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Combining management control practices for organizational learning: A situational strength perspective

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ABSTRACT

Organizational learning (OL) is a critical organizational capability. Yet designing management control (MC) that effectively supports OL is challenging, as learning outcomes are often intangible and unfold over extended time horizons. Employing situational strength theory, we examine combinations of MC practices that affect OL contingent on environmental uncertainty. Drawing on a survey of 210 senior business unit controllers, we use fuzzy-set Qualitative Comparative Analysis (fsQCA) to identify multiple combinations of MC practices that achieve high OL in different uncertainty contexts. In a subsequent step, we examine whether the situational strength of certain combinations of MC practices is associated with OL. Results show that in a low-uncertainty environment, the combined use of diverse performance measures and social controls, as well as performance pay and a mechanistic administrative structure, have a synergetic effect on OL. In a high-uncertainty context, the combined use of measure diversity and deliberate formal strategic planning is beneficial for achieving OL. Our results suggest that the effectiveness of MC practices for OL depends on aligning MC practices with the internal as well as the external context.

1. Introduction

Literature identifies organizational learning (OL) as a critical strategic priority for organizations (Abernethy et al., 2015). The ability to learn has been considered a vital source of an organization's sustainable competitive advantage (De Geus, 1988) and a determinant of the performance of an organization (Argote & Miron-Spektor, 2011). Management control (MC) literature describes OL as an organizational capability, depending upon the use of MC practices (Henri, 2006a). Accordingly, the design and use of effective organizational controls to achieve OL is a core management task (Cardinal et al., 2017). OL, however, creates a challenging control context as desired outcomes are intangible and obtained only over relatively long periods (Abernethy et al., 2015). These characteristics of OL make it inherently difficult to align individual actions with organizational goals, as the returns to learning-related activities are uncertain and hard to observe, creating conditions under which a goal congruence problem may emerge (Abernethy et al., 2015; Cardinal et al., 2017). In contemporary organizations, where short-term performance pressures may prevail, employees may be insufficiently motivated to engage in learning activities when their efforts go unrecognized or when the value of such activities remains unclear (Cardinal et al., 2017). This challenge is further amplified in high-uncertainty contexts where a lack of reliable information for decision-making makes it particularly difficult to contract upon 'adequate' results and to align individual actions with organizational goals (Abernethy et al., 2015; Dirks & Wouters, 2025; Townsend et al., 2018; Yang et al., 2022). We investigate how, when and why organizations combine MC practices to address this goal congruence

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problem.

Previous literature has started investigating how to design and use MC to facilitate OL (Abernethy et al., 2015; Batac & Carassus, 2009; Kloot, 1997; Widener, 2007); however, empirical evidence is mixed. While literature has been relatively advanced in examining the relations between individual MC practices and OL, little research has examined the effects of combined MC practices on OL. Different MC practices serve different purposes; when MC practices are combined, literature suggests that the interplay between MC practices should also be examined (Bedford et al., 2016; Drazin & Van de Ven, 1985; Gerdin, 2005; Gerdin et al., 2019). Furthermore, the design and use of MC systems are significantly influenced by the external context, specifically the environmental uncertainty the organization faces (Chenhall, 2003; Henri & Wouters, 2020; Otley, 2016). Some researchers even indicate that OL is a must to survive in uncertain environments (e.g., Fiol & Lyles, 1985; Garvin, 1993). March (1991), however, postulates that OL is not just needed when uncertainty is high. Different degrees of environmental uncertainty may require different ways of learning as well as of dealing with a control problem (Abernethy et al., 2015; Yang et al., 2022). Consequently, the effectiveness of MC practices does not only depend on how they are combined but is also contingent upon the external uncertainty (Gerdin et al., 2019). Despite the aforementioned research, it remains unclear how organizations combine certain MC practices to achieve OL and what role uncertainty plays; in this paper, we intend to shed light on these issues.

We examine the effect of combinations of MC practices on OL through the lens of situational strength theory. Situational strength theory suggests that situational features present implicit and explicit indications about what counts as (un)desirable behavior (Gerdin et al., 2019; Meyer et al., 2010), thus addressing the control problem of goal congruence (De Jong et al., 2014; Gerdin et al., 2019). There is a strong control situation when such cues make individuals expound "particular events in the same way, [and] induce uniform expectancies regarding the most appropriate response pattern" (Mischel, 1973, p. 276). Meyer et al. (2010) suggest a four-facet framework that defines how different MC practices may contribute to achieving strong control situations; the facets are clarity, consistency, constraints, and consequentiality. Previous literature has identified situational strength theory as useful for disentangling the abilities of single MC practices to evaluate how they contribute to creating strong control situations (Gerdin et al., 2019). In this paper, we examine how organizations combine different MC practices with reinforcing situation strength features (i.e., different yet complementary abilities) to achieve OL (Gerdin et al., 2019). Building on previous literature, we propose that the combination of different MC practices varies depending on the level of environmental uncertainty, as these combinations influence both the strength of control situations (Gerdin et al., 2019) and OL (March, 1991).

To empirically investigate the link between MC and OL, we follow previous literature adopting a two-step approach to evaluate effective combinations of MC practices (Bedford et al., 2016). Our selection of MC practices is guided by the Malmi and Brown (2008) typology, which ensures comprehensive coverage of the full spectrum of MC practices. Accordingly, we include a broad range of MC practices: cybernetic controls (measure diversity), reward and compensation controls, administrative controls, planning controls, and cultural controls. Based on survey data from 210 senior business unit controllers, we first apply a fuzzy-set Qualitative Comparative Analysis (fsQCA) to determine effective control configurations for OL and exploratively identify the relative importance of the individual MC practices in control configurations that are associated with superior OL, contingent on environmental uncertainty. Second, based on previously identified control configurations, we develop hypotheses and use Ordinary Least Squares (OLS) regressions to determine whether these MC practices jointly enhance OL.

Our results show that there are several equally effective ways by which organizations can achieve OL. Further, measure diversity (which provides clarity and consequentiality) and the use of social controls (which provides consistency and constraints) have a synergetic effect in low-uncertainty contexts, meaning they mutually compensate for their individual weaknesses to contribute to a strong control situation (Gerdin et al., 2019; Kreutzer et al., 2016; Meyer et al., 2010). Similarly, and consistent with situational strength theory, performance-contingent incentives and rewards and mechanistic administrative controls have a synergetic effect on OL in a low-uncertainty environment. In a high-uncertainty context, we find that performance measure diversity and a deliberate formal strategic planning mode have a synergetic effect on OL, which is also consistent with situational strength theory. Finally, while an organic structure is combined with social controls in a fourth cluster of organizations, these MC practices do not have a synergetic effect on OL in a high-uncertainty context.

Our study contributes to the – rather limited – literature that studies the link between MC and OL. First, by applying situational strength theory, we add to prior research investigating the consequences of combinations of MC practices (Gerdin et al., 2019). According to situational strength theory, the effectiveness of an MC practice to achieve a specific outcome depends on the presence of other MC practices with different abilities to create a strong control situation (i.e., provision of clarity, consistency, constraints, and consequentiality; Gerdin, 2005; Gerdin et al., 2019; Gerdin & Greve, 2004). Prior literature has relied heavily on the reductionist approach, assuming that single MC practices are not interdependent and can be studied in isolation (Chapman et al., 2020). If this assumption does not hold, the underspecified statistical model might provide disputable findings (Chenhall, 2003). Otley (2016) indicates that the understanding of MC remains fragmented as long as empirical research ignores the interdependencies between different MC practices. Our study shows that situational strength theory is useful in predicting which specific combinations of MC practices help to achieve higher levels of OL.

Second, building upon previous literature, we include a broader range of MC practices relative to previous studies (e.g., Abernethy et al., 2015; Chenhall, 2005; Widener, 2007) to study the relation between MC and OL. Previous studies primarily relied on conceptual typologies (Meyer et al., 1993; Miles & Snow, 1978) and typically used cluster analysis or profile deviation analysis when analyzing configurations (Gerdin, 2005; Gerdin & Greve, 2004, 2008; King & Clarkson, 2015; Moores & Yuen, 2001; Selto et al., 1995). This resulted in little knowledge about whether a single element in a configuration is redundant or actually contributes to the outcome. Following Bedford et al.'s (2016) approach, we use the fsQCA methodology as an explorative first step of our analysis to identify combinations of MC practices that are equally effective in achieving the desired outcomes (i.e., OL); thus, we also provide evidence for equifinality (Sandelin, 2008). Conventional approaches are unlikely to provide such a holistic understanding of the combination of a range of viable MC alternatives.

Third, we examine whether the context of an organization (in terms of uncertainty) influences the relationship between MC and OL. Specifically, our research adds to the expanding body of work on the situational nature of MC combinations (Grabner & Moers, 2013). We argue that the demand for and the ability of different MC practices to produce strong control situations vary across environmental contexts (Gerdin et al., 2019). Contingency theory, which explains why MC practices are unlikely to be appropriate under all circumstances (e.g., Otley, 2016), explicitly emphasizes how the external environment shapes demands within the internal environment (Chapman et al., 2020). What contingency theory often lacks is evidence about the effectiveness of particular combinations of MC practices (Chapman et al., 2020). We show that combinations of MC practices that affect OL differ across uncertainty contexts; thus, the effectiveness of combinations of MC practices depends on both the type of combination (which practices are combined) as well as the context (in what type of setting practices are combined).

The remainder of the paper is structured as follows: Section 2

provides an overview of the relevant literature and ends with a research proposition. Section 3 describes the research method, including data collection and construct measurement. Furthermore, it includes an overview of the explorative analysis of MC configurations (fsQCA) and subsequent use of OLS regressions. Section 4 displays MC configurations that achieve high OL (fsQCA results), the development of the hypotheses, and the identification of those MC practices with a synergetic effect within these effective configurations. The paper finalizes with a discussion and conclusion in Section 5.

2. Literature review

2.1. Organizational learning

Organizational learning (OL) is a fundamental process that enables organizations to adapt, innovate, and thrive in an ever-evolving environment. OL is "the dynamic process of creating new knowledge and transferring it to where it is needed and used, resulting in the creation of new knowledge for later transfer of use" (Kane & Alavi, 2007, p. 296). OL comprises four contributing interrelated processes (Huber, 1991): knowledge acquisition, information distribution, information interpretation, and organizational memory. Knowledge acquisition describes the process of obtaining knowledge through congenital, experiential, or vicarious learning, grafting, or searching (Huber, 1991). Information distribution is when this information is shared, leading to new information and understanding (Huber, 1991). Information interpretation is "the process by which distributed information is given one or more commonly understood interpretations" (Huber, 1991, p. 90). Organizational memory then secures the knowledge and stores it for future use (Huber, 1991). Each process contributes to OL (Huber, 1991) and provides an opportunity to achieve competitive performance (Chenhall, 2005).

OL finds its roots in the historical experiences of an organization, which subsequently become embedded in established routines that "guide behavior" (Levitt & March, 1988, p. 320). Yeung et al. (2007, p. 2459) describe OL as paramount, as it represents the "most critical intangible assets" for achieving higher organizational performance in a knowledge-driven economy. Through OL, organizations constantly advance present operations (Garvin, 1993) and achieve competitive strategic outcomes (Chenhall, 2005). Thus, OL facilitates long-term and sustainable growth (Raisch & Birkinshaw, 2008); organizations will likely fail if they cannot reorganize and adapt to changing requirements and circumstances (Cardinal et al., 2017). Therefore, OL is considered one of the organizations' most important sources of sustainable competitiveness (Argyris & Schön, 1978; Senge, 1990), a critical factor in surviving in competitive markets (Hult, 1998; Slater & Narver, 1995) and an important driver of corporate performance (Stata, 1989).

However, OL creates a control environment where goal congruence problems are likely to emerge. OL as a strategic priority creates a particularly challenging contracting environment as objectives are intangible and desired outcomes materialize only over long time horizons, making them difficult to contract upon (Abernethy et al., 2015). Employees may therefore be uncertain whether their learning-related efforts are recognized and valued by organizations, and may be reluctant to engage in learning behaviors when outcomes are unclear or when such behaviors go unrecognized by supervisors (Cardinal et al., 2017; Henri, 2006a). In addition, if managers change jobs frequently, they are unlikely to benefit from OL; as a result, they may not invest in it. The inherent ambiguity surrounding learning processes may reduce employees' motivation to invest effort in learning activities, as the returns are uncertain and difficult to observe in the short term. These factors combine to create conditions under which individual and organizational goals may become misaligned. Situational strength theory offers a valuable framework for understanding how (combinations of) MC practices can help to achieve goal congruence in such contexts.

2.2. Situational strength theory

Situational strength is defined as the "implicit or explicit cues provided by external entities regarding the desirability of potential behaviors" (Meyer et al., 2010, p. 122). A strong control situation exists when clear expectations and norms guide employees' behaviors, fostering a shared understanding of appropriate responses and creating pressure to adopt those behaviors, thereby enhancing cohesion and alignment within the organization (De Jong et al., 2014; Meyer et al., 2010; Mischel, 1973). By providing explicit cues and reducing behavioral variability, situational strength theory directly addresses the goal congruence problem, as strong control situations enhance the alignment between individual behavior and organizational objectives (Gerdin et al., 2019). In contrast, weak control situations are characterized by ambiguity or lack of clear cues, allowing individual traits and personal differences to have a greater influence on employee and managerial behavior (Mischel, 1973). This distinction highlights that behavior is jointly determined by individual characteristics and situational factors, with strong control situations characterized by cues that reduce individual behavioral variability and diminish the influence of personality traits (Meyer et al., 2010; Mischel, 1973).

Building upon Meyer et al. (2010), Gerdin et al. (2019) argue that situational strength theory can be used to identify the different abilities of MC practices to generate synergetic effects.[1] The underlying assumption is that only control forms that have complementary abilities to address the control problem at hand have the potential to create synergetic effects on organizational outcomes (in our case, high levels of OL; Gerdin et al., 2019). Similar to Gerdin et al. (2019), we mobilize situational strength theory to conceptually discriminate among the different abilities of these different MC practices to convey clarity, consistency, constraints, and consequentiality (i.e., the four facets proposed by situational strength theory; see Meyer et al., 2010).

Clarity describes "the extent to which cues regarding work-related responsibilities or requirements are available and easy to understand" (Meyer et al., 2010, p. 125). Clarity can be created, e.g., through formal processes, clear directions provided by (top) management (Meyer et al., 2010), or specific, transparent performance targets (Bowen & Ostroff, 2004). Consistency describes "the extent to which cues regarding work-related responsibilities or requirements are compatible with each other" (Meyer et al., 2010, p. 126). Consistency can be linked to, e.g., the compatibility of the stream of information over time (Meyer et al., 2010), between avowed and lived values (Meyer et al., 2010), and among internal rules (Bowen & Ostroff, 2004; De Jong et al., 2014). Constraints describe "the extent to which an individual's freedom of decision and action is limited by forces outside his or her control" (Meyer et al., 2010, p. 126). Constraints can be set, e.g., by formal policies and procedures (Meyer et al., 2010; Simons, 1995) or a shared understanding about what is (not) considered appropriate behavior (De Jong et al., 2014). Consequentiality describes "the extent to which

[1] Following Gerdin et al. (2019), we use the term *synergetic effects* in this paper to describe the outcome of complementary choices of MC practices. We start our analysis of MC practices as a *package*, which is consistent with configuration theory (Fiss, 2011; Gerdin & Greve, 2004). This approach allows for the recognition of multiple control configurations that are equally effective in achieving the desired outcomes (i.e., equifinality; see Gerdin, 2005). In addition, we follow Gerdin et al. (2019) by assuming that MCSs are rarely completely in equilibrium states (see also Gerdin & Greve, 2004; Grabner & Moers, 2013; Masschelein & Moers, 2020, for a more extensive discussion on this topic). The analysis of MC practices as a *system* is based on the outcomes of complementary MC practices. While this second step of the analysis is consistent with complementarity theory (Grabner & Moers, 2013), our first step of the analysis may deviate from the underlying assumptions of complementarity theory. Thus, we consistently use the term *synergetic effects* rather than *complementary effects* in the remainder of our paper (even though Gerdin et al. (2019) use the terms interchangeably).

decisions or actions have important positive or negative implications for any relevant person or entity" (Meyer et al., 2010, p. 127). Consequentiality can, e.g., result from using reward and compensation controls (Meyer et al., 2010); i.e., deviation from predefined performance standards usually has negative implications for managerial bonuses or careers (Merchant & Van der Stede, 2023).

While each of the four facets plays a critical role in guiding behavior, none of them in isolation is likely to be effective in achieving goal congruence; instead, a combination of these dimensions is necessary to create a strong control situation. The effectiveness of MC in promoting OL is therefore contingent upon the broader organizational context, including both internal factors (such as other MC practices with different facets) as well as external factors (including environmental uncertainty; Gerdin et al., 2019; Meyer et al., 2010). We discuss this in more detail in the following sections.

2.2.1. *Management control practices*

Several empirical studies have explored the link between individual MC practices and OL (see also Table 1). The selection of MC practices draws on this previous literature, and our categorization is guided by the Malmi and Brown (2008) typology, which ensures comprehensive coverage of the full spectrum of MC practices. The typology was specifically developed to guide scholars when studying combined MC practices. In particular, Malmi and Brown (2008) provide a broad view of the *design* of MC practices (whereas, for example, the levers of control (Simons, 1995) place emphasis on how managers *use* these practices). While we acknowledge that the use of controls, as analyzed in one of the studies discussing MC and OL (Widener, 2007), has been theorized to relate to OL, we decided to focus on the design of the control system. Accordingly, constructs from Simons' (1995) levers of control framework, i.e., interactive and diagnostic use of performance measurement systems and belief and boundary systems, are not included, as mixing constructs from two different frameworks would compromise the coherence of our approach. Practices are classified as cybernetic, reward and compensation, administrative, planning, and cultural controls, which depict the main groups of MC (Malmi & Brown, 2008). Table 1 indicates the characteristics of each MC practice in terms of how they help create a strong control situation (clarity, consistency, constraints, consequentiality) and highlights the relevant body of research on the link between MC and OL.

Cybernetic controls, which include the definition of performance dimensions that should be achieved and the different attributes that could be measured, are generally considered beneficial for OL (e.g., Chenhall, 2005; Choe, 2002, 2004; Chong et al., 2023). Measure diversity contributes to a strong control situation by providing ex-ante information on how employees' performance is measured (clarity), i.e., what is expected, and by evaluating their performance ex-post accordingly (consequentiality) (Gerdin et al., 2019). If the actual performance deviates from what was expected, it becomes apparent and can be modified (Chenhall, 2005; Greve, 2003). Thus, having a variety of performance metrics not only provides insights into and clarity about an organization's strategy (Widener, 2007) but also serves as a system for identifying and rectifying errors early (Argyris & Schön, 1978; Greve, 2003).

The results of the other MC practices appear to be mixed. The association between different reward and compensation controls (use of incentive pay, objectivity of performance measures, and time horizon) and OL is sometimes positive (e.g., Kloot, 1997). Performance-contingent incentives provide clarity by outlining expectations and consequentiality by ensuring that compensation is directly tied to performance. Objectively determined incentives contribute to clarity and consistency by basing compensation on pre-determined formulas or targets. A long-term compensation time horizon fosters consistency and consequentiality to achieve situational strength. Yet, in other studies, reward and compensation controls negatively affect OL (e.g., Lee & Puranam, 2017) as they can undermine the intrinsic motivation to 'look beyond the rim of the plate' (Lee & Meyer-Doyle, 2017) and result in dysfunctional behavior (Wabnegg, 2024). Lee and Puranam (2017), for example, indicate that a fixed salary incentive system (rather than individual pay-for-performance) promotes knowledge transfer among employees, a key part of OL. It has also been argued that compensation systems may impair risk-taking and experimenting (Gerdin et al., 2019), which are critical success factors for OL (Kloot, 1997).

When it comes to administrative controls, there seems to be little consensus on whether organizational administrative design and structure (i.e., designating who is responsible for specific actions and defining how activities and behaviors should [not] be carried out) are methods that hinder (e.g., Siggelkow & Levinthal, 2003) or facilitate (e.g., Sorenson, 2003) OL. Administrative structure (specifically, procedures as 'best practices') is often considered a result of OL, but the administrative structure also affects OL processes (Fiol & Lyles, 1985). Indeed, Meyer (1982, p. 533) indicates that "formalized and complex structures retard learning, but […] learning is enhanced by structures that diffuse decision influence." Actively involving employees in decision-making and empowering them contributes to OL; furthermore, it is essential to establish mechanisms promoting participation, thereby shifting responsibility to lower organizational levels where employees assume accountability for their decisions and resulting outcomes (Kloot, 1997). This usually implies a shift from a mechanistic administrative structure to an organic one (Fiol & Lyles, 1985). While a mechanistic administrative structure contributes situational strength by providing clarity through formalized roles, consistency through standardized procedures, and constraints through clear hierarchies and rules, an organic administrative structure contributes to situational strength by fostering clarity through open communication and ensuring consequentiality through increased accountability.

The same applies to planning controls, an ex-ante form of control (Malmi & Brown, 2008) which is sometimes considered to contribute to OL when they are formalized and give direction (i.e., clarity, consistency, and constraints; see, e.g., Brews & Hunt, 1999; Simons, 1990). Others argue that planning needs to be flexible to be able to react quickly to unexpected developments (e.g., Kloot, 1997). According to Kloot (1997), the emphasis should shift toward contingency planning involving a broad spectrum of managers and employees, thus encouraging adaptability and creativity when responding to unexpected external shifts.

Cultural controls, i.e., the reliance on shared values, norms, and beliefs to control employees' work activities (Malmi & Brown, 2008; Merchant & Van der Stede, 2023), are mostly considered helpful to achieve OL (e.g., Abernethy et al., 2015; Kloot, 1997; Widener, 2007). Shared values, norms and beliefs influence "the behavioral and cognitive development" that the organization can undergo (Fiol & Lyles, 1985, p. 804) by providing consistency and constraints. The shared language used by employees is one of the key factors that contribute to better understanding and learning from their individual experiences, among other benefits (Argote et al., 2021). However, literature also indicates that cultural controls may result in reduced turnover, fostering compartmentalization that, in consequence, reduces the transfer of knowledge among employees (Batac & Carassus, 2009).

While each of the four characteristics of MC practices (i.e., 4 Cs) plays a critical role in facilitating OL, relying on just one may not be

Table 1
MC practice definitions and summary of empirical evidence classified acc. to Malmi and Brown (2008).

MC practice	Definitions used by Bedford and Malmi (2015, p. 7)	Situational strength characteristics[a]				Assoc. with OL	Empirical evidence[e]
		Clarity	Consistency	Constraints	Consequentiality		
Cybernetic controls							
Measure diversity	Diversity of performance measures: narrow to broad and non-financial	+			+	+[b]	[b] BC, CHO, CHE, CMSW, D, H, JMS, K, V
Reward and compensation controls							
Incentive pay	Use of performance-contingent rewards and incentives	+			+	+[b], -[c]	[b] ADS, JCV, K, JMS; [c] EM, LM, LP
Incentive determination	Approach of determining individual remuneration: subjective to objective	+	+			+[b], -[c]	[b] ADS, M, MSL; [c] S
Compensation time horizon	Time horizon of determining individual remuneration: short- to long-term		+		+	+[b], /[d]	[b] EM, M, MSL; [d] JCV
Administrative controls							
Organic administrative structure	Organic organizational structure according to authority, decision-making, and communication	+			+	+[b]	[b]BC, BZ, CEM, K, MCAG, MSL, CG, CO, SO, SL
Mechanistic administrative structure	Mechanistic organizational structure according to authority, decision-making, and communication	+	+	+		+[b]	[b]BB, BZ, CHE, JMS, RGJ, SO
Planning controls							
Strategic planning mode	Way of developing the long-term ends/means of an organization: ad-hoc, adaptive, and emergent to formalized, deterministic, and deliberate	+	+	+		+[b], -[c]	[b] BH, K; [c] BC, BH, S
Cultural controls							
Social controls	Reliance on shared values, norms, and beliefs to manage work activities		+	+		+[b], -[c]	[b] ADS, B, CHE, CO, K, MSL, P, RGJ, W; [c] BC

[a] A '+' indicates that the MC practice contributes to a stronger control situation with the respective characteristics.
[b] A '+' indicates a greater emphasis on the MC practice facilitating OL.
[c] A '-' indicates a greater emphasis on the MC practice hindering OL.
[d] A '/' implies that empirical research investigates the link but did not find an effect.
[e] Abbreviations ('*' indicates that environmental uncertainty has been discussed within that paper): *ADS, Abernethy et al. (2015); B, Bedford (2015); BB, Bunderson and Boumgarden (2010); BC, Batac and Carassus (2009); BZ, Bresman and Zellmer-Bruhn (2013); *BH, Brews and Hunt (1999); CEM, Campbell et al. (2011); CG, Carmona and Grönlund (1998), CHE, Chenhall (2005); CHO, Choe (2002, 2004); CMSW, Chong et al. (2023); CO, Coad (1996), D, Dent (1990); EM, Ederer and Manso (2013); H, Henri (2006a); JCV, Jerez-Gómez et al. (2005); JMS, Johanson et al. (2001a, 2001b); *K, Kloot (1997); LM, Lee and Meyer-Doyle (2017); LP, Lee and Puranam (2017); M, Manso (2011); MCAG, Mallen et al. (2016); MSL, McGill et al. (1992); P, Pettersen (2001); S, Simons (1990); SL, Siggelkow and Levinthal (2003); *SO, Sorenson (2003); *RGJ, Rachmawati et al. (2025); V, Vaivio (2004); *W, Widener (2007).

sufficient. Instead, it is the combination that creates strong control situations. The effectiveness of MC practices in promoting OL, therefore, depends on how these practices are combined, drawing on their complementary characteristics (Gerdin et al., 2019).

2.2.2. Environmental uncertainty

Govindarajan (1984, p. 127) refers to environmental uncertainty as "the unpredictability in the actions of different actors […] that comprise the external environment of the business unit."[2] Environmental uncertainty results in a gap between the information necessary and the information accessible to make effective decisions (Galbraith, 1977). Environmental uncertainty drives both the use of MC practices as well as OL. Previous literature emphasizes the necessity of OL to navigate and thrive in uncertain environments (e.g., Fiol & Lyles, 1985; Garvin, 1993). March (1991), however, proposes that the necessity for OL extends beyond high-uncertainty environments and suggests that environmental factors (including uncertainty) shape how organizations learn.

Environmental uncertainty is a critical external factor identified in the management accounting literature (Gerdin & Greve, 2004; Grabner & Moers, 2013). Previous literature indicates that the effectiveness of an MC system depends on design choices that are the "best fit" with the specific attributes of the organizational environment, among other relevant factors (Chenhall, 2003, p. 127). As for MC practices, organizations that experience higher uncertainty increase the use of broad-scope information (Chenhall & Morris, 1986; Chong & Chong, 1997; Gul & Chia, 1994), rely more on subjective performance evaluations (Abernethy & Mundy, 2014; Govindarajan, 1984), and alter the use of incentives (Bloom & Milkovich, 1998; Ittner et al., 2007) as environmental uncertainty increases the noise in performance measures (e.g., Abernethy et al., 2015). Furthermore, environmental uncertainty has been argued to affect combinations of MC practices (e.g., Abernethy et al., 2015; Chen et al., 2023; Gerdin et al., 2019; Henri & Wouters, 2020; Kreutzer et al., 2016; Yang et al., 2022).

Therefore, it can be assumed that environmental uncertainty influences how MC practices are combined to achieve OL, with organizations adjusting their practices to align individual behavior and organizational goals in response to varying conditions of uncertainty.

2.3. Research proposition

The previous review suggests that the impact of combinations of MC practices on OL will vary across different degrees of environmental uncertainty. This argument is based on two assumptions. First, different MC practices have different abilities to create strong control situations yet suffer from limitations if used in isolation; and second, the strength of control situations varies across the context of organizations (Gerdin et al., 2019). Management accounting literature has recognized that interdependencies amongst MC practices affect OL. For example, Widener (2007), using complementarity theory, finds that the levers of control (i.e., belief and boundary system as well as interactive and diagnostic use of controls) are interdependent for OL. Abernethy et al. (2015) explicitly show that incentive contracts and employee selection are complements when organizations become more committed to OL; in addition, they also show that this relationship is contingent on the environmental setting (Abernethy et al., 2015).

While we expect that organizations combine MC practices to create strong control combinations, we have no precise predictions for what *specific* MC practices combine to affect OL in different uncertainty settings. Therefore, we first perform an exploratory analysis using fsQCA to identify effective MC combinations for OL and determine which MC practices are relevant for further analysis in a second step (Bedford et al., 2016). In the second step, we examine interdependencies between MC practices. Our underlying assumption is that one MC practice helps to mitigate the limitations of the other MC practice. Thus, organizations should achieve higher OL if the combination of MC practices with reinforcing situational strength features is 'adequate,' which depends on both the context (i.e., level of environmental uncertainty) as well as the characteristics of the other practices. We put forth the following:

Proposition. Organizations combine different MC practices with reinforcing situational strength features to achieve OL, depending on the environmental uncertainty.

[2] This study focuses on the relatively broad concept of perceived environmental uncertainty, which has been widely used as a proxy for strategic uncertainty in management accounting (Fisher, 1995; Ittner & Larcker, 2001). While this can be considered a subjective measure, it can equally be argued that this is the most crucial facet of uncertainty, as one's perception of uncertainty influences behavior (Otley, 2016).

Table 2
Demographic data.

Panel A: industry		Panel B: listed vs. non-listed		Panel C: BU size (employees)	
Agriculture, forestry, fishing	1	Listed	44	250–499	51
Manufacturing	90	Non-listed	166	500–999	39
Mining	5			1000–4,999	65
Construction	17			5000–9,999	21
Retail & wholesale	33			≥ 10,000	34
Transportation & utilities	21				
Health & social services	17				
Other services	26				
Total	210	Total	210	Total	210

3. Research method

3.1. Data collection

Data for the empirical analysis were collected through a cross-sectional survey. We use survey data as it gathers information on the many dimensions required to study systematic links and outcomes in the natural setting in which they appear (Speklé & Widener, 2020). The target group for the sample was senior business unit (BU) controllers. We chose controllers as they are likely to be knowledgeable about both OL and an organization's MC practices (Järvenpää, 2007). We used the

Table 3
Standardized factor loadings, average variance extracted (AVE), and composite reliability (CR).

Construct/Item	Std. loading	AVE	CR
Organizational learning (*LEARN*)		0.524	0.814
LEARN1	0.756		
LEARN2	0.812		
LEARN3	0.655		
LEARN4	0.686		
Incentive pay (*INPAY*)		0.428	0.683
INPAY1	0.800		
INPAY2	0.578		
INPAY3	0.558		
Administrative structure (*STRUC*)		0.465	0.771
STRUC2	0.478		
STRUC3	0.747		
STRUC4	0.789		
STRUC5	0.669		
Strategic planning mode (*PLANN*)		0.564	0.835
PLANN1	0.679		
PLANN2	0.888		
PLANN3	0.708		
PLANN4	0.694		
Social control (*SOC*)		0.756	0.925
SOC1	0.888		
SOC2	0.898		
SOC3	0.906		
SOC4	0.776		

Orbis database and limited the survey radius to controllers from BUs that have a certain size (≥ 250 legal entity employment; ≥ CHF 40 million revenues in the last available year) to ensure advanced MC systems are in place (e.g., Bedford et al., 2016). Further, they are located in the German-speaking area, for-profit, and not active in the financial industry to avoid distortion of answers due to distinct cultural, legal, or other socio-economic differences (Bedford et al., 2016).

This search resulted in 9,996 BUs. We randomly sampled 2,550 BUs from the overall search, identified all respondents manually, and contacted them directly. The questionnaire was sent to those controllers who agreed to participate. They were reminded twice in a two-week interval when they had not answered the survey yet. Further, we offered incentives to increase participation (study report and two seminar spots). Out of 1,412 contacted persons[3] and 285 survey questionnaires sent, we received 212 fully completed questionnaires. 210 met the sample criteria[4] and were retained for analysis, corresponding to a response rate of 14.9% (210/1,412). Demographic information on the final sample is found in Table 2.

We adopted several measures addressing potential biases (Podsakoff et al., 2003). First, the survey was translated back and forth. As the survey was answered in German, an independent person translated the final survey, initially consisting of English constructs, into German and then back into English to verify that the original meaning was not changed during the process (Grabner, 2014). Second, the questionnaire was extensively pilot-tested with practitioners of the target population who did not participate in the final survey and independent academics to ensure consistency in understanding and avoid equivocalness in wording, as well as to ascertain face and construct validity. These measures resulted in minor phrasing modifications. Third, we used reverse-coded items and variance in naming the anchors. Fourth, the survey was conducted anonymously to limit social desirability. Fifth, Harman's one-factor test was applied to ensure that a single-source bias is not a significant issue. The first factor in an unrotated solution was substantially less than 50% of the overall variance, indicating no evidence for a single-source bias.

3.2. Construct measurement

Existing survey instruments are used (Bedford et al., 2016; Bedford & Malmi, 2015); the appendix includes the survey questionnaire. The validity of reflective constructs is evaluated using (1) confirmatory factor analysis (CFA) with maximum-likelihood robust estimation, (2) correlation analysis, and (3) Cronbach's Alphas (Bedford et al., 2016). The CFA results provide strong support for the soundness of the measurement model. Model fit indices indicate a good fit to the data (CFI = 0.955, TLI = 0.946, RMSEA = 0.053 [90% CI: 0.040, 0.066], SRMR = 0.062), all meeting the recommended thresholds (Hair et al., 2019). The CFA confirms unidimensionality for each reflective construct, with the exception of *STRUC*, for which one item was removed due to cross-loadings in the factor analysis (*STRUC1*). Full CFA results, including factor loadings, average variance extracted (AVE), and composite reliability (CR), are reported in Table 3. Although factor loadings for individual items of *INPAY* and *STRUC* are modest, they are consistent with values reported in prior studies using these established scales (Bedford et al., 2016; Bedford & Malmi, 2015). Further, item-deletion analyses confirm that the retained items optimize reliability and convergent validity.

Table 4 provides the descriptive statistics and the correlations for the variables. The correlation analysis reveals that several MC practices are correlated, yet does not raise concerns about multicollinearity. It also indicates that several MC practices are associated with OL, emphasizing the need to consider multiple MC practices. The value of the respective square root of the AVE for each construct is above the bivariate correlations with other constructs analyzed, demonstrating discriminant validity (Fornell & Larcker, 1981). Discriminant validity is further supported by heterotrait-monotrait (HTMT) ratios displayed in Table 5, all of which are below the threshold of 0.85 (Hair et al., 2019). Cronbach's Alphas are between 0.67 and 0.92, suggesting adequate construct reliability (Hair et al., 2019). The validity of formative constructs is evaluated using (1) principal component analysis (PCA) weightings, as well as (2) variance inflation factors (VIFs) (Bedford et al., 2016). PCA reveals weights above the recommended minimum with one exception (*ENV5*) (Hair et al., 2019). The maximum VIF is below the general threshold of 10 (Hair et al., 2019).

Criterion validity is further assessed by comparing the correlations of our constructs with theoretically related variables against those reported in Bedford and Malmi (2015) and Bedford et al. (2016). The results confirm strong criterion validity across all constructs, with correlations closely mirroring those found in prior studies using the same constructs (Online Appendix Table 9).

3.2.1. Dependent variable

Organizational learning (*LEARN*) is captured through four items, each representing one dimension of OL according to Huber (1991): the existence of established ways to (1) acquire information and (2) share information as well as (3) an organization's beliefs and attitudes to interpret information and (4) the storage of information and knowledge for future use. This construct has been used by Chenhall (2005); following Chenhall (2005), we interpret the construct as reflective. Factor analysis reveals loadings of at least 0.655 on a single factor for all items (AVE 52.4%, CR 0.814, $\alpha = 0.818$). The positive and significant correlation ($r = 0.639$, $p < 0.01$) with another established construct, organizational attitude toward learning (Abernethy et al., 2015; Henri, 2006a; King & Clarkson, 2015; Widener, 2007), supports the construct validity of this measure.

3.2.2. Independent variables

Measure diversity (*DIVER*) is measured by asking respondents to evaluate the extent to which six performance dimensions (customer, employee, operational process, innovation, quality, social responsibility) are used to assess the performance of employees (1 = very low extent; 7 = very high extent). Performance dimensions are based on those used in prior studies (Bedford et al., 2016; Bedford & Malmi, 2015; Henri, 2006b; Henri & Wouters, 2020). Following previous literature (e.g., Henri, 2006b; Ittner et al., 2003), we created the construct by deriving the mean score across the performance categories.

Incentive pay (*INPAY*) describes performance-based compensation and is captured using a pre-existing instrument consisting of three items (e.g., Bedford et al., 2016; Bedford & Malmi, 2015). Factor analysis reveals loadings > 0.558 of all items on a single factor. The AVE is less than 50%. However, as CR is higher than 0.6 (0.683) and Cronbach's alpha is 0.669, the convergent validity of the construct is still considered adequate (Fornell & Larcker, 1981).

Incentive determination (*INDET*) is measured using a single item that reflects a continuum from entirely (1) "determined subjectively (based on top management assessment)," (4) "intermediate," to entirely (7) "determined objectively (based on pre-determined formulas or targets)" (Simons, 1987).

Compensation time horizon (*COMP*) is measured with a single indicator with endpoints reflecting a short-term (one year or less) or long-term (three years or more) orientation in compensation determination as defined by Galbraith and Merrill (1991).

Administrative structure (*STRUC*), displaying the nature of decentralization, decision-making, and communication in an organization, is

[3] While our sampling frame consisted of 2,550 BUs, a suitable contact person could only be identified for 1,412 of these BUs. For the remaining BUs, no appropriate contact person could be identified.

[4] The two participants were excluded from the analysis as it was identified that the BUs they are working for have a too small number of employees (i.e., < 250 legal entity employment).

Table 4
Descriptive statistics and correlation matrix.

		Mean	SD	1	2	3	4	5	6	7	8	9
1	Measure diversity	4.28	1.30	—								
2	Incentive pay	3.41	1.42	0.27**	0.65							
3	Incentive determination	4.78	1.85	0.10	0.30**	—						
4	Compensation time horizon	1.50	0.60	0.17*	0.00	−0.20**	—					
5	Administrative structure	4.42	1.14	−0.27**	−0.35**	−0.17*	−0.11	0.68				
6	Strategic planning mode	4.10	1.28	0.32**	0.27**	0.14*	0.04	−0.17*	0.75			
7	Social control	4.16	1.32	0.46**	0.39**	0.10	0.11	−0.55**	0.35**	0.87		
8	Environmental uncertainty	2.99	0.89	−0.09	0.01	−0.03	0.10	−0.08	0.05	0.00	—	
9	Organizational learning	4.38	1.24	0.54**	0.22**	0.16*	0.06	−0.38**	0.40**	0.57**	−0.12	0.72

This table reports estimated Pearson bivariate correlations between constructs. The diagonal values represent the square root of AVEs for the reflective constructs. *, ** represent $p < 0.05$, $p < 0.01$ (two-tailed), respectively.

Table 5
HTMT ratios.

	LEARN	INPAY	STRUC	PLANN	SOC
LEARN	—				
INPAY	0.240	—			
STRUC	0.456	0.481	—		
PLANN	0.463	0.322	0.173	—	
SOC	0.648	0.494	0.666	0.364	—

LEARN organizational learning, *INPAY* incentive pay, *STRUC* administrative structure (organic to mechanistic), *PLANN* strategic planning mode (informal/emergent to formal/deliberate), *SOC* social controls.

measured using five items by Bedford et al. (2016). In the questionnaire, endpoints represent an (1) entirely mechanistic or (7) entirely organic administrative structure. The interpretation of the scores, however, was reversed for this manuscript. A low score now reflects a more organic administrative structure (i.e., flexible, decentralized, empowering), while a high score now reflects a more mechanistic administrative structure (i.e., rigid, centralized, controlling). One item is dropped from the analysis as it did not load on the same factor; the remaining four items have loadings on a single factor with adequate convergent validity (AVE 46.5%, CR 0.771) and internal consistency ($\propto = 0.754$).

Strategic planning mode (*PLANN*) is assessed through four items based on existing instruments by Brews and Hunt (1999) as used by Bedford and Malmi (2015). Endpoints of the indicator generally represent a continuum from formalized, deterministic, and deliberate to ad-hoc, adaptive, informal strategic planning. For consistency with other constructs in this study, the interpretation of the scores was reversed. In this analysis, a score of (1) represents ad-hoc, adaptive and informal strategic planning, while a score of (7) represents formalized, deterministic, and deliberate strategic planning. Factor analysis reveals item loadings of at least 0.679 on a single factor, adequate convergent validity (AVE 56.4%, CR 0.835), and internal consistency ($\propto = 0.827$).

Social control (*SOC*) is measured through a four-item construct reflecting the existence as well as reliance and commitment on shared values, norms, and beliefs within the organization, as used by Bedford and Malmi (2015). Factor analysis reveals loadings of all items on a single factor of minimum 0.776 (AVE 75.6%, CR 0.925, $\propto = 0.923$).

3.2.3. Moderating variable

Environmental uncertainty (*ENV*) is measured by asking respondents to assess how (un)predictable each of the five selected factors (customers, suppliers, competitors, technological, economic/regulatory) has been in the context of their organizations over the past three years (1 = very predictable; 7 = very unpredictable). The selected dimensions represent the primary facets of an organization's external environment (Bedford & Malmi, 2015; Gordon & Narayanan, 1984). As uncertainty in one dimension does not necessarily indicate the same for another dimension, the variable is treated as a formative construct (Bedford & Malmi, 2015). The item 'economic changes and government regulations' was removed from the final analysis due to its low PCA weight, resulting in perceived environmental uncertainty being measured according to four dimensions. Similar to Henri and Wouters (2020), we split the sample into high- and low-environmental uncertainty subsamples.

3.3. Data analysis

We follow the two-step approach proposed by Bedford et al. (2016) to study MC combinations. First, we conduct fsQCA to identify which MC practices go together to achieve OL; second, we use OLS regressions to test for the joint effect of MC practices on OL.

3.3.1. Fuzzy-set Qualitative Comparative Analysis

We use fsQCA to empirically explore which MC configurations organizations adopt to achieve OL, contingent on their environmental context. Compared to fsQCA, traditional approaches to studying configurations (such as clustering and profile deviation analysis; see, e.g., Gerdin, 2005) have shortcomings concerning arbitrary assumptions or providing no information about whether the individual elements in an estimated configuration contribute to the outcome (Fiss, 2007). Consequently, research has been limited due to a mismatch between reality and methods (Fiss, 2011).

The primary goal of fsQCA is to identify which sets, if any, contribute to a defined outcome (Fiss, 2007). For this study, we use it to determine an organization's membership in different sets and compare these to the degree of membership the organizations have for a defined outcome, i.e., *high LEARN*. Adopting fsQCA to analyze complex business phenomena is considered appropriate in today's dynamic environment. It has been demonstrated to be an effective and rigorous method for explaining and evaluating non-linear relationships that reflect actual business situations (Kumar et al., 2022). In contrast to widely used methods for studying configurations, fsQCA is grounded in set theory and considers logical relations between sets (for a detailed explanation, see Fiss, 2007, 2011). A set-theoretic approach is based on the fact "that attributes of cases are best described in set relations and not in terms of values" (Rihoux & Marx, 2013, p. 168). It reveals which MC practices are core, peripheral, and redundant for achieving a particular outcome (Fiss, 2011). Further, fsQCA contains information on coverage (similar to an R-squared value in regression analysis) and consistency (similar to a p-value in regression analysis) (Fiss, 2007). Lastly, fsQCA accounts for multiple configurations that are effective in achieving desired outcomes, i.e., equifinality (Gerdin, 2005; Sandelin, 2008).

An fsQCA consists of three stages. The first step is to calibrate the degree of membership to assess the presence (or absence) of a specific practice in different sets (Ragin, 2008). The sense of presence and absence varies according to how the particular construct is set up (Bedford et al., 2016). For some MC practices, presence and absence refer to their conceptual endpoints. For instance, presence for incentive determination refers to incentives determined based on management's assessment (subjective), while absence refers to compensation determined based on pre-determined

guidelines (objective). For other MC practices, presence and absence refer to high and low use, respectively (e.g., social controls). By calibrating, we transform raw scores to fuzzy-set membership scores and thus make measurement directly interpretable (Ragin, 2008); 0 representing complete non-membership/absence (notation: ⊗) and 1 full membership/presence (●) (Ragin, 2008). The calibration follows the direct method (Ragin, 2008); Likert scales are calibrated accordingly: 6 (1 full membership), 4 (0.5001 crossover point),[5] and 2 (0 non-membership) (Pappas & Woodside, 2021). One exception is *COMP*, which includes three anchors directly marking the three thresholds (3 = full membership, 2 = crossover point, 1 = non-membership). Further, as we want to define OL as *high LEARN*, we calibrate it as follows: 6 (full membership), 4.5 (crossover point), and 3 (non-membership). To verify the reliability of our results, we tested the robustness by applying different calibrations.[6]

In a second step, Boolean algebra assesses similarities between rows in the truth table that consistently lead to a superior outcome (Ragin, 2008), i.e., *high LEARN*. As control configurations that are effective for OL are expected to be contingent on an organization's environmental uncertainty (Henri & Wouters, 2020), we split the sample into two groups. Truth tables are separated for low (n = 104) and high uncertainty (n = 106). The assessment of similarities requires the specification of a minimum frequency of observations and consistency thresholds (Fiss, 2011). Frequency is limited to at least two organizations to prevent conclusions from a single observation (Bedford et al., 2016). Even though Fiss (2011) suggests maximizing this number and recommends using a threshold of three observations when n is higher than 100, we give more weight to the general recommendation to include around 80% of all cases in the analysis (Ragin, 2008). In addition, the consistency threshold is set to a minimum of 0.81, which is above the recommended threshold in the literature (Ragin, 2008).

The final step reduces the information in the truth table to logical optimal solutions to identify the similarities among a set of MC practices that consistently result in high OL (Ragin, 2008), i.e., highlight the relative importance of MC practices within a configuration/solution. It classifies MC practices as core (notation: large circle), peripheral (small circle), or redundant (blank space) (Fiss, 2007). Core practices are defined as "those causal conditions for which the evidence indicates a strong causal relationship with the outcome," while peripheral ones are those "for which the evidence for a causal relationship with the outcome is weaker" (Fiss, 2011, p. 394). In technical fsQCA terms, those MC practices included in the parsimonious solution and the intermediate solution are classified as core (Pappas & Woodside, 2021). In contrast, those included in the intermediate but not the parsimonious solution are classified as peripheral MC practices (Pappas & Woodside, 2021). This implies that core practices are assumed to be necessary components of a configuration to achieve an outcome but may not be sufficient in isolation unless paired with specific peripheral practices (Bedford et al., 2016). Furthermore, peripheral practices are loosely linked, indicating that they can be substituted or exchanged, resulting in more than one optimal solution (Bedford et al., 2016).

3.3.2. OLS regressions

In a second step, we use OL regressions to test whether the MC practices identified in the fsQCA (1) facilitate OL and (2) whether they are interdependent, i.e., have a synergetic effect on OL (Bedford et al., 2016). Prior to this second step, we develop hypotheses based on both situational strength theory and the fsQCA findings. To test whether MC practices have a synergetic effect, we regress interaction terms[7] on OL separately for organizations in a low- and high-uncertainty context (Bedford et al., 2016), as the mere observation of absent and present MC practices in an MC configuration does not necessarily imply that the combined use of MC practices is beneficial (Misangyi & Acharya, 2014). The differentiation between core and peripheral MC practices is relevant here. Because core MC practices are considered more closely connected to each other than peripheral MC practices are, a synergetic effect between them is expected in achieving the desired outcome (Fiss, 2011). The presence of more than one core MC practice within a solution in the same environmental context suggests that the marginal return of the combined use of MC practices is larger than the marginal returns from each MC practice used individually (Gerdin et al., 2019; Misangyi & Acharya, 2014).

4. Results

4.1. Results of fsQCA

The fsQCA results for organizations achieving OL in low- and high-uncertainty environments are displayed in Table 6. Based upon their mutually shared core MC practices, we cluster the 16 configurations (solutions 1a-1i for low-uncertainty context; 2a-2g for high-uncertainty context) into four groups (1 to 4).[8] Furthermore, measures for consistency and coverage are shown. Consistency displays the proportion of cases with a given combination of conditions in common that agree on the presence of the outcome, i.e., significance (Ragin, 2008). Coverage displays the proportion for which a causal combination 'accounts for' the occurrence of an outcome, i.e., strength (Ragin, 2008). Coverage can be split into raw and unique coverage (Ragin, 2008). Raw coverage assesses the proportion of all organizations sharing the outcome of high OL that are accounted for by each MC configuration, while unique coverage displays the proportion of organizations not covered by any other MC configuration (Ragin, 2008). The minimum overall solution consistency threshold (0.75) is met for both samples (0.84 and 0.81, respectively; Greckhamer et al., 2018; Pappas & Woodside, 2021; Ragin, 2008). The overall solution coverage of 0.66 and 0.60, respectively, suggests that the identified solutions cover a substantial amount of the outcome (Greckhamer et al., 2018; Pappas & Woodside, 2021).

The fsQCA results for organizations in a low-uncertainty environment provide nine solutions that achieve similarly high levels of OL; based upon their shared core practices, these solutions are clustered in configuration groups 1 and 2. Measure diversity is classified as core for OL for all solutions in configuration group 1 (1a-1g). In addition to measure diversity, configuration group 1 identifies social controls as core (combined with different peripheral control practices). An alternative configuration in the low-uncertainty subsample (configuration group 2, solutions 1g-1i) identifies incentive pay (linking financial rewards to performance targets) and a mechanistic administrative structure as core MC practices. Furthermore, the short-term (one year or less) and objective determination of incentives operate as peripheral practices. This solution suggests a more 'performance-based approach' to OL based on performance measures and incentives. Finally, solution 1g shows the combination of all four core practices of configuration groups 1 and 2 (i.e., measure diversity, incentive pay, mechanistic administrative structure, and social controls).

The fsQCA results for organizations in a high-uncertainty environment reveal seven effective solutions for OL, which are combined in configuration groups 3 and 4 based on their shared core MC practices.

[5] We add 0.001 to all calibrated values equal to 0.5 to prevent cases with attributes that fall on the crossover point from being dropped in the analysis (e.g., Pappas & Woodside, 2021, following Fiss, 2011).

[6] The analysis is also conducted with MC practices calibrated at 7 (full membership), 4 (midpoint) and 1 (non-membership) and/or with OL calibrated at 6 (full membership), 4 (midpoint) and 2 (non-membership). The overall solution consistency and solution coverage, however, are lower, and results do not change substantially, indicating that the analysis is not too sensitive to the definition of the specified thresholds.

[7] Before building interaction terms, all independent variables were mean-centered (Bedford et al., 2016).

[8] Solution 1g (n = 4) is included in configuration group 1 and 2 as it combines and includes the two core MC practices of configuration group 1 and the two core MC practices of configuration group 2. We discuss this in more detail in one of the robustness checks.

Table 6
FsQCA results for the total sample, firms in a low (n = 104) and high (n = 106) uncertainty context, outcome: high organizational learning.

Context	Low uncertainty									High uncertainty						
Group	Group 1							Group 2		Group 3		Group 4				
Solution / Configuration	1a	1b	1c	1d	1e	1f	1g	1h	1i	2a	2b	2c	2d	2e	2f	2g
Cybernetic controls																
Measure diversity *broad ●, narrow ⊗*	●	●	●	●	●	●	●	⊗	•	●	●	•	•	⊗	⊗	
Reward and compensation controls																
Incentive pay *high use ●, low use ⊗*	⊗	•		⊗	⊗	•	●	●	●	⊗		•		⊗	⊗	⊗
Incentive determination *objective ●, subjective ⊗*	•	•	•	•	⊗			•	•	•	•	•	•	•	•	•
Compensation time horizon *long- ●, short-term ⊗*	⊗		⊗		•	•	⊗	⊗	⊗		⊗				⊗	⊗
Administrative controls																
Administrative structure *mechanistic ●, organic ⊗*			⊗	⊗		⊗	●	●	●	•	•	⊗	⊗	⊗	⊗	⊗
Planning controls																
Strategic planning mode *formal/deliberate ●, informal/emergent ⊗*		•			⊗	•	•		⊗	●	●		⊗	•		⊗
Cultural controls																
Social controls *high use ●, low use ⊗*	●	●	●	●	●	●	●	•	⊗	⊗	•	●	●	●	●	●
Consistency	0.84	0.93	0.90	0.88	0.82	0.93	0.91	0.83	0.85	0.84	0.84	0.86	0.79	0.86	0.84	0.82
Raw coverage	0.36	0.37	0.42	0.31	0.14	0.20	0.30	0.19	0.17	0.29	0.33	0.36	0.26	0.25	0.26	0.25
Unique coverage	0.05	0.03	0.02	0.01	0.03	0.01	0.03	0.01	0.01	0.06	0.03	0.07	0.00	0.01	0.00	0.00
Overall solution consistency	0.84									0.81						
Overall solution coverage	0.66									0.60						

Presence of an MC practice ●, absence of an MC practice ⊗.
Core MC practice: large circle, peripheral MC practice: small circle, redundant MC practice: blank space.

Solutions in configuration group 3 (2a-2b) share the same core MC practices of measure diversity and a formal/deliberate strategic planning mode. Finally, solutions in configuration group 4 (2c-2g) share an organic administrative structure and a high use of social controls as core practices. Several robustness checks confirm our findings.[9]

4.2. Hypotheses development

4.2.1. Synergetic effects of management control practices

Broadly, the fsQCA analysis reveals MC combinations that consistently achieve higher organizational learning in low- and high-uncertainty contexts. Given the context (level of environmental uncertainty), we rely on situational strength theory to hypothesize and subsequently test whether there is a synergetic effect between the identified MC practices and OL. MC combinations have synergetic effects when they are interdependent, meaning that the benefits from one MC practice depend upon the use of the other (Bedford et al., 2016).[10] Previous literature (Bedford et al., 2016; Fiss, 2011) indicates that the core MC practices are most likely to have synergetic effects[11]; observing multiple core MC practices within a combination suggests that these control practices act as complements (Bedford, 2020), consistent with fsQCA results indicating that they are jointly required to achieve synergetic effects (Bedford et al., 2016).

Previous literature (e.g., Abernethy et al., 2015; Gerdin et al., 2019; Kreutzer et al., 2015) also shows that uncertainty is a relevant contextual variable that may affect the synergetic effects of specific control practices. Uncertainty may affect the strength of specific control combinations, and relatedly, the strength of specific control practices may change across different environmental contexts (Gerdin et al., 2019).

4.2.2. Hypotheses for low-uncertainty environment

When uncertainty is low, the control situation is more likely to be strong (Gerdin et al., 2019). In such an environment, changes in customer and supplier behavior, competitor actions and technological developments are foreseeable and can be anticipated. As a result, organizational objectives are typically well-established, implying that they can be unambiguously codified in a set of quantitative metrics that together capture the critical success factors of the company (Abernethy et al., 2015; Townsend et al., 2018; Yang et al., 2022). That is, the possibility to design and rely on a more complete performance measurement system will increase the likelihood that the behaviors of lower-level managers and employees in the organization are consistent with (and constrained by) company-wide objectives (Gerdin et al., 2019). As a result, the weaknesses of result controls (performance measures and incentive pay) are relatively small in a low-uncertainty environment, and other controls may be used to reinforce these result controls.

In configuration group 1, all solutions (1a-1g) rely on measure diversity and social controls as core control practices. A diverse set of performance measures not only informs about an organization's strategy (Widener, 2007) but can also be considered a learning system itself (i.e., an error detection and correction system; Argyris & Schön, 1978). Social

[9] We compared mean differences of MC practices between high OL organizations in low-vs. high-uncertainty clusters; results show similar patterns to those presented in the fsQCA results. Moreover, we grouped and matched all organizations to their corresponding configuration group (1-4) to analyze and test for characteristic differences concerning uncertainty, strategy, and size. Neither configuration groups 1 and 2 (low uncertainty) nor 3 and 4 (high uncertainty) significantly differ in their degree of uncertainty; furthermore, none of the groups are significantly different in terms of strategy or size.

[10] Considering the challenge of interpreting higher-order interactions (Hartmann & Moers, 1999), hypotheses are limited to pairwise interactions (Bedford et al., 2016). We revisit this issue in our robustness checks.

[11] For a detailed analysis of their individual impacts, refer to Table 1.

controls typically imply that managers seek to more indirectly influence subordinates' behavior through shaping their mindset in the hope that they will internalize the values and beliefs of the organization and act in accordance with them (Abernethy et al., 2015; Gerdin, 2020). As such, social controls align values, norms, and understanding of the desired performance, directing employees to achieve both long-term goals as well as short-term targets (Brenner & Ambos, 2013; Simons, 1994; Yang et al., 2022). A common understanding of the values and beliefs of the organization among employees can foster knowledge sharing and improve learning from joint experiences and shared social identities (Argote et al., 2021). In addition, social controls are associated with joint problem solving, participatory decision making and thorough information exchange (Li et al., 2010). Social controls thus enhance the usefulness of performance measures (Wabnegg, 2024); they increase the exchange of information within the organization (Argote et al., 2021; Li et al., 2010) and impose constraints as to what kind of behavior is (un) acceptable to peers (Gerdin et al., 2019; Simons, 1994).

Performance measures generally provide freedom to deal with emerging issues effectively (Merchant & Van der Stede, 2023; Ouchi, 1979), but without social controls, employees may lack a sense of purpose (Mundy, 2010). Diverse performance measures provide a more comprehensive understanding of how to achieve corporate objectives; social controls can provide context for why specific performance measures are important to the organization (Gerdin et al., 2019; Merchant & Van der Stede, 2023). That is, a diverse set of performance measures provides clarity and consequentiality about the goals to be achieved (Gerdin et al., 2019); in addition, social controls will increase the consistency with overall objectives and constraints of these performance measures, focusing employees on measures that are 'acceptable' within the organization. Thus, situational strength theory suggests that a combination of measure diversity and social controls reinforces each other (Gerdin et al., 2019; Kreutzer et al., 2016):

H1. Measure diversity and social controls have a synergetic effect on OL in a low-uncertainty environment.

Configuration group 2 (solutions 1g-1i) relies on performance-contingent rewards and mechanistic administrative controls as core control practices. The motivation to learn oftentimes depends on incentives (e.g., Lee & Meyer-Doyle, 2017; Lee & Puranam, 2017). In a low-uncertainty environment, contracting upon OL may be relatively feasible; compared to a high-uncertainty environment, the noise is lower and objectives tend to be less ambiguous (Abernethy et al., 2015). Therefore, in such contexts, performance-contingent incentives are an effective tool for assuring goal congruence (Abernethy et al., 2015; Gerdin et al., 2019).

Mechanistic administrative controls constrain employee behavior to align it with organizational objectives (Clement & Puranam, 2018). Experimentation is costly and may degenerate into a resource-consuming 'art for art's sake' exercise that takes too long to converge into sensible initiatives and action plans (Speklé et al., 2022). A mechanistic administrative structure enhances OL by emphasizing resource efficiency (e.g., Miles & Snow, 1978) and focusing the search for new ideas within a prescribed acceptable domain (Marginson, 2002). In low-uncertainty environments, mechanistic controls provide a structured framework that facilitates focused learning and refine existing processes, building upon past knowledge (Sorenson, 2003).

Given that it is relatively easy to translate organizational objectives to a set of quantitative metrics in a low-uncertainty environment, we hypothesize that mechanistic administrative controls reinforce these metrics. That is, in a low-uncertainty setting, incentive systems provide clarity and consequentiality about goals that should be pursued; and if the performance measurement system is fairly complete, the incentives associated with them increase the likelihood that employee behaviors are consistent with, and constrained by, these goals (Gerdin et al., 2019). Mechanistic administrative controls limit the autonomy of units to explore alternative domains, focusing efforts on learning-by-doing within the unit (Sorenson, 2003). Given this, we hypothesize that performance-contingent rewards jointly with a mechanistic administrative structure create a strong control situation in a low-uncertainty setting (Gerdin et al., 2019):

H2. A mechanistic administrative structure and performance-contingent incentives have a synergetic effect on OL in a low-uncertainty environment.

4.2.3. *Hypotheses for high-uncertainty environment*

As the level of environmental uncertainty increases, we expect that the synergetic effects of control practices may change. When cues from exogenous actors such as customers, competitors, suppliers and industry regulators become more difficult to predict, the control situation within the organization becomes less strong (Meyer et al., 2010). Organizational objectives are more likely to be ambiguous, which means that it is difficult to codify them into a set of metrics that capture the critical success factors of the company (Hartmann, 2000). As a consequence, employees will have less clear expectations about what is expected from them; as such, organizations may rely on other control practices to provide additional clarity and consequentiality as a means of making such a weak situation stronger (Gerdin et al., 2019).

In configuration group 3 (solutions 2a-2b), organizations rely, similar to those in group 1, on measure diversity as a core control practice; yet rather than with social controls, they combine this with a formal strategic planning mode to achieve high OL in a high-uncertainty environment. In high-uncertainty settings, relying on a narrow set of performance measures can lead to a negligence of relevant information; measure diversity provides a rich informational foundation, allowing organizations to detect emerging patterns, adapt more flexibly and learn from a wider range of experiences (which increases the likelihood that new developments are identified; see Abernethy et al., 2015; Chenhall & Morris, 1986). Unforeseen changes in customer demands, competitor actions, technology and macro-economic conditions make the strategic orientation of companies volatile and emergent (Bedford, 2015), and strategic assumptions are continuously challenged to verify whether they are adequate (Simons, 1990). This environment requires the discovery of evolving opportunities and the creation of new capabilities (Henri, 2006a), generally through the autonomous experimentation and search activities of lower-level managers (Bedford, 2015). As such, this increases the risk that lower-level managers take actions that are not in line with overall values and beliefs of the company, given that performance measurement systems tend to be incomplete in high uncertainty settings (Abernethy et al., 2015; Jordan & Messner, 2012; Townsend et al., 2018; Yang et al., 2022).

In such situations, a formal/deliberate planning mode provides top management with the ability to identify, discuss and act upon new information as it emerges, ensuring that organizations remain responsive and adaptive (Kaplan & Norton, 2008; Simons, 1990, 1995). Through a formal and deliberate strategic planning mode, the long-term goals, expectations and courses of action are constantly discussed and agreed upon amongst top management and lower-level managers (Langfield-Smith, 2006; Simons, 1990). Deliberate strategic planning achieves goal congruence by pre-determining the activities and behaviors required to realize desired objectives (Bedford & Malmi, 2015); such strategic planning tends to be more sophisticated when uncertainty is high (Brews & Hunt, 1999). These formal plans are amenable to change (Nguyen Huy et al., 2017), providing the ability to respond to changing circumstances and requirements quickly (Cardinal et al., 2017).

In an uncertain environment, a formal/deliberate strategic planning mode provides the opportunity to debate strategy and action plans in the face of rapidly changing environmental conditions (Langfield-Smith, 2006; Palermo, 2018). This provides top management with the opportunity to (re)establish clarity about organizational objectives, constraints with regard to strategy execution and the variety of legitimate courses of action within subunits, and consistency of plans within the organization (Gerdin et al., 2019). Thus, while measure diversity provides clarity and strengthens consequentiality by defining metrics in alignment with strategic priorities, a formal/deliberate strategic

Table 7
Summary of hypotheses following situational strength theory.

Hypotheses	MC practices	Situational strength characteristics			
		Clarity	Consistency	Constraints	Consequentiality
H1: Measure diversity and social controls have a synergetic effect on OL in a low-uncertainty environment.	Measure diversity	+			+
	Social controls		+	+	
H2: A mechanistic administrative structure and performance-contingent incentives have a synergetic effect on OL in a low-uncertainty environment.	Mechanistic administrative structure	+	+	+	
	Incentive pay	+			+
H3: Formal/deliberate strategic planning and measure diversity have a synergetic effect on OL in a high-uncertainty environment.	Formal/deliberate strategic planning	+	+	+	
	Measure diversity	+			+
H4: An organic administrative structure and social controls have a synergetic effect on OL in a high-uncertainty environment.	Organic administrative structure	+			+
	Social controls		+	+	

planning mode complements measure diversity by offering top management the opportunity to provide clarity, consistency, and constraints through a structured approach to decision-making. Therefore, we hypothesize:

H3. Measure diversity and formal/deliberate strategic planning have a synergetic effect on OL in a high-uncertainty environment.

Previous literature (e.g., Kreutzer et al., 2016; Merchant, 1982; Merchant & Van der Stede, 2023; Ouchi, 1979) suggests that performance measures become less useful as uncertainty increases. In such a situation, the value of 'old' knowledge is reduced (Sorenson, 2003) and outputs cannot be measured adequately due to increasing noise in performance measures (Abernethy et al., 2015). While performance measures may still be useful as a tool to foster organizational dialogue (Henri, 2006a; Simons, 1990), they are less useful for communicating clarity and consequentiality of goals, as this could result in dysfunctional behaviors (Abernethy et al., 2015; Speklé et al., 2022).

Rather than combining a diverse set of performance measures with a formal/deliberate planning strategy (as in group 3), configuration group 4 (solutions 2c-2g) combines an organic administrative structure with social controls as core control practices in a high-uncertainty environment. An organic administrative structure can provide the flexibility to adapt and respond to new developments by enabling employees to explore new ideas, challenge existing beliefs, and adapt their actions to changing environments (Fiol & Lyles, 1985; Kreutzer et al., 2016). Organic structures make experimentation and the generation of new knowledge possible (Burns & Stalker, 1961) and facilitate learning-by-doing (Sorenson, 2003), enabling employees to develop new practices and knowledge through direct experience. An organic administrative structure also plays a key role in fostering accountability through participation in decision-making and power-sharing. Kloot (1997) finds that "real-power sharing" (p. 59) and participation in decisions strengthen overall accountability, as employees are more likely to align their actions with organizational goals when they feel a sense of ownership and responsibility. As such, organic structures provide clarity (through the sharing of information and ideas to achieve organizational objectives, and on how individuals can contribute to that; Ylinen & Gullkvist, 2014) and consequentiality (by increasing overall accountability through a sense of ownership and responsibility; Kloot, 1997).

By systematically reinforcing what is (or is not) considered adequate behavior in the organization, social controls increase the likelihood that employees align with organizational objectives (Bedford & Malmi, 2015). Social controls rely on shared values, norms and beliefs to ensure that employees' decisions align with organizational interests (Das & Teng, 2001), thus providing consistency (in what organizational objectives should be pursued) and constraints (through group controls). Previous literature has highlighted the effectiveness of social controls in environments characterized by uncertainty (e.g., Chenhall, 2003). Jointly, an organic administrative structure and social controls provide a strong control situation: while organic administrative structures provide clarity and consequentiality (Ylinen & Gullkvist, 2014), social controls complement this administrative structure in terms of consistency and constraints. Kloot (1997) highlights the synergy between social controls and organic structures, as participation fosters a shared vision, which in turn enhances participation in decision-making and increased overall accountability. Given the previous review, we expect:

H4. An organic administrative structure and social controls have a synergetic effect on OL in a high-uncertainty environment.

Table 7 summarizes the four hypotheses derived from the fsQCA results in combination with situational strength theory. We assume positive interaction effects for H1, H2, and H3; for H4, we expect a negative interaction effect (as a low level of administrative structure indicates an organic administrative structure).

4.3. Results of regression analysis

Model 0 in Table 8 shows the regression results for the total sample. Measure diversity ($p < 0.01$), low use of incentive pay ($p < 0.1$), organic administrative structure ($p < 0.1$), formal/deliberate strategic planning ($p < 0.01$), and the use of social controls ($p < 0.01$) facilitate OL. However, as seen in the fsQCA and previous literature, environmental uncertainty seems to matter. Indeed, Model 1a, which presents the results without interaction effects, highlights only the relevance of measure diversity ($p < 0.01$) and social controls ($p < 0.01$) for OL in a low-uncertainty context. Model 1b tests hypotheses 1 and 2. H1 assumes that measure diversity and the use of social controls have a synergetic effect on OL in a low-uncertainty context. The interaction term between measure diversity and social controls is positive and significant in Model 1b ($p < 0.05$). This result supports H1: more diverse performance measurement combined with higher use of social controls is associated with increased OL compared to individual effects. H2 predicts that a mechanistic administrative structure and the use of performance pay have a synergetic effect on OL. The interaction term Model 1b is positive and significant ($p < 0.1$); thus, H2 is supported.

Models 2a and 2b show the regression results for a high-uncertainty environment. Model 2a shows the results without any interactions, proving the importance of different MC practices for OL in a high- compared to a low-uncertainty context. In comparison to the low-uncertainty context, not only measure diversity ($p < 0.01$) and social controls ($p < 0.05$) significantly impact OL, but also incentive pay (negative effect, $p < 0.05$), an organic administrative structure ($p < 0.05$), and a formal/deliberate strategic planning mode ($p < 0.01$).

Model 2b tests H3 and H4, respectively. H3 posits that a formal/deliberate strategic planning mode and measure diversity have a synergetic effect on OL for organizations in a high-uncertainty context. The interaction term between measure diversity and strategic planning mode is positive and significant ($p < 0.1$). This result supports H3: a more formal/deliberate strategic planning mode, with higher performance measurement diversity, is associated with increased OL. H4 assumes that the combination of an organic administrative structure and social controls has a synergetic effect on OL in a high-uncertainty context. The interaction effect between the two is found to be insignificant, indicating the absence of a synergetic effect, while both an organic administrative structure and social controls independently show a significant positive influence on OL in the high-uncertainty context.

Table 8
OLS regression results for the total sample, firms in a low (n = 104) and high (n = 106) uncertainty context, dependent variable: organizational learning.

		Total sample		Low uncertainty				High uncertainty			
		Model 0		Model 1a		Model 1b		Model 2a		Model 2b	
		Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
MC practices											
DIVER		0.335	5.638***	0.381	4.210***	0.381	4.317***	0.294	3.687***	0.319	3.993***
INPAY		−0.113	−1.902*	−0.024	−0.299	−0.018	−0.227	−0.224	−2.488**	−0.238	−2.668***
INDET		0.080	1.447	0.055	0.708	0.059	0.782	0.133	1.642	0.145	1.801*
COMP		−0.031	−0.588	−0.034	−0.442	0.001	0.016	0.027	0.339	0.055	0.695
STRUC		−0.109	−1.731*	−0.044	−0.514	−0.019	−0.224	−0.215	−2.318**	−0.222	−2.398**
PLANN		0.174	3.084***	0.042	0.497	0.048	0.582	0.322	4.091***	0.348	4.398***
SOC		0.335	4.822***	0.372	3.756***	0.400	4.123***	0.263	2.604**	0.270	2.689***
MC practice interactions											
*DIVER*SOC*	H1					0.171	2.280**				
*STRUC*INPAY*	H2					0.135	1.856*				
*PLANN*DIVER*	H3									0.148	1.977*
*STRUC*SOC*	H4									−0.045	−0.583
Adj. R^2		0.452		0.448		0.478		0.461		0.476	
F-Value		25.598		12.936		11.496		13.832		11.578	
Sig. F		0.000		0.000		0.000		0.000		0.000	

Note: Standardized coefficients reported.
DIVER measure diversity, *INPAY* incentive pay, *INDET* incentive determination (subjective to objective), *COMP* compensation time horizon (short- to long-term), *STRUC* administrative structure (organic to mechanistic), *PLANN* strategic planning mode (informal/emergent to formal/deliberate), *SOC* social controls.
*, **, *** represent $p < 0.1$, $p < 0.05$, and $p < 0.01$, respectively.

4.4. Robustness checks

The results of the robustness checks are presented in the Online Appendix.

The fsQCA analysis reveals an objective (rather than subjective) incentive determination throughout as a peripheral MC practice in a high-uncertainty context. Given this finding, we examine whether objective incentive determination may also be an MC practice interacting with the other core practices in a high-uncertainty context (Model 2c, Online Appendix Table 10). We follow Bedford et al. (2016) and focus on two-way interactions with INDET and the other four MC practices that are relevant in the high-uncertainty context. We find significant negative interactions for *INDET*STRUC* ($p < 0.01$) and *INDET*SOC* ($p < 0.01$). These findings indicate that objective incentive determination is less conducive to OL when combined with an organic administrative structure or a high use of social controls in a high-uncertainty context. From a configurational perspective, these findings indicate that objective incentive determination does not constitute a central element of the learning-oriented control configurations identified in the fsQCA analysis. Instead, when combined with MC practices that are core to OL under high uncertainty (particularly organic administrative structures and social controls), the relative importance of objective incentive determination diminishes, which explains why it emerges only as a peripheral rather than a core condition in the fsQCA solutions. Accordingly, the clarity and consistency associated with objective incentive determination do not reinforce the flexibility and socially embedded interaction through which organic structures and social controls foster learning under high uncertainty. For the interactions *INDET*DIVER* and *INDET*PLANN*, we cannot find any significant relationships.[12]

Further, we conducted a more in-depth analysis of solution 1g of the fsQCA results, which indicates that four core MC practices (i.e., *DIVER*, *SOC*, *INPAY*, and *STRUC*) are relevant in this subset. To investigate this further, we performed a regression analysis excluding the four organizations that belong to solution 1g and compared these results with those from Models 1a and 1b (i.e., comparing solutions 1a-1g and 1g-1i with solutions 1a-1f and 1h-1i) (Model 1c, Online Appendix Table 11). No significant differences were found, indicating that the organizations behind solution 1g do not influence/change the regression analysis results. We also checked whether the interactions among all possible combinations of the four core practices (*DIVER*STRUC*, *DIVER*INPAY*, *SOC*PLANN*, *SOC*INPAY*) are also significant (Model 1d, Online Appendix Table 11). We cannot find any evidence for this.

Finally, we test whether the observed and identified relations between core MC practices apply to all organizations or are contingent on the uncertainty context (Bedford et al., 2016; Gerdin et al., 2019) (Model 1e and Model 2d, Online Appendix Table 12). The regression coefficients for the interactions between *DIVER* and *SOC* and between *STRUC* and *INPAY* (observed in a low-uncertainty context) are compared with those from the analysis run on the high-uncertainty sample. No significant interaction is found in the high-uncertainty context for *DIVER*SOC* and *STRUC*INPAY* compared to two significant interaction terms in the low-uncertainty context. The same is done with *PLANN*DIVER* and *STRUC*SOC* (observed in a high-uncertainty context) in a low-uncertainty environment; again, we do not find a significant interaction. Therefore, none of the hypothesized relationships is significant in the other uncertainty context, suggesting that environmental uncertainty indeed affects the interaction between MC practices.

5. Discussion and conclusion

The goal of this study is to examine the link between combinations of management control (MC) practices and organizational learning (OL), contingent on environmental uncertainty. OL creates a control environment where goal congruence problems are likely to emerge as intangible outcomes and extended time horizons make it difficult to contract upon results (Abernethy et al., 2015). In line with our theoretical framework, this challenge arises because individual MC practices differ in their ability to create strong control situations and may be limited when used in isolation, particularly under varying degrees of environmental uncertainty. Previous literature suggests that environmental uncertainty affects individual MC practices, their interaction, and OL. Yet, there is a lack of empirical knowledge about how, when,

[12] Moreover, we have tested three-way interactions (*INDET*DIVER*PLANN* and *INDET*STRUC*SOC*) to examine whether incentive determination jointly interacts with the two configurations of MC practices underlying H3 and H4. We do not find any significant three-way interaction effects. However, the two significant two-way interactions, *INDET*STRUC* ($p < 0.01$) and *INDET*SOC* ($p < 0.01$), remain robust.

and why MC practices combine to achieve OL, depending upon the context. To shed light on this issue, we first examine MC configurations that achieve high OL in both low- and high-uncertainty contexts. Based on the results of the first step, we use situational strength theory to evaluate whether the identified MC practices have a synergetic effect on OL.

Our results show that there is not just one way to achieve OL: there are equally effective ways to combine MC practices to achieve OL, and they differ across levels of uncertainty. Consistent with previous literature (e.g., Abernethy et al., 2015; Batac & Carassus, 2009; Chenhall, 2005; Fiol & Lyles, 1985; Kloot, 1997), measure diversity and social controls were identified as core MC practices for achieving OL in both uncertainty contexts. While diverse measurement helps decision-making by providing more information and evaluating employees on a broader level ('error detection and correction'), social controls are helpful for long-term cooperation and mutual understanding of an organization's interests, like learning. In addition, based on situational strength theory, other MC practices were identified as effective, depending on the context (e.g., the use of organic administrative structure is associated with OL in a high-uncertainty context but not in a low-uncertainty context). Moreover, not all individually observed MC practices are effective when combined, and not all MC practices observed to be beneficial when combined with others contribute to OL on their own.

This finding suggests that organizations choose different combinations of MC practices (with varying abilities to provide clarity, constraints, consistency, and consequentiality) to create a strong control situation that facilitates OL, depending on the context in which they operate. Results show that the diversity of performance measures and social controls have a synergetic effect on OL when organizations face low environmental uncertainty. While measure diversity directs employees on what to pursue (i.e., ex-ante clarity and ex-post consequentiality), social controls provide direction (i.e., consistency and constraints) (Gerdin et al., 2019; Merchant, 1982; Ouchi, 1979). Thus, according to situational strength theory, the two have different abilities to create a strong control situation (Gerdin et al., 2019). Alternatively, performance-contingent rewards and incentives (clarity and consequentiality) and the use of mechanistic administrative controls (clarity, consistency and constraints) have synergetic effects in the low-uncertainty context, even though, on their own, they do not affect OL.

In a high-uncertainty context, emergent formal strategic planning and measure diversity have a synergetic effect on OL. This result suggests that extensive planning may give top management information on how strategic uncertainties affect the achievement of goals and help coordinate activities across the organization (Simons, 1995; Widener, 2007). On the other hand, a combination of organic administrative structure and social controls, although observed in the first step, did not have a synergetic effect on OL in a high-uncertainty context. One potential explanation is that these organizations have other MC practices that complement these two MC practices to contribute to strong control situations. Alternatively, it may reflect a different management style focusing on a different type of OL (i.e., more explorative; Sorenson, 2003). Overall, our results indicate that firms use different control configurations to achieve OL, depending upon the organizational context.

There are several limitations to this study. First, we are not identifying all possible MC combinations that have synergetic effects on OL but are constrained to our sample: just those MC combinations that are observed in the fsQCA are included. Second, we base the selection of MC practices included in the analysis on previous empirical findings on the relation between MC practices and OL. However, there are various other MC practices present in normative frameworks (e.g., Ferreira & Otley, 2009; Malmi & Brown, 2008; Simons, 1995) that might be (individually or jointly) associated with OL. Using finer-grained variables may also provide opportunities for identifying and analyzing combinations of MC practices (Bedford et al., 2016). Third, even though external uncertainty is a key determinant of MC practices (Chenhall, 2003), the study does not consider the influence of other contextual variables that may impact the relationship between MC and OL. For instance, an organization's lifecycle, strategy, and resource position may be other essential determinants of MC and OL (Bapuji & Crossan, 2004; Chenhall, 2003, 2006). Future research may investigate additional MC practices and other drivers behind MC practice combinations (Malmi et al., 2020) or focus on in-depth qualitative analyses of how and why organizations combine different MC practices (Toldbod & Van der Kolk, 2022). Fourth, we rely on survey data obtained from the subjective assessment of controllers. Controllers are involved in the design and use of control systems and we have been careful in developing the questionnaire, did extensive pre-testing, obtained the data anonymously, and assessed the constructs' validity; yet, despite that, data may still be biased even though tests assume that non-response and single-source biases are not significant issues. Generalizability must also be taken cautiously, given that our research solely focuses on German-speaking countries. Furthermore, although the sample is not smaller than in other survey studies, a larger sample size may be beneficial for studying interaction effects. Fifth, for the analysis, we applied a median split for uncertainty to divide into low- and high-uncertainty environments; however, different splits may implicate different results. Finally, OL may also be examined more explicitly at the process level, as uncertainty may differentially affect the relative importance of specific learning processes (i.e., knowledge acquisition, information distribution, information interpretation, and organizational memory). While our study conceptualizes OL as an aggregate construct, our additional analyses indicate that knowledge acquisition differs significantly across uncertainty contexts. This finding suggests that examining OL at a more fine-grained process level may yield additional insights (Argote et al., 2021).

Despite these limitations, this is one of the first papers to provide comprehensive insights into the relationship between the external environment, MC practices and OL. As such, it provides insights into which combinations of MC practices are helpful to facilitate OL and whether MC practices and combinations thereof enable OL in different settings. The knowledge that some MC practices create a synergetic effect might even be more important for practitioners, as implementing MC practices is costly (Merchant, 1982). As such, the paper contributes to the understanding and provides a theoretical explanation of how organizations can combine MC practices to facilitate OL contingent on environmental uncertainty.

Ethics declaration

Written informed consent to take part in the study and to publish the article has been obtained from all participants or their legal representatives. The privacy rights of participants have been observed.

This study was performed in compliance with relevant laws, regulatory frameworks and guidelines where the research took place. Ethics committee approval was not required under relevant laws and institutional guidelines. The study was assessed in accordance with the University of St.Gallen's Procedure for the Ethical Evaluation of Research Projects using the HSG Ethics Committee checklist. None of the checklist criteria requiring ethical review were met. The project was therefore considered ethically unproblematic and did not require further ethical evaluation or ethics committee approval.

Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this paper. The funding body had no role in the design of the study, collection and analysis of data, or preparation of the manuscript.

Appendix. Questionnaire

Organizational learning (Chenhall, 2005)
Indicate to what extent (theoretical range: 1 = very low extent; 7 = very high extent):

There are well-established ways to share information and knowledge between people within your organization (e.g., formal and informal forums for debate, well-developed systems, and practices for sharing information).
The BU's beliefs, attitudes, and ways of doing business provide a strong basis for interpreting information (e.g., the BU's mission or culture is reflected in distributed information).
There are extensive formal and informal procedures and processes for acquiring information and knowledge from internal and external sources potentially useful to your BU (e.g., routine and/or special reports on markets and production processes, regular informal discussions).
The organization stores information and knowledge from prior experiences in formal systems (e.g., databases, documentation of programs, plans, procedures, and reports).

Measure diversity (Bedford et al., 2016)
Indicate to what extent measures are related to the following dimensions used to evaluate employee performance (theoretical range: 1 = very low extent; 7 = very high extent):

Customer (e.g., market share, satisfaction, retention).
Employee (e.g., employee satisfaction, turnover, workforce capabilities, and development).
Operational process (e.g., productivity, safety, cycle time).
Innovation (e.g., R&D, new product/service success, development cycle time).
Quality (e.g., product/service quality, defects, awards).
Social responsibility (e.g., environmental compliance, community impact, public image).

Incentive pay (Bedford et al., 2016)
Indicate to what extent (theoretical range: 1 = very low extent; 7 = very high extent):

The financial rewards of employees increase as actual performance increasingly exceeds targets.
Employees whose performance relative to targets is among the top 25% are given larger financial rewards than those given to managers among the bottom 25%.
Compensation contracts clearly specify how compensation is related to employee performance relative to performance targets.

Incentive determination (Bedford et al., 2016)

What is the usual basis for determining performance-based or bonus compensation for employees? (theoretical range: 1 = determined subjectively (based on top management assessment); 4 = intermediate; 7 = determined objectively (based on pre-determined formulas or targets)

Compensation time horizon (Bedford & Malmi, 2015)

Indicate the emphasis on short-term performance (one year or less) relative to long-term performance (three years or more) for employee compensation. (theoretical range: 1 = based on short-term performance; 2 = equal emphasis; 3 = based on long-term performance)

Administrative structure (Bedford et al., 2016)

Indicate how control information is typically communicated in your BU.[1] (theoretical range: 1 = through highly structured, formal channels of communication; 7 = through open, informal channels of communication)
Indicate the accessibility of operational information in your BU. (theoretical range: 1 = highly restrictive access to important operational information; 7 = free flow of important operational information throughout the BU)
Indicate the content of work-related communication between top management and employees. (theoretical range: 1 = top management decisions and mandates, instructional, direction giving; 7 = information and idea sharing, consultative, advice giving)
In general, the operating management philosophy in my BU favors … (theoretical range: 1 = emphasis on giving the most say in decision-making to formal line managers; 7 = emphasis on giving the most say to the expert in a given situation even if this means bypassing formal line authority)
In general, the operating management philosophy in my BU favors … (theoretical range: 1 = emphasis on specialization and top level coordination; 7 = emphasis on initiative and adaptation to the local situation)

Strategic planning mode (Bedford & Malmi, 2015)

How would you describe the strategic goals of your BU? (theoretical range: 1 = specific, detailed, quantified; 7 = broad, general, qualitative)
How would you characterize the strategic plan of your BU? (theoretical range: 1 = highly detailed, comprehensive outline of strategic actions; 7 = little detail, rough outline of strategic actions)
How closely is the strategic plan followed in your BU? (theoretical range: 1 = tightly followed, plans implemented as outlined; 7 = loosely followed, acts as a guide only)
How would you describe the process by which strategy develops in your BU? (theoretical range: 1 = develops through formalized and deliberate processes; 7 = develops through often unintended and emergent processes)

Social controls (Bedford et al., 2016)
Indicate to what extent (theoretical range: 1 = very low extent; 7 = very high extent):

Is there a sense of shared values, beliefs, and expectations among employees?
Is there a consensus among employees on BU objectives and direction?
Are employees committed to the values and objectives outlined by top management?
Does top management rely on shared values and forms of employees to provide direction when faced with uncertainty?

(*continued on next page*)

(*continued*)

Environmental uncertainty (Bedford & Malmi, 2015) Indicate how predictable or unpredictable each of the following factors is in the context of your BU (theoretical range: 1 = highly predictable; 7 = highly unpredictable):
Customers.
Suppliers.
Competitors.
Technology.
Economic/regulatory.[2]

[1] Item excluded from the analysis due to cross-loadings in the factor analysis.

[2] Item excluded from the analysis due to its low weight in the principal component analysis. We note that data collection took place during the COVID-19 pandemic, which may have distorted responses to this item given the exceptional and heterogeneous nature of economic and regulatory disruptions during that period.

Online Appendix. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.aos.2026.101662.

Data availability

The data that has been used is confidential.

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