Organizational Error Management Culture and Its Impact on Performance: A Two-Study Replication

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Abstract

We argue that a high organizational error management culture, conceptualized to include norms and common practices in organizations (e.g., communicating about errors, detecting, analyzing, and correcting errors quickly), is pivotal to the reduction of negative and the promotion of positive error consequences. Organizational error management culture was positively related to firm performance across two studies conducted in two different European countries. Based on quantitative and qualitative cross-sectional data from 65 Dutch organizations, Study 1 revealed that organizational error management culture was significantly correlated with both organizational goal achievement and an objective indicator of economic performance. This finding was confirmed in Study 2, using change of profitability data from 47 German organizations. Our results suggest that organizations may want to introduce organizational error management as a way to boost firm performance.

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Abstract

We argue that a high organizational error management culture, conceptualized to include norms and common practices in organizations (e.g., communicating about errors, detecting, analyzing, and correcting errors quickly), is pivotal to the reduction of negative and the promotion of positive error consequences. Organizational error management culture was positively related to firm performance across two studies conducted in two different European countries. Based on quantitative and qualitative cross-sectional data from 65 Dutch organizations, Study 1 revealed that organizational error management culture was significantly correlated with both organizational goal achievement and an objective indicator of economic performance. This finding was confirmed in Study 2, using change of profitability data from 47 German organizations. Our results suggest that organizations may want to introduce organizational error management as a way to boost firm performance.

Every organization is confronted with errors. Errors can result in negative consequences (e.g., loss of time, faulty products) as well as positive ones (e.g., learning, innovation). The negative consequences—for example, accidents such as the Chernobyl or Challenger disasters—tend to be observable (Meijman & Mulder, 1998) and have been of high interest to scholars and laypeople alike (Reason, 1990). The scientific understanding of the negative effects of errors is much better developed than that of the potential positive effects of errors. Much of accident research and approaches within cognitive psychology, as well as popular ideas, have conceptualized errors as constituting primarily negative events. This line of research has supported the concept of error prevention—the attempt to block erroneous actions whenever possible (Reason, 1990).

The potential long-term positive consequences of errors, such as learning, innovation, and resilience, however, are less obvious (Sitkin, 1996) although people readily agree that they can learn from errors (e.g., Jones & O'Brien, 1991; McCune, 1997). In the long run, organizations that have an effective approach to errors may be more profitable, because these organizations learn from errors, are more apt to experiment, and are more likely to innovate. Unfortunately, much of the evidence for using a positive organizational approach to errors is still anecdotal (Peters, 1987) and needs to be empirically validated.

One way to contain the negative and to promote the positive consequences of errors is to employ error management. This approach assumes that human errors per se can never be completely prevented and, therefore, it is necessary to ask the question of what can be done *after* an error has occurred (Frese, 1991, 1995). The error management approach distinguishes between errors and their consequences. While error prevention aims at avoiding negative error consequences by avoiding the error altogether, error management focuses on reducing negative error consequences and on increasing potentially positive consequences. We conceptualize error

management similarly to how others have conceptualized stress management—an approach that does not aim at changing the stressor itself but rather focuses on how to change individuals' responses to these stressors to reduce their negative consequences (Murphy, 1996). As such, error management is an approach that does not attempt to do away with errors completely but rather attempts to deal with errors and their consequences after an error has occurred. In addition, it ensures that errors are quickly reported and detected, that negative error consequences are effectively handled and minimized, and that learning occurs (Frese, 1991, 1995). Examples of employing an error management approach can be found in software systems (e.g., the Undo function), physical set-ups (e.g., the containment egg around nuclear power plants), crew and individual behaviors (e.g., cross-checking in the cockpit that leads to "error trapping", that is, catching the error before its negative consequences can unfold, see Helmreich & Merritt, 2000), and organizational practices (see discussion below). Although the focus of this research is on error management, we believe that organizations should use both error prevention and error management approaches so that, despite the ubiquity of errors, negative error consequences are effectively handled.

Theoretical Development

Errors are not easily defined (Senders & Moray, 1991). Errors are unintended deviations from goals, standards, a code of behavior, the truth, or from some true value (Webster' Dictionary, 1967). In our study, we are primarily concerned with action errors, which we define as unintended deviations from plans, goals, or adequate feedback processing, as well as a incorrect action that result from lack of knowledge (Reason, 1990; Zapf, Brodbeck, Frese, Peters, & Prümper, 1992). People may make errors by selecting wrong objectives in the first place, which are wrong from a higher level perspective (e.g., Columbus had the goal of sailing West; however from a higher level perspective, this was an error because he wanted to find a short

route to India). Errors can, in principle, be differentiated from inefficiencies, because inefficient pursuit does in the end reach the goal. However, most people hold a standard of efficiency (and certainly companies do); thus, inefficient routes are deviations from this standard and from this perspective inefficient actions are erroneous and managers sometimes report inefficiencies as examples of errors. Because of the unintentional nature of the deviation that characterizes errors, errors typically lead to the aversive feeling that one should have known better. The unintentional nature of the deviation is also one way to differentiate errors from violations (which are intentional deviations from standards, norms, practices, or recommendations).

Often, organizations rely on error prevention only. We argue that the exclusive emphasis on error prevention has its limits because total elimination of errors is impossible (Garud, Nayyar, & Shapira, 1999; Reason, 1997). The fallibility of human reasoning is the flipside of the advantages of the human cognitive apparatus characterized by fast processing in uncertain environments (Reason, 1990) and bounded rationality (March & Simon, 1958). Therefore, a pure error prevention approach cannot deal adequately with the fact that errors are ubiquitous. Although we usually cannot predict which specific error will occur (or when), invariably, errors will occur and may lead to negative consequences. Moreover, a pure error prevention approach reduces the chances to learn from errors and minimizes the possibility to benefit from the potential long-term positive consequences of errors.

Organizational theorists have differentiated between control and learning perspectives, with both perspectives being important for the long-term success of organizations (Sitkin, Sutcliffe, Roger, & Schroeder, 1994). The organizational goal of avoiding negative error consequences is conceptually associated with the more general goal of control. Pure error prevention does not necessarily allow for learning to occur (Sitkin, 1996), and some learning strategies, such as experimentation (Huber, 1991), are in direct conflict with error prevention's

goal of control. In contrast, an organizational error management approach is conceptually associated with the more general goal of learning. This view is supported by research on error management training, which has demonstrated that errors can contribute to learning in individuals (Frese, 1995; Nordstrom, Wendland, & Williams, 1998). Errors may represent a form of negative feedback (i.e., one has not achieved a goal) and, as such, present the individual with valuable information about how to alter one's course of action to ultimately achieve a goal. Learning takes place when people are encouraged to learn from errors (Heimbeck, Frese, Sonnentag, & Keith, 2003), when they think about errors metacognitively (e.g., planning, monitoring, and evaluating one's actions), and when the negative emotional impact of errors is reduced (Keith & Frese, in press). One may be tempted to suggest presenting hypothetical errors (i.e., errors that have not occurred) to learn from them (March, 1991). However, this strategy has drawbacks stemming from artificiality, lack of validity, and absence of real consequences of the hypothetical errors (Ivancic & Hesketh, 2000).

Organizations may be able to benefit from simultaneously pursuing the goal of control and the goal of learning, and we propose that error management is well suited for supporting such an approach. On the control side, error management implies quick error detection and damage control. With regard to learning from errors, error management uses errors as learning opportunities and encourages exploration and experimentation. Error management, thus, overcomes the inherent conflict in allocating resources between control and learning perspectives.

Error Management Culture

We suggest that error management can be applied to the organizational level using the concept of culture (Klein, Dansereau, & Hall, 1994). Culture implies that there is a system of shared norms and values and a set of common practices in an organization (Reichers &

Schneider, 1990). Culture and climate are inherently difficult to differentiate (Reichers & Schneider, 1990). In keeping with cross-cultural psychology, culture should be defined as referring to both, norms *and* practices (House, Hanges, Javidan, Dorfman, & Gupta, 2004). However, because we believe that individuals are more likely to accurately assess the more visible aspects of their organization's culture rather than the hidden norms and assumptions, this paper focuses on shared practices and procedures.

Figure 1 displays our theoretical arguments. Error management culture encompasses organizational practices related to communicating about errors, to sharing error knowledge, to helping in error situations, and to quickly detecting and handling errors. We suggest that high error management culture translates into high firm performance via mediators that decrease negative error consequences (via control of these consequences) and simultaneously increase positive consequences of errors (via learning, initiative, and innovation). In this article, we are not concerned with safety, accidents, and catastrophes (although we believe that these areas may also benefit from an error management culture), but rather with the impact of errors on firm performance.

Communication about errors probably constitutes the most important error management practice (see Figure 1). A high degree of communication about errors allows for the development of shared knowledge about errors. Because people talk freely about their errors in a high error management culture, they develop a mutual understanding of high risk situations (i.e., error traps) and of effective error handling strategies (Mathieu, Goodwin, Heffner, Salas, & Cannon-Bowers, 2000). Communicating about errors makes it possible for others to help in error situations. For example, if employees know a coworker is working in an area that is conducive to making errors (e.g., preparing complex negotiations or writing complex software). In addition, open communication should also facilitate the quick detection and handling of errors (see

Helmreich & Merritt, 2000). The time between the occurrence and the detection of an error is crucial because errors that remain undetected produce negative consequences that are more severe than errors that are detected quickly (cf. Reason's, 1990, notion of latent failure). Open communication about errors, a shared understanding of potential error situations, being able to help others in such situations, and fast error detection should allow for quick, smooth, and well-coordinated error handling, reducing the potential negative error consequences frequently associated with errors (Sitkin, 1996).

There are some organizations that have cultivated certain systematic approaches to facilitate communication about errors. For example, an American consulting firm throws a party whenever a project fails, explicitly creating a situation in which communication about errors can naturally occur. Similarly, a CEO of a large German organization keeps a "golden book" to record errors that occurred over the course of various projects. However, many organizations tend to punish the occurrence of errors, thereby reducing potential communication about such incidents. This is detrimental, especially considering that people are inherently hesitant to talk about their errors because they know that this likely leads to negative attributions. Hindsight bias and the fundamental attribution bias (Brown, Williams, & Leeshaley, 1994; Gilbert & Malone, 1995) make it difficult to discuss one's errors because people suspect that they will be blamed and that errors will be attributed to undesirable personality traits, lack of knowledge and skills, or low intelligence. Organizational error management culture must actively work against these biases by rewarding the communication about errors and by inhibiting their punishment (Edmondson, 1999).

High error management culture reduces negative and promotes positive error consequences (see mediators – the second block in Figure 1, that is in a box with interrupted lines because these mediators are theoretically described but have not been operationalized in our

studies). In organizations with a high error management culture, the negative consequences of errors are likely to be reduced or, at least, more easily contained more quickly because people in such organizations know that errors appear and, consequently, may attempt to control the potential damage resulting from errors. In addition, a high error management culture, especially open error communication, encourages learning from errors—without communication, employees are only able to benefit from their own errors. However, when errors are openly communicated, learning from others' errors becomes possible as well. Secondary error prevention follows from better, that is, shared, knowledge of different error situations. An error management culture may also stimulate organizational innovativeness. Innovations are inherently uncertain and, therefore, errors are likely to occur. An organization's innovativeness should be higher when people are confident they will not be blamed or ridiculed when errors occur (Edmondson, 1999). Moreover, accepting errors as a natural part of work and communicating about errors should encourage individuals to explore and experiment. Errors may actually inspire individuals to develop a better and more sophisticated understanding of a particular situation that caused an error to occur. Exploration and experimentation may, therefore, be increased after an error occurred (Dormann & Frese, 1994). Employees do not tend to show initiative when they expect to be punished for their errors that may co-occur while acting proactively. Therefore, a high degree of personal initiative and experimentation may follow from a better error management culture. Communication about errors, quick error detection as well as effective and coordinated error handling make it possible to improve product quality, service quality, and work procedures.

Empirically, there is evidence that the absence of errors is not necessarily a good predictor of future success. Given dynamic changes, prior success may lead to a lower degree of success in the future (Audia, Locke, & Smith, 2000; Bragger, Hantula, Bragger, & Kirnan, 2003).

Lack of error management in a firm may help to explain the "paradox of success". Since successful firms have developed successful routines, there are fewer errors, there is less attention paid to errors, and the negative feedback from errors is less salient and less clear—all of which may diminish future success: "Following success, the amount of information sought from unfavorable sources decreases" (Audia et al., 2000, pp. 849-850).

On the group level, Edmondson's (1996) research on errors in a medical setting revealed that highly performing teams reported more errors. Edmondson concluded that these teams had a better error climate, which allowed them to talk about errors, in turn, increasing error detection and correction. Furthermore, the open climate, characterized by willingness to report and discuss errors, probably stimulated learning from errors (cf. also Cannon & Edmondson, 2001).

Building on this research, we propose that an error management approach be studied in terms of organizational culture. In line with Rochlin (1999), we argue that there is a cultural dimension to how organizations deal with errors. However, we do not assume homogeneous cultural dimensions to exist in large organizations, and, obviously, homogeneity has to be shown empirically (Kozlowski & Klein, 2000). Consequently, preference should be given to medium-sized or smaller companies when doing organizational culture research because the likelihood of a homogeneous culture to exist in such organizations is higher than in large companies. On the basis of these arguments and the previous literature, we advance the following hypothesis:

Hypothesis: Error management culture is positively related to firm performance.

In addition to examining the potential relation between error management culture and company performance, we explored the possibility that error aversion culture—another dimension of organizations' error culture and comprising aspects such as covering up and experiencing strain from errors—may relate negatively to firm performance and to error management culture. Errors may produce strain by causing additional demands on the erring

individual. In error situations, individuals not only have to deal with the task at hand but also with the error and its potential consequences, along with their negative self image. In organizations in which errors tend not to be punished and are accepted as part of work, the additional cognitive demands of errors may be potentially reduced because there is less need for individuals to cope with their negative self image by hiding errors or blaming others (Hockey, 1996; see also Hollenbeck, Ilgen, Tuttle, & Sego, 1995). Moreover, because strain may lead to additional errors, it is likely that in organizations with low error aversion culture, secondary errors tend to be avoided and error handling is done more effectively, ultimately resulting in better firm performance.

Research question: Is error aversion culture negatively related to firm performance and to error management culture?

To test our hypothesis and research question, we conducted two studies surveying medium-sized companies in two European countries. In addition, Study 1 also included qualitative interviews with a subset of organizations.

STUDY 1

Sample and Procedures

To obtain a random sample of medium-sized firms in the Netherlands, we used a commercial agency's database. In total, we approached 300 companies employing 100 and 500 employees working in the same plant, office, or site. To ensure that the relations between error culture and firm performance would not be restricted to certain industry sectors, we included different industries in our sample: automation (IT), retail trade, construction, publishing, wholesale, machine and appliances, transport, insurance, consultancy, and banks. Based on these sectors, we developed four broad industry categories: production and construction (N = 19),

business services (N = 16), finances and insurances (N = 10), and trade (N = 20) with companies randomly selected from these categories.

In collecting information on organizational culture, we focused on managers for two reasons: First, managers receive information on a wide variety of departments and are therefore a more valid source for the assessment of an organization's culture. Second, managers play a key role in forming and shaping an organization's culture by setting the tone in the organization and determining the kinds of behaviors that are expected and supported (Schein, 1992). One or two managers per company were invited to participate in our study. We asked these contact persons to distribute questionnaires on organizational error culture to their colleagues providing us with what they considered the most representative cross-section of their company's management. We only included firms that returned at least three completed questionnaires. In terms of individual participants, 380 questionnaires were returned. Since only organizations with three or more respondents were included in our analyses, a usable sample of 65 organizations resulted (22% response rate). Of the 350 participants in these 65 organizations, 297 respondents were male, 43 were female, and 10 did not reveal their gender. On average, 5.4 managers per organization participated in our study (the range was from 3 to 10 participants per company). Participating managers generally had a position just above mid-level management.

Study 1: Survey

Measures

Error culture. We derived our measure of error management culture from an earlier instrument—the Error Orientation Questionnaire—(EOQ; Rybowiak, Garst, Frese, & Batinic, 1999), which was validated and developed for individuals. Specifically, we adapted the items of the EOQ in such a way that they referred to common organizational practices and instructed participants to rate the extent to which each statement applied to the people in their organization

in general. A factor analysis of these aggregated, company-level scores revealed two factors: error management culture and error aversion culture. Items were answered on a scale ranging from (1) "doesn't apply at all" to (5) "applies completely"; coefficient alphas were .92 for the 17-item error management scale and .88 for the 11-item error aversion measure (see Appendix for items).

As we sampled managers from different functional areas and from organizations from a variety of industries, we did not specify the type of errors respondents were to think about while responding to our questionnaire. However, at the end of the survey we asked managers to report on the situations they had thought of while filling out the questionnaire. Examples of these error situations include: Misplacing a finished product, ordering wrong supplies so that a product could not be finished on time, errors in planning and budgeting a project, and error of not sharing a piece of information. The examples show that most errors that occurred were not catastrophic in nature but rather related to everyday actions in organizations. Moreover, there were no errors that were directly related to the area of safety.

Firm performance. To be able to compare performance among the diverse set of companies and industries represented in our sample, we used two indicators of firm performance: firm goal achievement and survivability. Firm goal achievement captures one aspect of firm performance, namely, how well a company is doing with regard to its own goals and in comparison to its direct competitors ("To what degree has your organization achieved its most important goal in the last year?"; "How successful is your organization in comparison to other companies in the same line of industry and of (about) the same size?"). The first item was rated on a scale that ranged from (1) "not at all" to (5) "completely"; the second item was rated on a scale that ranged from (1) "not at all" to (5) "extremely". Items were averaged to form a single indicator (Cronbach's alpha was .65, which is adequate for a two-item measure).

Survivability as an indicator of firm economic performance was taken from a yearbook published by a Dutch consultancy agency that collects information on the yearly performance of a large number of Dutch companies (De Breed & Partners, 1996). The advantages of this measure are that it combines several economic performance indicators and that it allows for the comparison of firms across different lines of industry.[1] A major disadvantage of this index, however, is that is only available for a subset of 25 firms in our sample. Another disadvantage is that the precise nature of the regression analyses used to calculate the index is proprietary material of De Breed and Partners and cannot be published. However, the index is widely used in Dutch industry because it constitutes a good indicator of company success and survival.

Control variables. We controlled for company age (years), firm size (number of employees), and line of industry (for which we created three dummy-coded variables to represent the four broad industry categories).

The unit of analysis in the present study is the organization. For a construct to exist at the organizational level, however, two criteria must be met (Kenny & LaVoie, 1985; Klein et al., 2000). First, the construct must be conceptually meaningful at the organizational level. We have argued above that this is indeed the case. Second, individual judgments of organizational dimensions must converge so that there is good within-group agreement. To test whether there was agreement within organizations on the ratings of error culture and firm goal achievement, we calculated estimates of within-group interrater reliability (James, Demaree, & Wolf, 1984). The average values for $r_{WG(J)}$ across all 65 companies were .92 for error management culture, .90 for error aversion culture, and .86 for firm goal achievement. Overall, values of interrater reliability exceeded the .70 criterion suggested by Klein et al. (2000), indicating an acceptable level of agreement within organizations and justifying aggregation of data to the organizational level.

Study 1: Survey Results

Descriptive statistics and correlations of all study variables are displayed in Table 1. In line with our expectations, we found error aversion culture to be negatively associated with error management culture, although the correlation missed the conventional significance criterion (r = –.20, $p < .10$). In contrast to our expectation, the correlation between firm goal achievement and economic performance did not reach statistical significance (r = .24, $p > .05$; please note that N=25 for economic performance).

We tested our hypothesis using hierarchical regression analyses entering the control variables of age, size, and industry categories in the first step and error management culture and error aversion culture in step 2. As hypothesized, error management culture was positively and significantly related to both firm economic performance and firm goal achievement (β = .42, $p <$ .01 and β = .51, $p < .05$, respectively, see Table 2). However, we found no significant relations between error aversion culture and the two indicators of performance, firm goal achievement and economic performance (β = .16, $p > .05$ and β = .31, $p > .05$, respectively). Thus, Hypothesis 1 was supported. [2] With respect to our research question, there was no evidence that error aversion culture was related to firm performance.

Study 1: Interviews

The qualitative part of the study was done at the same time as the survey was administered and served to embellish the survey results and to illustrate managers' thinking about errors. To this end, we approached 10 of the 65 participating companies. Of these, eight (from the fields of automation, administration, retail, construction, wholesale, insurance, and technical consultancy) were willing to participate in an interview study. These companies were selected for their variation on the following dimensions: error management culture (ranging from 3.09 to 3.67 in the survey), error aversion culture (ranging from 2.21 to 3.00), firm goal achievement (ranging from 2.89 to 3.96), and economic performance (ranging from 3.00 to 5.00). Using a critical

incident approach (Flanagan, 1954), two research assistants interviewed two managers from each of the eight companies about two separate error incidents resulting in 16 interviews on a total of 32 incidents. All of the interview partners had been participants in the survey. Interviews lasted 1-1.5 hours and were administered face-to-face, audio-recorded, and later transcribed.

The goal of our qualitative study was to get answers to the following questions: (1) How difficult or easy was it for managers to talk about errors? (2) What kind of errors did managers think about when they talked about errors? (3) Did managers and their organizations have a clear vision or mission statement regarding errors and was there a general rationale and conscious approach towards errors? (4) Did managers' statements about errors and how organizations dealt with them naturally fall into categories of error management culture and error aversion culture (and potentially additional categories)?

We used the following procedure to code the interview material. First, two raters unfamiliar with the study identified all text segments that were related to an organization's error culture (yes/no; Cohen's Kappa = .86). In cases of disagreement, raters discussed and decided together whether or not a segment was indicative of the way errors were dealt with in the organization. About half of the total number of segments captured aspects of an organization's error culture (resulting in a total of 261 segments), and these segments were further categorized and scored. In particular, two raters familiar with the theoretical underpinnings of this study examined the text segments and developed four broad error culture categories: Error management, empathy, blame and punishment, and error aversion. Next, the same raters sorted the error culture segments of the transcripts into the four categories (Cohen's Kappa = .69). In cases of disagreement, raters discussed the differences and mutually agreed on a category. Finally, these raters assigned a score between 1 (low) and 5 (high) to each segment of the transcripts (Cohen's Kappa = .76). In cases of disagreement, scores of the two raters were

averaged. On average, 16.1 segments per interview were categorized and scored. For each company, we calculated a mean score for each of the four categories.

Study 1: Interview Results and Discussion

An interesting finding of our qualitative study was the absence of mission statements and organizational visions concerning errors. Only one of the 16 managers indicated that their organization had an explicit approach to errors, which, in this particular case, focused on error prevention. Ten other managers indicated that their organization did not have a specific vision regarding errors. The remaining five managers indicated that errors had never been discussed on the organizational level. Statements were, for example: "Errors have never been discussed on the organizational level. We do, however, have a quality system, which implies a focus on error prevention, procedures for dealing with specific errors, and registration of customer complaints aimed at improvement." and "Yes, we do have a very precise procedure for the registration of errors, deviations, and accidents." While the latter seems to indicate a systematic approach to errors, it was only related to the registration and not to the handling of errors.

The absence of organizational visions regarding errors suggests that managers took their approach to handling errors for granted and did not think deeply about the topic. This provides suggestive evidence for the notion that how errors are dealt with is to some extent anchored in organizations' implicit norms and assumptions and, as such, more hidden. However, interviewees did not have any difficulties to come up with examples of recent error situations or to articulate how management dealt with such situations. Examples of errors mentioned by the interviewees are: calculation errors in offers to clients, errors in employment contracts, bad planning and not meeting the deadline for a product presentation, purchasing errors, not being alert when getting false or insufficient information from clients, faulty delivery of products, printing of three million letters in which the address headings did not match the envelope

windows, and the duplicate hiring of 17 temporary employees from two different agencies. As these examples show, what managers discussed in the interviews were errors with social, quality, and financial consequences; there were no errors that were directly related to the area of safety.

Table 3 presents some illustrative quotes of the four dimensions of error culture that were extracted from the interview data. For example, error management culture implies an open, free, and constructive communication about errors. Moreover, it entails error analysis with a focus on quick error recovery and learning. The quotes on error aversion culture suggest that fear of being caught while making a mistake is an important issue. People put a lot of energy into hiding the fact that they have made errors. This factor certainly needs to be developed in more detail in future studies.

Although the number of interviewees does not warrant a quantitative analysis of our qualitative data as the lack of power may render any result nonsignificant, the correlation between error management culture as rated in the qualitative study and the error management culture scale was $r = .40$ (N = 16, $p = .07$, one-tailed). In addition, there were substantial relations between the interview measures of error management culture, empathy, and blame and punishment. For example, managers who worked in a high error management culture tended to be less castigatory when errors occurred and showed more empathy ($r = –.64$, N=13, $p<.05$ and $r = .59$, N = 14, $p<.05$, respectively). These correlations suggest that high empathy and low blame and punishment may be normative prerequisites for the development of a high error management culture.

Another finding from our interview study was that managers from organizations that scored high on error management and empathy, and low on blame and punishment, tended to offer an explicit rationale for their approach to errors (e.g., “We believe that is the only way to control damage”, and “[otherwise] people will get frustrated, fearful, they will be less open […]

and therefore errors will be discovered later on"). Conversely, those from cultures characterized by low error management and empathy, and high blame and punishment tended to merely restate their approach (e.g., "[…] this shouldn't happen again. And that was the end of it."). Thus, an error management culture may be the result of a conscious decision by the company and its managers. This interpretation underlines our argument that a firm needs some sort of explicit concept of how to deal with errors to be high on error management culture; in firms that do not have such an explicit strategy, the fundamental attribution error will tend to produce some kind of blaming culture.

In conclusion, the results of our qualitative study suggest that managers were indeed able to talk about errors, but that they generally did not hold explicit concepts for how to deal with errors. Moreover, there were few explicit organizational mission statements or visions with regard to errors. Managers typically thought of errors that were related to quality and financial effects, but not to safety issues. Moreover, the two dimensions used in the survey—error management culture and error aversion culture—could also be found in the interview study. However, it also became obvious that not all interview segments relating to error culture could be categorized into those two categories. Two additional concepts appeared—empathy and blame and punishment—and although we did not include items on these dimensions in our survey, the qualitative material suggests that both were related to error management culture.

Study 1: Overall Discussion

To establish the concept of error culture, its subdimensions, and its relation to firm performance we collected both qualitative and quantitative data from a random sample of organizations in the Netherlands. The results of our interview study reinforced our belief that it was possible to meaningfully study error culture in organizations. Moreover, they provided us with valuable insights into the nature of errors typically occurring in organizations. Finally, they

highlighted the importance for managers to develop a systematic error management approach to rationally deal with errors and to learn from them. Important mechanisms suggested by the qualitative study for the successful cultivation of a systematic error management approach may be low blame and punishment and a relatively high degree of empathy with the erring individual.

The results of our survey study provided initial support for the hypothesis that error management culture positively relates to firm performance—our measure of error management culture significantly correlated with two indicators of firm performance, firm goal achievement and economic performance. This effect was upheld when we controlled for age, organizational size, and line of industry. However, there was no evidence that error aversion culture was related to firm performance.

Contrary to our expectation, the relation between firm goal achievement and firm economic performance failed to reach statistical significance. Although lack of statistical power (the power to detect a correlation of .30 in a sample with 25 participating firms is below .40) may partially account for this non-finding, the two measures may also relate to different aspects of firm performance. Firm goal achievement refers to organizational goals and goal attainment relative to direct competitors and is more subjective. Our objective measure of firm performance comprises several economic indicators weighted according to their prediction of organizational survival in that line of industry. Previous research suggests that different measures of firm performance may not always converge. For example, Meyer and Gupta (1994) argued that organizational effectiveness is a multidimensional concept with indicators of these various dimensions frequently demonstrating zero or negative correlations among each other.

Although a definite strength of our quantitative study is that we collected data from different sources to measure error culture and firm performance (i.e., our objective indicator of firm performance was developed by a commercial firm for purposes unrelated to our research

efforts), there are a number of limitations to this study. First, we employed a cross-sectional design prohibiting us from conclusively refuting the claim that it is not error management culture that leads to better firm performance but rather that it is high firm performance that enables or encourages the development of a systematic error management approach. Second, although one would not expect a high correlation between various indicators of firm performance, no relation emerged between firm goal achievement and firm survivability. Third, the number of participating companies was low; the most important finding—the relation between firm economic performance and error management culture—was only based on 25 companies.

To address these concerns and to reduce the uncertainties associated with drawing conclusions from any single study, we conducted a second study designed to provide a constructive replication of Study 1. In contrast to the first study, Study 2 allowed for the assessment of change in firm economic performance thereby directly addressing one of the primary ambiguities of Study 1.

STUDY 2

Study 2 was carried out in Germany. This provided us with the opportunity to test whether the significant relation between error management culture and performance found in Study 1 would also emerge in a different cultural context. Germany and the Netherlands belong to different clusters of leadership culture (Brodbeck et al. 2000). The Netherlands scores lower on error intolerance (among 62 countries, the Netherlands ranked 12th in terms of error intolerance, while West Germany ranked second[3]) and lower on uncertainty avoidance (indicating that the uncertainties brought about by errors are expected to have less negative consequences) than Germany (House et al., 2004). Because we focused on the replication of the significant effects of error management culture on performance, only error management culture was included in our questionnaire.

Sample and Procedures

Drawing on the 1998 Hoppenstedt, a large database of German firms that provides company profiles and financial information, we selected firms based on four criteria. First, since a company's culture tends to become more fragmented as the number of employees increases we focused on mid-sized firms as we did in Study 1. Second, to ensure that companies included in our sample would be representative of the German economy at large, we mainly selected firms from the industrial and service sectors (Simon, 1996). Third, we only included companies for which current financial performance data were available. Finally, since merging can have a negative effect on a firm's economic performance, we excluded companies that had recently merged.

Using these criteria we identified 269 companies. To ensure consistency across firms, we contacted the managers of the personnel or marketing departments of the companies and asked them to distribute the surveys to their colleagues, providing as much a representative cross-section of the company's management as possible. We considered a company response usable if at least three managers returned their surveys. Usable responses were obtained from 47 companies, for a participation rate of 17 percent (165 respondents). There were no statistically significant differences between participating and nonparticipating companies in terms of sector distribution ($\chi^2 = 1.90$, $p > .05$), average number of employees ($t = 1.14$, $p > .05$), and return on assets 1998 ($t = -.74$, $p > .05$).

Companies were located throughout Germany. More than half of them were manufacturing firms from the food, clothing, metal goods, mechanical/computer engineering, and electrical engineering sectors, among others. Our sample also included companies from the transportation, utilities, wholesale trade, financial services, and miscellaneous services sectors. Almost all of the companies were profitable and reported a positive return on assets for the

period between January and December 1998 with a mean of 8.61%. The average firm size was 410 employees. Of the 47 companies, 49% were limited liability companies and 51% were publicly traded.

Measures

Error management culture. We used the same 17-item measure as in Study 1. Items were rated on a scale that ranged from (1) "doesn't apply at all" to (5) "applies completely" and averaged to form a single indicator ($\alpha = .93$).

Firm performance. Two measures assessed firm performance: firm goal achievement and return on assets. Firm goal achievement was based on the two items developed for Study 1; items were averaged to form a single indicator ($\alpha = .83$). Return on assets, a common accounting-based measure of firm profitability was calculated by dividing annual profit plus interest expense by averaged invested capital. We focused on return on assets as our indicator of firm profitability for several reasons. First, return on assets is a relevant measure of operating efficiency as it reflects a company's long-term financial strength. Second, return on assets has frequently been used by researchers to measure company profitability (e.g., Staw & Epstein, 2000; Wan & Hoskisson, 2003). Third, it is the profitability ratio most consistently reported by the Hoppenstedt database.

Surveys were sent out in the fall of 1998 and archival data on company profitability for the period between January and December 1998 were obtained in the summer and fall of 1999 from the 1999 Hoppenstedt. Archival profitability data for the period between January and December 1997 were taken from the same database. The Hoppenstedt database did not report return on assets for companies that made losses but rather approximated their profitability with zero. This was the case for six companies in 1998 and for four companies in 1997, and to avoid a reduction in sample size we used this approximation for those companies.

Control variables. We controlled for company size (natural logarithm of average number of employees) and industry sector (0 = manufacturing, 1 = nonmanufacturing) in all substantive analyses. In addition, to calculate the effects of error management culture on *changes* in company profitability, we controlled for prior firm performance (return on assets 1997).

We calculated estimates of within-group interrater reliability using the formula suggested by James et al. (1984). The average value for $r_{WG(J)}$ across all 47 companies was .91 for error management culture and .80 for firm goal achievement, exceeding the .70 criterion suggested by Klein et al. (2000). These values indicate an acceptable level of agreement within organizations, thus justifying aggregation and averaging of data to the organizational level.

Results

Descriptive statistics and intercorrelations of the study variables are presented in Table 4. There was a significant positive correlation between firm goal achievement and return on assets 1998 ($r = .41$, $p < .01$), indicating moderate convergence between the two measures of firm performance. Return on assets 1998 was significantly related to prior profitability ($r = .52$, $p < .01$).

To test our hypothesis, we conducted hierarchical regression analyses (Table 5). Entering the control variables of size, industry sector, and return on assets 1997 into the regression model yielded significant equations for return on assets 1998 as well as firm goal achievement ($\Delta R^2 = .33$, $p < .01$ and $\Delta R^2 = .17$, $p < .05$, respectively), with prior firm profitability positively relating to both performance indicators ($\beta = .46$, $p < .01$ and $\beta = .40$, $p < .01$, respectively). In step 2 of the model, we entered error management culture. As expected, error management culture was positively and significantly related to both change of return on assets 1998 and firm goal achievement ($\beta = .27$, $p < .05$ and $\beta = .58$, $p < .01$, respectively). These results provide support for our hypothesis by demonstrating that error management culture predicts profitability over and

above the effects accounted for by prior firm performance. Thus, our hypothesis was confirmed and the results obtained in Study 1 replicated using change in firm profitability.

General Discussion

Previous research has emphasized the difficulties of establishing significant relations with firm performance (March & Sutton, 1997). This makes our cross-replicated findings of the relation between error management culture and firm performance in medium-sized companies that much more important. In line with our hypothesis, the results of both studies seem to suggest that error management culture contributes positively to firm performance and survivability. This makes sense because error management is at the core of what error culture is all about. Communicating about errors, sharing error knowledge, helping in error situations, as well as quick error detection and analysis, effective error recovery, and coordinated error handling efforts—the facets of error management culture—are all directly aimed at avoiding and reducing negative error consequences and developing better strategies for handling errors in the future. Our results are consistent with Edmondson (1996), Rochlin (1999), and Helmreich and Merritt (2000) who emphasized the importance of free-flowing communication, rewarding the reporting of errors (or at least not punishing them), and a continuous reflexive and interactive learning approach in enhancing the success and safety in high-reliability organizations.

In contrast to our expectations, however, we found no support for a relation between error aversion culture and firm performance in Study 1. Two reasons may account for this non-finding. First, error aversion may be the result of two separate processes that do not always coincide; people may feel strain when an error occurs because of high commitment to good performance or because their supervisors react negatively to errors. Second, the error aversion measure used may be conceptually ambiguous as it not only captures the extent to which individuals experience

strain due to errors but also the extent to which they cover up their errors. Strain and covering up may not be part of the same construct. Further research is needed in this area.

Strengths and Limitations

One strength of our study is that we obtained objective indicators of firm performance in both samples. Although these performance measures were conceptually different—the one used in the Netherlands was a measure of firm survivability derived from a complex regression analysis, and the one employed in Germany was a relatively straightforward and frequently used index of profitability—they both were significantly related to error management culture. In addition, although there was no significant correlation between firm goal achievement and firm economic performance in Study 1, we did find a significant association between firm goal achievement and return on assets in Study 2. The correlations from Studies 1 and 2 did not significantly differ from each other ($z = -.87$, $p > .05$), suggesting that lack of power may have been the reason that the correlation between firm goal achievement and economic performance did not reach statistical significance in Study 1. An additional strength of our study is that we controlled for prior return on assets in Study 2, allowing us to demonstrate that firms' error management culture affected changes in firm profitability.

Despite these strengths, there are limitations that need to be considered. First, although our study is unique in that we established and replicated a significant relation between organizational error management and firm performance across two different cultural and economic contexts, our quantitative findings do not reveal the precise mechanisms by which error management culture translates into better performance. Future research should address this issue by examining the factors suggested in Figure 1—variables such as learning, secondary error prevention, and exploration, may shed light on the potential mechanisms mediating the effects of error management culture on firm performance.

A second limitation of our study is that we exclusively focused on managers as potential informants for our study. Although it makes sense to do so (see our earlier arguments), a legitimate concern is whether perceptions of organizational error culture are similar across managers and rank and file workers. To partially address this concern, we attempted in both studies to include a wide range of managers from different departments occupying different hierarchical positions. Despite this diversity in positions and departmental affiliations, managers tended to agree in their assessment of their company's error culture indicating that error culture might indeed be a pervasive organizational characteristic. Nevertheless, it is still possible that managers and rank and file workers differ in their assessment of their company's culture. Future research should address this concern by collecting information from both managers and workers.

Although all companies may benefit from an error management approach, we believe that they do so in different ways and to a different extent, depending upon certain organizational and contextual conditions. Specifically, in line with the contingency argument advanced by Sitkin et al. (1994), we argue that for some organizations the advantages resulting from implementing a systematic error management approach may be associated with the issue of control (e.g., quick error detection, quick damage control, etc.), while for others they may be associated with the issue of learning (i.e., exploration, experimentations, etc.). The issue may depend on the line of industry, on the rate of organizational change, or on economic conditions present in the industry. Moreover, we think that environmental and production uncertainty may affect the extent to which error management enhances firm performance (Wall & Jackson, 1995). Specifically, companies with complex products or services that operate in a turbulent environment should benefit relatively more from an error management approach than companies in which production and services are highly standardized and the environment is relatively predictable.

Error management may also be more or less effective depending upon the type of error occurring. An empirically tested error taxonomy suggested by Zapf et al. (1992) could be used to examine the usefulness of error management vis-à-vis different errors. For example, Zapf et al. showed that error handling time was higher for knowledge errors (i.e., errors due to lack of knowledge) and judgment errors (i.e., not understanding feedback correctly) than for habit errors (i.e., errors due to over-routinized use of a habit). Longer error handling times may imply that certain errors are more difficult to detect than others (Zapf et al., 1992). Error management approaches may still be effective but require higher skills when dealing with such errors.

Practical Implications

One may argue that the relations observed in both studies may not be strong enough to justify any practical implications (betas ranging from .27 to .58). For the following argument, we assume that an intervention program is able to improve an organization's error management culture by one standard deviation—a number that seems reasonable given the effects sizes obtained from managerial training interventions (e.g., Burke & Day, 1986). A utility calculation based on the unstandardized regression weights from Study 2 informs us that manufacturing companies could increase their return on assets from 7.7% to 10% (9.9% to 12.2% for nonmanufacturing companies) if they would intervene to improve their error management culture by one standard deviation. Thus, a one standard deviation improvement in error management culture results in an increase in firm profitability by approximately 19 to 23 %. A company that generates a $1,000,000 return on investment could thereby increase its gains by approximately $200,000. We believe that organizations should be interested in such increases and that programs that cultivate a systematic error management approach would most likely prove to be cost effective.

Previous research suggests that individuals can learn from errors (Keith & Frese, in press), and that quick error detection and recovery, as well as open communication about errors—hallmarks of an error management approach—can have positive implications for organizations (Edmondson, 1996, 1999; Helmreich & Merritt, 2000, Reason, 1997). Our results extend this earlier research by demonstrating that the extent to which medium sized firms cultivate an error management approach positively relates to their financial performance. Although more scientific information is needed on how error management culture functions and how it affects firm performance before we can give any detailed suggestions and changing culture is inherently difficult (Trice & Beyer, 1993), our research allows us to offer some more general recommendations. Specifically, it suggests that organizations may want to act on errors more quickly and analyze them more effectively to better control their negative consequence. Moreover, it highlights the importance of organizations opening up communication channels to allow for the discussion of errors, documenting errors, and utilizing errors strategically as potential learning opportunities. Small errors that have relatively minor or no negative consequences are of particular importance here (e.g., near misses) (Helmreich, 2000; Sitkin, 1996). The aviation industry has made significant advances in this regard, and with respect to implementing error management principles in general—training has been used to increase within-crew communication about errors (Helmreich, 2000), documentation of errors has been systematically organized, and the Federal Aviation Administration has stipulated that near misses have to be reported anonymously and that disciplinary actions against those reporting such incidents are waived (Reason, 1997).

Although we focused in this paper on error management, we do not wish to suggest that error prevention is unimportant. Rather, we argue that error prevention is required as a first line of defense to ensure smooth flow and high quality of production and services, as well as to

enhance safety in organizations. However, while most firms employ error prevention strategies, few attempt to explicitly utilize error management principles as a second line of defense against negative error consequences. Our qualitative data suggest that error prevention was generally done in an non-conscious way, and that error management culture required a more explicit effort. Thus, organizations may need to implement explicit, systematic error management strategies to successfully deal with errors.

Managers sometimes argue against our error management ideas because companies cannot afford to produce faulty products. The latter is obviously correct. However, a faulty product is an error *consequence*. In fact, faulty products may be the result of a breakdown of error prevention *and* lack of error management. Managers may also ask how they can reward performance, punish nonperformance and still be tolerant of errors. Are frequent errors not symptoms of a low degree of performance? The answer to this question is difficult because errors and lack of performance are probably related. Managers have to walk a fine line between taking errors seriously and emphasizing error tolerance, and between using information on errors as examples of (lack of) performance and using errors as opportunities for learning. This duality of control and learning has been applied and recognized in areas such as Total Quality Management (Total Quality *Control* and Total Quality *Learning*, Sitkin et al., 1994), exploitation versus exploration (March, 1991), and organizational learning (Argyris, 1992; Huber, 1991). An organization attempting to implement an error management culture may learn from this literature.

There are some, albeit not many, companies that incorporate a constructive orientation towards errors as part of their policy statement (e.g., BMW suggested in their mission statement that employees should not look for the guilty party in an error situation but solve the problem; 3M is known for its constructive and innovative orientation which includes learning from errors; Southwest Airlines proposed that “failure is a natural result of the competitive process”, Trice &

Beyer, 1993, p. 3). Some companies even use errors explicitly as a learning opportunity (e.g., in one small German consulting company people take turns talking about one error they have encountered at each of their meetings). Yet despite these encouraging examples, we believe that to this date, the potential for error management culture to provide organizations with a competitive edge has not been fully realized.

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Table 1

Descriptive Statistics and Correlations Among All Variables (Study 1)

Variables	*M*	*SD*	1	2	3	4	5	6	7	8
1. Age	49.39	41.34	—							
2. Size	227.69	101.95	–.10	—						
3. Business services	—	—	–.31*	–.05	—					
4. Production	—	—	.15	–.08	–.37**	—				
5. Trade	—	—	.11	.07	–.38**	–.43**	—			
6. Error management culture	3.22	0.27	–.02	–.23†	.04	.16	–.07	—		
7. Error aversion culture	2.61	0.30	–.04	.21†	.02	–.23†	.16	–.20†	—	
8. Firm goal achievement	3.53	0.44	–.04	.09	–.11	–.05	.26*	.34**	.14	—
9. Firm survivability	4.08	1.00	.13	–.16	.22	.11	–.25	.46*	.00	.24

Note. N ranges between 25 (correlations involving firm survivability) and 65 (all other correlations).

$^{\dagger}p < .10$, $^{*}p < .05$, $^{**}p < .01$ (two-tailed).

Table 2

Hierarchical Regression Analyses of Firm Goal Achievement and Firm Survivability on Error Management Culture and Error Aversion Culture (Study 1)

Independent Variables	Firm goal achievement						Firm survivability					
	β	*df*	ΔR^2	ΔF	R^2	*F*	β	*df*	ΔR^2	ΔF	R^2	*F*
Step 1		5, 59	.08	1.08				4, 20	.11	.60		
Age	–.07						.15					
Size	.08						–.05					
Business services	.05						—					
Production	.13						–.31					
Trade	.33†						–.45					
Step 2		2, 57	.16	6.23**	.25	2.69*		2, 18	.21	3.35†	.35	1.61
Error management culture	.42**						.51*					
Error aversion culture	.16						.31					

Note. N = 65 for firm goal achievement and 25 for firm survivability.

$^{\dagger}p < .10$, $^{*}p < .05$, $^{**}p < .01$ (two-tailed).

Table 3

Illustrative Interview Quotes for Error Culture Dimensions (Study 1)

Dimension	Low	High
Error management culture	"But I don't want to discuss errors at great length. I indicated that this shouldn't happen again. And that was the end of it." (Retail, Score: 2.85)	"I try to create an open atmosphere and tell people they should inform me if they have made a mistake, so that we can do something about it. We try to be open and discuss errors, because we believe that is the only way to control damage." (Administration, Score: 4.75)
	"In this organization, we don't talk about errors." (Consultancy, Score: 2.73)	"I have spoken to the responsible manager, and have asked him to use this incident as a learning opportunity in his department." (Wholesale 2, Score: 4.50)
		"What we do is talk about it with people and analyze what has to be done in order to prevent these errors in the future." (Wholesale 1, Score: 4.35)
		"First, we try to discover where the error originated, what caused it, and how we can correct it as quickly as possible." (Automation, Score: 3.90)
Empathy	"I said to her: 'tell him.' 'But,' she responded, 'I have already informed him [that a certain person would get a raise].' 'Well, that's your problem,' I replied." (Retail, Score: 2.00)	"If I would have said to that guy, 'You idiot, how could you have done that?', he would have felt really small, while 'why don't you come up with something that will prevent this error in the future' will make him feel like a hero." (Administration, Score: 4.50)

Dimension	High	Low
Blame and punishment	"Errors... Well, I accept errors in the sense that when a person makes too many, they're fired." (Construction, Score: 3.80)	"When I first started as a supervisor, I used to get angry at people when they made a mistake. That is very easy and seems forceful. But you have to get used to the fact that it simply does not work. People will get frustrated, fearful, they will be less open about their mistakes and therefore errors will be discovered later." (Administration, Score: 1.25)
	"It will be fatal for him [the employee who made a mistake] if the customer finds out."	"Don't keep matters bottled up. People shouldn't be given hell about their errors. People have to learn from their errors. I make errors myself." (Wholesale 1, Score: 1.75)
Error aversion culture	"We specifically don't want to disguise our own mistakes. We want them out in the open." (Wholesale 1, Score: 1.00)	"The funny thing was that I got an evasive reaction at first, like 'don't worry, nothing's wrong.' And then when I started digging a bit deeper, I found a chain of things that indicated people were protecting each other." (Consultancy, Score: 4.30)
		"The workers have to put a stamp with their identification code on their work [...]. But they're even smarter, they just don't put down their identification code, so that we don't know who made the mistake." (Retail, Score: 3.15)

Table 4

Descriptive Statistics and Correlations Among All Variables (Study 2)

Variable	*M*	*SD*	1	2	3	4	5
1. Size	5.79	0.70	—				
2. Industry sector	—	—	–.29†	—			
3. Error management culture	3.43	0.41	.17	–.05	—		
4. Firm goal achievement	3.39	0.64	.15	–.05	.65**	—	
5. Return on assets 1997	9.61	9.30	–.19	.27†	.26†	.34*	—
6. Return on assets 1998	8.61	8.28	–.31*	.29†	.32*	.41**	.52**

Note. N = 47.

†$p < .10$, *$p < .05$, **$p < .01$ (two-tailed).

Table 5

Hierarchical Regression Analyses of Firm Goal Achievement and Return on Assets 1998 on Error Management Culture (Study 2)

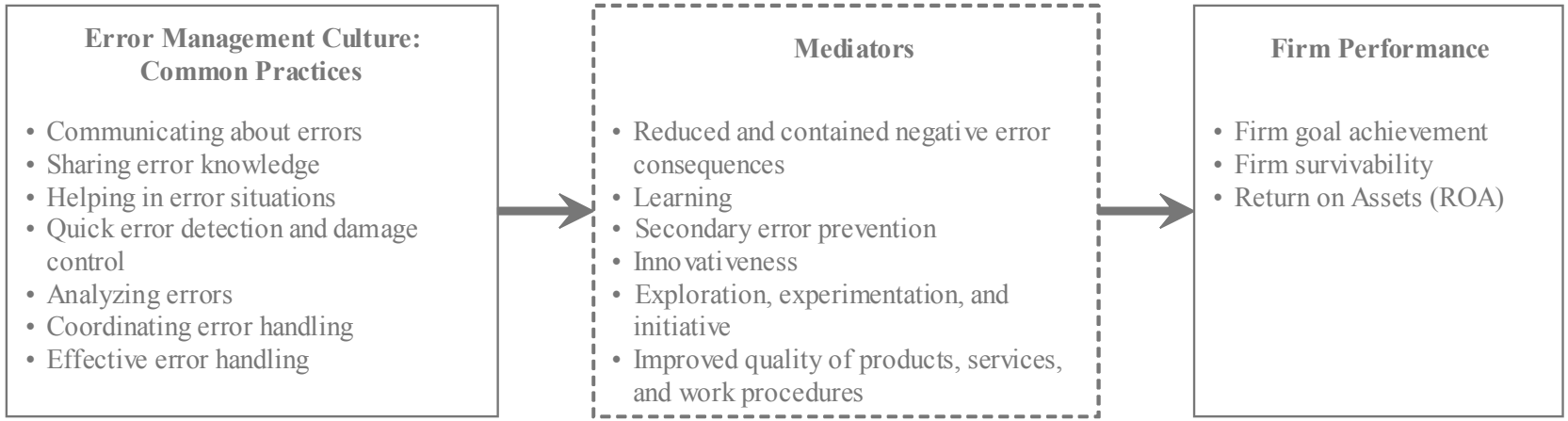
Independent Variables	Firm goal achievement						Return on assets 1998					
	β	*df*	ΔR^2	ΔF	R^2	*F*	β	*df*	ΔR^2	ΔF	R^2	*F*
Step 1		3, 43	.17	2.93*				3, 43	.33	6.93**		
Size	.20						–.19					
Industry sector	–.10						.11					
Return on assets 1997	.40**						.46**					
Step 2		1, 42	.30	23.29**	.47	9.16**		1, 42	.06	4.51*	.39	6.75**
Error management culture	.58**						.27*					

Note. N = 47.

†$p < .10$, *$p < .05$, **$p < .01$ (two-tailed).

Figure 1

Error Management Culture and Its Potential Effects



Appendix

Scales and Items

Error Management Culture	
1.	For us, errors are very useful for improving the work process.
2.	After an error, people think through how to correct it.
3.	After an error has occurred, it is analyzed thoroughly.
4.	If something went wrong, people take the time to think it through.
5.	After making a mistake, people try to analyze what caused it.
6.	In this organization, people think a lot about how an error could have been avoided.
7.	An error provides important information for the continuation of the work.
8.	Our errors point us at what we can improve.
9.	When mastering a task, people can learn a lot from their mistakes.
10.	When an error has occurred, we usually know how to rectify it.
11.	When an error is made, it is corrected right away.
12.	Although we make mistakes, we don't let go of the final goal.
13.	When people are unable to correct an error by themselves, they turn to their colleagues.
14.	If people are unable to continue their work after an error, they can rely on others.
15.	When people make an error they can ask others for advice on how to continue.
16.	When someone makes an error, (s)he shares it with others so that they don't make the same mistake.
17.	In this organization, people think a lot about how an error could have been avoided.

Error Aversion Culture	
1.	In this organization, people feel stressed when making mistakes.
2.	In general, people in this organization feel embarrassed after making a mistake.
3.	People in this organization are often afraid of making errors.
4.	In this organization, people get upset and irritated if an error occurs.
5.	During their work, people are often concerned that errors might occur.
6.	Our motto is; “Why admit an error when no one will find out?”
7.	There is no point in discussing errors with others.
8.	There are advantages in covering up one’s errors.
9.	People prefer to keep errors to themselves.
10.	Employees who admit their errors are asking for trouble.
11.	It can be harmful to make your errors known to others.

Footnotes

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[1] More specifically, multiple discriminant analysis was used to distinguish between solvent and insolvent companies (De Breed & Partners, 1996). For each line of business, separate regression models were developed, based on recent data on insolvency in that particular industry. These regression models took into account commonly used economic data such as profit rate, cash flow, and added value and resulted in a score between 1 (very poor) and five (excellent). A low score indicated high resemblance to companies that had become insolvent in previous years, while a high score indicated high resemblance to companies that had been successful in previous years.

[2] As described in the methods section, the data loss on the objective measure of performance is not random, but relates to line of business, type of organization, and size of the company. To test for size and industry effects (in addition to our use of control variables for the full sample), we divided the entire sample of 65 firms into two subsamples—one consisting of organizations for which we had economic performance information and the other consisting of firms we had no such information available—and repeated our analyses predicting firm goal achievement using both of these samples. Both analyses yielded virtually identical results.

[3] Thanks are due to xxxxxxx for calculating this particular item across all 62 participating GLOBE countries.