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ORIGINAL PAPER

Resilience-oriented management control systems: a systematic review of the relationships between organizational resilience and management control systems

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Abstract

Organizations regularly face serious challenges due to pandemics, recessions, and financial crises. One reason some organizations cope better than others may be that their management control systems (MCSs) more effectively foster organizational resilience. Despite considerable literature on MCSs and organizational resilience, there is a lack of research on the impact of an MCS's use on organizational resilience. This study examines and bridges the literatures on MCSs and organizational resilience to illuminate how organizations can better cope with adversity. To identify potential relationships between management controls, MCSs, and organizational resilience, we systematically review the literature and perform a content analysis. We examine the relationships between organizational resilience measures, capabilities, and management controls. We propose the use of resilience-oriented management controls and discuss whether organizations can increase their resilience by building resilience-oriented MCSs. Based on Simons's levers of control framework and Duchek's capability-based conceptualization of organizational resilience, we develop a conceptual organizational resilience/MCS framework. Our study reveals relationships and gaps between the literatures on MCSs and organizational resilience and proposes avenues for future research. Our findings suggest that resilience-oriented MCSs are beneficial to organizational resilience.

Keywords Management control systems · Levers of control · Organizational resilience · Systematic literature review

JEL Classification M10 · M40 · M41 · L20

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1 Introduction

In 2020, the COVID-19 pandemic arrived, and it has profoundly affected organizations worldwide. In the context of recent unforeseen crises like this, the design of organizational resilience has become increasingly important (Leoni et al., 2021; Mokline et al., 2021). Organizational resilience can be understood as an outgrowth of the measures (Annarelli & Nonino, 2016) and capabilities (Duchek, 2020) that constitute an organization's resilience capacity.[1] To address adverse events in a changing business environment, organizations need resilience (e.g., Lengnick-Hall et al., 2011; Ruiz-Martin et al., 2018; Seville et al., 2008; Teixeira & Werther, 2013; Vargo & Seville, 2011). One reason why some organizations cope with adversity better than others may be that they have better management control systems (MCSs) in place to increase their resilience (Williams et al., 2017).

It remains unclear how management controls and MCSs might support the implementation of resilience measures and the development of resilience capabilities aligned with an organization's strategy.

The inclusion of resilience aspects in the organization is not detached from organizational management systems, such as MCSs. The concept of organizational resilience cannot be anchored in the organization without suitable management tools for translating strategies into managerial action. The term anchoring means that the systematic design and monitoring of measures for increasing resilience and the monitoring of the progress in the implementation of resilience measures require an integration into MCSs, with such systematic design and monitoring being a prerequisite for the use of corresponding maturity models (e.g., British Standards Institution, 2014). Consequently, it will be difficult to increase organizational resilience without the use of management controls and MCSs, which argues for the need for joint research on MCSs and organizational resilience, in particular organizational resilience measures and capabilities. The term "organizational resilience *measures*," synonymous with organizational resilience practices, refers to the efforts of organizations to respond to disruptions (Cotta & Salvador, 2020) that impact resilience. "Organizational resilience *capabilities*," on the other hand, include cognitive and behavioral capabilities, such as observation, identification, and preparation (Duchek, 2020). Linking the literatures on MCSs and organizational resilience could be a further step toward answering the question of why some organizations are more resilient than others.

This study aims to systematically analyze the literature on MCSs and organizational resilience to identify studies that link both fields and to provide a state of the art and a framework for the analysis and identify of future research opportunities. We are looking for specific management controls and MCSs with a resilience orientation or with a particular suitability for anchoring resilience aspects in the organization. In this regard, we focus on how management controls and MCSs help

[1] In this study, the term "measures" encompasses similar terms used in the literature in connection with resilience, such as "actions," "practices," and "tools." In the same way, the term "capabilities" encompasses such terms as "traits," "properties," and "abilities.".

organizations support the implementation of their resilience measures and the development of their resilience capabilities. We thus search the literature on MCSs and organizational resilience to identify measures and capabilities associated with management controls and MCSs and examine these literatures in terms of how management controls and MCSs impact the use of organizational resilience measures and support resilience capabilities.

This paper contributes in four ways to the literatures on MCSs and organizational resilience:

The first contribution entails a systematic analysis of the extant literature on MCSs and organizational resilience to identify studies that link both fields, and to provide a state-of-the-art framework for the analysis and the identification of future research opportunities. Second, given the need for joint research on MCSs and organizational resilience, we develop and propose the concept of resilience-oriented management controls and resilience-oriented MCSs in our framework. The framework undergirds our literature search, our analysis of the studies identified, and the discussion of our findings. The third contribution includes uncovering the relationships between organizational resilience measures and capabilities, management controls, and MCSs, and the results of the analysis of the literature on MCSs and organizational resilience to determine the benefits of using MCSs to efficiently increase organizational resilience. Our review reveals multiple evidence that the organizational resilience generally benefits from the integration of organizational resilience into MCSs. Fourth, based on the comparison of our conceptual OR/MCS framework with our findings, our study shows underdeveloped research areas and provides avenues for future research.

The remainder of the paper is structured as follows. Section 2 introduces the concept of resilience-oriented management controls and resilience-oriented MCSs and presents a conceptual framework. Section 3 outlines our research design and methodology. Section 4 presents the results. Section 5 discusses the findings, and Sect. 6 concludes.

2 A conceptual organizational resilience/MCS framework

There is little research in the literatures on management control, and organizational resilience that investigates the connection between both domains, even though it is necessary to understand how the management of organizational resilience and MCSs interact. Bracci and Tallaki (2021) have started to examine MCSs in the context of public sector resilience. The study revealed that MCSs were a crucial factor in the development of organizational resilience capacity. Möller et al. (2022) investigated the relationships between control levers and control context with contextual ambidexterity and organizational performance, considering contextual ambidexterity as a key strategic priority for organizations to foster their resilience. Recently, Baird et al. (2023) examined the mediating role of levers of controls on the association between sustainable leadership and organizational resilience. Our study follows the literatures on public sector accounting (Barbera et al., 2020; Bracci & Tallaki, 2021), quality management systems (Al Balushi, 2021), and crisis management and

resilience (Williams et al., 2017) as well as the broader literatures of organizational (Kantur & İşeri-Say, 2012) and environmental studies (Clément & Rivera, 2016).

In their systematic review, Williams et al. (2017) hit upon the potential application of management control theory in the crisis and resilience literature. The authors raise the question of whether organizations can build controls for promoting resilience and, if so, how these controls can help build resilient organizations, systems, and communities. We likewise pose the question of how to build resilience-oriented management controls to support the implementation of organizational resilience measures and the development of organizational resilience capabilities.

Reviews of the literature on resilience at the organizational level include the studies by, e.g., Annarelli and Nonino (2016), Barasa et al. (2018), Bhamra et al. (2011), Conz and Magnani (2020), Duchek (2020), Hillmann (2021), Hillmann and Guenther (2021), Linnenluecke (2017), Koronis and Ponis (2018), and Ruiz-Martin et al. (2018). However, none of these studies examines organizational resilience in the context of MCSs. Prior literature on the relationships between organizational resilience and MCSs is sparse and provides just a narrow range of findings, which indicate that there are relationships between organizational resilience and characteristics or practices of MCSs, but not conceptualizing or embedding these relationships as MCS.

The field of MCS research is fragmented (e.g., Berry et al., 2009; Martyn et al., 2016; Merchant & Otley, 2006). The empirical management control literature can be divided into three lines, that is, research on (1) management controls in isolation, (2) how contingency factors influence the use and effectiveness of management controls, and (3) interdependencies among different management controls (Feichter & Grabner, 2020). Management controls are the rules, practices, values and other activities that top management introduces to direct employee behavior. In contrast to simple rules, MCSs are robust systems for directing behavior (Malmi & Brown, 2008).

Simons's levers of control represents a perspective that centers innovation and control (Simons, 1995b). Scholars, such as Tuomela (2005) and Ferreira and Otley (2009), have used it as a theoretical frame of reference for introducing new performance measurement systems. Widener (2007) has used it to explore relations among MCSs. According to Guenther et al. (2016), Simons's framework is the most frequently used in empirical research on MCSs apart from the "object of control" (OOC) framework of Merchant and van der Stede (2003), and it illuminates the relationships between strategy and control and how organizations use an MCS to implement or revise their strategy (Martyn et al., 2016).

With our study, we follow Duchek (2020), who defines organizational resilience as "an organization's ability to anticipate potential threats, to cope effectively with adverse events, and to adapt to changing conditions" (p. 220). Duchek's (2020) capability-based conceptualization of organizational resilience combines a processual approach with a focus on resilience capabilities and distinguishes three successive stages of resilience: the "anticipation" (proactive) stage, the "coping" (concurrent) stage, and the "adaptation" (reactive) stage (p. 217). The anticipation stage describes preventive aspects related to a disruption and includes such capabilities as observation, identification, and preparation. The coping stage entails the effective handling

of unexpected events to resist destruction, including such capabilities as accepting, developing, and implementing solutions. The adaptation stage describes the ability to respond to crises and use change for one's own purposes and includes such specific capabilities as reflection, learning, and organizational change (pp. 225–232).

Duchek based her framework on process-oriented studies (Williams et al., 2017) to account for the dynamic nature of resilience, that is, the interaction between the organization and the changing environment. Furthermore, to structure the process of developing and maintaining organizational resilience, she follows similar approaches discussed in the crisis management literature.

We use Simons's framework to focus on ways of supporting the implementation of resilience measures and the development of resilience capabilities with the organization's MCS. Simons's framework comprises elements such as early warning systems based on key performance indicators (diagnostic control systems), elements to promote the organizational culture and increase awareness (beliefs systems), elements to increase flexibility and learning (interactive control systems) and, at the same time, risk management elements (boundary controls). The four levers that constitute the system create tension: two of them—beliefs systems and interactive control systems—generate positive energy, while the other two—boundary systems and diagnostic control systems—generate negative energy (Simons, 1995b). As a core idea of this strategic control framework is to balance the need for innovation and constraints (Tuomela, 2005), Simons calls this interaction "yin and yang" (Simons, 1995b, p. 57). Although Simons envisages management controls and MCSs as tools for implementing top management's strategies, his framework allows for variations in behavior that, if approved by top management, can lead to new strategies (Strauß & Zecher, 2013). Furthermore, we follow this framework because, in contrast to the perspectives of Merchant and van der Stede (2003), organizational strategy represents its core.

Simon's levers of control concept is well suited to support the management of organizational resilience. To increase resilience, organizations must align their business strategy according to all three resilience stages, as differentiated by Duchek (2020). We use Duchek's (2020) framework because managers need to control the anticipative, coping, and adaptive aspects of organizational resilience through rewards or punishments, which must be integrated into the business's strategy to ensure long-term success and short-term survival. The levers of control framework relies on both positive and inspirational forces and on ensuring compliance with orders to create an effective control environment (Simons, 1995b). The arguments mentioned above make it an ideal candidate for supporting the implementation of organizational resilience measures and, in combination with Duchek's (2020) framework, for supporting the development of organizational resilience capabilities. In his second book and his later work, Simons (2000, 2010) addresses topics that are not covered by the levers of control but may be relevant to organizational resilience and MCSs—for instance, resource allocation, organizational structure, motivation, and incentive systems.[2] To the best of our knowledge, our study is the first

[2] We focus on Simons's original conceptual levers of control model (Simons, 1995b) because his textbook (Simons, 2000) is essentially based on his monograph (Simons, 1995b); also, his later work (Simons, 2010) has been cited only 92 times since its publication in 2010. In contrast, Simons's forma-

to draw extensively on Simons's work (Simons, 1987, 1991, 1992, 1994, 1995a) and the levers of control framework (Simons, 1995b) in the context of organizational resilience.

Simons argues that "interactive control systems enable top-level managers to focus on strategic uncertainties, to learn about threats and opportunities as competitive conditions change, and to respond proactively" (Simons, 1995a, p. 81). Simons describes strategic uncertainties as the "emerging threats and opportunities" (Simons, 2000, p. 215) that "derive from senior management's perception of the known and unknown contingencies that could threaten or invalidate the assumptions underlying the current strategy" (Simons, 1995b, p. 94). He also includes the "uncertainties that top managers believe they must monitor personally to ensure that the goals of the firm are achieved" (Simons 1990, p. 136) and constitute the "joint function of senior management's vision for the future and their assessment of the contingencies that could undermine that vision" (Simons, 1995a, b, p. 169).

Interactive processes of management control can help managers "anticipate strategic uncertainties" by energizing the organization (Simons, 1990, p. 141) and direct attention to emerging threats and opportunities. For example, interactive control systems that are regularly updated could alert organizational members to potential changes in familiar patterns (Simons, 1995b). Simons (1994) argues that managers could hold "face-to-face meetings with subordinates to discuss both new data generated by the interactive control system and resulting action plans to preempt emerging threats and opportunities" (Simons, 1994, p. 180). The term "preempt," as Simons uses it, resembles the term "proactive," which Duchek (2020, p. 238) uses to describe her anticipation stage. Like Duchek (2020), Simons argues that the timeframe in which interactive control systems designed to act preemptively—or proactively—should encompass the "present and future" (Simons, 1995b, p. 124). Here the present time can be considered equivalent to "concurrent" efforts in what Duchek (2020, p. 232) describes as the coping stage.

In her empirical analysis of the levers of control framework, Widener (2007) similarly argues that both strategic risk and strategic uncertainty drive the importance and use of diagnostic or interactive MCSs. As she explains, like "strategic uncertainty, strategic risk requires increased information processing to assess the likelihood of risk and the magnitude of any resultant harm" (Widener, 2007, p. 763). In certain conditions, to process lots of information, it is necessary to apply measures both interactively and diagnostically (Widener, 2007).

Simons further argues that "implementing a strategy successfully requires the anticipation and proactive control of the risks […] associated with that strategy" (Simons, 1995b, p. 168), an approach to strategy that relies on boundary systems and relates to the anticipation stage and proactive approach Duchek (2020) describes.

Several aspects that Simons discusses correspond to the adaptation stage and the reactive approach Duchek (2020) describes. Specifically, Simons (1987) has argued

Footnote 2 (continued)
tive work (Simons, 1995b) has been cited 4,790 times during the same period. To determine the number of citations, we ran a search using Google Scholar in January 2024.

that organizations facing high uncertainty will extensively use their control systems and that "management control systems play a critical role in creating competitive pressures within the organization to innovate and adapt" (Simons, 1995b, p. 92). In their review of the literature, Merchant and Otley (2006) conclude that "in broad terms, a management control system is designed to help an organization adapt to the environment in which it is set" (Merchant & Otley, 2006, p. 785), a conclusion that similarly relates to the adaptation stage and reactive approach Duchek (2020) describes.

According to Simons, interactive control systems are "adaptive systems [with] structures that change to adapt to changing environment" (Simons, 1995b, p. 105). Interactive control systems stimulate search and learning and enable organizations to develop new strategies when their members respond to perceived opportunities and threats (Simons, 1995b).

We propose that the integration of organizational resilience into MCS takes place by using "resilience-oriented management controls" and the respective systems ("resilience-oriented MCSs"). We define resilience-oriented management controls as management controls that an organization can include into an MCS to support the implementation of resilience measures and the development of resilience capabilities. Resilience-oriented controls can already be in place and anchored in the organization's MCS and used to increase organizational resilience. They can also be new controls with a resilience orientation. By doing this, organizations might strengthen their resilience and secure their survival in the face of expected or unexpected adversity.

We divide our OR/MCS framework into three distinct levels—(1) business strategy, (2) organizational resilience measures and capabilities, and (3) control. The top level (business strategy level) focuses on defining the resilience strategy and objectives. Following Duchek's (2020) anticipative, coping, and adaptive stages, the middle level (capabilities and measures) represents the relationship between resilience measures and capabilities embedded in the organization's business strategy. These measures and capabilities relate to each other at the same level (i.e., they are positioned next to each other) and can have different effects on the organization's resilience. We consider measures and capabilities to be positioned next to each other, as although there are interdependent relationships, there is no clear relationship of superiority or inferiority. On the one hand, resilience capabilities are required for the implementation of resilience measures. On the other hand, there are resilience measures that are explicitly designed to increase resilience capabilities. Based on Simons's (1995b) levers of control framework, the lower level (control level) focuses on the use of resilience-oriented management controls and management controls in general within the MCS to apply resilience measures and leverage resilience capabilities. Figure 1 shows the conceptual framework.

3 Research design and methodology

To review the literature systematically, we follow the research protocol depicted in Fig. 2, which is based on the PRISMA (the Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines proposed by Page et al. (2021) and the

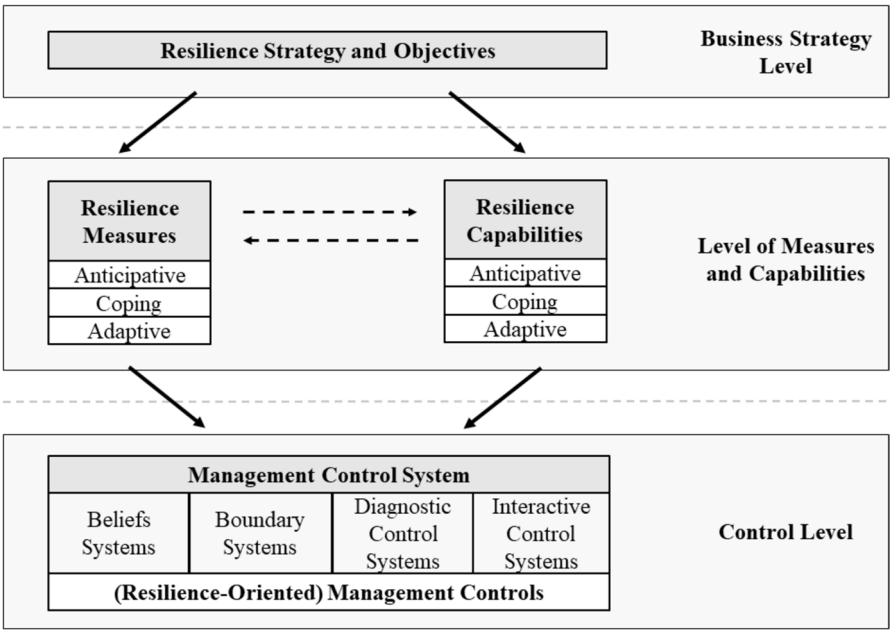

Fig. 1 Conceptual organizational resilience/management control system (OR/MCS) framework

guidelines proposed by Tranfield et al. (2003). We chose Tranfield et al.'s (2003) guidelines because (1) they have been used in prior research on MCSs and research on organizational resilience (Hillmann, 2021; Hillmann & Guenther, 2021; Ruiz-Martin et al., 2018; Strauß & Zecher, 2013) and (2) they seem to be appropriate for the problem at hand.

To define the research questions, boundaries, and search criteria and terms, a researcher first must conduct a so-called scoping study (Tranfield et al., 2003). To that end, we manually searched for reviews in these literatures. We presented the results of this search in Sect. 2.

In the first step of the research process, we established two research questions:

(1) Do the MCS literatures identify relationships between organizational resilience measures and capabilities, management controls, and MCSs?
(2) Does the literature on organizational resilience identify relationships between organizational resilience measures and capabilities, management controls, and MCSs?

In the second step, we defined the search criteria, selected our databases, and defined the search boundaries, the period of interest, and search terms. For the

Step 1	**Defining Research Questions**	
	1)	Do the MCS literatures identify relationships between organizational resilience measures and capabilities, management controls, and MCSs?
	2)	Does the literature on organizational resilience identify relationships between organizational resilience measures and capabilities, management controls, and MCSs?
Step 2	**Defining Boundaries and Search Criteria**	
	Data Bases:	EBSCO (Business Source Complete) and ScienceDirect
	Scope of Research:	Business, management and accounting literature (english-language publications)
	Search Modes	Boolean/Phrase
	Journals:	Peer-reviewed
	Cover Period:	1987 - 2023
	Search Terms:	'management control system' or 'levers of control' or 'MCS' or 'management control' or 'managerial control' or 'belief system' or 'boundary system' or 'diagnostic control system' or 'interative control system' (and) 'resilience' or 'anticipation' or 'coping' or 'adaptation' or 'redundancy'
Step 3	**Exclusion Criteria**	
	1)	Papers whose title is not related to organizational resilience, management control systems or Simons' levers of control
	2)	Papers whose abstract is not related to organizational resilience, management control systems or Simons' levers of control
Step 4	**Analyzing Selected Articles and Including Additional Papers**	
	1)	Checking the references of the articles to find literature that did not show up in our search
	2)	Reading and analyzing the full articles to decide which studies become part of the final publication

Fig. 2 Research protocol

search, we used the EBSCO (Business Source Complete) and ScienceDirect databases. We limited the scope of our search to peer-reviewed works written in English and published in academic journals[3] in the areas of business, management, and

[3] Organizational resilience is a relatively new concept in business and management research (Annarelli & Nonino, 2016; Linnenluecke, 2017). We considered peer-reviewed publications in both high- and low-ranked academic journals to ensure that our search was objective and took into account the approaches of differently rated academic journals in the areas of business, management, and accounting. Table 1 lists the journals with most publications among our results.

Table 1 Distribution of publications that we found among various journals in the MCS and organizational resilience literatures

Journal	Total	Management control systems	Organizational resilience
Management Accounting Research	22	22	–
Accounting, Organizations and Society	16	16	–
International Journal of Production Research	9	–	9
Journal of Accounting & Organizational Change	6	5	1
Accounting, Auditing & Accountability Journal	4	3	1
Journal of Management Accounting Research	4	4	-
Schmalenbach Journal of Business Research	4	1	3
Sustainability	4	–	4
European Management Journal	3	1	2
International Journal of Management Reviews	3	–	3
International Journal of Production Economics	3	–	3
Journal of Business Continuity & Emergency Planning	3	–	3
Journal of Business Research	3	1	2
Journal of Cleaner Production	3	3	–
Journal of Management Control	3	3	–
Strategic Management Journal	3	2	1
The British Accounting Review	3	3	–
Business Strategy & the Environment	2	1	1
European Accounting Review	2	2	–
Handbook of Management Accounting Research	2	2	–
Industrial Marketing Management	2	–	2
International Journal of Project Management	2	1	1
Journal of Business Strategy	2	–	2
Journal of Contingencies and Crisis Management	2	–	2
Journal of Management & Organization	2	–	2
Natural Hazards Review	2	–	2
Omega	2	–	2
Scandinavian Journal of Management	2	1	1
Others	80	28	52
Total	198	99	99

accounting,[4] covering the period from 1987 through 2023. We chose this period because (1) resilience in the business and management literature originated in the 1980s, when researchers began to explore how organizations respond to external

[4] To bridge the literatures on organizational resilience and MCSs, we limit this study to works in the field of organizational resilience that focus on management at the organizational level. Research in other relevant areas, such as supply chain resilience (Annarelli & Nonino, 2016; Giancotto & Mauro, 2020), is beyond this study's scope.

threats (Linnenluecke, 2017), and (2) Robert Simons (1995b) published the levers of control framework in 1995. That framework culminated his research, which he had published in academic journals in the late 1980s and early 1990s (Simons, 1987, 1991, 1992, 1994, 1995a).

As part of our search, we seek articles containing such common search terms as "management control system" and "resilience" or "levers of control" and "resilience." As this search returned only a few results, we decided to use additional keywords, including management control-specific and resilience-specific terms to find publications that do not explicitly use the terms MCS, levers of control, or resilience but cover relevant aspects in both literatures. For additional search terms in the MCS literature, we were guided by literature reviews of the relationship between MCSs and other research topics, such as environmental MCSs (EMCSs) (e.g., Guenther et al., 2016), sustainability MCSs (SMCSs) (e.g., Roos & Guenther, 2020), sustainable development (e.g., Lueg & Radlach, 2016), and digitalization (e.g., Fähndrich, 2023). We seek articles containing such common search terms as "MCS" and "resilience," "management control" and "resilience," or "managerial control" and "resilience." For additional search terms related to Simons's levers of control, we were guided by a literature review in the fields of MCSs and sustainability reporting (e.g., Traxler et al., 2020). We seek articles containing such common search terms as "belief system" and "resilience," "boundary system" and "resilience," "diagnostic control system" and "resilience," or "interactive control system" and "resilience." For additional search terms in the organizational resilience literature, we were guided by the work of Duchek (2020). We seek articles containing such common search terms as "anticipation" and "management control system," "coping" and "management control system," "adaptation" and "management control system," or "redundancy" and "management control system." In addition, we seek further articles by combining the additional search terms in the literatures on MCSs, levers of control, and organizational resilience mentioned above.

In the third step, we defined the exclusion criteria, namely all papers whose title or abstract does not refer to management control, organizational resilience, or at least to related aspects in the sense of our conceptual OR/MCS framework and the associated search terms mentioned above. We include articles that use the levers of control framework as well as those that use a different MCS framework (e.g., Merchant & van der Stede, 2003) in the context of organizational resilience. We also consider articles that contain the term MCS or one of the other management control-specific terms listed above in the context of organizational resilience in the title or abstract.

In the last step of the search, we checked the references in the articles we had collected to identify works our search had omitted. In this step, we did consider the limitations of "snowball sampling" or "chain referral sampling," as Biernacki and Waldorf (1981, p. 141) describe them. In addition, we read and analyzed each article in the final sample of 198 articles.

Figure 2 shows the research protocol we describe above, while Appendix 1 displays the search terms and the respective results in the EBSCO and ScienceDirect databases. Figure 3 views the relationship between the two literatures described above from the perspective of our systematic literature search, while Fig. 4 provides

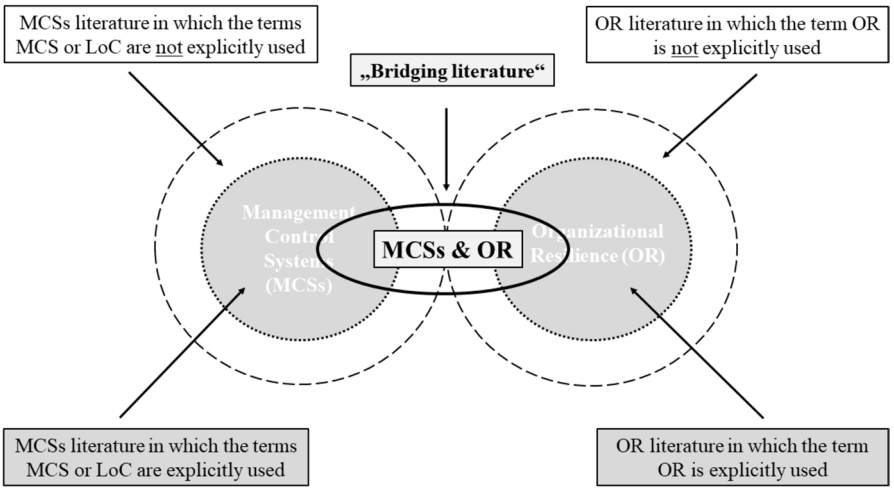

Fig. 3 The relationship between the literatures on MCSs and organizational resilience from the perspective of the systematic literature search

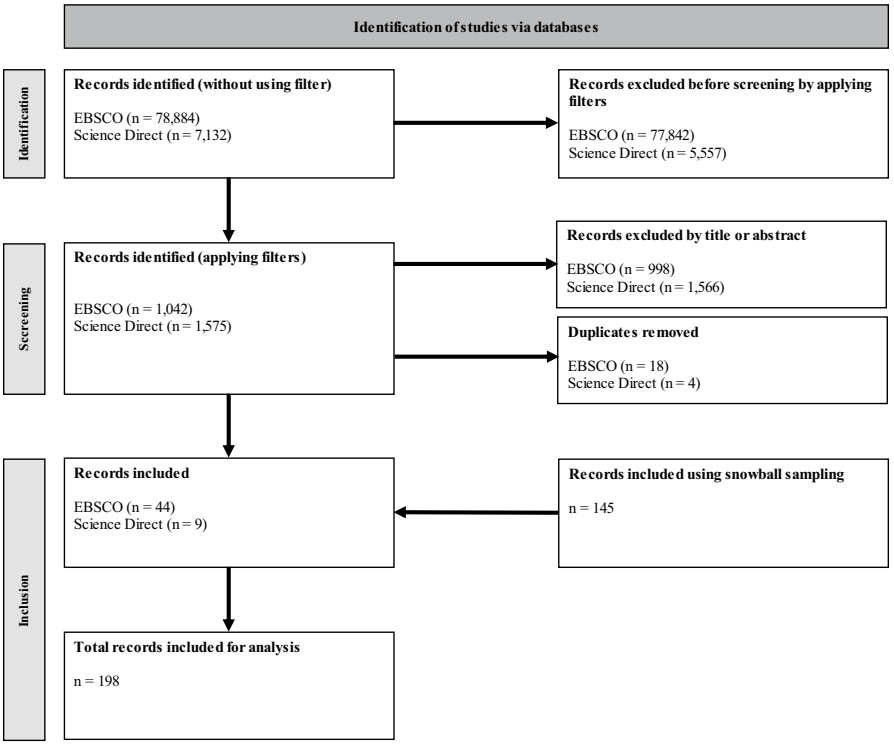

Fig. 4 Identification, screening, and inclusion of studies following the PRISMA guidelines

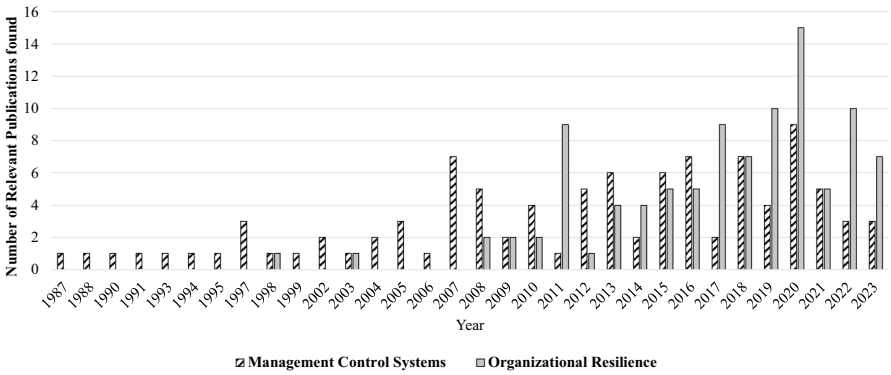

Fig. 5 Temporal distribution of relevant publications found in the literatures on organizational resilience and MCSs from 1987 to 2023 inclusive (total: 198)

an overview of the search process to obtain the final number of publications for analysis following the PRISMA guidelines proposed by Page et al. (2021).

In addition to the bibliometric and content analysis, we used the conceptual OR/MCS framework that we develop in Sect. 2 to classify the existing approaches in Simons's works on levers of control and in the literatures on MCSs and organizational resilience (see Sect. 4.2).

We conducted thematic analyses following Bisbe et al. (2007) and applied code-development techniques based on Boyatzis (1998). We proceeded in three steps. First, we classified in ascending chronological order excerpts from Simons's publications (Simons, 1987, 1991, 1992, 1994, 1995a, b) that relate to measures or capabilities of organizational resilience or to organizational resilience in general. Next, we summarized the quotations to the four levers of control (i.e., beliefs systems, boundary systems, diagnostic control systems, and interactive control systems). Finally, we mapped the excerpts according to the three stages and the related temporal reference that Duchek (2020) distinguishes in her resilience framework.

To classify approaches to organizational resilience in the MCSs literatures and approaches to management controls and MCSs in the organizational resilience literatures, we followed the same methods described above.

4 Results

In this section, we provide and investigate the results of the PRISMA and Tranfield et al. (2003) based systematic literature review (Sect. 3). The results section consists of two parts: First, we provide a descriptive analysis and bibliometric analysis. In the second part, we use our framework (Fig. 1), which bases on the stages of Duchek (2020).

4.1 Descriptive analysis

Figure 5 shows the number of publications in the fields of organizational resilience and MCSs that we identified through our literature research. Resilience is a relatively new concept in the organizational literature, but academic interest in organizational resilience has grown steadily. The number of publications in the field of organizational resilience has trended upward since 2008 (Annarelli & Nonino, 2016; Giancotti & Mauro, 2020). Table 1 shows how the publications in our sample are distributed by journal.

Regarding the publications in business research-relevant journals, a comparison between disciplines of business research shows that the dominant disciplines driving forward research on organizational resilience and MCSs are Management Accounting, Production, Sustainability, and General Management (see Table 1).

4.2 The relationship between organizational resilience and MCSs

To support the implementation of organizational resilience measures and the development of organizational resilience capabilities with MCSs and to investigate how MCSs need to be designed to increase resilience, we began by researching the relevant literature. Specifically, we sought approaches to or indications of organizational resilience aspects in the literatures on MCSs. We also examined the literature on organizational resilience to identify possible approaches to or hints about management controls or MCSs.

4.2.1 Approaches to organizational resilience in the MCS literatures

Addressing organizational resilience and MCSs could provide insights into how organizations can better integrate resilience into their strategies. Specifically, understanding the relationship between resilience measures and capabilities, management controls, and MCSs could help organizations design relevant controls, including controls we describe as resilience-oriented management controls. The results of our search, which we present below, are listed in Tables 6 and 7 (Appendix).

There are several observations on interactive control systems in Simons's studies and the MCSs literature that are relevant to the anticipation and proactive approaches Duchek (2020) describes. In the literature on MCS, initial empirical findings on management controls, MCSs and Simons's levers of control have emerged that are relevant to organizational resilience in general and to Duchek's (2020) three resilience stages. With their study of MCSs and firm performance in the face of complex environments, Arrive and Feng (2018) show that an MCS with an anticipatory or, following Duchek (2020), proactive focus is a relevant factor for effective management control. With their empirical study during the COVID-19 pandemic, Passetti et al. (2021) find that management control mechanisms such as beliefs systems and interactive control systems enable crisis management, which relates to the coping stage and concurrent approach Duchek (2020) describes. On the other hand, these mechanisms enable an immediate

response to the crisis, which also increases the resilience of the organization and relates to the adaptation stage and reactive approach Duchek (2020) describes. Möller et al. (2022) empirically investigate the relationships between beliefs and boundary systems and control context, contextual ambidexterity, and organizational performance. The authors find that the use of boundary systems is positively associated with contextual ambidexterity, which seems to be a dynamic capability for organizations to increase their resilience, a result that similarly relates to the coping and adaptation stage Duchek (2020) describes. Recently, Baird et al. (2023) initially have examined the mediating role of levers of control on the association between sustainable leadership and organizational resilience. The authors show that the use of belief systems as well as diagnostic and interactive control systems mediates the impact of sustainable leadership on organizational resilience, thus increasing organizational resilience. Also recently, Martins et al. (2023) has investigated the role of management control practices as facilitators of organizational performance during crises. They empirically show that, in tumultuous times, organizations consider that management control practices have a significant impact on organizational performance.

In the literature we scanned, several aspects can relate to what Duchek (2020) describes as the coping stage, which involves concurrent action. Using the example of accounting information systems, Ezzamel and Bourn (1990) document how an organization facing an external crisis used its MCS interactively. Before the crisis, the accounting information systems operated "initially as a dialogue machine, and [during the crisis] as an idea machine" (Ezzamel & Bourn, 1990, p. 416). The authors distinguish among "pre-crisis management," "real time-crisis management," and "post-crisis management" (Ezzamel & Bourn, 1990, p. 400).

In their case study of top-performing organizations in the United States and Europe, Euske et al. (1993) show that, in the face of a crisis, organizations relinquished both their formal and informal control mechanisms to exercise high intensity forms of control over errant individuals or groups. The authors find that the performance measurement systems that firms use as diagnostic controls in these cases reflect their strategic objectives under stable operating conditions. The degree to which the firms in their study used or relied on formal measurement systems appeared to vary, depending on the firm's environment (Euske et al., 1993).

According to Tuomela (2005), who examines the interplay of different levers of control, "in uncertain environments financial [performance] measures are well suited [to] interactive use to stimulate discussion about different strategic uncertainties and how to deal with them" (Tuomela, 2005, p. 300). This finding relies on interactive control systems and relates to the coping stage and concurrent approach Duchek (2020) describes.

Using the levers of control framework to examine how banks responded to an external crisis, Janke et al. (2014) investigate how the perception of negative external factors affects the interactive use of MCSs and vice versa. The authors indicate that, when banks became increasingly aware of negative external factors, they used their MCS more interactively. The findings show that the interactive use of MCSs enhances how senior managers perceive such factors and events.

Regarding interactive control systems, Gond et al. (2012), who reviewed the use of MCSs in strategy-making, define interactive MCSs as "control systems that stimulate and guide emergent strategies in response to opportunities and/or threats within an organization's operating environment" (Gond et al., 2012, p. 207). According to the authors, interactive control systems draw the managers' attention to strategic uncertainties and generate new strategic responses to a changing environment (Gond et al., 2012).

In Table 2, we use a five × three matrix to list the citations we located in Simons's works on levers of control and the MCS literatures that contain aspects relevant to Duchek's (2020) stages of organizational resilience.

The table shows that, in these literatures, most of the approaches to implementing organizational resilience measures and supporting capabilities with an MCS relate to interactive control systems.

In Appendix 1, we detail further approaches to organizational resilience that we found in Simons's works on levers of control and the MCS literatures.

4.2.2 Approaches to levers of control and MCSs in the organizational resilience literature

To support the implementation of organizational resilience measures and the development of organizational resilience capabilities with MCSs, and to further explore how MCSs need to be designed to increase resilience, we also reviewed the literature on organizational resilience. We grouped the identified quotes to Simons's four levers of control and mapped the excerpts according to Duchek's (2020) anticipation, coping, and adaptation stages. The full list of citations in the organizational resilience literature, which we relate to MCSs according to Duchek (2020) is shown in Table 8 (Appendix).

Our literature review shows that there are several concepts and arguments regarding MCSs and management controls in general that are relevant to Duchek's (2020) three stages. Kantur and İşeri-Say (2012), for example, present an integrative framework and argue that how organizational resilience and strategic

Table 2 Number of citations in LoC and MCS publications relating to the stages of organizational resilience Duchek (2020) developed (5 × 3 matrix)

		Duchek's (2020) organizational resilience framework		
		Anticipation stage	Coping stage	Adaptation stage
Simons' levers of control	Beliefs systems	1	2	4
	Boundary systems	1	1	7
	Diagnostic control systems	2	2	3
	Interactive control systems	8	8	20
MCS	Unspecified	1	1	10

management might interrelate is a research question worth asking. They consider possible "sources of organizational resilience" that "incorporate factors of proactiveness and creativity," such as "strategic acting," and conclude that "resilience is directly related to innovation, intrapreneurship, or strategic entrepreneurship concepts," all of which are "central to discussions in strategic management research" (p. 772). In evolving environments, organizations must be resilient to thrive; resilience is associated with renewal. Consequently, the authors conclude, to achieve organizational outcomes, it is necessary to link entrepreneurial activities and strategies for organizational resilience (Kantur & İşeri-Say, 2012).

In their multiple-case analysis of the public sector before and after the global financial crisis, Barbera et al. (2020) conclude that accounting practices, such as planning, monitoring, control, and budgeting, support an organization's anticipatory and coping capacities and that these practices increase organizational resilience. The authors also note that MCSs were increasingly introduced during and after the financial crisis to improve revenue collection and support decision-making. Palmi et al. (2018) show that organizational resilience depends on the adoption of corporate governance practices, such as incentives systems; the adoption of corporate governance and control processes increases long-term economic performance and resilience. Ortiz-de-Mandojana and Bansal (2016) similarly demonstrate that certain social and environmental practices, such as investment in reliable high-quality goods and services, contribute to resilience.

With their longitudinal case study on public-sector organizations, Bracci and Tallaki (2021) examine how an MCS, as the driver of organizational change, can increase resilience. The authors show that the four MCSs Simons (1995b) describes (i.e., beliefs systems, boundary systems, diagnostic control systems, and interactive control systems) help create and strengthen such capabilities as anticipation and coping, which render an organization financially resilient.

In his empirical study, Al Balushi (2021) examines how a management system, such as ISO 9.001, affects internal transparency by enabling a public entity's MCS and therefore its resilience. He notes that implementing a management system based on teamwork and performance indicators improves both the flow of information (through extensive documentation and reporting) and teamwork, enhances communication, and helps establish norms, standards, accountability, and responsibility.

Andersson et al. (2019) show that organizational processes and structures, such as corporate philosophy, a decentralized structure, information systems, and human-resource management processes can foster such resilience capabilities as risk awareness, agility, and improvisation. In addition, they note that, to achieve organizational resilience, organizations need to balance aspects such as power distribution (which creates preparedness for local action) and normative control to support alignment and stability.

In their case study, Ignatiadis and Nandhakumar (2007) show that enterprise-wide information systems can impact organizational resilience. While power differentials, that is, disembedding processes, can increase control, they may decrease organizational resilience. Consistent embedding processes, however, can cause drift,

Table 3 Number of citations in the organizational resilience literature relating to MCS or LoC (5×3 matrix)

		Duchek's (2020) organizational resilience framework		
		Anticipation stage	Coping stage	Adaptation stage
Simons' levers of control	Beliefs systems	6	7	6
	Boundary systems	3	3	3
	Diagnostic control systems	4	4	4
	Interactive control systems	6	7	6
MCS	Unspecified	9	10	9

which, if managed, can increase organizational resilience. To increase resilience, organizations must balance both processes (Ignatiadis & Nandhakumar, 2007).

In the organizational resilience literature, we located a study whose findings are broadly relevant to the coping stage in Duchek's (2020) framework. Pal et al. (2014), who empirically study the antecedents of organizational resilience in Swedish textile and clothing small and medium-size enterprises, find that leadership and management decision-making facilitated resilience during a crisis. The authors observe that the companies they studied "could [break away] from the 'command and control culture' generally prevalent in small family firms [and] became more entrepreneurial and open, and showed [higher] economic resilience" (Pal et al., 2014, p. 420).

In Table 3, we use a five×three matrix to summarize the citations we found on organizational resilience that are relevant to MCSs.

As the table shows, in this literature, most studies relate to beliefs systems and interactive control systems, while a few relate to diagnostic control systems and boundary systems. Due to the general resilience perspective of the respective authors, most relevant references can relate to all three stages of Duchek's (2020) framework. Appendix 2 details further approaches to management controls and MCSs that we found in the organizational resilience literatures.

Below we summarize the studies that initially examine relationships between management controls, MCSs, and organizational resilience, and we highlight their methods and themes. Following Edmondson and McManus (2007, p. 1158), we divide the respective research topics, which we have categorized according to the key words of the studies, into three categories—"nascent," "intermediate," and "mature" in terms of their theoretical contribution and the balance between existing and novel research.[5] The studies we consider employ a number of empirical research methods, which we summarize in Table 4. The research areas these studies

[5] "Nascent theory" is characterized by the open-ended investigation of a phenomenon that can generate novel theory. "Intermediate theory" is positioned between "nascent" and "mature" areas. The respective studies draw on prior work, often from different literatures, and suggest relationships between new and established constructs. A "mature theory" includes precise models, focused research questions, and multiple settings and relates to a growing body of interrelated theories. The respective works tend to refine previous research (Edmondson & McManus, 2007, p. 1158).

Table 4 Research methods and categorization of topics in the literatures on joint MCS and organizational resilience research

Research method	Number	Percent
Single-Case studies	5	21.7
Multiple-Case studies	1	4.3
Survey	9	39.1
Interview	2	8.7
Panel-Data analysis	3	13.0
Mixed method	3	13.0
Total	23	100
Nascent	Intermediate	Mature
(Quality) Management systems Organizational studies Environmental studies Crisis management and Resilience studies Strategic management Studies Organizational Performance COVID-19 Crisis Contextual Ambidexterity Sustainable leadership	Sustainable Business Practices Public sector Accounting Enterprise (Information) Systems	

cover are also listed in Table 4, according to the level of maturity the research has reached. The classification by maturity level follows the guidelines of Edmondson and McManus (2007, p. 1158).

5 Discussion

Within our systematic literature review, we identify initial empirical results and approaches in recent research showing that organizations can benefit from using existing management controls and MCSs to support the development of resilience. We argue that these results suggest that it is better to use MCSs to implement resilience-oriented parts of the business strategy in organizations. We thus argue that organizations can increase their resilience if they support the implementation of resilience measures and the development of resilience capabilities within their existing MCSs. Our analysis also points to key questions about how an organization should design and apply each of Simons's (1995b) levers of control, which resilience measures it should implement, and which capabilities it should support with its management controls and its MCS. The answers are likely to become decisive indicators of an organization's resilience in a dynamic environment and in times of strategic uncertainty.

Although we found research papers in the resilience literatures that deal with organizational resilience from a strategic perspective, such as Mamouni Limnios et al. (2014), Annarelli and Nonino (2016), the resilience literatures tend toward a more general understanding of terms related to uncertainty, mostly in the context of organizational survival.

Some authors refer generally to "potential threats," "adverse events," and "changing conditions" (e.g., Duchek, 2020, p. 220) or to "adversity" (e.g., Williams et al., 2017, p. 742), while others refer to "disturbances" (e.g., Ruiz-Martin et al., 2018, p. 21) or to "perturbation" (e.g., Koronis & Ponis, 2018, p. 33), using the terms almost synonymously. Lengnick-Hall et al. (2011), for instance, note that "a firm's capacity for developing organizational resilience […] when aggregated at the organizational level, make[s] it possible for organizations to effectively absorb uncertainty, develop situation-specific responses to threats, and ultimately engage in transformative activities so that they can capitalize on disruptive surprises that potentially threaten their survival" (p. 248).

The findings in Tables 2 and 3 confirm that a direct link between MCSs and organizational resilience has not been sufficiently investigated in the literature and there are only initial results or approaches to bridging the issues in both literatures. As Tables 2 and 3 illustrate, our analysis of the literatures on MCSs and organizational resilience found more approaches or hints in the MCSs literature that can be linked to organizational resilience than approaches or hints in the literature on organizational resilience with relation to MCSs. From the perspective of organizational resilience, it is more difficult to establish a relationship between resilience measures and management controls or MCSs. In crises, maintaining organizational resilience is not directly associated with an adjustment of the organization's business strategy and the alignment of management controls and MCSs, as the focus is often on survival in the short term (Ruiz-Martin et al., 2018). This supports our argument that it could be better to implement resilience aspects with existing MCSs to be better prepared for a crisis.

For the purposes of our analysis, we drew connections between resilience at the organizational level and management controls and we based our framework on Duchek (2020) and the four levers of control of Simons (1995b). Simons (1995b) emphasizes that a firm must establish and balance four types of MCSs to provide an effective control environment (Kruis et al., 2016; Nilsson, 2010; Simons, 2000). Our OR/MCS framework suggests that managers must integrate and balance management controls and MCSs to support the implementation of anticipatory, coping, and adaptive measures and the development of resilience capabilities to implement their strategies and to survive in the short term and thrive in the long term. The term "balance" means that managers must choose appropriate management controls and MCSs (i.e., management controls and MCSs that can be used to increase resilience) that are already in use or are additions and use them more or less actively, depending on the situation.

Table 2 shows that interactive control systems are suitable for implementing anticipatory resilience measures and supporting anticipatory resilience capabilities, as they enable organizations to assess and preempt threats, that is, to build resilience proactively. Similarly, our results show that interactive control systems help organizations cope with crises. This finding comports with previous evidence that organizations use the levers of management control interactively when faced with unexpected adversity (Euske et al., 1993; Ezzamel & Bourn, 1990; Janke et al., 2014; Simons, 1991, 1994, 1995b; Tuomela, 2005). It would be interesting for researchers to investigate possible interactions between individual

control levers at different stages of organizational resilience (i.e., the anticipative, coping, and adaptive resilience stage). As Simons (1995b, p. 153) points out, "the power of the control levers does not lie in how each is used alone but rather in how they complement each other when used together."

Furthermore, as Table 2 shows, reactive and adaptive measures could be implemented, and reactive and adaptive capabilities of resilience could be supported with interactive control systems. We argue that, if organizations do not adapt, their resilience will weaken. Teixeira and Werther (2013) find that innovation (which includes reactive, proactive, and anticipatory elements) and how organizations manage it by means of interactive control systems (such as establishing communication between the top management and the rest of the organization) are fundamental to resilience capacity and that organizations that adapt continuously remain resilient. This finding comports with the conclusions of Hillmann and Guenther (2021) that innovations are a crucial source of organizational resilience. Consequently, an innovative, adaptable organization could prove more resilient than less innovative, less adaptable one by designing and using its management controls and MCSs to support its resilience.

In crises, managers must pursue not only short-term operational goals but also long-term strategic ones. To that end, they must consider the aspects of anticipation, coping, and adaptation by choosing the appropriate control levers and preparing for future crises. In other words, based on our conceptual OR/MCS framework, our findings indicate that organizations must use management control levers interactively to support the implementation of anticipatory, coping, and adaptive resilience measures and the continued development of their resilience capabilities.

With our study, we identified recent research that provides initial empirical evidence on the relationships of MCSs, management controls, and organizational resilience in the MCS literature, such as Passetti et al. (2021), Möller et al. (2022), Baird et al. (2023), and Martins et al. (2023). Passetti et al. (2021) find that the use of beliefs systems and interactive control systems enable crisis management, which also increases resilience. Möller et al. (2022) find that the use of boundary systems is positively associated with contextual ambidexterity, which seems to be a dynamic capability for organizations to increase their resilience. Baird et al. (2023) show that the use of belief systems as well as diagnostic and interactive control systems mediates the impact of sustainable leadership on organizational resilience, thus increasing resilience. Martins et al. (2023) show that, in tumultuous times, organizations consider that management controls significantly impact organizational performance, thus increasing resilience.

Considering these studies together, they provide initial empirical support for the use of all four levers of control, supporting our argument in favor of setting up integrated MCSs, instead of separate systems, and supporting our conceptual OR/MCS framework.

Our analysis also identified relationships between organizational resilience and MCSs in the organizational resilience literatures, although fewer than in the MCS literature, as Table 3 shows.

According to Mamouni Limnios et al. (2014), organizational resilience is typically conceived as a desirable attribute in such approaches as complex systems survival, system adaptation, absorbance of disturbance, or the ability to rebound

and recover from adversity. Simons (1995b) takes a different view. He argues that two of the control levers (beliefs systems and interactive control systems) can be viewed as motivators and the other two (boundary systems and diagnostic control systems) as constraints. He describes this interaction as yin and yang and explains that "the interplay of positive and negative forces generated by these systems creates a dynamic tension between the opportunistic innovation and predictable goal achievement that is necessary for profitable growth" (Simons, 1995b, p. 153). Following Mamouni Limnios et al.'s (2014) argument that organizational resilience is typically understood as a desirable attribute, we conclude that organizations might benefit from implementing resilience measures or developing resilience capabilities with beliefs systems and interactive control systems. This conclusion comports with the views of Akgün and Keskin (2014), Seville et al. (2015), Koronis and Ponis (2018), and Hollands et al. (2023) and is shown in Table 3.

We further identified empirical studies on the relationships of MCSs, management controls, and organizational resilience measures and capabilities in the organizational resilience literatures. Our analysis shows that researchers often consider the concept of resilience in the organizational context in a rather general way (see Table 3), without specifying it and without dividing it into individual stages, as Duchek (2020) does.

In a recent study, Beuren et al. (2020) find that the enabling perception of MCSs influences the capabilities of organizational resilience. Previously, Akgün and Keskin (2014) had found that organizations that increase resilience capacity through MCSs (such as beliefs systems like open communication channels and interactive control systems like face-to-face dialogues) exhibit higher product innovativeness and performance. Similarly, Bracci and Tallaki (2021) show that MCSs shape the anticipatory and coping capacities of organizations and enable them to remain financially resilient when faced with external shocks. We argue that their work, like the previous studies, shows that there are effects between existing management controls, MCSs, and the organization's resilience capacity—in this case, anticipatory and coping organizational resilience measures (Bracci & Tallaki, 2021).

Ortiz-de-Mandojana and Bansal (2016) show that social and environmental practices associated with management control practices or management controls contribute to organizational resilience. They find that, over the 15 years their study covers, organizations that adopted responsible practices exhibited lower financial volatility, higher revenue growth, and higher survival rates, all of which indicate resilience. This finding agrees with the findings of Palmi et al. (2018) that corporate governance and environmental and social practices influence the long-term outcomes of organizations and thus indicate resilience. The findings of Ortiz-de-Mandojana and Bansal (2016) and Palmi et al. (2018) support our conceptual organizational resilience/MCS framework and the associated argument that appropriate management controls or resilience-oriented management controls boost resilience capacity (for instance, by supporting the implementation of organizational resilience measures and the development of resilience capabilities with integrated resilience-oriented MCSs).

In their pioneering empirical study on how accounting shapes financial resilience in organizations, Barbera et al. (2020) find that accounting practices, such as

planning, monitoring, control and budgeting, complement anticipatory and coping resilience capacity. Andersson et al. (2019) provide initial empirical evidence that organizational processes and structures associated with MCSs (particularly beliefs systems and diagnostic control systems) can foster such organizational resilience principles as risk awareness, agility, improvisation, and cooperation. We argue that these principles underpin measures and capabilities for increasing organizational resilience, and, like the findings of Barbera et al. (2020), these results further strengthen our argument that integrated resilience-oriented management controls and MCSs support the implementation of resilience measures and the development of resilience capabilities.

Based on semi-structured interviews, Al Balushi (2021) examines how quality management systems enable MCSs, affecting internal transparency and thus increasing resilience capacity as well as the mediating role of management systems in organizational resilience. These results suggest a positive relationship between MCSs (resilience-oriented MCSs) and resilience capacity, further supporting our conceptual framework.

We expect that practices of governance, in the sense of control (Ortiz-de-Mandojana & Bansal, 2016), contribute to the implementation of organizational resilience measures and the development of organizational resilience capabilities, provided that the organization's MCS is well designed and implemented. In this regard, the findings of Barasa et al. (2018) indicate that traditional governance practices, such as decentralization or nonlinear planning, support resilience. Van der Meer-Kooistra and Scapens (2008) likewise find that, when specific management control practices are underpinned by social, technical, institutional, and economic structures, they strengthen relationships between and within organizations and allow organizations to manage more flexibly. We argue that their findings support the argument that the design of an MCS can increase resilience capacity by fostering the selection and use of appropriate governance practices. This, in turn, can create supporting effects between governance practices and organizational resilience measures and increase overall resilience.

The work of Pal et al. (2014) supports the above argument. The authors find that firms that could break away from the command-and-control culture showed greater economic resilience. Simons (1995b) also proposes innovation and control, rather than the more traditional command and control, in his levers of control framework. We therefore argue that organizations that focus on innovation and control and select and implement an appropriate MCS with resilience-oriented management controls could increase their resilience.

Moreover, our findings could also help supplement current organizational resilience approaches and contribute to the development of an organizational resilience theory. Currently, resilience theory is limited to subareas, such as socio-ecological resilience (Clément & Rivera, 2016; Quinlan et al., 2016). Resilience theory in the organizational context is nascent (Cheng et al., 2020; Mallak, 1998; Vogus & Sutcliffe, 2007) and lacks integration with MCSs. This approach is also intended to encourage top managers to make their management controls and MCSs more resilience-oriented to achieve the resilience objectives embedded in the organization's business strategy.

Finally, regarding the question of whether integrating organizational resilience into regular MCS or using separate MCS, we see links to other streams of research, in particular SMCSs. Without the linking of regular MCSs with sustainability, i.e., the development of SMCSs, EMCSs, or, in the case of this study, integrated MCSs with resilience orientation, employees will stick to the regular or separate MCSs. We consider a separate system to be an independent system in the context of MCS, such as a separate monitoring system for target achievement. If targets from different areas, such as incentive targets or efficiency targets, are combined in a common monitoring system, we consider this to be an integrated system.

We assume that resilience issues, similarly to sustainability or environmental issues, can be managed with regular MCSs (e.g., Simons, 1995b). In the case of sustainability or environmental issues, there are MCSs with an explicit focus on sustainability or sustainability orientation or with an environmental focus (e.g., research on SMCSs, such as by De Villiers et al., 2016 and Crutzen et al., 2017, or on EMCSs, such as by Günther et al., 2016 and Rötzel et al., 2019). Rötzel et al. (2019), for instance, found that the integration of MCSs is advantageous compared to separate MCSs.

Management controls and MCSs are used, for example, with an explicit focus on sustainability to translate an organization's sustainability strategy into managerial actions. However, in contrast to sustainability, it could be advantageous for organizations to have a separate MCS to manage resilience aspects due to a dynamic organizational structure or a difficult and challenging market environment. In terms of the strategy's focus and alignment, the question arises whether it is better to implement resilience aspects with existing MCSs or to consider them separate from existing MCSs. Finally, following Gond et al. (2012), who state that, when used and designed appropriately, an MCS can drive an organization toward sustainability, we argue that an appropriately designed and implemented resilience-oriented MCS in regular MCS can support the enhancement of resilience and, in turn, the achievement of the resilience objectives embedded in the organization's business strategy.

Based on the comparison of our conceptual OR/MCS framework with our findings, we identified underdeveloped research areas and open research questions. We hope that these research avenues serve as a starting point for fruitful discussion on these topics.

We have identified a few very recent studies that explicitly address the topics of MCSs and organizational resilience. Furthermore, we identified various studies dealing with individual MCSs in the resilience context, mostly of general nature without much detail. We found no study that explicitly investigated the joint use of Simons's four levers of control and their interrelationship in the context of organizational resilience.

We should add that the research we review in the organizational resilience literature does not extend to how MCSs should be explicitly designed and implemented, i.e., which individual levers of control should be strengthened to support organizational resilience measures and capabilities, and what supporting effects different levers can have on resilience.

As Table 4 shows, we found no experimental research linking the field of organizational resilience and MCSs. We call for future experimental research (see Sprinkle & Williamson, 2006) that bridges the gap between the design of organizational resilience and the ability of top management to control organizational behavior, for example, via management controls and MCSs.

Most of the studies we have identified are empirical but none of them examine explicitly and in detail how organizations should design and use their management controls and MCSs and which levers of control they should strengthen to increase their resilience. Similarly, there is a lack of research on how different levers interact and how their interaction might affect resilience. We think this is a potential avenue for further research.

We also call for further research on whether implementing organizational resilience measures and supporting resilience capabilities with MCSs is better than using two parallel management systems. In this regard, researchers could explore whether organizations can better increase resilience by implementing resilience measures and supporting resilience capabilities with their MCSs to build resilience-oriented management controls and MCSs, focusing on the design or use of the MCS, or both. Investigating the complementarity between individual management controls (Widener, 2007) in the context of organizational resilience could also be a fruitful avenue for research. For example, scholars could examine which individual levers of control an organization should strengthen, how different levers interact, and how they jointly affect resilience. In the context of sustainability, future research could also investigate how the economic, environmental, and social aspects of sustainability may interrelate with MCSs as well as anticipatory, coping, and adaptive organizational resilience measures and capabilities. Examining the impact of implementing resilience measures and supporting resilience capabilities with MCSs between organizations in the same and in different industries could provide further insights.

The literature in our sample draw primarily on single-case or survey research (Table 4). We propose that future studies use both quantitative and qualitative methods as well as mixed methods (e.g., Venkatesh et al., 2013) to examine the link between MCSs and organizational resilience to get a broader approach to this phenomenon. Martyn et al. (2016) argue that "the use of control systems in an interactive manner during crisis periods merits further attention" (p. 292; see also Janke et al., 2014). Researchers could respond by conducting, for instance, cross-sectional or longitudinal studies on crises to gain insights that, according to van der Stede (2011), are unavailable in normal times.

6 Concluding remarks

Managing challenges and crises in a changing business climate requires developing organizational capacities to anticipate, cope, and adapt. Crises can have a lasting impact on organizations. In this context, understanding how the implementation of organizational resilience measures and the support of resilience capabilities through MCSs can help organizations survive and thrive is becoming increasingly important.

We build a framework by synthesizing Duchek's (2020) capability-based organizational resilience conceptualization and Simons's (1995b) levers of control framework to analyze the literatures on MCSs and organizational resilience. We search these literatures for approaches for how organizations can support the implementation of resilience measures and the development of resilience capabilities with their management controls and MCS.

We contribute to both the literatures on MCSs and organizational resilience a systematic bibliometric analysis of how organizational resilience relates to MCSs, which we supplement with a content analysis. We propose the labeling of resilience-oriented management controls and resilience-oriented MCSs and present a conceptual framework that integrates organizational resilience aspects into the organization's business strategy.

Our results show that there are few initial empirical approaches in both literatures that begin to describe the relationship between the design and use of existing management controls and MCSs and an associated increase in resilience, but mostly without much detail. Based on the sum of our studies identified, we conclude that the design and use of management controls and MCSs can increase organizational resilience. We conclude that it is better to integrate resilience-oriented MCSs in regular MCS rather than setting up standalone MCSs to increase organizational resilience. The results of our literature analysis support our conceptual OR/MCS framework. The results of the studies identified, such as those by Barasa et al. (2018), Ortiz-de-Mandojana and Bansal (2016) and Pal et al. (2014), suggest that, by applying suitable management controls and MCSs, resilience aspects can be embedded within the organization. This in turn enables the support of the implementation of organizational resilience measures and the development of organizational resilience capabilities as well as the implementation of the resilience objectives embedded in the organization's strategy. One practical implication of our findings would be that organizations could save themselves the effort and associated resources to build a separate MCS for resilience aspects and use their resources in other ways. Furthermore, an integrated MCS with a focus on resilience means that organizations can better prepare for (i.e., anticipate) any unforeseen events, as resilience aspects are already anchored, i.e., integrated, in the existing MCS. As it is generally not possible for organizations to prepare for all unforeseen events, they can react more flexibly, develop and implement solutions more quickly, and adapt better and faster to new situations when an unforeseen event occurs if they already have an MCS with resilience aspects in place. This could be an MCS, for example, which monitors resilience-related aspects or focuses on networking with regard to resilience-related aspects.

We respond to previous calls for more research in these areas (e.g., Al Balushi, 2021; Barbera et al., 2020; Bracci & Tallaki, 2021; Clément & Rivera, 2016; Kantur & İşeri-Say, 2012; Williams et al., 2017), as we take a step toward closing gaps between the literatures on MCSs and organizational resilience and toward helping researchers and managers understand why some organizations are more resilient than others.

Like most studies, ours has limitations. First, to investigate the literature, we relied exclusively on the EBSCO and ScienceDirect databases. Future research

could investigate other research areas (e.g., on logistics or supply chains) for insights into how organizations can design and use their MCS or how they can design and use what we describe as resilience-oriented management controls and MCSs. Despite our efforts, we may have missed some relevant studies. Future research could use additional databases and additional resilience-related search terms, such as "crisis/es", "adversity" or additional MCSs-related search terms, such as "performance measurement", "accounting", and "budgeting".

A second limitation might be that we focus primarily on Simons's levers of control (Simons, 1995b) when classifying studies. Other researchers could extend this focus to Simons's later works, which address topics that his earlier works do not cover, such as the roles of resource allocation, organizational structure, motivation, and incentive systems in organizational resilience. In addition, research could use other MCS frameworks (e.g., Merchant & van der Stede, 2003) to classify the bridging studies in both literatures and to provide additional research avenues and opportunities. Third, literature reviews, such as ours, only provide meta-analytical or theoretical insights. Future researchers could use our study as a starting point for empirical research linking the topics of MCSs and organizational resilience.

Appendix

See Tables 5, 6 and 7.

Appendix 1

MCSs and Duchek's anticipation stage—Interactive control systems

Top managers can combine and use various measures and mechanisms to draw the attention of the entire organization to strategic uncertainties (Simons, 1991). Unlike "defenders," organizations described as "prospectors" (i.e., firms that compete through new products and market development) are likely to use their MCSs more intensively to monitor uncertain and changing environments (Simons, 1987).

MCSs and Duchek's anticipation stage—Boundary systems

To design boundary systems, managers must explicitly recognize the risks posed by both industry competitive dynamics and organizational strategic decisions (Simons, 1995b).

MCSs and Duchek's coping stage—Interactive control systems

The qualitative evidence that Janke et al. (2014) provide suggests that the banks in their study used cash-flow information, forecasts, and budgeting more interactively during an economic crisis. It is noteworthy that, in line with the literature,

Table 5 Number of results in the EBSCO and Science Direct Databases. Duplicates for different search terms were excluded manually in both databases

Database	Search term 1	Search term 2	Total results without filters	Results after applying filters	Selected due to title or abstract	Excluded due to duplicates	Included due to title or abstract	Excluded due title or abstract
EBSCO	Management control system	Resilience	1,775	21	1	0	1	20
	Levers of control	Resilience	260	96	7	0	7	89
	Management control	Resilience	8,829	58	4	0	4	54
	Managerial control	Resilience	654	6	1	1	0	6
	MCS	Resilience	457	8	2	1	1	7
	Belief system	Resilience	1,416	12	1	1	0	12
	Boundary system	Resilience	1,018	17	3	1	2	15
	Diagnostic control system	Resilience	37	76	9	1	8	68
	Interactive control system	Resilience	34	1	1	1	0	1
	Anticipation	Management control system	1,026	5	1	0	1	4
	Anticipation	Levers of control	264	91	4	0	4	87
	Anticipation	Management control	5,923	12	1	1	0	12
	Anticipation	Managerial control	761	56	1	1	0	56
	Anticipation	MCS	326	2	0	0	0	2
	Anticipation	Belief system	1,026	25	1	0	1	24
	Anticipation	Boundary system	489	2	0	0	0	2
	Anticipation	Diagnostic control system	28	22	1	0	1	21
	Anticipation	Interactive control system	21	11	4	2	2	9
	Coping	Management control system	1,061	7	1	0	1	6
	Coping	Levers of control	222	1	1	0	1	0

Table 5 (continued)

Database	Search term 1	Search term 2	Total results without filters	Results after applying filters	Selected due to title or abstract	Excluded due to duplicates	Included due to title or abstract	Excluded due title or abstract
	Coping	Management control	6,390	32	1	1	0	32
	Coping	Managerial control	1,222	1	0	0	0	1
	Coping	MCS	236	1	0	0	0	1
	Coping	Belief system	2,475	13	0	0	0	13
	Coping	Boundary system	817	6	0	0	0	6
	Coping	Diagnostic control system	22	1	0	0	0	1
	Coping	Interactive control system	62	15	0	0	0	15
	Adaptation	Management control system	3,293	55	2	1	1	54
	Adaptation	Levers of control	570	6	0	0	0	6
	Adaptation	Management control	17,149	138	5	2	3	135
	Adaptation	Managerial control	2,404	13	0	0	0	13
	Adaptation	MCS	728	28	0	0	0	28
	Adaptation	Belief system	3,947	25	0	0	0	25
	Adaptation	Boundary system	2,250	24	1	1	0	24
	Adaptation	Diagnostic control system	132	33	6	0	6	27
	Adaptation	Interactive control system	173	2	0	0	0	2
	Redundancy	Management control system	1,619	8	0	0	0	8
	Redundancy	Levers of control	213	78	3	3	0	78
	Redundancy	Management control	6,923	22	0	0	0	22
	Redundancy	Managerial control	740	2	0	0	0	2
	redundancy	MCS	347	8	0	0	0	8

Table 5 (continued)

Database	Search term 1	Search term 2	Total results without filters	Results after applying filters	Selected due to title or abstract	Excluded due to duplicates	Included due to title or abstract	Excluded due title or abstract
	Redundancy	Belief system	697	1	0	0	0	1
	Redundancy	Boundary system	728	1	0	0	0	1
	Redundancy	Diagnostic control system	81	0	0	0	0	0
	Redundancy	Interactive control system	39	0	0	0	0	0
		EBSCO Total	**78,884**	**1,042**	**62**	**18**	**44**	**998**
Science Direct	Management control system	Resilience	480	15	1	0	1	14
	Levers of control	Resilience	9	1	0	0	0	1
	Management control	Resilience	991	23	1	0	1	22
	managerial Control	Resilience	16	5	0	0	0	5
	MCS	Resilience	35	2	0	0	0	2
	Belief system	Resilience	89	0	0	0	0	0
	boundary System	Resilience	249	12	0	0	0	12
	Diagnostic control system	Resilience	14	0	0	0	0	0
	Interactive control system	Resilience	66	47	0	0	0	47
	Anticipation	Management control system	56	3	0	0	0	3
	Anticipation	Levers of control	2	2	0	0	0	2
	Anticipation	Management control	137	8	0	0	0	8
	Anticipation	Managerial control	5	5	1	1	0	5
	Anticipation	MCS	5	4	0	0	0	4
	Anticipation	Belief system	12	9	0	0	0	9
	Anticipation	Boundary system	22	17	0	0	0	17

Table 5 (continued)

Database	Search term 1	Search term 2	Total results without filters	Results after applying filters	Selected due to title or abstract	Excluded due to duplicates	Included due to title or abstract	Excluded due title or abstract
	Anticipation	Diagnostic control system	5	3	0	0	0	3
	Anticipation	Interactive control system	21	16	0	0	0	16
	Coping	Management control system	131	0	0	0	0	0
	Coping	Levers of control	5	5	0	0	0	5
	Coping	Management control	731	21	3	0	3	18
	Coping	Managerial control	18	18	1	1	0	18
	Coping	MCS	27	22	0	0	0	22
	Coping	Belief system	92	68	0	0	0	68
	Coping	Boundary system	48	38	1	0	1	37
	Coping	Diagnostic control system	8	6	0	0	0	6
	Coping	Interactive control system	24	16	0	0	0	16
	Adaptation	Management control system	615	0	0	0	0	0
	Adaptation	Levers of control	26	21	0	0	0	21
	Adaptation	Management control	1,540	49	3	1	2	47
	Adaptation	Managerial control	23	23	1	1	0	23
	Adaptation	MCS	48	36	0	0	0	36
	Adaptation	Belief system	144	112	0	0	0	112
	Adaptation	Boundary system	429	341	1	0	1	340
	Adaptation	Diagnostic control system	82	51	0	0	0	51
	Adaptation	Interactive control system	239	165	0	0	0	165

Table 5 (continued)

Database	Search term 1	Search term 2	Total results without filters	Results after applying filters	Selected due to title or abstract	Excluded due to duplicates	Included due to title or abstract	Excluded due title or abstract
	Redundancy	Management control system	175	0	0	0	0	0
	Redundancy	Levers of control	1	1	0	0	0	1
	Redundancy	Management control	312	255	0	0	0	255
	Redundancy	Managerial control	4	4	0	0	0	4
	Redundancy	MCS	16	10	0	0	0	10
	Redundancy	Belief system	24	21	0	0	0	21
	Redundancy	Boundary system	69	59	0	0	0	59
	Redundancy	Diagnostic control system	41	30	0	0	0	30
	Redundancy	Interactive control system	46	31	0	0	0	31
		Science direct total	**7,132**	**1,575**	**13**	**4**	**9**	**1,566**

Table 6 Citations in Simons's publications, which we relate to organizational resilience according to Duchek (2020)

Source	Levers of control	Organizational resilience stage	Time reference	Main findings potentially related to organizational resilience
1991	Interactive	Anticipation	Proactive	"Top managers focus their attention on strategic uncertainties that could derail their vision for the future and use selected systems interactively to focus the attention of the entire organization on these uncertainties" (p. 50)
1992	Interactive	Anticipation	Proactive	"These results (Simons, 1987) led to speculation that prospectors use their management control systems intensively to monitor uncertain and changing environments. Defenders, by contrast, use management control systems less actively" (p. 628)
1992	Interactive	Anticipation	Proactive	"The analysis shows that interactive management control processes can be used to manage emergent strategy: rather than focusing on what the organization already understands and does well, these systems direct organizational attention to emerging threats and opportunities" (p. 641)
1992	Interactive	Anticipation	Proactive	"The organization is energized [by the interactive process]: momentum is created to exploit existing strategies and to anticipate strategic uncertainties" (p. 641)
1994	Interactive	Anticipation	Proactive	"Managers participated actively in face-to-face meetings with subordinates to discuss both new data generated by the interactive control system and resulting action plans to preempt emerging threats and opportunities" (p. 180)
1995a	Interactive	Anticipation	Proactive	"Interactive control systems enable top-level managers to focus on strategic uncertainties to learn about threats and opportunities as competitive conditions change and to respond proactively" (p. 81)
1995b	Interactive	Anticipation	Proactive	"Changes evident in the data (of interactive control systems) warn participants to anticipate patterns of potential change in the future" (p. 108)
1995b	Boundary	Anticipation	Proactive	"Implementing a strategy successfully requires the anticipation and proactive control of the risks associated with that strategy (Risks to be avoided)" (p. 168)
1995b	Interactive	Anticipation	Proactive	"The time frame of diagnostic control systems is past and present, the time frame of interactive control systems is present and future" (p. 124)
1995b	Diagnostic	Coping	Concurrent	"The time frame of diagnostic control systems is past and present, the time frame of interactive control systems is present and future" (p. 124)
1995b	Interactive	Coping	Concurrent	"The time frame of diagnostic control systems is past and present, the time frame of interactive control systems is present and future" (p. 124)

Table 6 (continued)

Source	Levers of control	Organizational resilience stage	Time reference	Main findings potentially related to organizational resilience
1987	Unspecified	Adaptation	Reactive	"Hambrick (1983), however, found that Prospectors outperform Defenders in industries which are innovative and dynamic; Hambrick argues that this is due to their superior adaptability in these industries" (p. 370)
1991	Unspecified	Adaptation	Reactive	"Three of these businesses faced crises due to failed strategies and resultant losses. The strategic focus for top managers of these business was survival and the strategic uncertainty was: how do we change?" (p. 59)
1994	Unspecified	Adaptation	Reactive	"Allocation of attention is an especially serious constraint for new top managers attempting strategic turnaround as each attempts to learn the business, deal with problems and crises, develop new agendas, and marshall resources to implement new strategies" (p. 187)
1995b	Unspecified	Adaptation	Reactive	"Management control systems play a critical role in creating competitive pressures within the organization to innovate and adapt" (p. 92)
1995a	Beliefs	Adaptation	Reactive	"When problems arise, such as when J&J [Johnson & Johnson] faced the Tylenol crisis, the strong beliefs system embedded in its credo provided guidance regarding the types of solutions to search for" (p. 83)
1995a	Boundary	Adaptation	Reactive	"Each of those codes [codes of business conduct] was instituted after a major crisis impaired the integrity of the business" (p. 85)
1995b	Boundary	Adaptation	Reactive	"Most business conduct boundaries, then are developed and communicated after an incident or crisis exposes the firm to unexpected asset or reputation losses" (p. 44)
1995b	Boundary	Adaptation	Reactive	"Learning about an incident or crisis in another firm is a vicarious way of estimating the benefits of boundary systems" (p. 45)
1995b	Boundary	Adaptation	Reactive	"Just as business conduct boundaries are usually imposed after an incident or crisis, strategic boundaries are usually imposed when excessive search behaviour and experimentation have risked dissipating the firm's resources" (p. 48)
1995b	Boundary	Adaptation	Reactive	"Finally, business conduct boundaries are imposed any time that a crisis demonstrates the costs of errant employee actions' (p. 128)
1995b	Diagnostic	Adaptation	Reactive	'The time frame of diagnostic control systems is past and present, the time frame of interactive control systems is present and future" (p. 124)

Table 6 (continued)

Source	Levers of control	Organizational resilience stage	Time reference	Main findings potentially related to organizational resilience
1987	Interactive	Adaptation	Reactive	"Simons (in press) concludes that firms operating in uncertain environments employ control processes which are highly interactive and require the ongoing attention of operating managers" (p. 370)
1991	Interactive	Adaptation	Reactive	"Crises may develop. A new top manager may bring a new vision to the organization. With each of this changes, systems that were previously interactive may be de-emphasized and used diagnostically, and other systems made newly interactive" (p. 61)
1991	Interactive	Adaptation	Reactive	"Top managers use multiple control systems interactively only during short periods of crisis" (p. 58)
1991	Interactive	Adaptation	Reactive	"Existing management control systems that had previously been used diagnostically were made interactive to create a sense of urgency in the organization" (p. 59)
1991	Interactive	Adaptation	Reactive	"Once crisis began to subside, top managers removed themselves from active involvement in multiple interactive control processes" (p. 59)
1991	Interactive	Adaptation	Reactive	"It was evident from the data gathered during this study that top management's assessment of strategic uncertainties may change as business mature, move into new markets, or react to changes in their environment" (p. 61)
1994	Interactive	Adaptation	Reactive	"The computer company was in crisis and the top management made multiple systems interactive" (p. 180)
1995b	Interactive	Adaptation	Reactive	"The manager of the computer company, which was in crisis, made multiple systems interactive" (p. 139)
1995b	Interactive	Adaptation	Reactive	The main question related to strategic uncertainties was "how can we survive?" (p. 140)
1995b	Interactive	Adaptation	Reactive	"Effective managers scan for disruptive changes (environmental change) that signal the need to reconfigure organization structures, capabilities, and product technologies" (p. 91)
1995b	Interactive	Adaptation	Reactive	"These control systems (interactive) stimulate search and learning, allowing new strategies to emerge as participants throughout the organization respond to perceived opportunities and threats" (p. 91)
1995b	Interactive	Adaptation	Reactive	Interactive control systems are "adaptive systems, which have structures that change to adapt to changing environment" (p. 105)
1995b	Interactive	Adaptation	Reactive	"In our framework interactive control systems guide the experimentation and learning that are necessary for new autonomous (autonomous initiatives have adaptive value for the organization) strategic initiatives to emerge and be tested in the organization" (p. 107)

Table 6 (continued)

Source	Levers of control	Organizational resilience stage	Time reference	Main findings potentially related to organizational resilience
1995b	Interactive	Adaptation	Reactive	Managers with an unclear vision use multiple interactive systems in crisis "to change and survive" (see Fig. 5.5) (p. 111)
1995b	Interactive	Adaptation	Reactive	"Managers of firms in crisis typically use all control systems interactively for the short period necessary to figure out how to change and survive" (p. 117)
1995b	All four levers	Adaptation	Reactive	"These systems (four levers) provide the motivation, measurement, learning, and control that allow efficient goal achievement, creative adaption, and profitable growth" (p. 156)

Table 7 Citations in the MCS literatures, which we relate to organizational resilience according to Duchek (2020)

Author	Year	Levers of control	Organizational resilience stage	Time reference	Main findings potentially related to organizational resilience
Widener	2007	Interactive/ Diagnostic	Anticipation	Proactive	"Similar to strategic uncertainty, strategic risk requires increased information processing to assess the likelihood of risk and the magnitude of any resultant harm" (p. 763)
Ezzamel & Bourn	1990	Interactive	Coping	Concurrent	"With high uncertainty on both dimensions, decision making becomes 'inspirational'. This calls for the AIS to operate as an 'idea machine', providing multiple streams of thought, Delphi processes, and experience sharing in order to encourage creativity" (p. 401) […] "the AIS was observed to operate initially as a dialogue machine, and thereafter as an idea machine" (p. 416)
Euske et al	1993	Interactive	Coping	Concurrent	"Finally, the use of, or reliance upon, formal measurement systems appeared to vary depending on the type of environmental conditions faced by the organization. When faced with a crisis, organizations abandoned both their formal and informal control mechanisms to exert specific, high intensity forms of control over the 'errant' individual or group. The combined results suggest that performance measurement systems do reflect the strategic objectives of a firm under stable operating conditions" (p. 275)
Tuomela	2005	Interactive	Coping	Concurrent	"In uncertain environments financial [performance] measures are well suited for interactive use to stimulate discussion about different strategic uncertainties and how to deal with them" (p. 300)

Table 7 (continued)

Author	Year	Levers of control	Organizational resilience stage	Time reference	Main findings potentially related to organizational resilience
Janke et al	2014	Interactive	Coping	Concurrent	"This reasoning suggests that the use of interactive MCS represents a way to cope with the increased demand for information processing during an externally induced economic crisis. In other words, the stronger an organization's senior managers perceive negative external crisis effects to be, the more interactively the MCS are used" (p. 3) […] "The results show that perception of negative external crisis effects leads to more interactive use of MCS. Moreover, our findings support a positive effect of the interactive use of MCS on senior managers' perception of negative external crisis effects" (p. 13)
Martyn et al	2016	Interactive	Coping	Concurrent	"the use of control systems in an interactive manner during crisis periods merits further attention" (p. 292)
Otley & Berry	1980	Unspecified	Adaptation	Reactive	"A full description of organisational control procedures must therefore include an analysis of those procedures which act to maintain viability through goal achievement, those concerned with the co-ordination and integration of differentiated parts, and those which promote adaptation to both internal and external change" (p.232)
Merchant & Otley	2007	Unspecified	Adaptation	Reactive	"In broad terms, a management control system is designed to help an organization adapt to the environment in which it is set" (p. 785)

Table 7 (continued)

Author	Year	Levers of control	Organizational resilience stage	Time reference	Main findings potentially related to organizational resilience
Gond et al	2012	Interactive	Adaptation	Reactive	"Interactive control systems stimulate and guide emergent strategies in response to opportunities and/or threats within an organization's operating environment. The purpose of interactive control systems is to direct managers' attention toward strategic uncertainties and to learning novel strategic responses to a changing environment" (p. 207)
Arrive and Feng	2018	Unspecified	Anticipation	Proactive	"[…] it can be seen that competent staff (in terms of management control and anticipation of the facts) is the relevant factor for effective management control in the face of environmental complexity" (p. 6)
Passetti et al	2021	Beliefs, Interactive	Coping, adaptation	Concurrent, reactive	"Management encouraged proactive communication to advance organizational resilience" (p. 1435). […] "The cultural controls expressed in terms of social values and beliefs were a key organic mechanism in shaping organizational resilience. These controls were influential in communicating values, motivating employees and giving direction to the enterprise as highlighted by different managers" (p. 1436)
Möller et al	2022	Boundary	Coping, adaptation	Concurrent, reactive	"We find that the emphasis on formal boundary systems and an informal social context are positively related to contextual ambidexterity, which positively affects firm performance" (p. 603)
Baird et al	2023	Beliefs, Interactive, Diagnostic	Anticipation, coping, adaptation	Proactive, concurrent, reactive	"Managers are advised to enhance organisational resilience through employing a sustainable leadership approach and employing belief systems and the interactive and diagnostic use of controls" (p. 167)

Table 7 (continued)

Author	Year	Levers of control	Organizational resilience stage	Time reference	Main findings potentially related to organizational resilience
Martins et al	2023	Unspecified	Coping, Adaptation	Concurrent, reactive	"We found that companies perceived that MCP do influence organisational performance and leverage organisational competitiveness in a Covid-19 context. MCP do seem to amount to important resources that allow a firm to be competitive an perform well (p. 13)

the results of Janke et al. (2014) indicate that there is a time lag between perceiving the negative effects of an external crisis and intensifying the interactive use of an MCS. In their work, Janke et al. (2014) call for more qualitative research in management accounting on why MCSs are used more intensively in economic crises. Furthermore, the authors criticize existing research in management accounting for providing very little theoretical guidance on how long it takes until changes in the environment can lead to changes in accounting practices. In the same vein, they call on scholars to study in greater depth time-lagged effects—for instance the exact timing of the effects that key factors and potentially mediating factors cause and how such factors interrelate (Janke et al., 2014). Finally, in a related study, Martyn et al. (2016) call on scholars to investigate how MCSs are used interactively during a crisis and what implications the increased use of interactive control systems has for managers. The authors believe that studying "the increased use of ICS" as a result of a crisis "is a promising area for future research" (Martyn et al., 2016, p. 293).

MCSs, and Duchek's adaptation stage

In this context, Simons (1987) draws on Hambrick (1983), according to whom, prospectors outperform defenders in industries that are innovative and dynamic, because in such industries prospectors tend to have superior capabilities to adapt to change.

Simons (1987, p. 370) has furthermore shown that the degree to which an industry is dynamic, in terms of "the extent of change and the unpredictability in the technical and economic dimensions of the industry environment" (p. 363), is positively related with the return on investment (ROI) among prospectors and negatively among defenders. This indicates that prospectors tend to match their business strategy well to their industry environment (Simons, 1987). The idea of "matching" can be interpreted as a response to this environment and captures the "reactive" approaches of organizations in the "adaptation" stage that Duchek (2020) describes. Simons indicates that for the top managers of businesses facing a crisis, the main strategic focus is survival, and the main strategic uncertainty lies in adapting to change (Simons, 1991). In this context, Simons argues that a key constraint that new top managers face is the need to allocate their attention to different challenges: becoming familiar with their new role, effecting strategic turnaround, managing problems and crises, developing new agendas, and providing sufficient resources for the implementation of new strategies (Simons, 1994).

In an early study of the design of accounting control systems (e.g., accounting information systems), Otley and Berry (1980) argue that a full description of organisational control procedures must therefore include an analysis of those procedures which act to maintain viability through goal achievement, those concerned with the co-ordination and integration of differentiated parts, and those which promote adaptation to both internal and external change. (Otley & Berry, 1980, p. 232).

This argument relies on control systems and is related to the "adaptation" stage and "reactive" approach that Duchek (2020) describes.

Several arguments that Simons (Simons, 1987, 1991, 1994, 1995a, b) makes in relation to the four LoC, i.e., beliefs systems, boundary systems, diagnostic control systems, and interactive control systems, can also be connected to the "reactive" approaches that Duchek (2020) discusses in the context of the "adaptation" stage. We examine these connections below.

MCSs, and Duchek's adaptation stage—Beliefs systems

We were only able to find one direct reference to beliefs systems in Simons's works (Simons, 1987, 1991, 1994, 1995a, b). In his study of the Johnson & Johnson Tylenol crisis, Simons (1995a) argues that the strong beliefs system embedded in the company's credo guided the managers to the appropriate solutions to the problems that the crisis had created. These beliefs include the organization's clearly and passionately articulated responsibilities to customers, employees, local communities, and stockholders.

MCSs, and Duchek's adaptation stage—Boundary controls

In the context of boundary controls, Simons notes that an organization will typically introduce a code of business conduct after experiencing either directly a major crisis that affects its integrity (Simons, 1995a) or vicariously, through news of a crisis in another business (Simons, 1995b). The boundaries that business conduct defines "are developed and communicated after an incident or crisis exposes the firm to unexpected asset or reputation losses" (Simons, 1995b, p. 44). Just as boundaries to business conduct are usually set after an incident or crisis (e.g., when the costs of wrongful employee actions become apparent), strategic boundaries are usually set when excessive experimentation threatens to exhaust a firm's resources.

MCSs, and Duchek's adaptation stage—Diagnostic controls

Like the "reactive" approach that Duchek (2020) describes as a response to an unexpected event, Simons also defines the time frame in which diagnostic control systems need to be implemented as the "past and present" (Simons, 1995b, p. 124). As mentioned previously, the reference to the "present" can also be related to the "concurrent" approaches in the coping stage that Duchek (2020) describes.

MCSs, and Duchek's adaptation stage—Interactive control systems

Simons argues that "firms operating in uncertain environments employ control processes which are highly interactive and require the ongoing attention of operating managers" (Simons, 1987, p. 370). These processes correspond to the interactive control systems used in the "reactive" adaptation stage that Duchek (2020) discusses.

Table 8 Citations in the organizational resilience literature, which we relate to MCSs according to Duchek (2020)

Author	Year	Levers of control	Organizational resilience stage	Time reference	Main findings potentially related to MCSs
Ignatiadis & Nandhakumar	2007	Diagnostic	Anticipation, coping, adaptation	Proactive, concurrent, reactive	"The results can similarly be generalized for other enterprise-wide information systems." […] "The results of this research shed a new light on the way that enterprise systems can impact the organizational resilience of a company." […] "The disembedding process can lead to increased control, which if done excessively can stifle resilience. On the other hand, the consequent embedding process can lead to drift, which, if not left to get out of control, can serve to increase organizational resilience" (p. 42)
Kantur & İşeri-Say	2012	Unspecified	Anticipation, coping, adaptation	Proactive, concurrent, reactive	"Another further research question would be establishing the relationship of organizational resilience to strategic management. Considering the proposed sources of organizational resilience such as strategic acting which incorporate factors of proactiveness and creativity, resilience is directly related to innovation, intrapreneurship or strategic entrepreneurship concepts which are central to discussions in strategic management research. Organizations facing continuously changing environments need to differentiate themselves from others through innovation and entrepreneurial initiatives. These same environments also require resilience in order for the organization to thrive and continue functioning. However, resilience is also related with renewal. Considering these, entrepreneurial activities and resilience strategies can be expected to be interconnected so as to create successful organizational outcomes" (p. 772)
Teixeira & Werther	2013	Interactive	Adaptation	Reactive	"leadership's dialog within the organization – if it cascades from top management to lower levels in the organization – creates an open culture of resilience" (p. 337)

Table 8 (continued)

Author	Year	Levers of control	Organizational resilience stage	Time reference	Main findings potentially related to MCSs
Akgün & Keskin	2014	Beliefs, interactive	Anticipation, coping, adaptation	Proactive, concurrent, reactive	"Based on this study, management should improve firm resilience capacity to leverage the firm's product innovativeness and performance and to cope with environmental turbulence. To this end, management can develop values that lead to routines of collaboration and traditions of flexibility, create open communication channels and interpersonal ties as well as informal and face-to-face dialogues, seek multiple sources of information, encourage unlearning of obsolete information or dysfunctional heuristics, and promote creativity. Management might also establish a clear sense of purpose and identity throughout the organisation, instill a mindset that questions fundamental assumptions and positive perceptions of experiences, foster a psychologically safe environment where people can take interpersonal risks, and impose individual and group accountability" (p. 6930)
Pal et al	2014	Unspecified	Coping	Concurrent	"The role of leadership and management decision-making were influential factors in facilitating resilience during the recent crunch." […] "Firms like those could break-away from the 'command and control culture' generally prevalent in small family firms, and became more entrepreneurial and open, and showed better economic resilience" (p. 420)

Table 8 (continued)

Author	Year	Levers of control	Organizational resilience stage	Time reference	Main findings potentially related to MCSs
Seville et al	2015	Beliefs, interactive	Anticipation, coping, adaptation	Proactive, concurrent, reactive	"The way in which people throughout an organization—from the CEO to call center employees—demonstrate leadership influences resilience" (p. 8). […] "Leadership needs to be provided to internal as well as external stakeholders of the organization. Every organization is made up of people. Face-to-face contact with those people will provide a much better diagnostic of the organization's health than any KPI scorecard." […] "Learning goes in tandem with leadership." […] "a culture of learning is one of the underpinnings of resilience." […] "Employees believe that they are an integral part of the enterprise's success and accept their role as both contributors and change agents" (p. 9)
Ortiz-de-Mandojana & Bansal	2016	Unspecified	Anticipation, coping, adaptation	Proactive, concurrent, reactive	"Because organizational resilience is a latent, path-dependent construct, we assess it through the long-term outcomes, including improved financial volatility, sales growth, and survival rates." […] "We show that firms that adopt responsible social and environmental practices, relative to a carefully matched control group, have lower financial volatility, higher sales growth, and higher chances of survival over a 15-year period" (p. 1615)
Clément & Rivera	2017	Unspecified	Anticipation, coping, adaptation	Proactive, concurrent, reactive	"From an organizational perspective, certain industries, especially those that directly depend on natural systems, appear to already be at the forefront of the resilience challenges posed by ecological adversity. Organization and natural environment scholars are therefore perfectly positioned to tackle and anticipate future research avenues in this area and their potential implications for strategy and management" (p. 15)

Table 8 (continued)

Author	Year	Levers of control	Organizational resilience stage	Time reference	Main findings potentially related to MCSs
Williams et al	2017	Unspecified	Anticipation, coping, adaptation	Proactive, concurrent, reactive	"despite the potential connection, our systematic review did not uncover 'control theory' as a substantial research theme in the crisis and resilience literatures" […] "We anticipate that future research might explore how organizations design mechanisms of 'control' that involve responding to disturbances" […] "Is it possible to build resilient controls and if so, how can these be used to build resilient organizations, systems, and communities" (p. 756) […] "We anticipate that contributions can be made to control theory by addressing how organizations recognize potential disruptions, prepare for those challenges, and overcome surprises in an effective way" (p. 754)
Koronis & Ponis	2018	Beliefs	Anticipation, coping, adaptation	Proactive, concurrent, reactive	"management theory and business executives need to further explore their capacity to absorb and adapt in a changing environment full of strategic challenges, emerging crises and sudden and unexpected accidents and disasters" (p. 33). […] "Our proposed framework, based on a review of extant literature" […] "integrates the four drivers of resilience under a common set of social capital and organizational values, including trust, perceived organizational identity and an error-friendly culture. The key notion is that resilience requires an open-minded and dedicated spirit, traits which" […] "require the existence of core values" (p. 39)

Table 8 (continued)

Author	Year	Levers of control	Organizational resilience stage	Time reference	Main findings potentially related to MCSs
Barasa et al	2018	Boundary, interactive	Anticipation, coping, adaptation	Proactive, concurrent, reactive	"The resilience of organizations was influenced by the following factors: Material resources, preparedness and planning, information management, collateral pathways and redundancy, governance processes, leadership practices, organizational culture, human capital, social networks and collaboration" (p. 491). […] "Governance practices are also shown to influence the resilience of organizations to both acute and everyday challenges, in both health and other sectors. Governance is used here to mean the rules and processes that guide operations and affairs of organization. A number of governance practices are identified as critical for organizational resilience. The first is decentralization; resilient organizations adopted a form of governance characterized by distributed control, rather than top down hierarchy, under central control." […] "Another governance practice that distinguished resilient from non-resilient organizations was non-linear planning." […]and was instead replaced by a non-linear approach that was evolving, open-ended, iterative, and characterized by feedback loops between stages, and learning by trial and error" (p. 498)
Palmi et al	2018	Unspecified	Anticipation, coping, adaptation	Proactive, concurrent, reactive	"The role of organizational resilience as an attitude, depending on the adoption of corporate governance, environmental and social practices" […] "The results of the empirical analysis highlight, that economic performances of listed companies are influenced, over the 14 year period considered in the study, not only by the traditional sustainable pillars (SEPs), but also by the corporate governance ones (CESPs)" (p. 54)

Table 8 (continued)

Author	Year	Levers of control	Organizational resilience stage	Time reference	Main findings potentially related to MCSs
Andersson et al	2019	Beliefs, diagnostic	Anticipation, coping, adaptation	Proactive, concurrent, reactive	"Corporate philosophy includes the objectives, shared values and strategies that guide daily action events" […] "Information systems contain choices of who should know what, including formal planning and follow-up and feedback processes" (p. 39). […] "We describe and explain how corporate philosophy, decentralized structure, information system and HRM processes can foster risk awareness and preference for cooperation, important traits for organizational resilience, without losing the capacity to act with agility or improvisation to stop undesired events. Moreover, balancing power distribution that creates preparedness for local action, and normative control to support organizational alignment and stability, was important for achieving organizational resilience." […] "Resilient organizations need to balance a number of aspects" (p. 44)
Beuren & d. Santos	2019	Unspecified	Anticipation, coping, adaptation	Proactive, concurrent, reactive	"understanding the role of MCSs in the creation and use of resilience capacities offers a new way of explaining why some companies manage to outperform others during adverse and turbulent events" (p. 307). […] "the design and use of an MCS can contribute to the organization's capacity for dealing with turbulences and unexpected events in advance" (p. 319). […] "other taxonomies of MCS could be used to understand how the design and use of an MCS affect organizational resilience capacity" (p. 320)

Table 8 (continued)

Author	Year	Levers of control	Organizational resilience stage	Time reference	Main findings potentially related to MCSs
Barbera et al	2020	Unspecified	Anticipation, coping, adaptation	Proactive, concurrent, reactive	"In Barletta (after 2013), Forli (after 2008) and Lodi (after 2011), management control systems were put in place to improve revenue collection" (p. 544). […] "In particular, as a consequence of the bailout, Caserta created an office in charge of strategic management and performance evaluation and introduced management control systems to support decision-making" (p. 547)
Beuren et al	2020	Unspecified	Anticipation, coping, adaptation	Proactive, concurrent, reactive	"Thus, it is assumed that the MCS with more flexible characteristics favors changes and helps individuals to face challenges, giving them greater capacity for organizational resilience" (p. 212). […] "the combination of managerial practices at the organizational level (MCS), in parsimony with influence at the individual level (empowerment), act together to support organizational resilience" (p.213). […] "Other taxonomies of the MCS can be used to explore the relationship between MCS, […] and organizational resilience" (p. 228)
Al Balushi	2021	Beliefs, boundary, diagnostic, interactive	Anticipation, coping, adaptation	Proactive, concurrent, reactive	"Internal transparency is an enabler for the use of management control systems" (p. 1250) […] "The results demonstrate that ISO 9001 implementation had improved internal transparency in many ways. It enhanced information flow through extensive documentation and reporting, and teamwork. This improved communication throughout the whole organization. Similarly, the standard emphasized teamwork and performance indicators, which allowed for more employee engagement as employees had to measure performance and ensure conformance to standard. With ISO implementation, roles, rules and criteria were set, and accountability and responsibility activated" (p. 1259)

Table 8 (continued)

Author	Year	Levers of control	Organizational resilience stage	Time reference	Main findings potentially related to MCSs
Bracci & Tallaki	2021	Beliefs, boundary, diagnostic, interactive	Anticipation, coping, adaptation	Proactive, concurrent, reactive	"We detected business planning, budgeting, monitoring, operations control and environmental awareness, considered as anticipatory capacities." […] "Coping capacities significantly reduced the impact of budget cuts, both in the forms of buffering and adaptive capacities" (p. 344). […] "While MCSs contributed to shaping anticipatory and coping capacities, the financial shocks provided opportunities for investing in new MCSs, cyclically strengthening or developing new anticipatory and coping capacities" (p. 345)
Hollands et al	2023	Beliefs, interactive	Coping	Concurrent	"*Strong Culture & Values* was raised as a General Readiness Facilitator by the managers, who referred to the benefits of a generally supportive, inclusive, and open environment with accessible communication and learning" (p. 15)

Simons argues that the "managers of firms in crisis typically use all control systems interactively for the short period" in which they have to find ways to help the organization "change and survive" (Simons, 1995b p. 117; see also: Simons, 1991, 1994). Systems that were previously interactive might now be used diagnostically, while other systems, that were previously used diagnostically, might be redesigned to work interactively to create a sense of urgency in the organization. However, as soon as the crisis subsides, top managers move away from actively participating in multiple interactive control processes (Simons, 1991). Simons argues that the top management's view of strategic uncertainties can change as the business matures, enters new markets, or reacts to changes in its environment (Simons, 1991). Furthermore, "effective managers scan [the environment] for disruptive changes that signal the need to reconfigure [organizational] structures, capabilities, and product technologies" (Simons, 1995b, p. 91). However, the main question that strategic uncertainties pose is how the organization can survive (Simons, 1995b).

Searching through Simons's works for ideas that reflect the "reactive" approaches in the "adaptation" stage that Duchek (2020) describes, we located only one relevant reference pertaining to all four LoC; i.e., beliefs systems, boundary systems, diagnostic control systems, and interactive control systems (Appendix Table 8). In his LoC book, Simons argues that "these systems provide the motivation, measurement, learning, and control that allow efficient goal achievement, creative adaptation, and profitable growth" (Simons, 1995b, p. 156).

Appendix 2

MCSs and Duchek's organizational resilience stages

In their extended research agenda on organizational resilience to adversity in the natural environment, Clément and Rivera (2016) found that certain industries, especially those that directly depend on natural systems, are already at the forefront of addressing the challenges that ecological adversity poses to organizational resilience. The authors argue that scholars in the field of organization studies, particularly those concerned with the organizations' natural environment, are perfectly positioned to address these issues and suggest research avenues and their implications for strategy and management (Clément & Rivera, 2016).

Williams et al. (2017) conducted a systematic review of the literatures on crises and resilience. Although the authors do not discuss management control theory as a key research topic, despite its potential relevance, they anticipate that future research could examine how organizations design mechanisms of control in response to disturbances. They also suggest that examining how organizations recognize and prepare for potential disruptions and overcome surprise effectively can advance control

theory (Williams et al., 2017). Following van der Vegt et al. (2015), Williams et al. (2017) furthermore raise the question of whether it is possible to build resilient controls and, if so, how such controls can be used to build resilient organizations, systems, and communities.

In the literature on human resource management, Beuren and d. Santos (2019) provide empirical evidence that MCSs can be regarded as antecedents of an organization's resilience capacity. The authors suggest that how an MCS is designed and implemented influences whether the organization will develop the necessary capacity for dealing with turbulences and unexpected adverse events. Beuren et al. (2020) also show empirically that the more flexible an organization's MCS, the greater the organization's capability to cope with and adapt to change.

MCSs and Duchek's organizational resilience stages—Beliefs systems and interactive control systems

The works of both Akgün and Keskin (2014) and Seville et al. (2015) contain points that can be related to beliefs systems and interactive control systems. Akgün and Keskin (2014) suggest that managers need to improve their organization's resilience capacity in order to leverage product innovativeness and performance and enable it to cope with environmental turbulence. The authors argue that to this end, management can develop values that lead to routines of collaboration and traditions of flexibility, create open communication channels and interpersonal ties as well as informal and face-to-face dialogues, seek multiple sources of information, encourage unlearning of obsolete information or dysfunctional heuristics, and promote creativity. [The] management might also establish a clear sense of purpose and identity throughout the organisation, instill a mindset that questions fundamental assumptions and positive perceptions of experiences, foster a psychologically safe environment where people can take interpersonal risks, and impose individual and group accountability (Akgün & Keskin, 2014 p. 6930).

Seville et al. (2015), who elaborate the principles of a resilient organization, conclude that "every organization is made up of people" and "face-to-face contact with those people will provide a much better diagnostic of the organization's health than any KPI scorecard" (Seville et al., 2015, p. 9). They also argue that learning goes hand in hand with leadership and that a learning culture is fundamental to resilience. Furthermore, employees who believe that they are essential to the organization's success accept their role as both contributors and agents of change (Seville et al., 2015).

Koronis and Ponis (2018) propose a framework based on their review of the literature that integrates the four drivers of resilience (i.e., preparedness, responsiveness, adaptability, and learning) with social capital, shared organizational values such as trust, perceived organizational identity, and an error-friendly culture. The key principle of their framework is that resilience requires an open mind and dedication,

which in turn presuppose certain core values (Koronis & Ponis, 2018). The authors conclude that "management theory [scholars] and business executives need to further explore their capacity to absorb and adapt in a changing environment full of strategic challenges, emerging crises and sudden and unexpected accidents and disasters" (Koronis & Ponis, 2018, p. 33).

MCSs and Duchek's organizational resilience stages—Boundary systems and interactive control systems

Some of the findings of Barasa et al. (2018) can be related to boundary systems and interactive control systems. The authors found that the resilience of organizations is influenced by preparedness, planning, and governance processes. Their study shows that governance practices[6] determine how resiliently organizations respond to acute and everyday challenges in the healthcare and other sectors. Barasa et al. (2018) identified a number of governance practices as critical to organizational resilience. One such practice is decentralization; that is, a form of governance characterized by distributed control rather than a top-down hierarchy and centralized control. Another governance practice that is common among resilient organizations is non-linear planning. This type of planning constantly evolves, is open-ended and iterative (i.e., there are feedback loops between different stages of planning), and involves learning based on trial and error (Barasa et al., 2018).

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Declarations

Conflict of interest The authors confirm that the data supporting the findings of this study are available within the article [and/or] its supplementary materials.

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[6] Here, "governance" refers to the rules and processes that guide the operations and affairs of the organization.

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