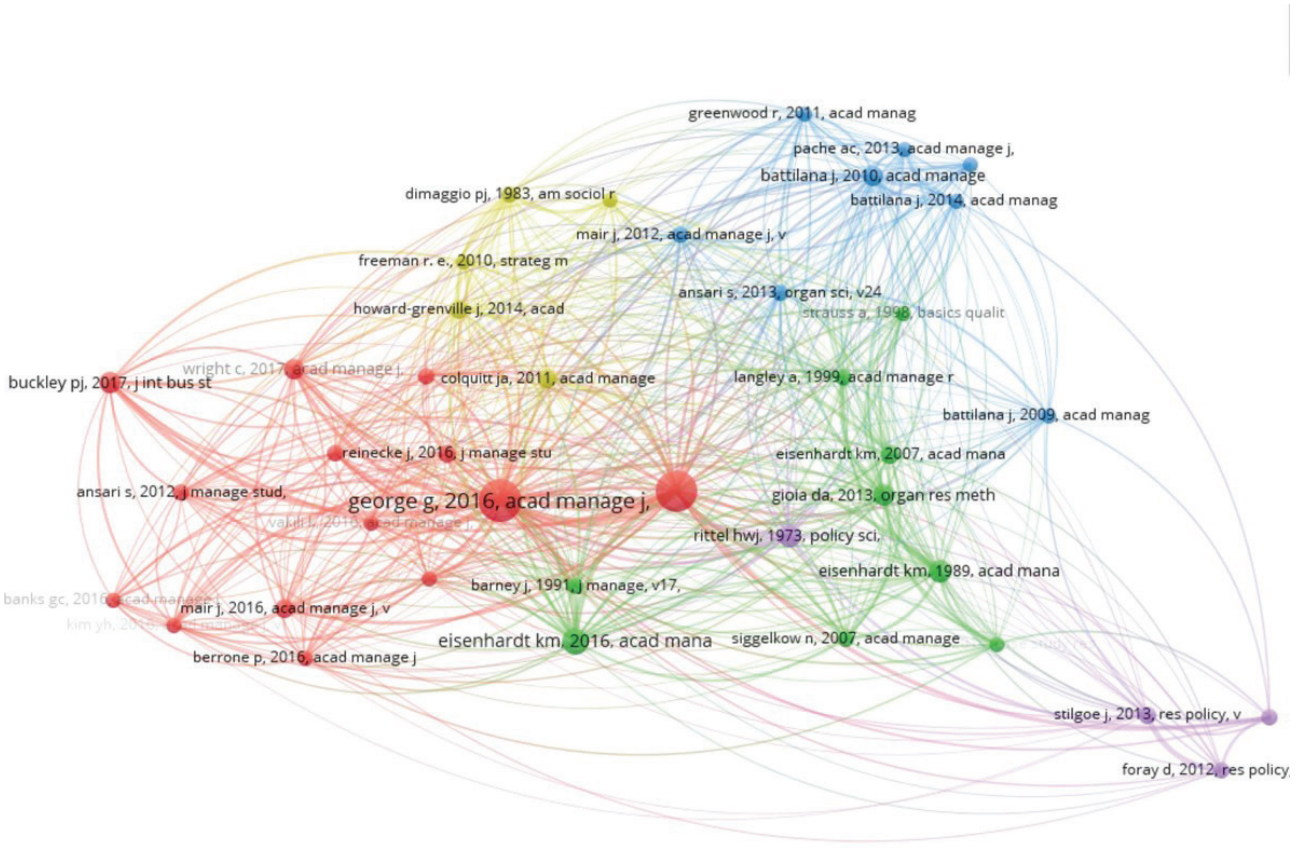

Figure 2. The intellectual foundations of the literature on grand challenges.
Source: Own elaboration

focus on well-established management theories, such as neo-institutionalism, stakeholder theory, and the resource-based approach. Another cluster consists of key references to qualitative methods. A final cluster is made up of concepts that are older but close to grand challenges.

Cluster A (red) contains 14 references, seven of which were published in the *Academy of Management Journal* and four in the *Journal of Management Studies*. This first cluster concerns the definition of the concept of grand challenges and the legitimization of the field. We distinguish two types of publications within this cluster. A first group of six articles explicitly mentions the concept or term 'Grand Challenges'. Logically, we also find them in the sample analyzed as part of our research. These include seminal works that propose a definition and a framework for research and action (Buckley et al., 2017; Ferraro et al., 2015; George et al., 2016). This group also includes empirical articles that are particularly influential in the literature and focus on organizational strategies and responses to various grand challenges such as climate change (Wright & Nyberg, 2017), tackling income inequality in the US (Berrone et al., 2016), access to healthcare for the poorest (Vakili & McGahan, 2016), or the gap between management theory and practice (Banks et al., 2016). It is worth noting that these empirical articles were all published as part of the *Academy of Management Journal*'s 2016 special issue on grand challenges.

Cluster A also includes a second group of publications that do not explicitly mention the term 'Grand Challenges', but aim to gain a better understanding of the role and responsibility of organizations – and in particular businesses – with regard to societal issues. The object of study and the approaches used are similar to those of the first group, the aim being to examine the problems faced by businesses – such as the globalization of supply chains and the resulting risks such as slavery and child labor (Crane, 2013; Kim & Davis, 2016; Reinecke & Ansari, 2016) – or the fight against inequality and poverty (Mair et al., 2016). Several theoretical articles bear witness to the questions and debates running through these fields, such as Whiteman et al. (2013) who propose the integration of planetary boundaries into corporate activities and call for more systematic research on how to measure their impact.

In contrast to Friedman's approach to responsibility, Scherer and Palazzo's (2011) founding article on the political corporate social responsibility (CSR) movement is also part of this cluster. This current proposes a Habermasian reading of the

geopolitical context at the beginning of the 21st century when businesses have to assume greater social responsibility because of the shortcomings of nation-states. To sum up, Cluster A reveals the evolution of the objects of study within the discipline, which themselves reflect the social upheavals and the growing expectations of organizations and, more specifically, of businesses. We note the low level of theoretical renewal in the literature employing the concept of grand challenges and the over-representation of the *Academy of Management Journal*, in which 16 of the 40 references were published. The *Academy of Management Review* and the *Journal of Management Studies* come a long way behind with four articles each.

Cluster B (nine publications; in green) focuses on qualitative methods for studying grand challenges. To address problems that are by definition complex and ambiguous, the literature seems to favor inductive approaches and qualitative methodologies (Corbin & Strauss, 2008), especially the case method (Eisenhardt & Graebner, 2007; Yin, 2009). Publications on grand challenges share common concerns, such as the importance of rigorous analytical processes (Eisenhardt et al., 2016; Gioia et al., 2013). The frequent citation of references such as Eisenhardt (1989) and Langley (1999) testifies to the difficulties faced by qualitative approaches to grand challenges. How to generate new theoretical elements, or at least contribute to existing frameworks, from objects that are by definition complex and therefore particularly difficult to grasp? The title of one of the cluster's references, Persuasion with Case Studies (Siggelkow, 2007), illustrates this difficulty. The predominance of qualitative methods is also indicative of the low level of maturity of the field.

Of the nine publications in this cluster, three were published in the *Academy of Management Journal*, two in the *Academy of Management Review*, and two are books (Corbin & Strauss, 2008; Yin, 2009). A striking publication in this methodological cluster is Barney's (1991) article on resource theory, which represents one of the intellectual filiations of the grand challenges literature. Its inclusion in this cluster suggests that work based on resource theory often uses qualitative methods, and that this theoretical framework is used in isolation from the others. To sum up, cluster B brings together work cited in the grand challenges literature to support its use of qualitative methodologies.

Clusters C (eight articles; in blue) and D (five publications; in yellow) both focus on the neo-institutional and stakeholder approaches to grand challenges. We therefore present them together. They contain influential work from the main theoretical framework used by the literature on grand challenges, namely institutionalism. Logically enough, this cluster includes the founding article of neo-institutional theory (DiMaggio & Powell, 1983). The strong reliance on this theory in the grand challenges literature can be explained by the complexity of the problems faced by the actors studied and their heterogeneity (Ansari et al., 2012; Greenwood et al., 2011). Several publications focus on the tensions between institutional logics in hybrid organizations. Grand challenges have a contradictory dimension (Jay, 2013) that leads for-profit actors to develop strategies and organizations with a societal vocation (Pache & Santos, 2013) or non-profit actors (NGOs, public service) to adopt practices and systems that are closer to the for-profit sector (Battilana & Dorado, 2010; Battilana & Lee, 2014). The institutional and strategic legitimacy of actors and organizations within the framework of action vis-à-vis grand challenges is also a key issue (Suchman, 1995).

Alongside this current, only the stakeholder approach seems to have some intellectual influence through the seminal work of Freeman (2010 [1984]). The bibliographic coupling analysis (3.2) also reveals work on grand challenges using the stakeholder approach, especially in cluster 3. The presence of the *Academy of Management Journal* is also strong in clusters C and D: of the 13 articles in these two clusters, six were published in the *Academy of Management Journal* (and three in the *Academy of Management Annals*). Two in particular are cited in the literature on grand challenges: on the one hand, the editorial by Colquitt and George (2011), which states that studying a grand challenge is an essential criterion for publication in the *Academy of Management Journal*. On the other hand, an article by Howard-Grenville et al. (2014) stresses the need for the academic community to better understand the science and politics of climate change. To sum up, clusters C and D contain publications that are predominantly positioned within the neo-institutionalist theory and that are particularly concerned with the tensions and paradoxes faced by hybrid organizations.

Cluster E (four articles; in purple) is characterized by its interdisciplinary dimension: these publications, at the frontier or even outside the field of management, focus on science and innovation policies in the face of grand challenges. Three of the four articles were published in *Research Policy*. The fourth was published in *Policy Science* and is a major reference for grand challenges. The urban planners Rittel and Webber's (1973) article defines wicked problems as the intractable, never-before-seen problems, for which most solutions do not satisfy all the actors concerned. The authors show that these social problems are inherently political in nature and therefore cannot be solved by science and technology. It is this line of thinking that appears to underpin the publications in this cluster. The editorial by Foray et al. (2012) poses the problem of a special issue on the relevance and effectiveness of research and development programs aimed at helping to tackle societal problems. In this same vein, Schot and Steinmueller (2018) propose to explore the different frameworks that have historically shaped science, technology and innovation (STI) policies to address 'contemporary social and environmental challenges', the latter materializing in practice through the SDGs. Finally, this cluster's last reference also fits into the STI policy framework by focusing on the conditions for responsible governance of innovation in the controversial research area of geoengineering (Stilgoe et al., 2013).

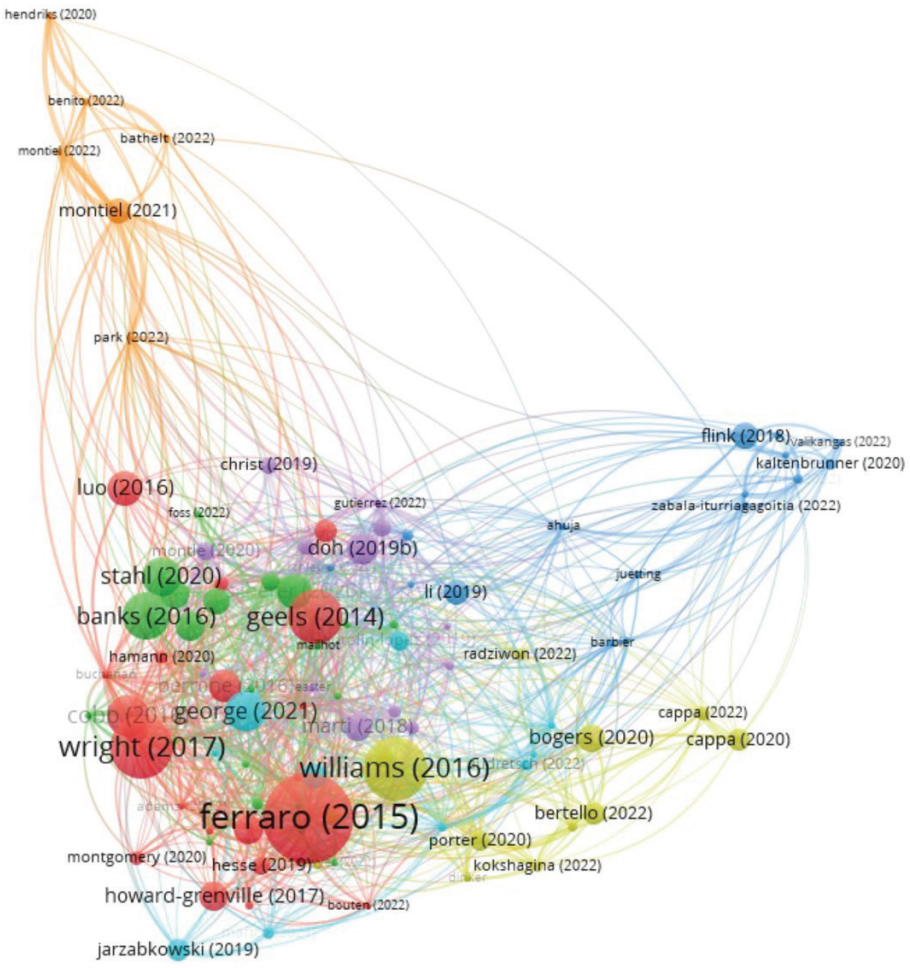

Figure 3. Bibliographic coupling analysis.
Source: Own elaboration

In this first results section, we have been able to identify the different intellectual foundations of the literature on grand challenges which include well-known theoretical management frameworks (neo-institutionalism, stakeholder theory, resource-based approach), major references on qualitative methods (Eisenhardt et al., 2016; Gioia et al., 2013), and finally long-standing concepts related to grand challenges such as 'wicked problems'. Cluster A highlights both the recent increase in research activity around grand challenges and the influence of a number of contributions that do not use the term grand challenge but propose a theoretical and conceptual renewal of management research.

Research conversations on grand challenges

In the second stage of the data analysis, bibliographic coupling analysis was used to identify seven clusters within the 'research front' on grand challenges and the most influential articles within them (Figure 3 and Table 2 in the Appendices). These are all 'conversations' within communities that address grand challenges in the academic management literature. We have aggregated them into three groups. Within the first group, the two most active clusters share common theoretical approaches, institutional logics for one and stakeholder theory for the other. Both are concerned with strategic management and organizational theory. The clusters in the second, less active group focus on inter-organizational collaboration, collaborative innovation, and the organization of research and innovation. A third group of clusters corresponds to the disciplines of entrepreneurship and international management.

The first two clusters share conversations firmly centered on common theoretical approaches. The 22 publications in cluster 1 (red) focus on organizational dynamics and institutional rationales in the face of grand challenges. This cluster contains the oldest publications, most published between 2014 and 2017, unlike those in the other clusters (2020–2022). The

vast majority have been published in general management and strategy journals (*Academy of Management Journal*, *Journal of Management Studies*, *Journal of Business Ethics*, *Strategic Management Journal*) and organization theory journals (*Organization Science*, *Organization Studies*, *Administrative Science Quarterly*). As in co-citation cluster A, the influence of the *Academy of Management Journal* is notable. This cluster is made up of publications that use the concept of grand challenges to study a wide range of social, environmental, and technological issues.

The institutional prism is adopted by 11 publications that explicitly use this theoretical framework. They focus on how the institutional logics of different actors evolve, interact, and confront each other. These studies cover grand challenges as diverse as financial inclusion (Cobb et al., 2016), income inequality (Berrone et al., 2016), racial inequality (Adams & Luiz, 2022), refugee integration (Hesse et al., 2019), food production biosecurity (Bryant & Higgins, 2019), or land conservation for sustainable agriculture (Callagher et al., 2022).

Without relying on neo-institutional theory, other publications use grand challenges to address climate change (Wright & Nyberg, 2017), technological innovation in the molecular sciences (Grodal & O'Mohani, 2017), or corporate accountability in authoritarian regimes (Luo et al., 2016). Others use the term grand challenges to refer to societal issues from a very general perspective (Agarwal et al., 2017; Buchanan et al., 2023).

The publication by Ferraro et al. (2015) is the most central of the cluster, and gives a true conceptual framework for grand challenges. The authors suggest making progress in solving grand challenges thanks to the three strategies that involve 'robust action'. Ferraro et al. (2015) aim to overcome some of the limitations of neo-institutional and stakeholder theories with both a conceptual and actionable framework focused on interorganizational collaboration. However, while this article is one of the most commonly cited publications in the literature on grand challenges, its conceptual framework has rarely been adopted by empirical work.

Cluster 2 (green) includes 17 articles that question stakeholder engagement in the face of grand challenges. Eight publications appeared in strategic management and organization theory journals (*Academy of Management Journal*, *Academy of Management Perspectives*, *Journal of Management Studies*, *Organization Studies*) and four in business ethics journals (*Business Ethics, the Environment and Responsibility*, *Business Ethics Quarterly*, *Business & Society*). While several publications in this cluster focus on practical issues such as poverty (Hennchen & Schrempf-Stirling, 2021), plastic pollution (Castelló & Lopez-Berzosa, 2023), or modern slavery (Schleper et al., 2022), a larger number explore grand challenges in a reflection on stakeholder theory (Bacq & Aguilera, 2022; Roulet & Bothello, 2022; Scherer & Voegtlin, 2020) and methodologies (Kistruck & Slade Shantz, 2022). The question of management teaching practices in the context of grand challenges is also addressed (Mailhot & Lachapelle, 2022). More broadly, Fritzsche (2022) proposes to question the ability of management theory to solve them. More surprisingly, two papers identify the gap between management research and practice as a grand challenge in itself (Banks et al., 2016; Rauch & Ansari, 2022).

The second set of clusters covers different topics. Cluster 3 (purple) contains 12 articles on best practices and collaboration in the face of grand challenges. Half of these articles were published in journals specializing in the ethical, social, and environmental issues facing companies (*Journal of Business Ethics*, *Business & Society*, *Ecological Economics*). Most of the other journals are in the field of strategic management (*Journal of Management Studies*, *Australian Journal of Management*). The articles in this cluster have in common that they propose tools and frameworks to improve the performance of companies in their contribution to addressing grand challenges, especially in their collaboration with other stakeholders. Grand challenges in this cluster include climate change (Doh et al., 2019), homelessness in Canada (Easter et al., 2023), the refugee crisis in the Asia-Pacific region (Quayle et al., 2019), and the fight against HIV in Uganda (Ryan, 2022). Two articles use grand challenges to refer to health issues such as the Ebola epidemic (Arslan & Taracki, 2022) and covid-19 (Arslan et al., 2021). Finally, two articles use the term grand challenges more generally to address societal issues (Meisinger, 2022) or corporate sustainability (Montiel et al., 2020). While two publications equate grand challenges with the United Nation's SDGs (Christ & Burrit, 2019; Gutierrez et al., 2022), we note that Marti's (2018) article enters the discussion with Ferraro et al.'s (2015) robust action model by confronting it with specific types of business models that impact grand challenges.

Cluster 4 (yellow, 15 publications) focuses mainly on collaborative innovation in the face of grand challenges. Most of the papers were published in general management journals (*Academy of Management Journal*, *Academy of Management Perspectives*, *Journal of Management Studies*, *Administrative Science Quarterly*) and innovation journals (*R&D Management*). Publications from this cluster use the term grand challenges to refer to the covid-19 pandemic, ocean conservation, community resilience to natural disasters, the refugee crisis in Greece, or the commercial exploitation of sex workers. The covid-19 pandemic (Diriker et al., 2022; Kokshagina, 2022; Radziwon et al., 2022) is the most widely addressed Grand Challenge. While the spread of the virus is often associated with a global crisis, for Bertello et al. (2022, p. 178) it also requires both 'urgent action and long-term thinking'. Only the study on crowdsourcing in the context of marine conservation (Porter et al., 2020) empirically contributes to the framework of robust action (Ferraro et al., 2015). Finally, four papers mobilize

the notion of grand challenges to identify societal problems without particularly focusing on any specific one.

The 16 publications in cluster 5 (blue) focus on how to manage research and innovation to address grand challenges. The cluster is characterized by its multidisciplinarity. Beyond the field of management, it includes science and technology journals such as the *Journal of Responsible Innovation* and *Research Policy*, and regional studies journals such as *Regional Studies* and *European Planning Studies*. As a result, the articles use the term grand challenges in quite different ways. In 10 publications in this cluster, grand challenges refer to societal issues in the context of innovation and research policy, without focusing specifically on any particular one. A minority of publications use grand challenges for more specific issues, such as plastic pollution (Bours et al., 2022), poverty (Li et al., 2019), or reducing electricity demand (Cappa et al., 2022). The proximity is close between this cluster and co-citation cluster E.

Finally, two clusters form a third group of academic conversations within sub-disciplines. The 10 publications in cluster 6 (turquoise) were mainly published in entrepreneurship journals (*Entrepreneurship Theory and Practice*, *International Entrepreneurship and Management Journal*, *Journal of Business Venturing*). Several explore hybrid organizations created in response to grand challenges and the paradoxes they face. The work is thus located at the intersection of the economic, social, and environmental spheres. The majority of publications use grand challenges as a general term that can refer to the full range of societal issues (Hagedoorn et al., 2022; Mafico et al., 2021; Markman et al., 2019) or to corporate sustainability (Carmine & De Marchi, 2022; Moggi et al., 2022). A minority of publications mobilize grand challenges to investigate specific problems, such as climate change (George et al., 2021) and the inadequate protection of communities by insurance policies (Jarzabkowski et al., 2019). This cluster has a strong link with cluster E in the co-citation analysis.

Finally, cluster 7 (orange) includes six publications that deal with the responsibility of multinational corporations in the face of grand challenges. The journals in this cluster belong to the field of international management, including the *Journal of International Business Studies*, *Global Strategy*, and *Multinational Business Review*. The issues identified as grand challenges are pandemics (Montiel et al., 2022), economic development in emerging and less developed countries (Hendriks, 2020; Montiel et al., 2021), and protectionism (Bathelt & Li, 2022). Montiel et al. (2021) bring the notion of grand challenges closer to the SDGs.

The first group includes the two most dynamic clusters, institutional rationale, and stakeholder theory, but which differ in their theoretical approach. Clusters in the second group are less dynamic, focusing on interorganizational cooperation, collaborative innovation, and the organization of research and innovation. A third group of clusters corresponds to the disciplinary fields of entrepreneurship and international management. In all these research conversations, we find a common denominator with a variety of identified social or environmental issues addressed (climate change, poverty, inequality, covid-19, plastic pollution, migration, and refugee crises), but is also composed of publications that adopt a looser use of the concept of grand challenges.

Discussion: Facing the construct validity challenge

Our results provide initial answers to the validity test of the umbrella concept of grand challenges. We take these answers further in light of the inconsistencies identified by Seelos et al. (2022) in the attributes of grand challenges. We describe the distribution of these attributes across seven research conversations (4.1), then identify the principal inconsistencies and propose a tighter definition of the grand challenges concept (4.2) as well as its theoretical implications (4.3).

Characterizing the diversity of attributes of grand challenges

Our bibliographic coupling analysis reveals a variety of uses of grand challenges across all research conversations. The topics studied are diverse (climate change, income inequality, pandemics, slavery, racial inequality, plastic pollution, integration of climate refugees). Approaches to studying grand challenges range from action at the individual level, to organizations of all sizes, to broader collective action. Seelos et al. (2022) note that the field lacks conceptual coherence and clarity because it varies in relation to five attributes. (1) Timescale: Is the phenomenon being studied short term or long term? Is it closer to a specific event (crisis/emergency) or to a long-term problem? (2) Spatial scale: Is the phenomenon local, national, or global? (3) Level of action: Is the phenomenon with which the actors being studied interact a matter for individual or collective (intra- or inter-organizational) action? (4) Level of analysis: Is the phenomenon being studied at the micro level (individuals and small groups), meso level (larger social groups and organizations), or macro level (organization environments, nations)? (5) Nature of the phenomenon: Does the phenomenon identified as a grand challenge refer to a problem (poverty, climate change) or to ambitions (such as the SDGs)?

The 'dominant' distribution of these attributes in the clusters resulting from the bibliographic coupling (see Appendix, Table 3) allows us to confirm the lack of coherence pointed out by Seelos et al. (2022). Our analysis shows that the research conversations are about research objects with short and long timeframes, with local and global scope, perceived as problems to be solved but also as ambitions, and using diverse levels of action (individual, intra- and inter-organizational) and analysis (micro,

meso, and macro). Short-term problems, although in the minority, are mobilized in three conversations to designate the covid-19 and Ebola epidemics (clusters 3 and 4). Similarly, phenomena that are exclusively national in scope are in the minority and refer to issues of innovation, and research and development that are inherent to the local context and whose focus of observation is at the micro and meso levels (clusters 5 and 6). On the other hand, the majority of attributes are long-term phenomena, with a global, national, or even local scope, whose levels of action are intra- and inter-organizational and are studied at the meso and macro levels. These attributes correspond to the two most established and active conversations (clusters 1 and 2, 39% of the second-order sample). The distribution of the types of phenomena defined as grand challenges (problem or ambition) is less easy to characterize, with certain conversations and even certain publications identifying both problems (such as poverty) and ambitions (its eradication).

Redefining the attributes of the grand challenges concept

Following the life cycle of umbrella concepts described by Hirsch and Levin (1999), we propose a 'rationalization' of grand challenges to make them a 'good concept' in the sense of Gerring (1999). The limitations of the grand challenges as a concept stem from its original overly broad definitions and its short, vague list of attributes, which make it impossible to identify a coherent set of phenomena. The two most cited publications for their definitions of grand challenges are themselves different. The first refers to 'a specific and critical barrier(s) that, if removed, would help solve an important societal problem with a high likelihood of global impact through widespread implementation' (George et al., 2016, p. 1881), while the second refers to 'large unsolved problems […] complex, uncertain, and evaluative' (Ferraro et al., 2015, p. 365). We propose to limit grand challenges to problems rather than ambitions (goals, solutions). This would require several research conversations (especially cluster 2 on stakeholder engagement) to rethink the use of the concept.

In terms of timeframe, it seems difficult to maintain the conceptual coherence of grand challenges without focusing on long-term phenomena, with climate change being the 'ideal type'. The timeframe pitfall has been described as the 'tragedy of horizons' (Carney, 2015), which leads to inertia and even inaction, making the role of management research all the more important (Ferns & Amaeshi, 2021; Nyberg et al., 2022; Slawinski et al., 2017). In this regard, it is the prevention of pandemics, rather than the pandemics themselves, that needs to be addressed as a grand challenge.

The spatial scope of grand challenges also needs to be clarified. While the majority of conversations mobilize grand challenges as phenomena of 'national and global' scope, we point to a delicate choice to be made by the community. An extreme case is space pollution which is about 'jointly managing a complex problem on a planetary scale' (Toussaint, 2022, p. 1), in a place largely beyond the control of states and where inter-governmental institutions are relatively powerless. Action taken in space is the work of a multitude of both public and private actors, and attempts at regulation reflect this diversity (Toussaint & Dumez, 2020). In this sense, space pollution and climate change are physical phenomena with a strong interdependence of actors on a global scale. The same is true for plastic pollution and loss of biodiversity. In contrast, problems such as poverty and inequality, which are unfortunately widespread worldwide, involve less interdependence. These phenomena are closer to concepts such as wicked problems (Rittel & Webber, 1973), meta-problems (Trist, 1983), and messes (Ackoff, 1981). While such concepts refer to complex societal issues to which the answers cannot be purely technical, it is this global interdependence that could be the differentiating factor for the concept of grand challenges as defined by Gerring (1999).

To respond to calls to place grand challenges on a conceptual map (Carton et al., 2023; Dorado et al., 2022) and to rationalize the concept implies certain concessions. Tightening the definition around phenomena of global interdependence would of course provide a more coherent and differentiating concept, but grand challenges could lose their unifying power as an umbrella concept. A less radical approach would be to maintain the broad scope of grand challenges, including problems that are widespread globally but have little interdependence (such as poverty and aging), and to make their role as a 'meta-term' more explicit. As a consequence, labeling grand challenges as 'meta-terms' would involve mobilizing 'middle-range concepts' (Alvesson & Blom, 2022, p. 76) such as wicked problems and meta-problems for issues with low global interdependence, and global commons for problems with high global interdependence (Ostrom et al., 1999; Toussaint, 2022).

This redefinition differs from the typology developed by Brammer et al. (2019), which includes phenomena of local scope and/or short temporality within grand challenges. Figure 4 illustrates the distribution of phenomena according to the two key attributes discussed above. In summary, the crux of the debate lies at the top of the diagram, namely whether grand challenges should include local and national problems that do not have strong global interdependence.

Renewing the theoretical and conceptual frameworks of management research

What remains to be clarified is the level of analysis and the preferred level of action, two attributes that also characterize grand challenges. Co-citation analysis enabled us to observe that the literature on grand challenges is strongly influenced by

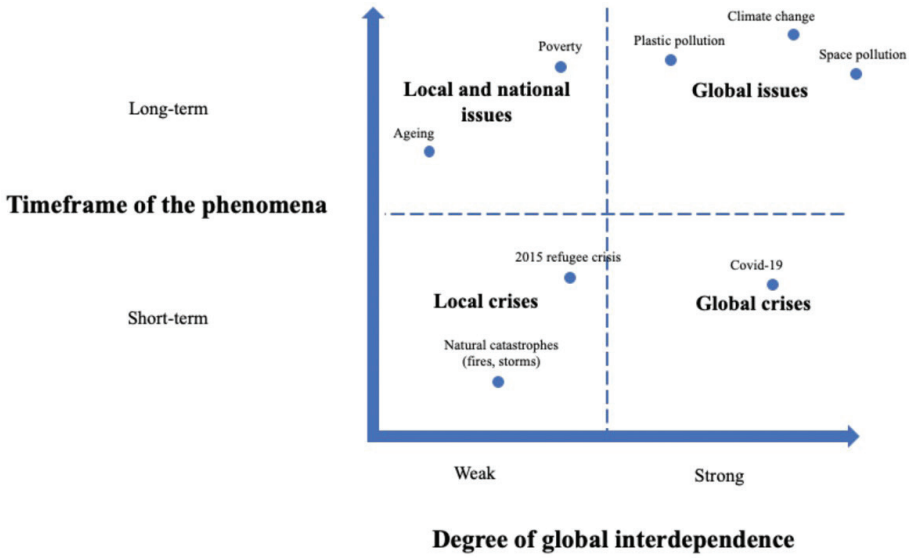

Figure 4. Proposal for a redefinition of grand challenges.

various strands of neo-institutional theory. This theoretical influence is consistent with the fact that the majority of conversations, especially the most active ones (clusters 1 and 2), explore grand challenges at the macro and meso levels. The over-representation of these levels stems from the global character of the most frequently cited definitions, and creates confusion (Seelos et al., 2022). Our analysis shows that micro-level research is not incompatible, provided that the notion of grand challenges is used according to the previously redefined attributes. Similarly, the preferred level of action (individual, intra-organizational, or inter-organizational) does not appear to be problematic if the work provides a better understanding of grand challenges as novel phenomena. Studying the actions of individuals or small groups in relation to climate change or plastic pollution contributes to a multi-level approach to grand challenges.

Beyond the neo-institutional and stakeholder theories identified as the main intellectual roots of work on grand challenges, the co-citation analysis highlights certain contributions that seem promising for the theoretical renewal of the field. A number of cluster A publications, without claiming to be grand challenges, have called for and contributed to theoretical and conceptual renewal in management. As early as 2013, planetary limits were identified as a key concept for the transition to more sustainable business models (Whiteman et al., 2013). Derived from the natural sciences (Rockström et al., 2023), this concept encompasses phenomena similar to the grand challenges as we redefine them.

Although numerous works focus on the interorganizational level, they have contributed little to the robust action framework proposed by Ferraro et al. (2015), whose publication is cited primarily for its definition of grand challenges. Indeed, there are few examples of research that develop this conceptual framework (Porter et al., 2020). By proposing to import various theories from economics and sociology (Callon et al., 2009; Ostrom, 1990), we aimed to respond to a gap identified by neo-institutional currents regarding 'understanding the links between organizational action and field-level change' (Ferraro et al., 2015, p. 364). However, our co-citation analysis did not reveal such intellectual roots. This framework and the proposed theories seem all the more promising in that they could potentially enter into dialogue with work on the political role of corporations (Aggeri, 2021; Scherer et al., 2016), especially the larger ones. The political CSR current is indeed present in the intellectual roots through its most prominent publication (Scherer & Palazzo, 2011). This current shares with Ferraro et al. (2015) the observation of a fragmentation of the politico-economic context due to the weakening of the nation-state (Habermas, 2018), the growing politicization of companies and the assertion of new actors and modes of organization (Etzion et al., 2017), resulting in the need for collective action led by a range of actors. In this respect, we note the absence of approaches capable of making a theoretical contribution to grand challenges, such as the broader concept of organization as defined by Ahrne and Brunsson (2011) instead of organizations (March & Simon, 1993), as well as that of partial organization (Ahrne et al., 2017; Rasche et al., 2013). These two concepts offer an appropriate level of granularity for better understanding the diversity of organizational phenomena in the face of grand challenges, such as networks, meta-organizations (Ahrne & Brunsson, 2008; Berkowitz et al., 2022), and markets. We consider them to be promising for a theoretical renewal that would allow the academic community to go beyond the institutional prism.

Conclusion

This article takes as its starting point the paradox between the steady and growing use of the concept of grand challenges by management researchers and the heavy criticism to which it has been subjected. Grand challenges is an umbrella concept that, after initial enthusiasm, now faces questions of validity and rationalization. To contribute to this transition, we analyzed 230 publications using a mixed-bibliometric methodology. Firstly, the analysis of co-citations revealed four 'intellectual roots' of this literature, with approaches largely dominated by neo-institutional theory and qualitative methods. Secondly, the bibliographic coupling analysis allowed us to identify seven academic conversations in the field of management on grand challenges, which we divided into three groups. Conversations in the first group show relative theoretical homogeneity; those in the second are thematic; and those in the third are disciplinary. We then characterized the dominant attributes of the research conducted in each of these clusters. To go beyond the heterogeneous use of the grand challenges concept, we refocused their definition on long-term problems (and not ambitions) which are highly interdependent at a global level. Theoretical frameworks that have been underused to date in connection with grand challenges, such as robust action, the commons, and meta-organizations, seem to us to be particularly conducive to the development of this field of research.

Our analysis of the literature on grand challenges is naturally not without limitations. A first limitation is that the sample is drawn solely from the WoS database, which is admittedly the most complete, but excludes certain publications and book chapters. In addition, the literature is constantly growing. Another limitation is the fact that the advantage of quantitative analysis of the literature, which certainly objectifies and structures, does not always make sense. One example is the inclusion of Barney's article (1991) in the 'intellectual filiation' cluster of quantitative methodologies.

While older, tried and tested concepts may be relevant to the study of many societal problems, we have shown that the grand challenges concept is valid under the conditions set out above. Some grand challenges, such as climate change, have begun to be explored, but not nearly enough given the stakes involved. Others, such as land and marine biodiversity, the use of natural resources, and plastic pollution, have received very little attention. The macro- and meso-levels of observation and the inter-organizational level of action have been favored until now. We believe it is vital not to neglect the micro-level of observation and individual action, which can also contribute to solving grand challenges, even in their redefined conceptualization.

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Zupic, I. & Čater, T. (2015). Bibliometric methods in management and organization. *Organizational Research Methods, 18*(3), 429–472. doi: 10.1177/1094428114562629

Appendices

Table 1. The five clusters of the co-citation analysis

Publications (full list of the 40 references included in the co-citation analysis)	Strength of bibliographic links	Number of citations
Cluster A (in red) – Definition of the concept and legitimization of the field		
George, G., Howard-Grenville, J., Joshi, A., & Tihanyi, L. (2016). Understanding and tackling societal grand challenges through management research. *Academy of Management Journal*, *59*(6), 1880–1895.	39	75
Ferraro, F., Etzion, D., & Gehman, J. (2015). Tackling grand challenges pragmatically: Robust action revisited. *Organization Studies*, *36*(3), 363–390.	39	70
Wright, C., & Nyberg, D. (2017). An inconvenient truth: How organizations translate climate change into business as usual. *Academy of Management Journal*, *60*(5), 1633–1661.	32	16
Reinecke, J., & Ansari, S. (2016). Taming wicked problems: The role of framing in the construction of corporate social responsibility. *Journal of Management Studies*, *53*(3), 299–329.	31	13
Mair, J., Wolf, M., & Seelos, C. (2016). Scaffolding: A process of transforming patterns of inequality in small-scale societies. *Academy of Management Journal*, *59*(6), 2021–2044.	30	14
Scherer, A. G., & Palazzo, G. (2011). The new political role of business in a globalized world: A review of a new perspective on CSR and its implications for the firm, governance, and democracy. *Journal of Management Studies*, *48*(4), 899–931.	29	12
Berrone, P., Gelabert, L., Massa-Saluzzo, F., & Rousseau, H. E. (2016). Understanding community dynamics in the study of grand challenges: How nonprofits, institutional actors, and the community fabric interact to influence income inequality. *Academy of Management Journal*, *59*(6), 1940–1964.	27	10
Crane, A. (2013). Modern slavery as a management practice: Exploring the conditions and capabilities for human exploitation. *Academy of Management Review*, *38*(1), 49–69.	27	9
Ansari, S., Munir, K., & Gregg, T. (2012). Impact at the 'bottom of the pyramid': The role of social capital in capability development and community empowerment. *Journal of Management Studies*, *49*(4), 813–842.	26	11
Vakili, K., & McGahan, A. M. (2016). Health care's grand challenge: Stimulating basic science on diseases that primarily afflict the poor. *Academy of Management Journal*, *59*(6), 1917–1939.	26	11
Whiteman, G., Walker, B., & Perego, P. (2013). Planetary boundaries: Ecological foundations for corporate sustainability. *Journal of Management Studies*, *50*(2), 307–336.	24	10
Kim, Y. H., & Davis, G. F. (2016). Challenges for global supply chain sustainability: Evidence from conflict minerals reports. *Academy of Management Journal*, *59*(6), 1896–1916.	22	10
Buckley, P. J., Doh, J. P., & Benischke, M. H. (2017). Towards a renaissance in international business research? Big questions, big challenges, and the future of IB scholarship. *Journal of International Business Studies*, *48*(9), 1045–1064.	19	20
Banks, G. C., Pollack, J. M., Bochantin, J. E., Kirkman, B. L., Whelpley, C. E., & O'Boyle, E. H. (2016). Management's science-practice gap: A grand challenge for all stakeholders. *Academy of Management Journal*, *59*(6), 2205–2231.	16	9
Cluster B (in green) – Qualitative methods		
Eisenhardt, K. M., Graebner, M. E., & Sonenshein, S. (2016). Grand challenges and inductive methods: Rigor without rigor mortis. *Academy of Management Journal*, *59*(4), 1113–1123.	38	30
Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review*, *14*(4), 532–550.	36	21
Gioia, D. A., Corley, K. G., & Hamilton, A. L. (2013). Seeking qualitative rigor in inductive research: Notes on the Gioia methodology. *Organizational Research Methods*, *16*(1), 15–31.	32	20
Langley, A. (1999). Strategies for theorizing from process data. *Academy of Management review*, *24*(4), 691–710.	30	12
Eisenhardt, K. M., & Graebner, M. E. (2007). Theory building from cases: Opportunities and challenges. *Academy of Management Journal, 50*(1), 25–32.	29	14
Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, *17*(1), 99–120.	26	12
Siggelkow, N. (2007). Persuasion with case studies. *Academy of Management Journal*, *50*(1), 20–24.	26	11
Corbin, J., & Strauss, A. (2008). *Basics of Qualitative Research: Techniques and procedures for developing grounded theory*. Sage.	23	9
Yin, R. K. (2009). *Case Study Research: Design and methods* (Vol. 5). Sage.	19	9

Table 1. (Continued)

Publications (full list of the 40 references included in the co-citation analysis)	Strength of bibliographic links	Number of citations
Cluster C (in blue) – Neo-institutional and stakeholder approaches (1)		
Battilana, J., & Dorado, S. (2010). Building sustainable hybrid organizations: The case of commercial microfinance organizations. *Academy of Management Journal*, *53*(6), 1419–1440.	32	16
Ansari, S., Wijen, F., & Gray, B. (2013). Constructing a climate change logic: An institutional perspective on the 'tragedy of the commons'. *Organization Science*, *24*(4), 1014–1040.	32	12
Mair, J., Marti, I., & Ventresca, M. J. (2012). Building inclusive markets in rural Bangladesh: How intermediaries work institutional voids. *Academy of Management Journal*, *55*(4), 819–850.	32	12
Pache, A. C., & Santos, F. (2013). Inside the hybrid organization: Selective coupling as a response to competing institutional logics. *Academy of Management Journal*, *56*(4), 972–1001.	27	9
Battilana, J., Leca, B., & Boxenbaum, E. (2009). How actors change institutions: toward a theory of institutional entrepreneurship. *Academy of Management Annals*, *3*(1), 65–107.	26	10
Battilana, J., & Lee, M. (2014). Advancing research on hybrid organizing – Insights from the study of social enterprises. *Academy of Management Annals*, *8*(1), 397–441.	25	10
Greenwood, R., Raynard, M., Kodeih, F., Micelotta, E. R., & Lounsbury, M. (2011). Institutional complexity and organizational responses. *Academy of Management Annals*, *5*(1), 317–371.	25	10
Jay, J. (2013). Navigating paradox as a mechanism of change and innovation in hybrid organizations. *Academy of Management Journal*, *56*(1), 137–159.	23	9
Cluster D (in yellow) – Neo-institutional and stakeholder approaches (2)		
Howard-Grenville, J., Buckle, S. J., Hoskins, B. J., & George, G. (2014). Climate change and management. *Academy of Management Journal*, *57*(3), 615–623.	34	15
Colquitt, J. A., & George, G. (2011). Publishing in *AMJ* – Part 1: Topic choice. *Academy of Management Journal*, *54*(3), 432–435.	32	15
DiMaggio, P. J., & Powell, W. W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American Sociological Review*, 147–160.	30	12
Freeman, R. E. (2010). *Strategic management: A stakeholder approach*. Cambridge University Press.	29	8
Suchman, M. C. (1995). Managing legitimacy: Strategic and institutional approaches. *Academy of Management Review*, *20*(3), 571–610.	25	10
Cluster E (in purple) – Science and innovation policies		
Rittel, H. W., & Webber, M. M. (1973). Dilemmas in a general theory of planning. *Policy Sciences*, *4*(2), 155–169.	35	22
Stilgoe, J., Owen R., & Macnaghten P. (2013), Developing a framework for responsible innovation, *Research Policy*, *42*(9), 1568–1580.	25	13
Foray, D., Mowery, D. C., & Nelson, R. R. (2012). Public R&D and social challenges: What lessons from mission R&D programs? *Research Policy*, *41*, 1697–1702.	14	12
Schot, J., & Steinmueller, W. E. (2018). Three frames for innovation policy: R&D, systems of innovation and transformative change. *Research Policy*, *47*(9), 1554–1567.	10	12

Source: own elaboration

Table 2. The seven conversations structuring the research front

Theoretical clusters: Neo-institutionalism and stakeholder approach	Strength of bibliographic links	Number of citations
Cluster 1 (in red) – Organizational dynamics and institutional rationale		
Ferraro, F., Etzion, D., & Gehman, J. (2015). Tackling grand challenges pragmatically: Robust action revisited. *Organization Studies*, *36*(3), 363–390.	80	399
Grodal, S. & O'Mahony, S. (2017). How does a grand challenge become displaced? Explaining the duality of field mobilization. *Academy of Management Journal*, *60*(5), 1801–1827.	57	42
Buchanan, S., Zietsma, C., & Matten, D. (2022). Settlement constellations and the dynamics of fields formed around social and environmental issues. *Organization Science*, *34*(2), 700–721.	54	0
Hiatt, S. R., & Carlos, W. C. (2019). From farms to fuel tanks: Stakeholder framing contests and entrepreneurship in the emergent US biodiesel market. *Strategic Management Journal*, *40*(6), 865–893.	53	31
Wright, C., & Nyberg, D. (2017). An inconvenient truth: How organizations translate climate change into business as usual. *Academy of Management Journal*, *60*(5), 1633–1661.	51	193
Hamann, R., Makaula, L., Ziervogel, G., Shearing, C., & Zhang, A. (2020). Strategic responses to grand challenges: Why and how corporations build community resilience. *Journal of Business Ethics*, *161*, 835–853.	42	10
Waldron, T. L., Navis, C., Karam, E. P., & Markman, G. D. (2022). Toward a theory of activist-driven responsible innovation: How activists pressure firms to adopt more responsible practices. *Journal of Management Studies*, *59*(1), 163–193.	38	11
Geels, F. W. (2014). Reconceptualising the co-evolution of firms-in-industries and their environments: Developing an inter-disciplinary triple embeddedness framework. *Research Policy*, *43*(2), 261–277.	37	147
Cluster 2 (in green) – Stakeholder engagement		
Scherer, A. G., & Voegtlin, C. (2020). Corporate governance for responsible innovation: Approaches to corporate governance and their implications for sustainable development. *Academy of Management Perspectives*, *34*(2), 182–208.	63	62
Bacq, S., & Aguilera, R. V. (2022). Stakeholder governance for responsible innovation: A theory of value creation, appropriation, and distribution. *Journal of Management Studies*, *59*(1), 29–60.	63	17
Rauch, M., & Ansari, S. (2022). From 'publish or perish' to societal impact: Organizational repurposing towards responsible innovation through creating a medical platform. *Journal of Management Studies*, *59*(1), 61–91.	44	3
Hennchen, E., & Schrempf-Stirling, J. (2021). Fit for addressing grand challenges? A process model for effective accountability relationships within multi-stakeholder initiatives in developing countries. *Business Ethics, the Environment & Responsibility*, *30*, 5–24.	38	3
Roulet, T. J., & Bothello, J. (2022). Tackling grand challenges beyond dyads and networks: Developing a stakeholder systems view using the metaphor of ballet. *Business Ethics Quarterly*, *32*(4), 573–603.	34	0
Stahl, G. K., Brewster, C. J., Collings, D. G., & Hajro, A. (2020). Enhancing the role of human resource management in corporate sustainability and social responsibility: A multi-stakeholder, multidimensional approach to HRM. *Human Resource Management Review*, *30*(3), 100708.	26	78
Cluster 3 (in purple) – Best practices and collaboration		
Montiel, I., Gallo, P. J., & Antolin-Lopez, R. (2020). What on Earth should managers learn about corporate sustainability? A threshold concept approach. *Journal of Business Ethics*, *162*, 857–880.	59	18
Gutierrez, L., Montiel, I., Surroca, J. A., & Tribo, J. A. (2022). Rainbow wash or rainbow revolution? Dynamic stakeholder engagement for SDG-driven responsible innovation. *Journal of Business Ethics*, *180*(4), 1113–1136.	46	0
Doh, J. P., Tashman, P., & Benischke, M. H. (2019). Adapting to grand environmental challenges through collective entrepreneurship. *Academy of Management Perspectives*, *33*(4), 450–468.	44	50
Easter, S., Murphy, M., & Brannen, M. Y. (2023). Negotiating meaning systems in multi-stakeholder partnerships addressing grand challenges: homelessness in Western Canada. *Journal of Business Ethics*, *183*(1), 31–52.	43	1
Arslan, B., & Tarakci, M. (2022). Negative spillovers across partnerships for responsible innovation: Evidence from the 2014 Ebola outbreak. *Journal of Management Studies*, *59*(1), 126–162.	39	14
Martí, I. (2018). Transformational business models, grand challenges, and social impact. *Journal of Business Ethics*, *152*(4), 965–976.	28	39
Arslan, A., Golgeci, I., Khan, Z., Al-Tabbaa, O., & Hurmelinna-Laukkanen, P. (2021). Adaptive learning in cross-sector collaboration during global emergency: conceptual insights in the context of COVID-19 pandemic. *Multinational Business Review*, *29*(1), 21–42.	28	16

Table 2. (Continued)

Theoretical clusters: Neo-institutionalism and stakeholder approach	Strength of bibliographic links	Number of citations
Cluster 4 (in yellow) – Collaborative innovation		
Porter, A. J., Tuertscher, P., & Huysman, M. (2020). Saving our oceans: Scaling the impact of robust action through crowdsourcing. *Journal of Management Studies*, *57*(2), 246–286.	43	20
Bertello, A., Bogers, M. L., & De Bernardi, P. (2022). Open innovation in the face of the COVID-19 grand challenge: insights from the Pan-European hackathon 'EUvsVirus'. *R&D Management*, *52*(2), 178–192.	38	25
Williams, T. A., & Shepherd, D. A. (2016). Building resilience or providing sustenance: Different paths of emergent ventures in the aftermath of the Haiti earthquake. *Academy of Management Journal*, *59*(6), 2069–2102.	29	200
Patvardhan, S., & Ramachandran, J. (2020). Shaping the future: Strategy making as artificial evolution. *Organization Science*, *31*(3), 671–697.	29	14
Jarvenpaa, S. L., & Välikangas, L. (2020). Advanced technology and end-time in organizations: A doomsday for collaborative creativity? *Academy of Management Perspectives*, *34*(4), 566–584.	26	13
Ricciardi, F., Cantino, V., & Rossignoli, C. (2021). Organisational learning for the common good: An emerging model. *Knowledge Management Research & Practice*, *19*(3), 277–290.	26	7
Kokshagina, O. (2022). Open COVID-19: Organizing an extreme crowdsourcing campaign to tackle grand challenges. *R&D Management*, *52*(2), 206–219.	26	6
Cluster 5 (in blue) – Management of research and innovation		
Ahuja, S., Chan, Y. E., & Krishnamurthy, R. (2023). Responsible innovation with digital platforms: Cases in India and Canada. *Information Systems Journal*, *33*(1), 76–129.	36	1
Garst, J., Blok, V., Branzei, O., Jansen, L., & Omta, O. S. (2021). Toward a value-sensitive absorptive capacity framework: Navigating intervalue and intravalue conflicts to answer the societal call for health. *Business & Society*, *60*(6), 1349–1386.	33	7
Cappa, F., Franco, S., & Rosso, F. (2022). Citizens and cities: Leveraging citizen science and big data for sustainable urban development. *Business Strategy and the Environment*, *31*(2), 648–667.	32	9
Flanagan, K., Uyarra, E., & Wanzenböck, I. (2022). Towards a problem-oriented regional industrial policy: possibilities for public intervention in framing, valuation and market formation. *Regional Studies*, *57*(6), 998–1010.	32	2
Barbier, R., Yahia, S. B., Le Masson, P., & Weil, B. (2022). Co-design for novelty anchoring into multiple socio-technical systems in transitions: The case of Earth observation data. *IEEE Transactions on Engineering Management*.	30	0
Ludwig, D., Blok, V., Garnier, M., Macnaghten, P., & Pols, A. (2022). What's wrong with global challenges? *Journal of Responsible Innovation*, *9*(1), 10–27.	29	0
Sub-disciplinary clusters: Entrepreneurship and international management	Strength of bibliographic links	Number of citations
Cluster 6 (in turquoise) – Entrepreneurship: Hybrid organizations and paradoxes		
Hagedoorn, J., Haugh, H., Robson, P., & Sugar, K. (2022). Social innovation, goal orientation, and openness: insights from social enterprise hybrids. *Small Business Economics*, *60*(1), 173–198.	59	1
George, G., Merrill, R. K., & Schillebeeckx, S. J. (2021). Digital sustainability and entrepreneurship: How digital innovations are helping tackle climate change and sustainable development. *Entrepreneurship Theory and Practice*, *45*(5), 999–1027.	50	82
De Bernardi, P., Bertello, A., Forliano, C., & Orlandi, L. B. (2021). Beyond the 'ivory tower'. Comparing academic and non-academic knowledge on social entrepreneurship. *International Entrepreneurship and Management Journal*, *18*, 999-1032.	50	4
Audretsch, D. B., Eichler, G. M., & Schwarz, E. J. (2022). Emerging needs of social innovators and social innovation ecosystems. *International Entrepreneurship and Management Journal*, *18*, 217–254.	42	5
Carmine, S., & De Marchi, V. (2022). Reviewing paradox theory in corporate sustainability toward a systems perspective. *Journal of Business Ethics*, *184*(1), 139–158.	41	3
Mafico, N., Krzeminska, A., Härtel, C., & Keller, J. (2021). The mirroring of intercultural and hybridity experiences: A study of African immigrant social entrepreneurs. *Journal of Business Venturing*, *36*(3), 106093.	34	6

Table 2. (Continued)

Theoretical clusters: Neo-institutionalism and stakeholder approach	Strength of bibliographic links	Number of citations
Cluster 7 (in orange) – International management: Responsibility of multinationals		
Montiel, I., Cuervo-Cazurra, A., Park, J., Antolín-López, R., & Husted, B. W. (2021). Implementing the United Nations' sustainable development goals in international business. *Journal of International Business Studies*, *52*(5), 999–1030.	69	30
Park, J., Montiel, I., Husted, B. W., & Balarezo, R. (2022). The grand challenge of human health: A review and an urgent call for business-health research. *Business & Society*, *61*(5), 1353–1415.	64	2
Montiel, I., Park, J., Husted, B. W., & Velez-Calle, A. (2022). Tracing the connections between international business and communicable diseases. *Journal of International Business Studies*, *53*(8), 1785–1804.	47	0
Benito, G. R., Cuervo-Cazurra, A., Mudambi, R., Pedersen, T., & Tallman, S. (2022). The future of global strategy. *Global Strategy Journal*, *12*(3), 421–450.	35	0
Hendriks, G. (2020). How outward investment from emerging markets affects economic development at home: Using the eclectic paradigm to synthesize two IB literatures. *Multinational Business Review*, *28*(4), 463–482.	30	0
Bathelt, H., & Li, P. (2022). The interplay between location and strategy in a turbulent age. *Global Strategy Journal*, *12*(3), 451–471.	28	2

Source: own elaboration

Table 3. Distribution of the attributes of grand challenges in the research conversations

Attributes	Timescale	Spatial scale	Preferred levels of action	Levels of analysis	Main types of phenomena
Cluster 1 – Organizational dynamics and institutional rationale	Long-term	Local, national and global	Intra- and inter-organizational	Meso, macro	Problems (social and environmental)
Cluster 2 – Stakeholder engagement	Long-term	National and global	Intra- and inter-organizational	Meso, macro	Mixed
Cluster 3 – Best practices and collaboration	Short- and long-term	National and global	Intra- and inter-organizational	Meso, macro	Mixed
Cluster 4 – Collaborative innovation	Short- and long-term	National and global	Intra- and inter-organizational	Meso, macro	Problems (social and environmental)
Cluster 5 – Management of research and innovation	Long-term	Local and national	Intra- and inter-organizational	Micro, meso	Ambitions (technologies)
Cluster 6 – Entrepreneurship: Hybrid organizations and paradoxes	Long-term	Local and national	Individual and intra-organizational	Micro, meso	Problems (social and environmental)
Cluster 7 – International management: responsibility of multinationals	Short- and long-term	National and global	Intra-organizational	Meso, macro	Mixed

Source: own elaboration