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Managing All Quarters of the Compass? How Internally Oriented Managerial Networking Moderates the Impact of Environmental Turbulence on Organizational Performance

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Abstract

The present study seeks to answer the question how, and to what extent, environmental turbulence—measured as percentage change in the number of pupils—affects organizational performance. We examine how different managerial networking orientations moderate the effect of percentage change in number of pupils on school performance. We hypothesize that percentage change in the number of pupils negatively affects school performance. We further hypothesize that different managerial networking orientations moderate the effect of percentage change in the number of pupils on school performance. The hypotheses are tested on a dataset of Dutch primary schools ($n = 546$), which includes information about school principals, school characteristics, and school performance. Results of the analyses show that our measure of environmental turbulence negatively affects school performance. Moreover, internally oriented networking activities (team involvement and networking for coproduction), rather than externally oriented networking activities, attenuate the negative effect of environmental turbulence on school performance.

Keywords

organizational performance, school performance, environmental turbulence, management, managerial networking

Introduction

The context in which public organizations operate is constantly changing (Aldrich, 2008; Emery & Trist, 1965). Changes often involve fluctuations in conditions, demands, and resources provided by external actors and external organizations (Pfeffer & Salancik, 1978). A core activity of

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public managers is to anticipate such fluctuations and shield their organization from changes that might hinder the organization in its efforts for goal attainment. Sometimes public managers are faced not with gradual changes but with turbulent events, such as sudden budget cuts, staff turnover, or natural disasters (Hicklin, O'Toole, Meier, & Robinson, 2009; Meier & O'Toole, 2009; O'Toole & Meier, 2011). In the public management literature, irregular changes in an organization's environment are referred to as "environmental turbulence" (Boyne & Meier, 2009; Emery & Trist, 1965) or "environmental shocks" (O'Toole & Meier, 2011).

Boyne and Meier (2009) define environmental turbulence as an unpredictable change in the munificence (such as available economic resources) and complexity (such as characteristics of organization's clients) of an organization's environment. These turbulent changes challenge the organization's necessary stability, and consequently will negatively affect organizational performance (O'Toole & Meier, 1999, 2011). Indeed, empirical studies show that environmental turbulence is negatively associated with the performance of organizations (Boyne & Meier, 2009; Koberg & Ungson, 1987; Lin & Germain, 2003; Meier & O'Toole, 2009; O'Toole & Meier, 2011; Zinn, Mor, Feng, & Intrator, 2009).

Two sets of variables are assumed to help public organizations protect, insulate, and mitigate the negative impact of environmental turbulence. The first set of variables taps the organization's structural and procedural features that help the organization bolster its administrative system for externally produced uncertainty and instability (Fennell & Alexander, 1987; O'Toole & Meier, 2011). For Texas school districts, vertical and horizontal structural stability (Boyne & Meier, 2009) and teacher stability (Meier, O'Toole, & Hicklin, 2010) appear to moderate the negative effect of turbulence on school district performance (Boyne & Meier, 2009). Meier et al. (2010) report that teacher stability has a similar, moderating effect on the impact of hurricanes Katrina and Rita (the negative effect of school enrollment and days missed due to school district closure on Texas school district performances).

The second set of variables taps the management activities, which contribute to the organization's internal and external stabilizing features (Barnard, 1938; O'Toole & Meier, 2011; Simon, 1997). Specifically, internally oriented management activities aim to stabilize the organization's structural and procedural features (Miner, Amburgey, & Stearns, 1990; O'Toole & Meier, 2011). Externally oriented management activities—relations with external actors and organizations—aim to exploit the environment, reduce uncertainties, and buffer for environmental shocks (Geletkanycz, Brian, Boyd, & Finkelstein, 2001; Meier & O'Toole, 2003; O'Toole & Meier, 1999, 2011; Pfeffer & Salancik, 1978). Empirical studies on the moderating effects of management are limited to the Texas school districts. O'Toole and Meier (2010) and Meier et al. (2010) report that managerial capacity, which constitutes as a potential for managerial action, moderates the negative relation between turbulence and school performance. Meier and O'Toole (2009) also show that, while controlling for the negative effect of budget shocks, internally oriented managerial activities (cost-reductions in personnel or salaries) contribute to stability in performance. Ryu (2012) reports that externally oriented managerial networking, measured as "number of key environmental actors," moderates the negative effect of days missed due to school district closure.

The present study builds on the Texas school district studies by (a) simultaneously testing moderating effects of the actual *internally* and *externally* oriented managerial networking activities, rather than the scope of the emergency network, on the negative relation between environmental turbulence and public service performance in (b) a new research context: Dutch primary education. Moreover, in line with recent measurement studies on managerial networking (Torenvlied, Akkerman, Meier, & O'Toole, 2013; Zhu, Robinson, & Torenvlied, 2014), we distinguish between several networking dimensions instead of a one-dimensional activity measure (or networking index), often used by existing studies on managerial networking (e.g., Meier & O'Toole, 2001; Meier & O'Toole, 2003; Walker, O'Toole, & Meier, 2007). The networking

orientations are (a) “upward,” (b) “downward,” and (c) “outward” (Moore, 1995). We add a fourth networking orientation: (d) “sideward.”

Empirically, we test our propositions using data obtained from a survey held in 2010 among Dutch school principals and combine these data with objective, independently measured constructs for turbulence and performance. We asked the school principals about their relations with 41 different types of external organizations, which enabled us to distinguish between four managerial networking orientations. The dataset makes it possible to analyze effects of managerial networking using a much finer grid than existing studies that use a one-dimensional activity measure. Thus, we contribute to the state-of-the-art research in the field by testing existing and novel hypotheses in a new (European) research context.

Research Context: Dutch Primary Education

In 2009, there were 6,901 primary schools that are responsible for the education of more than 1.5 million school pupils in the ages between 4 and 12. Dutch primary schools vary with respect to their educational philosophy or denomination. This variation developed from the principle of “freedom of education,” which is embodied in the Dutch Constitution. Almost 70% of all primary schools in the Netherlands are denominational schools.¹ Although parents are free to choose schools for their children, primary schools have some discretion to actively apply selection criteria, for example, the pupils’ geographical distance and religious background. The other 30% are non-denominational schools. These schools are obliged to accept all children, regardless of their religious background.

In recent years, two simultaneous demographic trends have resulted in a decrease in the number of Dutch pupils in primary education: (a) the aging population and declining birth rate (cohort effect) and (b) regional population shrinkage caused by intra-country rural-to-urban migration (Nationaal Netwerk Bevolkingsdaling, 2013). The latter trend is, in turn, also responsible for the increase in the number of pupils in urban regions of the Netherlands. In addition, a decline or increase in the number of pupils can also be caused by inter-school migration of pupils; parents can decide to transfer their children to other schools. Inter-school migration can be triggered by the closing of the original school (due to insufficient number of pupils or reorganizations) or reputation damage (due to underperformance or incidents).

A lot of research within the field of public management focuses on American public schools (e.g., the Texas school district studies). While American public schools are funded by federal funds, state funds, and local school district property taxes, Dutch primary schools are generally funded by national funds. Private schools, which rely on their own funds, are highly uncommon in the Netherlands, and therefore, almost all primary schools are “public” schools. There is no financial sponsoring of education from the private sector: All schools are entirely government-funded by a “block grant” from the Dutch Ministry of Education, Culture and Science. These grants are based primarily on school size: the number of pupils of the previous year who attended the primary school. Hence, schools are funded based on last year’s enrollment, whereas U.S. schools funding is based on real-time enrollment. Block grants are, however, partly dependent on “pupil weights”: Specific categories of pupils have their own weights, which are related to parental background characteristics, such as educational level or immigrant background (Ladd & Fiske, 2011).

In the Netherlands, the executive oversight and administrative powers, such as the internal organization, the personnel and employment policies, and the financial management of the school—and ultimately the school’s performance—are assigned to the school board (Turkenburg, 2008), whereas the chief operating officer of American schools is the superintendent. Although funding is based on schools’ pupil characteristics, school boards have some discretion in their decision of how to distribute the grants among their schools. About 45% of all school boards in

the Netherlands are responsible for a single school, and most school boards govern more than one school (sometimes even as many as than 60 schools). Despite their final accountability, most school boards delegate much authority and discretion to the school principal. In practice, most school principals establish the school's educational curriculum; supervise personnel processes; develop plans for pedagogical quality, pupil care, and quality control; and monitor pupil performance. School principals are the main representatives of the school in external contacts and therefore maintain relationships with organizations and actors in the school's environment, for example, the parent committee, the school board, local government, public libraries, youth care, the Inspectorate of Education, and test suppliers.

The Inspectorate of Education assesses all schools on the same final attainment levels. Most prominent is the standardized Cito test that provides information about both pupils' progress and the school's performance. Schools that fail to comply with the performance standards are subjected to an intensive supervision regime and an annual evaluation (which is made public). Schools that continue to fail ultimately risk losing their funding.

Theoretical Framework

Environmental Turbulence and Performance

The organizational environment is often defined as "all elements that exist outside the boundary of the organization and have the potential to affect all or part of the organization" (Daft, 2010, p. 220). Scott (2003) distinguishes between the task environment (resource munificence, complexity, and dynamism) and the institutional environment (governmental policies and regulations). The elements of the environment are inherently dynamic, which may turn the environment "unstable." Environmental stability induces organizations to develop fixed sets of routines for dealing with environmental elements (Aldrich, 2008, p. 67). In a turbulent environment, externally induced changes are "produced by forces that are obscure to administrators and therefore difficult to predict or plan for" (Aldrich, 2008, p. 69). Hence, environmental turbulence can be interpreted as "environmental shocks," threatening the core of the organization (Meier & O'Toole, 2009). Environmental shocks negatively affect stabilizing forces within organizations, such as "structural stability" (the organization's formal hierarchy), "mission stability" (organizational goals), "procedural stability" (organizational rules and operating procedures), "production or technology stability" (production tools), or "personnel stability" (O'Toole & Meier, 2011, p. 24). Hence, the hypothesis is that environmental shocks negatively affect organizational performance.

Empirical studies indeed show that environmental turbulence is negatively associated with the performance of public organizations. A study on nurses in a southeastern U.S. city (Salyer, 1995) reports that environmental turbulence—measured as the number of admissions relative to discharges from the unit in a 24-hr period—negatively affects the nurses' self-reported performance. A study of 205 state-owned enterprises in China (Lin & Germain, 2003) reports that managers' perceived "technological turbulence" negatively affects the self-reported growth performance of their firm relative to the industry. However, a study of school administrators of 88 schools in a northwest U.S. state (Koberg & Ungson, 1987) reports that the administrators' perceived unpredictable change in external circumstances are unrelated to their self-reported assessment of school performance.

Although these studies show some evidence for a negative relation between environmental turbulence and performance, they use self-reported measures, risking biases in estimates (Boyne & Meier, 2009; see also Boyd, Dess, & Rasheed, 1993). In recent years, scholars in public management therefore started to use objective measures for both turbulence and performance. A study of 10,901 U.S. nursing homes (Zinn et al., 2009), for example, shows that nursing homes

confronted with a new reimbursement policy are more likely to experience performance failures—measured as termination from Medicare and Medicaid programs.

Environmental Turbulence and School Performance

In an educational setting, negative shocks generally involve political turbulence, burdensome administrative rules and regulations, lawsuits, budget cuts, or changes in pupil intake (Meier & O'Toole, 2009). Studies of Texas school districts report that budget shocks and pupil enrollment negatively affect student scores on standardized tests, or dropout rates (Boyne & Meier, 2009; Meier & O'Toole, 2009; O'Toole & Meier, 2011).

In the present article, we focus on environmental turbulence in the task environment of Dutch primary schools, which is, changes in the number of pupils. A change in the number of pupils may constrain (a) stability in the production of education and educational technologies, (b) stability in funding and school facilities, and (c) personnel stability (Dutch Inspectorate of Education, 2012). In the context of Dutch primary education, a decrease in the number of pupils directly translates into a reduction of school funding—with a delay of 1 year.² The reduction of funding turns especially problematic if, after a year, the number of pupils has increased again and the primary school is confronted with a severe funding gap. In the present context where personnel systems are not flexible, funding gaps put pressures on the quality and costs of education, which negatively affect school performance.

A change in the number of pupils also constrains the short-term management of education. Research shows that a decline in the number of pupils directly results in a higher spending per pupil on personnel and facilities (Berdowski, Berger, Eshuis, & Van Oploo, 2006). Due to the decline in pupils, fewer schoolteachers are needed. In the Netherlands, personnel management at primary schools is highly constrained by nation and sector-wide regulations. Compulsory redundancies are avoided as much as possible, and management is legally obliged to help redundant employees find a new job.³ Consequently, employee surpluses may arise, which result in problematic personnel costs. Redundancy schemes also constrain managerial resources, at the expense of resources needed for improving or maintaining the quality of education. The reduction in pupils furthermore puts a burden on school facilities: Fewer classrooms are necessary, and fewer teaching materials are needed.⁴ Hence, a high spending per pupil puts severe short-term pressures on the quality and costs of education, which negatively affect school performance. We expect that these short-term costs outweigh the short-term benefits of a (temporary) surplus caused by the 1-year funding delay.

The mechanisms triggered by a sudden reduction in the number of pupils do not, *mutatis mutandis*, translate into a positive effect of an increased number of pupils. A sudden increase in pupil enrollment, for example, will also constrain a school's organizational and managerial resources, due to the time lag in funding, the restricted capacity for hiring high-quality teachers, and the limited short-term prospects for expanding school facilities and teaching materials. Such strains on school resources and managerial capacity would come at the expense of resources needed for maintaining educational quality. Hence, we arrive at our first hypothesis:

Hypothesis 1: Percentage change in the number of pupils negatively affects school performance.

Four Directions of Managerial Networking

In general, management involves the maintenance of relations with all kinds of individual and collective actors, such as employees, suppliers, stakeholders, clients, alliance partners, regulatory agencies, or political institutions. A distinction can be made between internally and externally

oriented managerial activities (O'Toole & Meier, 2011; O'Toole, Meier, & Nicholson-Crotty, 2005; Zhu & Johansen, 2013). Internally oriented networking activities aim to coordinate people and resources within the organization to accomplish public objectives (O'Toole et al., 2005). Such networking activities interact with environmental shocks, thus stabilizing the organization's primary process. Interactions with employees, for example, can help managers to further goal consensus (Floyd & Wooldridge, 1992), coordinate tasks, (re)allocate resources and personnel, and implement innovations (O'Toole et al., 2005; Zhu & Johansen, 2013). Externally oriented networking activities aim to reduce the impact of environmental shocks by compensating losses of resources or, instead, tap new opportunities in the environment. Goerdel (2006) distinguishes between proactive and reactive managerial networking. In the present study, we assume that both "types" can be beneficial to dealing with environmental turbulence.

Public managers have different managerial orientations (Moore, 1995, p. 17; O'Toole et al., 2005). Recent studies on managerial networking, applying novel measurement techniques, indeed reveal the existence of several, stable dimensions of managerial networking activity (Torenvlied et al., 2013; Zhu et al., 2014). Building on these studies, the present article proposes four fundamental orientations of managerial networking activity. For internal management, we propose three networking orientations. The first two orientations are networking "upward" and networking "downward" (Moore, 1995, p. 17; O'Toole et al., 2005). Whereas networking "upward" refers to meetings with, and reporting to, superiors (e.g., political principals), networking "downward" refers to the management of internal processes and human resources. We propose networking "sideward" as an additional, third orientation of internal management, referring to horizontal coproduction activities with stakeholders, necessary for the effective implementation of organizational strategies and programs. Each of the three networking orientations manifests in a particular intensity of networking with internal actors such as governance bodies (school board) in the upward orientation, employees (teachers) in the downward orientation, or stakeholders and client representatives (participatory council) in the sideward orientation.

External management is the fourth fundamental managerial networking orientation, which we refer to as networking "outward" (Moore, 1995, p. 17; O'Toole et al., 2005). Managing outward refers to managers' interactions with various types of external actors and external organizations such as suppliers, external stakeholders, alliance partners, regulatory agencies, or political institutions. Below, we develop hypotheses on the moderating effects of each of the managerial networking orientations in the Dutch educational context. Figure 1 summarizes the hypotheses.

Networking upward. Networking upward translates into school principals' efforts to interact with, and report to, their school board—which is the main "principal" to the school. Principals' interactions with the school board could provide a school with additional resources and (legal) advice in situations turbulence, for example, to reallocate a surplus in (shortage of) teachers. Theoretically, we would expect that upward networking activities neutralize the negative impact of percentage change in the number of pupils on school performance. Empirical studies, however, show that school district superintendents' managing upward *negatively* affects school district performance (Meier, O'Toole, Boyne, & Walker, 2007; O'Toole et al., 2005). O'Toole et al. (2005) suggest that the principal-agent problem, resulting from a divergence in goals and risk preferences, often materializes in "over-control" (Bozeman, 1993). Intense networking with the school board may also reflect negative feedback by the board on a poorly performing school (Goerdel, 2006). If managing upward is associated with over-control and negative feedback, it might reinforce, rather than neutralize, the negative effect of environmental turbulence on school performance—further drawing away necessary resources from the primary process and destabilizing the school organization. This results in the second hypothesis:

Hypothesis 2: School principals' intensity of upward-oriented managerial networking reinforces the negative effect of percentage change in the number of pupils on school performance.

Figure 1. Summary of hypotheses.

Networking downward. We define networking downward as principals' efforts to coordinate activities within the organization by interacting with schoolteachers and support staff. Such efforts involve team meetings, the delegation of authority, the development and implementation of protocols and guidelines, and HR-related activities. These activities help stabilize school performance in the face of external shocks. A proper delegation of responsibilities helps the school function well in a moment of turbulence. Involvement of the school team may bring flexibility in resources, new solutions to deal with the shock, and consensus among teachers and staff about strategic decisions. This leads us to the third hypothesis:

Hypothesis 3: School principals' intensity of downward-oriented managerial networking attenuates the negative effect of percentage change in the number of pupils on school performance.

Networking sideward. Education is a coproduced good, and school principals need cooperation from actors such as the school's participatory council (involving teachers and parents), the parents committee, or school principals from the same school board to properly implement their educational and organizational goals, strategies, and programs (Torenvlied et al., 2013). Coproduction with parents helps the school to buffer turbulence when environmental shocks occur, in terms of flexibility in parents' and pupils' demands, additional resources, and innovative solutions that help the school deal with the shock. This leads us to the fourth hypothesis:

Hypothesis 4: School principals' intensity of sideward-oriented managerial networking attenuates the negative effect of percentage change in the number of pupils on school performance.

Networking outward. Resource dependency theory specifies how organizations often lack resources needed to accomplish organizational goals (Fleishman, 2009; Pfeffer & Salancik, 1978). Managers' relations with external organizations aim to reduce uncertainties, generate external resources and support, and buffer for environmental shocks (Geletkanycz et al., 2001; O'Toole & Meier, 1999). In the field of education, such resources are the provision of funds, information about educational programs, peer advice, and the exchange of ideas (Meier & O'Toole, 2003). Outward managerial networking activities will moderate the negative effect of turbulence on performance by anticipation and by buffering for negative effects of environmental shocks through tapping necessary resources. This leads to our fifth hypothesis:

Hypothesis 5: School principals' intensity of outward-oriented managerial networking attenuates the negative effect of pupil percentage change on school performance.

Data and Measurement

To test our hypotheses, we use a dataset of 546 school principals, after a listwise deletion of respondents who have missing values on the variables used in the analyses. The dataset was constructed integrating three datasets of primary schools. The first dataset contains information from a nation-wide survey we held among the principals of Dutch primary schools in January 2010, using an Internet survey. We asked the school principals, among others, for their managerial activities in the previous calendar year (where the scholastic year starts late August and ends early July). Principals of all 6,896 Dutch primary schools were invited by both mail and email to participate in the survey. A reminder was sent after 2 weeks. After 6 weeks, the response rate was 19.55% ($n = 1,348$). This rate is comparable with response rates reported by other studies of Dutch school principals, and is substantial given the work pressure on school principals and the prevalence of survey research in this sector.⁵ The second dataset is a dataset from the Dutch Inspectorate for Education, which provides information about indicators of school performance, as well as a wide range of control variables. A third dataset from the DUO (Dienst Uitvoering Onderwijs; Education Executive Agency) provided information about the number of pupils and information on school boards in which Dutch primary schools are nested. The three datasets were matched by each school's unique identification number, assigned by the Dutch Ministry of Education, Culture, and Science—a four-digit code that allows the ministry to identify primary schools as separate educational units within school boards. Below, we discuss the construction of the different measures in the analysis.

Measures

School performance. The dependent variable in the present study is the school's average score of pupils on a standardized test for 2009 and 2010.⁶ Dutch primary schools must use reliable and valid tests that meet the criteria of the Committee on Test Affairs, the Netherlands (Dutch: Commissie Testaangelegenheden Nederland). The most commonly used standardized test is the "Cito" test—in 2009, roughly 75% of all primary schools participated on voluntary basis in this test. This test is taken in the second half of the eighth and final grade of primary education. The *Cito test score* is based on three sub-tests: for language (100 questions), arithmetic (60 questions), and study competences (40 questions). Pupils' scores on these 200 questions are transformed on a scale between 501 and 550. In 1976, Cito chose this range to avoid confusion with intelligence tests, while retaining a proper range (50 points) to map the responses from 200 questions. In 2009, about 154,000 pupils participated in the test—the average score of pupils was 535.5 (Cito, 2009). Each year, the test is calibrated, evaluated, and adjusted.⁷

All primary schools are allowed to exempt specific, well-defined categories of pupils from the test: (a) pupils with severe language problems who have been living in the Netherlands for a period shorter than 4 years, and (b) pupils with an indication for special secondary education, and sometimes for lower levels of vocational secondary education. Thus, our data do not include test scores of pupils referred to special education or “second language” pupils.

Despite the room for discretion, pupils’ average Cito test scores (corrected for pupil characteristics) are considered to be an authoritative indicator for school performance by the Dutch Inspectorate for Education—and by most teachers and parents as well. As of 2013, the average Cito test scores of schools are freely accessible on the Internet. However, in 2010, the use of these data for analysis required the school’s explicit consent. Therefore, we asked the school principal in the web-based survey to indicate whether the principal agreed on the use of the average Cito score data. About 75% of the school principals who responded to the survey gave permission to use the average Cito score data.⁸

Environmental turbulence. To measure environmental turbulence, we use the data from DUO and calculated the *percentage of change in the number of pupils*. This is the absolute value of the decrease or increase in the number of pupils. For the year 2009, we use the absolute value of the percentage change in pupils between 2008 and 2009, and for the year 2010, we use the absolute value of the percentage change in pupils between 2009 and 2010.⁹ For 11 schools in the dataset, the change exceeded 40% of the pupils (ranging between 41% and 137%). These schools are likely subject to changes not caused by environmental turbulence but rather by strategic choices, such as the merger of schools. These schools were excluded from the analyses.

Managerial networking orientation. We follow O’Toole and Meier’s (2011) measurement of managerial networking as captured by the frequency of relations with external organizations.¹⁰ We approached a number of key informants from the educational domain, such as school principals, school-board members, members from the Primary Education Council, and the Dutch Inspectorate for Education. These informants provided us with a list of potential types of external organizations: (a) organizations at different levels of the educational system (e.g., the national, regional, local, and school-board levels) and (b) organizations with different functions in the educational system as broadly described above in the research context. This procedure resulted in a list of 41 different types of external organizations and actors. We asked the school principals about their frequency of interaction with each of these organizations, using the categories “daily,” “weekly,” “monthly,” “several times per year,” “yearly,” and “never.” Thus, our research design replicates previous designs for the study of managerial networking (Meier & O’Toole, 2003; O’Toole & Meier, 2011) but uses a much finer grid for measuring external support than has been applied in previous research. Each of the four networking orientations is tapped by one or more networking scales. These scales are based on theoretical expectations about scale composition and are analyzed with non-parametric item-response models to test for internal consistency (Torenvlied et al., 2013; Zhu et al., 2014). For each of the networking variables composed of multiple organizations, we computed a sum scale, which we standardized with respect to the number of items in the scale.¹¹ All scales have a homogeneity *H* between 0.30 and 0.50, which is acceptable (Van Schuur, 2003). Below, we discuss the scales for each of the networking orientations in more detail.

“Networking upward” is conceptualized as the self-reported interaction frequency of the school principal with the *school board*.

To measure “networking downward” we use the variable *team involvement*. The items tap the school principals’ interaction frequency with the staff about several issues: (a) school identity and external communication, (b) school housing and maintenance, (c) financial affairs, (d) personnel and employment policy, (e) quality of education, (f) pupil results and performance monitoring,

(g) pupil care, (h) educational quality, (i) external relations, and (j) scheduling and other practicalities.¹² The same response options were used as in the conventional measurement of managerial networking. The items form a scale with high internal consistency ($H = 0.40$).

“Networking sideward” is conceptualized as managerial networking for *coproduction*. The contact frequency items are (a) “the parents committee,” (b) “the participatory council,” and (c) “principals of schools that are part of your school board.” The three external actors form a coproduction networking scale with an acceptable homogeneity ($H = 0.38$).

“Networking outward” is conceptualized as managerial networking with a number of organizations external to the primary school or school board. We asked the school principals for their interaction frequency with organizations and actors that represent *national government* actors, *local government* actors, and *interest organizations* in the labor relations domain (Torenvlied & Akkerman, 2012). *Local government* actors and organizations are (a) “members of city council,” who are the representatives in the local political arena; (b) the “aldermen,” who are the chief administrators in local government; and (c) the “municipal department of education,” which is the main local government department responsible for implementing education policies in the local domain. The items on local networking activity form together a strong scale ($H = 0.51$).

National government actors and organizations are (a) the “DUO,” which is the semi-autonomous government agency responsible for budgeting and finance; (b) the Dutch “Ministry of Education, Culture and Science,” which is the national government department responsible for formulating educational policies and programs; (c) “test suppliers,” which are corporations that develop standardized tests for primary education; and (d) the autonomous “Inspectorate of Education,” responsible for monitoring school performance and auditing the schools on a wide variety of performance indicators. The four networking frequency items form an intermediate strong “youth care” scale ($H = 0.46$).

Interest organizations in the labor relations domain are (a) “labor unions,” which are the labor unions for teaching and support staff; (b) “employer organizations,” which are organizations that represent the interests of school principals; and (c) “the Primary Education Council,” which is the employers’ organization for school boards in primary education. The items on interest organization networking form together an intermediate strong scale ($H = 0.42$).

Controls. We control for a number of variables that tap differences in the pupil population, institutional school characteristics, principal characteristics, and municipal characteristics. At the year level (which is “Level 1” in the analyses), we control for the percentage disadvantaged pupils and school size for $t = 2009$ and $t = 2010$. The variable *percentage disadvantaged pupils* taps the percentage of pupils who carry a “pupil weight,” indicating that the pupil needs additional support and resources.¹³ We control for this variable not only because it may affect the school Cito test scores but also for their over- or underrepresentation in the event of a large change in the number of pupils. We also control for school size because for larger schools a change in the absolute *number of pupils* translates into smaller percentages. In other words, larger schools are better able to buffer pupil changes.

We control for several institutional characteristics of the school. First, we control for the size of the school board measured as the *number of schools* that are governed by the school board. The variable *denomination* measures whether a school is a non-denominational school ($=1$) or a denominational school ($=0$). We furthermore include two measures that control for confounding effects that may arise from differences between school principals: their work engagement and experience. To measure *work engagement*, we use the “Utrecht Work Engagement Scale-9” (UWES-9; Schaufeli, Bakker, & Salanova, 2006). Nine items capture vigor, meaningfulness, enthusiasm, and well-being, among others. The items form a scale with high internal consistency ($H = 0.65$). *Experience* is captured by the number of years that the school principal has worked as head of this specific school.

Finally, we control for non-turbulence, that is, predictable changes in the number of pupils. For example, a decline or increase in birth rate in the municipality or neighborhood produces predictable “cohort” effects. To control for such predictable effects, we included the variable *population growth per 1,000 inhabitants* between 2007 and 2011 for the municipality in which the school is located. This variable is created by the National Institute for Public Health and the Environment (Dutch: Het Rijksinstituut voor Volksgezondheid en Milieu) and combines “natural increase” (excess of births over deaths) with “net migration” (excess of arrivals over departures).¹⁴ The variable consists of three categories: (a) strong increase: population growth larger than 5, (b) strong decrease: population growth smaller than -5 , and (c) no or small change: population growth between -5 and 5 .

Table 1 provides summaries of the descriptive statistics and correlations between the explanatory variables in the analysis. The results show that the percentage of disadvantaged pupils is moderately correlated with the Cito test scores. Other weak and moderate correlations exist between the managerial networking orientations.

Results

The study design nests the average Cito test scores of schools and the percentage change in number of pupils for two years (2009 and 2010) within schools. We apply a multilevel regression analysis to test our hypotheses.¹⁵ Multilevel regression analysis takes into account that observations at the lowest level (year level) are mutually dependent. Compared with ordinary least squares (OLS) regression analysis, multilevel models have more power and produce less biased standard errors (Hox, 2010), also compared with OLS regression analysis correcting for clustered standard errors (Cheah, 2009).

To test for the moderating effects of managerial networking orientations on the relation between percentage change in number of pupils and school performance, we constructed six variables interacting networking orientation with change in pupils.¹⁶ These interaction variables are, necessarily, highly correlated. Therefore, we test the interaction effect of each managerial networking variable in a separate model. To evaluate the explanatory power of the variables, we calculate the percentage reduction in variance within schools and between schools after adding the predictor variables to the new model (Raudenbush & Bryk, 2002). We use model deviance to compare the relative fit of two competing models (Hox, 2010).

Effect of Percentage Change in the Number of Pupils

Table 2 presents the results of a multilevel analysis testing whether percentage change in the number of pupils negatively affects school performance. We first fit the empty model (Model 0), which contains only an intercept term and variance estimates at “Level 1,” the year level (σ_e^2), and at “Level 2,” the school level (σ_{u0}^2).¹⁷ These estimates provide insight into how much variance in Cito test scores we observe *within* schools over time and how much variance we observe *between* schools. The “intraclass correlation coefficient” (ICC), which is the proportion of variance at the school level, is estimated as $p = 9.58 / (9.59 + 7.11) \approx .57$. Hence, 57% of the variance in average Cito test scores can be attributed to differences between schools. The remaining 43% can be attributed to differences *within* schools over time.¹⁸

In Model 1, all control variables are added. The control variables, *percentage of disadvantaged pupils* and *number of pupils*, significantly explain differences between schools in average Cito test scores. The principal’s *interest group networking activity* is negatively and significantly associated with the school’s average Cito test score. *Work engagement* has a significant and positive effect on Cito test scores, and the *number of schools per board* has a negative effect.¹⁹

Table 1. Descriptive Statistics and Correlations for All Variables in the Analyses.

Variable	M	SD	Range	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1. Average Cito test scores	535.17	4.10	518.10-545.20	1.00													
2. Percent change in number of pupils	4.78	4.48	0.00-37.77	-.10*	1.00												
3. Number of pupils	236.31	136.63	27.00-1,152.00	-.54*	.07	1.00											
4. Percent disadvantaged pupils	13.74	14.75	0.00-8.00	.16*	-.17*	-.14*	1.00										
5. School board contact	3.81	1.34	1.00-6.00	.01	.03	.05	.07	1.00									
6. Team involvement	2.41	0.55	1.20-4.20	.06	.04	-.06	.05	.18*	1.00								
7. Coproduction networking	4.06	0.66	1.33-6.00	-.06	.07	.03	-.03	.08	.23*	1.00							
8. Local government networking	2.14	0.72	1.00-4.67	-.02	.01	.07	.04	.20*	.19*	.16*	1.00						
9. National government networking	2.45	0.60	1.25-4.50	.01	.00	-.04	.05	.14*	.24*	.12	.25*	1.00					
10. Interest group networking	1.94	0.77	1.00-4.67	-.01	-.04	-.07	.03	.18*	.14*	.05	.25*	.48*	1.00				
11. Work engagement	4.24	0.85	1.44-6.00	.02	-.08	.06	.01	.09	.02	.07	.07	.02	.14*	1.00			
12. Work experience	8.15	7.92	0.00-4.50	.09	-.06	-.09	.14*	-.04	.02	.01	.10	.03	-.05	-.09	1.00		
13. Number of schools per board	15.97	12.48	1.00-64.00	-.14*	.05	.18*	.07	.13	.02	.21*	-.01	-.04	-.10	.10	-.03	1.00	
14. Denomination (non-denominational = 1)	0.28	0.45	0.00-1.00	-.12*	.07	.13*	-.04	-.06	.06	.21*	.09	.00	-.13*	-.04	.01	.14*	1.00
15. Strong increase population	0.33	0.47	0.00-1.00	-.07	.03	.13*	.22*	.12	-.02	.02	-.07	-.02	.04	.01	-.07	.11	-.02
16. Strong decrease population	0.03	0.16	0.00-1.00	.01	.03	-.03	-.09*	-.04	-.01	.00	-.04	.00	.03	-.03	.11	.05	-.02
17. Small change population	0.65	0.48	0.00-1.00	.07	-.04	-.12*	-.18*	-.11	.03	-.02	.08	.02	-.05	.00	.04	-.12	.02

*p<.05.

Table 2. Multilevel Regression Analysis of Cito Test Scores.

	Model 0	Model 1	Model 2
	<i>b</i> /SE	<i>b</i> /SE	<i>b</i> /SE
Year level (Level 1)			
Percent change in number of pupils			-.039† (.023)
Percent disadvantaged pupils		-.141*** (.009)	-.141*** (.009)
Number of pupils		.003** (.001)	.002** (.001)
Year = 2010	.479** (.162)	.451** (.164)	.461** (.164)
School level (Level 2)			
School board contact		.116 (.095)	.120 (.095)
Coproduction networking		-.159 (.196)	-.147 (.196)
Team involvement		.237 (.235)	.249 (.235)
Local government networking		.122 (.183)	.125 (.183)
National government networking		-.023 (.237)	-.020 (.236)
Interest group networking		-.405* (.186)	-.414* (.185)
Work engagement		.317* (.144)	.298* (.144)
Experience		.014 (.016)	.013 (.016)
Number of schools board		-.020* (.010)	-.020† (.010)
Denomination ^a		-.458 (.280)	-.441 (.279)
Strong increase population growth ^b		-.125 (.271)	-.103 (.271)
Strong decrease population growth ^b		.064 (.754)	.094 (.753)
Constant	534.927*** (.175)	535.115*** (.190)	535.097*** (.190)
σ^2_e (Level 1—Year)	7.108 (.433)	7.213 (.440)	7.205 (.439)
σ^2_{u0} (Level 2—School)	9.577 (.826)	4.163 (.522)	4.133 (.520)
N Level 1	1,083	1,083	1,083
N Level 2	546	546	546
Deviance	5,906.880	5,629.506	5,626.572
Likelihood-ratio test		277.37***	2.93†

Note. All explanatory variables except dichotomous variables are grand-mean centered; likelyhood-ratio test is used to compare fit of model to preceding model.

† $p < .10$. * $p < .05$. ** $p < .01$. *** $p < .001$.

^aReference category is denominational schools.

^bReference category is small change population growth.

Model 2 adds the environmental shock variable *percentage change in the number of pupils*. The effect of *percentage change in the number of pupils* on Cito test scores is significant and negative, as predicted by Hypothesis 1.²⁰ In terms of effect size, the effect of pupil change on Cito test scores is modest: $0.04 / (545.20 - 518.10) \times 100 \approx 0.14\%$. Hence, a change of 1% in pupil change reduces the average Cito test scores by 0.14%. Still, for the schools with the highest level of pupil change (40% change), this implies that their Cito test scores are expected to drop by 5.6%. The percentage reduction in variance at Level 1 is only 0.1, which shows that residual variance within schools barely decreases after adding pupil change. The residual variance at the school level decreases by 0.7%. The model fit significantly improves by adding the shock variable.

Moderating Effects of Managerial Networking

The second part of our theory specifies the moderating effects of different managerial networking orientations on the negative association between environmental turbulence and school performance. Hypothesis 2 predicts that school principals' intensity of upward-oriented managerial

networking *reinforces* the negative effect of percentage change in number of pupils on average Cito test scores. The other hypotheses predict that the intensity of downward- (Hypothesis 3), sideward- (Hypothesis 4), and outward-oriented managerial networking (Hypothesis 5) *attenuate* the negative effect of percentage change in number of pupils on average Cito test scores. Table 3 shows the abbreviated results of a series of multilevel models testing the hypotheses.

Model 1 in Table 3 adds the interaction variable of school board contact and percentage change in the number of pupils. The estimates show that *school board contact* does not significantly reinforce the negative effect of pupil change on Cito test scores. Hence, the data do not corroborate the “networking upward” Hypothesis 2. Model fit compared with Model 2 in Table 2 does not significantly improve.

The estimates in Model 2 show that *team involvement* attenuates the effect of pupil change on Cito test scores, which corroborates the “networking downward” Hypothesis 3. The unique effect of pupil change (-0.04) can be interpreted as the effect of pupil change on Cito test scores when team involvement is average, which is 2.41 (when data are not centered). The overall effect of pupil change on Cito test scores becomes $-0.04 + 0.09 \times \text{team involvement}$. For school principals with the highest level of team involvement, 4.20 in our data, this implies that the effect of pupil change is $-0.04 + 0.09 \times (4.20 - 2.41) \approx 0.12$. Hence, principals with highest levels of team involvement are able to attenuate the negative impact of pupil change on the performance of their school. In comparison with Model 2 in Table 2, the residual variance decreases with 0.2% at the year level, and with 1.0% at the school level. Hence, team involvement in interaction with pupil change explains 1.0% of the variance between schools. The model fit significantly improves compared with Model 2 in Table 2.

Model 3 presents the effect of the *coproduction* networking interaction variable. Coproduction networking significantly moderates the negative effect of percentage change in pupils on average Cito test scores, as predicted in the “networking sideward” Hypothesis 4. The negative effect of pupil change diminishes for school principals with highest levels of coproduction networking ($-0.04 + 0.08 \times (6.00 - 4.06) \approx 0.12$). In other words, principals with highest levels of coproduction networking are also able to temper the negative effect of pupil change. Residual variance within schools does not change, but between schools the residual variance drops by 1.5%. The model fit does significantly improve compared with Model 2 in Table 2.

Hypothesis 5 is tested in Models 4 to 6 for the three scales of external networking. The three models reveal that there is no moderating effect of local-, national government-, or interest group networking on the negative association between change in number of pupils and Cito test scores.²¹

Conclusion and Discussion

Based on the analyses, we can draw a number of conclusions. In the first place, we provide evidence for the hypothesis that environmental shocks negatively affect organizational performance. This replicates the results of previous studies by Boyne and Meier (2009), Meier and O'Toole (2009), O'Toole and Meier (2011), and Zinn et al. (2009) in a new context. In the second place, the data provide evidence for hypotheses about the attenuating effects of school principals' downward-oriented networking and sideward-oriented networking on the negative effect of external shocks on organizational performance. Internally oriented networking activities actually *neutralize* negative effects of environmental shocks. Finally, the data do not provide evidence for the existence of a reinforcing effect of school principals' upward-oriented networking or an attenuating effect of outward-oriented networking on the negative effect of external shocks on organizational performance.

The implication of the present study is that, in the context of primary schools in the Netherlands, the negative impact of turbulence and shocks in the school's environment is moderated by *internally* oriented networking activities, rather than *externally* oriented networking activities.

Table 3. Multilevel Regression Analysis of Cito Test Scores: Moderating Effects of Managerial Networking.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	b/SE	b/SE	b/SE	b/SE	b/SE	b/SE
Percent change in number of pupils	-.038† (.023)	-.044† (.023)	-.045† (.023)	-.040† (.023)	-.038† (.023)	-.042† (.023)
School board contact	.119 (.095)	.112 (.095)	.098 (.095)	.123 (.095)	.121 (.095)	.120 (.095)
Coproduction networking	.116 (.183)	.149 (.182)	.127 (.182)	.127 (.182)	.132 (.183)	.114 (.183)
Team involvement	-.029 (.236)	-.006 (.235)	-.024 (.235)	-.007 (.236)	-.021 (.236)	-.019 (.236)
Local government networking	-.135 (.196)	-.172 (.195)	-.086 (.197)	-.157 (.196)	-.153 (.196)	-.142 (.196)
National government networking	-.410* (.185)	-.416* (.185)	-.406* (.185)	-.412* (.185)	-.414* (.185)	-.415* (.185)
Interest group networking	.255 (.235)	.234 (.234)	.209 (.235)	.258 (.235)	.253 (.235)	.245 (.235)
Percent change in number of pupils × School board contact	-.012 (.018)					
Percent change in number of pupils × Team involvement		.093* (.041)				
Percent change in number of pupils × Coproduction networking			.083* (.036)			
Percent change in number of pupils × Local government networking				.040 (.033)		
Percent change in number of pupils × National government networking					.027 (.038)	
Percent change in number of pupils × Interest group networking						-.038 (.028)
Constant	535.106*** (.190)	535.075*** (.190)	535.071*** (.190)	535.092*** (.190)	535.094*** (.190)	535.100*** (.190)
σ^2_{ϵ} (Level 1—Year)	7.201 (.439)	7.187 (.438)	7.200 (.440)	7.205 (.440)	7.211 (.440)	7.171 (.438)
σ^2_{u0} (Level 2—School)	4.132 (.520)	4.089 (.517)	4.069 (.517)	4.112 (.519)	4.120 (.520)	4.161 (.520)
N Level 1	1,083	1,083	1,083	1,083	1,083	1,083
N Level 2	546	546	546	546	546	546
Deviance	5,626.086	5,621.464	5,621.474	5,625.128	5,626.07	5,624.796
Likelihood-ratio test	.49	5.11*	5.10*	1.45	.50	1.78

Note. All equations control for percentage disadvantaged pupils, number of pupils, yearly dummy variable, past performance, management capacity, work engagement, experience, number of schools per board, denomination (non-denominational = 1) and the population growth dummy variables; all explanatory variables except dichotomous variables are grand-mean centered; likelihood-ratio test is used to compare fit of model to Model 2 in Table 2.

† $p < .10$. * $p < .05$. ** $p < .01$. *** $p < .001$.

Environmental shocks, thus, interfere with organizational parameters that affect the internal stability of the school organization and not exclusively in interaction with environmental stability—which is a core assumption of the model of public management developed by O'Toole and Meier (2011). In the context of primary education in the Netherlands, it is not external networking that moderates the impact of external shocks on organizational performance but rather *internal* networking with teachers and co-producers. In situations of turbulence, Dutch primary school principals rely on their *downward*-oriented and *sideward*-oriented networking relations. The present research could be extended to other contexts or to conceptualizations of environmental shocks other than percentage change in pupils. Future research should try to reveal the mediating effects of environmental shocks on performance through specific internally stabilizing forces, such as structural-, personnel, or production stability (O'Toole & Meier, 2011). Future research should also further probe in the consequences of networking as a multidimensional concept. The present article clearly shows that a multidimensional approach to networking has improved our understanding of how public managers' networking activities with specific types of actors help moderate environmental shocks, and ultimately, how they affect organizational performance. The present study did not distinguish between proactive and reactive networking (Goerdel, 2006), and an intriguing question is whether proactive managers are better able to absorb negative effects of environmental turbulence than do managers who have a more reactive networking approach.

Finally, the results have practical implications for public managers, more specifically for managers in education. The present study clearly shows that there are limits to effective networking when an environmental shock hits a school. A dominant focus on externally oriented networking may drag away resources from internally oriented networking, essential to buffer internal organizational processes. Externally oriented relations may buffer an organization for future events. But once the storm breaks out, public managers are wise to fix their organizational compass on an internal orientation.

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Notes

1. Roughly 29% have a Roman Catholic background, 26% have a Protestant denomination, and 11% have another, not necessarily religious, denominational background (Islamic, Hindu, Jewish, or Waldorf school).
2. For schools with lesser than 145 students, a drop in the number of pupils will be (partly) compensated by a special funding for small primary schools.
3. The seniority criterion is applied for the designation of workers who are regarded as redundant and are eligible for compulsory redundancy.
4. Studies on the effect of class size on pupils' achievements show mixed results (Fredriksson, Öckert, & Oosterbeek, 2012). For example, a study of Dobbela, Levin, and Oosterbeek (2002) shows that

pupils in large classes do not perform worse—and sometimes even perform better—than identical pupils in small classes. By contrast, Kreuger and Whitmore (2001) found that attending a small class in early grades is associated with an increased likelihood of taking a college-entrance exam (especially among minority students) and somewhat higher test scores.

5. For example, the web-based survey of the Dutch Education Council (2008, p. 31) had a response of 15.6%. A study that uses the same dataset performed an elaborate non-response analysis shows that schools in the sample do not differ with respect to a large number of relevant characteristics, such as school size, location, denomination, or quality assessment by the inspectorate for education (Torenvlied & Akkerman, 2012, p. 466).
6. Rich assessment data from inspector reports are not available, except for underperforming schools in a strict regime of oversight by the inspectorate.
7. In the transformation, several steps are taken (Van Boxtel, Engelen, & De Wijs, 2011). Because each year new items are used, item-response models are applied to identify items that fit poorly on the scale. The item-difficulty is further calibrated using samples of pre-tests using tests from previous years. Comparability of test scores across years is guaranteed by estimating a normal curve equivalent. The 501 to 550 scale is devised as a linear equivalence transformation using the distribution of the earlier year. The standard error of the equivalence procedure is estimated by statistically comparing the variance in pupil scores for different groups of schools, using different years as a baseline. These tests show that the procedure is robust for different equivalence procedures.
8. On the basis of the consent rate of 75% of all school principals in our survey—combined with the percentage of schools that use the Cito score (75%)—we may expect that we have 56.25% of our cases valid for analysis. On the basis of 1,348 schools in our dataset, this percentage combines to 758 valid cases of performance. In the 2009 dataset, we have 718 valid cases for performance. Thus, the available cases roughly are what we would expect on the basis of the national data. The number of valid cases reduces to $N = 546$ because of missing cases in the various independent variables and controls.
9. In their study on public management and performance after hurricane Katrina, Meier, O'Toole, and Hicklin (2010) also used the percentage of student influx as a measures of environmental turbulence, as did Boyne and Meier (2009).
10. This assumption is strong, because interaction frequency does not fully capture the richness of network ties that may exist between organizations, nor does the interaction frequency provide information about who initiated the contact (Torenvlied & Akkerman, 2012). The Texas school data reveal that taking the initiative in networking and managerial networking activity are highly correlated variables (cf. Goerdel, 2006).
11. The use of standardized sum scales allows us to interpret effect sizes of managerial networking activity in a straightforward way (as they represent average interaction frequencies).
12. These aspects were also derived on the basis of in-depth interviews with school principals, board members, and representatives from the inspectorate of education.
13. The percentage of disadvantaged students is based on the so-called “pupil weights.” Students are assigned specific weights if both parents have only attended elementary school (0.25); they live in a foster home (0.4); both parents work in a circus or fair (0.7); one or both parents live at a trailer park (0.7); they have a non-Dutch cultural background; or if the father or mother (caretaker) has finished a lower professional education at most; or if the highest-earning parent is employed in a profession in which she or he does physical or hand labor, or is unemployed (0.9 if one of these conditions is satisfied). The numbers in parentheses are the weights used to calculate the additional funding for these disadvantaged pupils.
14. Because there were no dataset available, we harvested these data from the RIVM website in July 2014.
15. According to Gelman and Hill (2007), two observations, or occasions, per group is enough to fit a multilevel model.
16. All explanatory variables except dichotomous variables are grand-mean centered to simplify the interpretation of the intercept and the cross-level interactions (Hox, 2010).
17. For repeated measurement data (panel designs), the cases at the time level are sampled following an ordered scheme, which results in an overestimation of variance at the time level and an underestimation of variance at the individual level (for details, see Hox, 2010). To produce more realistic variance estimations for repeated measurement data, we add a time variable (year = 2010) to the empty model.

18. Because schools are also nested within school boards and municipalities, we also calculated the intra-class correlations after including the school board level and the municipal level in the empty model. We found that about 43% of the variance of Cito test score is attributed to differences within schools over time, 38% is attributed by differences between schools, 13% of the variance is explained by differences between boards, and 6% is explained by differences between municipalities.
19. We also find that inclusion of these variables make the residual variance at Level 1 increase. This is not an uncommon phenomenon in models with Level 1 variables without group variation (Wang, Xie, & Fisher, 2011).
20. In line with Texas school district studies, we also tested an autoregressive model by including the lagged dependent variable *Cito test scores 2008*. The autoregressive term has a strongly significant coefficient, which shows that past performance has a strong effect. As a result, the significant effect of percentage change in the number of pupils disappears. The main reason is that, in general, including a lagged dependent variables suppresses the explanatory power of other independent variables (Achen, 2000). Because past performance is also likely to influence turbulence (as parents choose to take their children out of bad schools), we modeled the two-way effect of past performance using Baron and Kenny's (1986) framework for mediation while controlling for all other variables. We find that past performance does not significantly affect turbulence, and the Sobel test was not significant. Hence, there is no mediating effect of turbulence.
21. We examined the robustness of findings in the "Results" section for differences in the shock: whether a decline or an increase in the number of pupils makes a difference in the effect on school performance. We performed a series of regression analyses to separately test the effect of positive and negative changes in the number of pupils. We find that—independently of one another—both "directions" have a negative, not significant, effect on school performance. We also examined whether the moderating effects of team involvement and coproduction networking are different for a positive or negative change in the number of pupils. We included a three-way interaction term for team involvement/coproduction networking, the percentage change in the number of pupils variable, and a dummy variable for decrease in the number of pupils. We find that the reinforcing effects of both team involvement and coproduction networking are significantly stronger for schools experiencing a decrease in number of pupils than for schools experiencing an increase in the number of pupils. Finally, to reduce potential bias produced by principals at a very early stage in their career, we confined the analysis to principals with at least 6 months of experience in their function. We find that results are comparable with results without this limitation.

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