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The effects of administrative innovation implementation on performance: an organizational learning approach

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Abstract

This study defines organizational learning as greater cognizance of action–outcome relationships and the effects that environmental events have on these relationships. It shows that two learning mechanisms, adaptation-in-use and change catalysis, are key factors in realizing gains from the implementation of administrative innovations. Adaptation-in-use denotes ongoing adjustment of the innovation to the organizational context. Change catalysis means that implementation is an occasion for rethinking the way the organization does business and an opportunity to introduce additional new practices and to innovate. A total of 1150 facilities belonging to 885 companies that implemented the worldwide quality standard ISO 9000 participated in this study. Results demonstrate that the effects of implementation of this administrative innovation on performance are curvilinear; both too little and too much implementation have a negative effect on performance. The two learning mechanisms moderate the relationship between implementation of the administrative innovation and subsequent performance, such that implementation is associated with higher performance when adaptation-in-use and change catalysis are high rather than low.

Key words • adaptation-in-use • change catalysis • implementation • ISO 9000 • organizational learning

Researchers such as Nutt (1986), Cooper and Zmud (1990), Kostova (1999) and Klein et al. (2001) have defined the implementation of administrative innovations as the extent to which organizations incorporate and routinely use the innovations. The degree to which organizations routinize new programs or systems so that they are regularly used is relevant to a wide array of processes (Fidler and Johnson, 1984; Nutt, 1986) from upper-level strategy making to lower-level decision-making. It has bearing on governmental initiatives and the diffusion of technological advances and plays a central role in reorganization and organizational regeneration. Organizational research has extensively

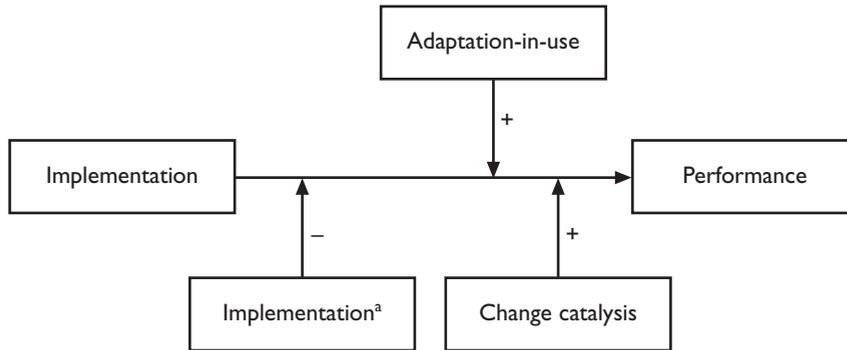
documented the importance of the implementation of administrative innovations (Bardach, 1977; Dierickx and Cool, 1989; Nutt, 1989; Reger et al., 1994; Pfeffer and Sutton, 1999; Bossidy and Charan, 2002; Orlikowski, 2002). Through the implementation of administrative innovations, organizations promulgate fresh rules and procedures, change roles and structures, and establish new relationships (Nutt, 1989). Just as planned change is ubiquitous in organizational life, so too is the implementation of administrative innovations. Yet actions which are taken to implement administrative innovations often fall short (Nutt, 1986; Cooper and Zmud, 1990; Kostova, 1999; Repeating, 2002). Implementation failure remains a main cause of organizations' inability to realize the benefits of planned change (Klein et al., 2001). Why does the implementation of administrative innovations so often fail to yield intended results?

This study relies on organizational learning theory to explain the effects of implementing administrative innovations on organizational performance. We argue that there is a curvilinear relationship between implementation and performance. Learning is then conceptualized by two mechanisms, adaptation-in-use and change catalysis, and we show that the interaction between the implementation of administrative innovation and these two learning mechanisms determines the impact of administrative innovations on organizational performance (Figure 1). This approach to implementing administrative innovations sheds new light on the often documented problem of implementation failure.

Many studies refer to implementation dichotomously: the organization either has or has not implemented the innovation (Staw and Epstein, 2000). This study measures the degree of implementation, rather than relying on the dichotomous measures upon which most past research depended (Douglas and Judge, 2001). We explain organizational performance with a variety of measures, subjective and objective, at the operating and firm levels, and test our proposed model on a large, multi-industry sample.

Implementation and learning: a conceptual model

The literature suggests three main reasons for the failure of administrative innovation implementation. Institutional theory (DiMaggio and Powell, 1983) argues that if the motivation for implementation is external pressure, organizations will not do a good job fitting the innovation to their operational and strategic requirements (Marcus, 1988; Abrahamson, 1997; Staw and Epstein, 2000). Another explanation for implementation failure emphasizes organizational climate, which is defined as employees' shared perceptions of the implementation's importance (Klein and Sorra, 1996; Schneider et al., 1998). Only in a supportive climate is implementation likely to be successful (Klein and Sorra, 1996; Baer and Frese, 2003). Yet a third explanation comes from leadership theory; it concentrates on managers' activities and the procedures they use in



Note

^a In this model implementation is squared (implementation \times implementation) and its relationship to performance is curvilinear. Too much and too little implementation have the potential to degrade performance.

Figure 1 A model that takes into account learning from adaptation-in-use and change catalysis on the results of implementing an administrative innovation

promoting planned changes (Nutt, 1986). If managers do not follow a sequence of stages starting with initiation and ending in routinization (Lewin, 1952), performance is not likely to improve (Nutt, 1986; Cooper and Zmud, 1990). March (1981), for instance, pointed out that if an organization has competing interests during the initiation stage then senior managers appeal to broader and broader principles to get agreement, but lower-level managers then experience difficulties because of vague language and inexact instructions when they try to put the planned change into action.

While valuable, these approaches to administrative innovation implementation failure do not take into account learning. Learning is defined as gaining greater cognizance of action–outcome relationships and the effects that environmental events have on these relationships (Polley and Van de Ven, 1996; Greve, 2002). Learning theory has been applied to the implementation of technological innovations, but rarely to administrative innovations. An example of the application of learning theory to technological innovations is the 1994 paper of Tyre and Orlikowski which suggests that implementation of new process technology is limited by routinization that comes with experience and that change takes place in an episodic manner, triggered either by learning from discrepant events or user discoveries. Other examples of learning theory applied to the implementation of technological innovations are Aiman-Smith and Green (2002), Cooper and Zmud (1990), and Pisano (1996). But more typical of the research on administrative innovations are Staw and Epstein (2000), who explain success in implementing total quality management programs by within-firm dynamics and internal and external legitimacy, and Klein and Sorra (1996), who report that financial resource availability, management support and a strong climate for implementation are responsible for successful implementation.

Unlike previous research on the implementation of administrative innovations, we not only argue that there is likely to be a curvilinear relationship between implementation and performance, but also that organizations are more likely to succeed in the implementation of administrative innovations if they learn. Their learning takes place via two mechanisms, adaptation-in-use and change catalysis. The interaction of these two factors with implementation has a decisive effect on subsequent performance.

The curvilinear relationship between implementation and performance

Prior approaches to implementation tended to view implementation as a linear process. They held that administrative innovations become integral parts of an organization's daily practices in a step-by-step way (Beyer and Trice, 1978; Fidler and Johnson, 1984; Rogers, 1995; Edmondson et al., 2001). Through a series of intended actions, an administrative innovation is applied, incorporated into an organization's repertoire of capabilities (Yin, 1977; Edmondson, 2003), becomes routine (Klein and Sorra, 1996) and has beneficial effects. It has beneficial effects because it alters the organization's regular pattern of behavior and activities in ways that improve efficiency, quality and productivity (Staw and Epstein, 2000). Earlier research assumed that the greater the implementation of an administrative innovation the more likely an organization would improve its performance, but we hold that the relationship between implementation and performance may not be linear in nature. Clearly, with insufficient implementation, the effects of implementation on performance are likely to be weak. Should the change not be sufficiently internalized, the effects will not be positive, since in-process change will not take place and daily routines will not be altered (Zbaracki, 1998). However, there also may be too much of a good thing: excessive implementation can be costly in terms of the effort required, the employees that need to be trained and the processes which must be coordinated. Katz-Navon et al. (2005) demonstrate empirically that over-implementation of safety procedures in hospitals reduces safety since it interrupts staff's capacity to do daily work. Excessive implementation can interfere with the ongoing activities of an organization and complicate employees' jobs. It can be a burden that demands the investment of disproportionate time and involvement of personnel in non-productive bureaucratic effort (Adler and Borys, 1996; Katz-Navon et al., 2005).

For instance, with the commonly applied ISO 9000 quality standard, Corbett et al. (2005) found that too much implementation could generate significant bureaucratic hassles and reduce flexibility, thereby impairing performance. Marcus and Naveh (2005) also report in a case study of ISO 9000 implementation that the organization they studied, GCI Secor:¹

engaged in a vast search of existing processes and scrutinized how the processes were carried out ... (but) The team that implemented ISO 9000 at Secor literally

was 'swimming in processes', to the point where they sometimes questioned why they were going so far ... just a year after certification, staff at Secor reflected on its experiences ... (and) concluded that they had gone overboard in documentation ... Because of over-documentation, employees were becoming paralyzed.

Over-implementation of ISO 9000 distracted GCI Secor employees from the more critical objective of adding value to customers.² That insufficient implementation is a serious problem has been well documented, but that too much implementation might be a problem has not received adequate attention. The claim that there is a curvilinear relationship between implementation to performance is consistent with Brown and Eisenhardt's reasoning about formal structure: too much of it makes a system too rigid while too little results in the organization flying 'chaotically apart' (Brown and Eisenhardt, 1997: 34).

Why do some organizations tend to over-implement administrative innovations like ISO 9000? We propose three related reasons. The first is inertia (Kelly and Amburgey, 1991). Organizations do not alter their courses lightly or easily. Once they gather momentum, they move in a certain way without much further reflection. The second factor is time lags with respect to useful feedback (Marcus and Nichols, 1999). The organization's staff may not be immediately aware that an administrative innovation is yielding negative returns. Useful feedback is likely to lag behind the need for and the ability to make adjustments. Another reason for over-implementation is reverse causality on the downward slope, in which case poor performance leads struggling firms to put increasing amounts of effort into administrative innovation implementation, which only reduces their performance further as they move beyond the point of useful change. Marcus (1988) documents this process and refers to it as a vicious cycle of negative performance which breeds further negative performance. Also worth considering in this regard is the extensive research on irrational escalation of commitment to failing or ineffective courses of action, some of which is represented by Salancik (1977a, 1977b) and Boulding et al. (1997).

Thus, we hypothesize that there is likely to be a curvilinear relationship between the degree of routine use of an administrative innovation and performance.

HYPOTHESIS 1: The relationship between the level of implementation and organizational performance is curvilinear (inverse U-shaped), with the best performance occurring at intermediate levels of implementation.

Learning during implementation

While standard approaches to implementation nearly uniformly maintain that the greater the degree of implementation the more positive results are likely to be (Klein et al., 2001), we suggest that there is likely to be a curvilinear relationship between implementation and performance. We maintain that if the drawbacks of over-implementation are to be avoided, there must be learning.

Learning is the key to mitigating the potential negative effects of excessive implementation.

Though some of the implementation literature argues for making adjustments during implementation, some does not (Bardach, 1977; Ingram and Baum, 1997). If the aim is precise replication, then performance should improve with each repetition and the organization should not deviate from an ideal model. Proponents of organizational learning (March, 1991; Crossan et al., 1999; Winter and Szulanski, 2001), however, argue against a framework that calls for this type of consistency in implementation. They argue that fine-tuning and correction should not be avoided or suppressed, but encouraged. Ongoing assessment during implementation leads to beneficial and useful tweaking. Edmondson et al. (2001), for instance, hold that the implementation of an administrative innovation should be a learning process which involves collective discussion and experimentation and the sharing of technical and social knowledge about who knows what and how to achieve tasks. 'An organization can be said to learn,' Edmondson writes, 'when its actions have been modified as a result of reflection' (2002: 128). 'A useful conception of organizational learning,' she maintains, 'must include change' (2002: 128). Edmondson's view is consistent with March (1991) who emphasized that people should avoid being single-minded in carrying out policies; rather they have to adjust their behavior to achieve their goals. Learning, then, is this process of improving organizational action through the knowledge and understanding that is gained during implementation (Edmondson, 2002). It is an interactive process of action and reflection, in which action is taken, assessed by the actor, and modified to produce better results (Schön, 1983; Kolb, 1984).

However, it is still unclear when and under what circumstances the adjustments which come from an understanding of an organization's changing operational and competitive experience lead to benefits that outweigh those that arise from perfect or nearly perfect compliance. According to such proponents of learning as Argote and Ingram (2000), Levitt and March (1988), Polley and Van de Ven (1996) the point at which the adjustments comprise an advantage depends on a trial-and-error process during which organizations adapt to situations they face. Organizations take action in real time, and the consequences of their actions lead to change in their activities and in their base of knowledge. The total experience of actions and outcomes informs further action or knowledge (Levin, 2000; March and Olsen, 1976; Miner et al., 2001). If this process of learning yields greater accuracy in understanding the preferences and needs of those for whom an administrative innovation has been adopted, such researchers as Winter and Szulanski (2001) maintain there should be movement away from perfect or near perfect compliance.

Learning theorists reference two types of learning (see for instance Argyris and Schon, 1978; Levitt and March, 1988; Edmondson, 2002). Adaptation-in-use and change catalysis are the terms this article uses to apply to the implementation of administrative innovations.³ Adaptation-in-use means that

organizations aim to achieve a better fit with their surroundings. They do so by adjusting administrative innovations to the context. Change catalysis means that implementation is an opportunity for additional innovation. It becomes an occasion for rethinking the ways organizations do business and a means for introducing new practices and innovating. Change catalysis may be a deep form of learning in which basic assumptions, models, norms, policies and objectives can be challenged (Carroll et al., 2003).

Adaptation-in-use and implementation

We expect that implementation combined with high adaptation-in-use will be associated with improved performance as opposed to when it is combined with low adaptation-in-use. Once employed, the physical manifestations of the innovation itself and the nature of its use necessitate re-adaptation which entails incremental changes. Such incremental changes do not challenge the working assumptions behind the innovation itself. Rather, they strive to better fit the organization and the innovation to each other (Argyris and Schön, 1978; Feldman, 2004).

Adaptation-in-use means local search for solutions to exploit the innovation. It relies on ongoing cycles of exploitation and refinement, choice, selection, execution and improvements in production efficiency (March, 1991) in order to realize the benefits embedded in the innovation. Adaptation-in-use that facilitates turning new routines into ongoing practice is necessary because, as comprehensive as implementation activities may be, not all conditions and contexts for the administrative innovative can be foreseen (Fidler and Johnson, 1984; Edmondson et al., 2001). The organizational change literature suggests that in complex settings it is not possible to plan completely or accurately because there are misunderstandings about how events will unfold (Feldman, 2004). Even with good planning, changes can create new contexts in which previously effective action does not work. Moreover, political struggles occur during planning that are only resolved through the real-time feedback and adaptation-in-use (March, 1981). During implementation, unexpected better ways to execute actions may be revealed and simple miscalculations made during planning can be identified and corrected.

When adaptation-in-use is low, the needs for adaptation are not resolved properly and thus performance is likely to decline in comparison with when adaptation-in-use is high. But when adaptation-in-use is high, it provides for ways to deal with contingencies that may not have been foreseen. Such ways only become apparent during implementation when there are appropriate opportunities for adjustments in organizational members' tasks and roles, work arrangements, patterns of interdependence, communication networks, authority relations, and distribution of status and expertise (Lewis and Seibold, 1993). Thus, we hypothesize that the relationship between implementation and performance depends upon the level of adaptation-in-use, as follows.

HYPOTHESIS 2 Adaptation-in-use moderates the relationship between implementation of administrative innovation and subsequent performance, such that implementation is associated with higher performance when adaptation-in-use is high rather than low.

Change catalysis and implementation

Change catalysis involves using the currently implemented change as a springboard for rethinking the way the organization does business. Such exploration can be a form of deep learning that involves skillful enquiry and the facility to gain insights, challenge assumptions, step beyond existing frames, and create new and more comprehensive models (Carroll et al., 2003). Thomas et al., (2001: 332) refer to this as strategic learning, a type of learning that 'leverages the organization's ability to generate, store, and transport rich de-embedded knowledge across multiple levels for the purpose of enhancing firm performance'. As an example of change catalysis we cite Nord and Tucker (1986: 305, 311) who found that the implementation of technical innovations in financial institutions allowed firms to discover organizational deficiencies and change them in ways that redefined the firms' fundamental policies. Similarly, Sitkin et al. (1994) hold that success in implementation depends not just on everyday use, but on independent thinking and initiative, for without them (Fidler and Johnson, 1984: 704), implementation would be just 'routine' and 'mechanical'. Sitkin et al. (1994) suggest that a process like change catalysis has the potential to overcome those always powerful inertial tendencies that are deeply rooted in organizational routines (Kelly and Amburgey, 1991).

As previously defined, implementation turns change into routine aspects of organizational operations, but routinization tends to lock organizations into competency traps (March, 1991), habitual routines (Gersick and Hackman, 1990) and core rigidities (Leonard-Barton, 1995). Change catalysis can create awareness and a state of mind that rejects inertia, and that is needed in order to improve performance. It can serve as a mechanism to avoid getting stuck in the habitual (Pfeffer and Sutton, 1999). Nevertheless, Feldman (2004) has maintained that organizational routines play an important role in learning in that they may facilitate additional changes despite being perceived and defined as unchanging. She suggests that responding to previous outcomes of routines can lead to far-reaching change in routines (March, 1991), and that implementation activities can act as an organizational resource (Lewis and Seibold, 1993: 333) that reduces the risks of innovation. Just as in playing jazz band, change catalysis starts with a performer's competency in the normal use of an instrument (Barrett, 1998) and progresses to reveal to the performer more about his or her skills, the skills of his or her colleagues and knowledge about the structure in which they are embedded (Argote, 1999). Change catalysis translates better into enhanced performance because it is built on practice-based knowledge rather than abstract knowledge (Pfeffer and Sutton, 1999). It may improve communication, establish new collective norms and goals, and facilitate rapid sharing of

novel ideas in communities of practice (Brown and Duguid, 2001). Reflecting on actions that have been taken and identifying new actions to take highlights the fruitful venues that may exist for additional innovation. As Greve and Taylor (2000: 57) comment: 'Interpretations, meaning, valuations, and the relevance of future options shift when organizations act.' Thus, we expect that implementation that is combined with high change catalysis would be associated with higher performance than when combined with low change catalysis, and so we get the following hypothesis.

HYPOTHESIS 3 Change catalysis moderates the relationship between implementation of administrative innovation and subsequent performance, such that implementation is associated with higher performance when change catalysis is high rather than low.

Methods

The context: ISO 9000 quality standard

The setting for our study revolves around the quality standard, ISO 9000. New quality models are continually evolving and being refined over time, and they are supposed to be a competitive factor in many industries (Reger et al., 1994; Cole, 1999). ISO 9000 is a subset of a broader category of quality initiatives, which are often referred to as administrative innovations (Brunsson et al., 2000). It requires organizations to have verifiable routines and procedures in place for product design, manufacture, delivery, service and support. They must strictly monitor the steps they take to complete a job (Cole, 1999; Brunsson et al., 2000). They are required to comply with procedures they establish for themselves. To guarantee compliance, third-party auditors carry out site visits twice a year.

ISO 9000 is the most commonly implemented quality standard in the world. By December 2004, about 700,000 certifications in over 100 countries had been issued (Guler et al., 2002; Wayhan et al., 2002; International Standard Organization, 2006). However, the results of its implementation are far from clear. While some studies (*ISO 9000 Survey*, 1996) show that the implementation of ISO 9000 has achieved real benefits, others say that it has accomplished little. For instance, Robin and Dennis (1994) found that ISO 9000 was effective in introducing statistical process control and improving business performance; Elmuti and Kathawala (1997) reported that productivity, quality of product and quality of work life improved due to certification; Brown and Loughton (1998) found benefits of greater quality awareness, improved awareness of problems and better product quality, but not improvements in productivity, costs, yield rates, staff motivation and staff retention; and Corbett et al. (2005) found a significant improvement in financial results among US companies that adopted the standard.

But many other studies have found very little benefit from the implementation of this standard. For example, Batchelor (1992) found that the benefits of certification were mainly procedural efficiency and error rate and not market share, staff motivation or cost; Powell's (1995) international quality study concluded that certification had no significant effect on performance; Hunt's (1997) main conclusion was that ISO 9000 did not guarantee product quality; Terziovski et al. (1997) rejected the hypothesis that there was a significant relationship between ISO 9000 implementation and organizational performance; and Naveh and Erez (2004) in an intervention longitudinal study found that ISO 9000 had a negative effect on organizational productivity.

We contend that variability in the effects of implementing ISO 9000 are due to unmodeled curvilinearity and the interactive effects of implementation with both adaptation-in-use and change catalysis.

Data collection

Our primary data collection vehicle was a survey mailed to all ISO 9000-registered facilities in North America. The questionnaire for this survey was designed in an iterative manner. We started with an extensive literature review on ISO 9000, then visited and interviewed 11 facilities of companies that had implemented ISO 9000. We consulted with world-leading experts on the ISO 9000 standard, such as members of the TC 176 group (the international committee that is in charge of the standard), US registrars, consultants and professional quality managers.⁴ Additionally, we conducted a pilot study in which several dozen respondents reviewed the questionnaire and provided comments.

The newsletter *Quality System Update* by McGraw-Hill routinely lists all facilities in North America that have demonstrated through external audits that they have implemented ISO 9000. We sent a postcard to the ISO 9000 management representatives which appeared in this list, asking them to participate in the study. They were given a code that gave them entry to an internet site where a questionnaire could be completed (full confidentiality was promised). A month after the first postcard was mailed out, we sent a second postcard to non-responders. The total number of ISO 9000 registrations in North America at the time of the survey was 4233. Depending on an organization's decision, registration could be held at the organizational or facility level. In organizations with more than one registration, we sent a separate postcard to each registered facility. In total, 1150 ISO 9000 facilities from 885 companies completed the survey, a response rate of more than 27 percent. Among surveys of quality managers, this response rate is typical; published empirical works by Flynn et al. (1994), Powell (1995), and Douglas and Judge (2001) drew conclusions from surveys with similar response rates. Seventy-five percent of the responders were manufacturing facilities and the balance were service facilities. About a third of the companies (304 companies) that responded to the questionnaire had

publicly available data in the financial dataset Compustat, which we used to augment our survey.

Because of a concern that the survey respondents might have a different profile from non-respondents, we divided the respondents by industry sector (using two-digit SIC codes), time since certification and size (measured as number of employees), and compared the percentage responding in these groups with the actual registrants in these groups. The results of *t*-tests showed no significant differences ($p > .05$) between those who responded to the research questionnaire and those who came from groups similar to the population as a whole. In addition, we sent mailed questionnaires to a sample of 50 non-responding organizations, and followed up with telephone calls until we obtained responses from nearly all 50. The findings of this study can be generalized because, in part, the sample was free of non-response bias. In order to strengthen this claim, a time trend extrapolation test (Armstrong and Overton, 1977) was also performed as a check on the non-response bias. The assumption behind this test was that late respondents (those whose responses came following the second postcard and the mailed questionnaires) would be very similar to non-respondents, given that they would have fallen into that category had a second set of postcards and questionnaires not been mailed. We used the multivariate general linear model (GLM) procedure to test the null hypothesis of no difference. The procedure simultaneously compared the three survey groups (responders after first and second postcards and for the mailed questionnaires) with respect to our study variables. This analysis indicated no difference (insignificant Wilks' Lambda). Although non-response bias cannot be ruled out, the results of the comparison testing of the second mailed postcards and mailed questionnaires increased our confidence in the representativeness of the sample. A similar comparison test for the responders' subgroup for which we had publicly available data (304 facilities) also showed proportions similar to the ISO 9000 certified population.

Measures

Independent variables

Table 1 lists our measures and scales. Our three independent variables (implementation, adaptation-in-use and change catalysis) were all computed from the respondents' answers to five-point Likert scale-type items. Implementation was measured as the mean score of five questionnaire items based on Brunsson et al. (2000) and Klein et al. (2001). This variable's reliability was 0.93 (0.92 for the public companies). Adaptation-in-use was measured as the mean score of three questionnaire items based on Cooper and Zmud (1990). This variable's reliability was 0.94. (0.94 for the public companies). Change catalysis was measured as the mean score of five questionnaire items based on Argote (1999). This variable's reliability was 0.92 (0.93 for the public companies).

Table 1 Results of confirmatory factor analyses

	1	2	3
Implementation			
The extent to which the documents created for the purpose of ISO 9000 registration were used in daily practice	0.80		
The extent to which preparations for external audits were made at the last minute (reverse-scored)	0.92		
The extent to which the system was regularly ignored (reverse-scored)	0.83		
The extent to which the system was an unnecessary burden (reverse-scored)	0.90		
The extent to which the system has become part of the regular routine	0.78		
Adaptation-in-use			
Have changes in your ISO 9000 system been made since registration?		0.85	
Are the documents regularly updated?		0.85	
Has ISO 9000 changed daily practice?		0.81	
Change catalysis			
The extent to which investment of time and resources in ISO 9000 was:			
A starting point for other more advanced practices			0.92
A catalyst for rethinking the way you do business			0.85
Understood as an opportunity to innovate.			0.80
To what extent was design and development of your ISO 9000 system a springboard to introduce new practices?			0.82
To what extent has ISO 9000 led to the discovery of improvement opportunities?			0.86

Results of a confirmatory factor analysis indicated a good fit with the data ($\chi^2 = 421.52$, d.f. = 0 316). The goodness of fit index was 0.95, the comparative fit index 0.94 and the root-mean-square error of approximation 0.053. Item loadings were as theorized and significant ($p < .01$; see Table 1). To validate the three-factor structure, we also conducted a second confirmatory factor analysis (CFA) in which all items were allowed to load on one factor. A third CFA in which adaptation-in-use and change catalysis were taken as one factor was also conducted. These CFA models did not exceed acceptable measures of fit (Hu and Bentler, 1999). Thus, the CFA results indicated that the three dependent variables were empirically distinct from each other.

Dependent variable – performance

We employed four measures of performance. Operating performance was calculated as the mean score of five questionnaire items. Specifically, each facility representative was asked about the operational improvements that resulted from

the implementation of ISO 9000 in the following five areas: defect rates, quality costs, productivity, on-time delivery and customer satisfaction. All these items were on a five-point Likert scale. The reliability of this measure was 0.89 (0.90 for the public companies). As mentioned above, for about a third of the organizations we had Compustat data. Therefore, we were able to incorporate three company-level measures of the change in performance: sales, gross profit margin (calculated as sales minus cost of goods sold divided by sales) and profit. Specifically, sales change, gross profit margin change and profit change were calculated by taking their value two years after obtaining their ISO 9000 registration minus the same variable two years prior to registration, divided by the average measure in the two years prior to registration.⁵ This timeframe of two years was based on Bagchi (1996) and Wayhan et al. (2002). We ran the analyses with three-, four- and five-year timeframes and obtained similar results.

Because of the difference in levels of analysis on Compustat data (company as opposed to facility), we included only firms for which meaningful ISO 9000-related analyses could be performed. Specifically, we included public firms based on three categories. First, we included all publicly-held firms that had only one facility that was ISO 9000 registered (249 firms). Second, we included firms with more than one ISO 9000 facility, where all facilities were registered and had been surveyed (35 firms). Lastly, we included firms that had more than one facility, one or more of these facilities was ISO 9000, and 95 percent of sales, or higher, originated from ISO 9000 facilities (20 firms). The second and third categories required averaging facility-level survey results. To ensure homogeneity of these multiple-facility items, we calculated Rwg (within-group interrater agreement). This coefficient ranged between 0.81 and 0.91, above the threshold value of 0.70 (James et al., 1984).

Control variables

Five control variables were included (Meyer and Goes, 1988):

- 1 time since registration;⁶
- 2 number of employees – at the facility for the facility level of analyses and total company employment for the company level analyses;
- 3 a dummy variable for the industrial sector that was equal to 1 when a registered facility was classified as belonging to a service or a software company and otherwise equal to zero;
- 4 external pressures, computed as the mean score of two five-point Likert scale questionnaire items in which the respondent estimated quality demands from customers and from regulators ($\alpha = 0.87$; 0.88 for the public companies subset);
- 5 technological uncertainty, computed as the mean score of three five-point Likert scale questionnaire items in which the respondents' estimated, for their industry setting, the rate of product change, the rate of process change and the amount of research and development ($\alpha = 0.90$; 0.90 for the public companies subset).

Table 2 Means, standard deviations and correlations

Variable	Facilities (without Compustat organizations)		Organizations (only Compustat organizations)		1	2	3	4	5	6	7	8	9	10	11	12
	Mean	SD	Mean	SD												
1. Implementation	3.7	0.9	3.8	1.0		0.21	0.25	0.26	0.17	0.18	0.19	0.12	0.05	0.15	0.10	-0.13
2. Adaptation-in-use	3.6	0.9	3.7	0.8	0.22		0.12	0.25	0.20	0.18	0.18	0.19	0.03	0.15	0.11	-0.13
3. Change catalysis	3.3	1.2	3.4	1.4	0.27	0.13		0.29	0.22	0.23	0.22	0.18	0.04	0.10	0.16	-0.17
4. Operating performance	3.6	0.7	3.5	0.6	0.25	0.26	0.28		0.17	0.18	0.19	0.19	0.05	0.08	0.17	-0.18
5. Δ Sales ^a	0.07	0.31	0.8	0.22						0.17	0.17	0.10	0.09	0.04	0.03	0.02
6. Δ Gross profit margin ^a	0.05	0.22	0.06	0.16							0.47	0.04	0.10	0.03	0.03	0.04
7. Δ Profit ^a	0.06	0.21	0.06	0.15								0.04	0.11	0.04	0.04	0.04
8. Time since registration	40.5	17.9	43	15.6	0.11	0.20	0.18	0.19					0.17	0.21	-0.15	0.08
9. Number of employees ^b	184	7258	210	6258	0.05	0.03	0.04	0.05				0.18		0.05	0.05	0.05
10. Manufacturing / Service	0.25		0.23		0.16	0.15	0.11	0.08				0.20	0.05		0.04	0.03
11. External pressures	4.0	0.6	3.9	0.7	0.10	0.13	0.15	0.17				-0.16	0.05	0.04		0.05
12. Technological uncertainty	3.5	0.8	3.3	0.8	-0.12	-0.13	-0.15	-0.17				0.07	0.07	0.03	0.06	

Notes

Correlations between facilities (full survey data) are below the diagonal, and correlations between companies (Compustat data) are above the diagonal.

n = 1150 for facilities and 304 for organizations (Compustat data).

Correlations values equal to or greater than 0.17 are significant at 0.05 for the full survey data, and 0.20 for the Compustat data.

^a normalized.

^b For the full sample, total number of facility employees, for the Compustat data total number of company employees; correlations are calculated for the natural logarithm of the total number of employees.

Five other control variables were tested. These variables were: the number of external audits to attain registration, the ratio of registered to total number of facilities within a firm, employees' education, product complexity and market-place competition. Three other additional Compustat variables were tested. These were R&D expenses, leverage and capital intensity. Since all these eight controls had a near-zero-magnitude insignificant effect, and since theoretically they suggest the less parsimonious explanation, we regressed the models without them (Cohen, 1988; Katz-Navon et al., 2005).

Descriptive statistics and correlations of the full and public companies' subset are presented in Table 2.

Analysis

In order to test the hypotheses we used hierarchical moderated OLS regression analyses. First, we regressed the dependent performance variables on implementation, implementation squared, adaptation-in-use, change catalysis and the control variables (Table 3, models 1.1–5.1). In the second step, we regressed the dependent performance variables on the above variables and the two two-way interactions of implementation and adaptation-in-use, and implementation and change catalysis (Table 3, models 1.2–5.2; McClelland and Judd, 1993). In all regressions the dependent variables were first normalized to obtain correct standardized coefficients, as recommended by Aiken and West (1991). Since ISO 9000 certification could be gained at the facility level (the questionnaire data in our study) and Compustat data are at the company level, a principal issue of concern was how to analyze and interpret data that reside both within group levels and between group levels. As explained earlier (in the section describing the Compustat performance measures), the vast majority of companies included had a single facility that was ISO 9000-registered. When a company had more than one registered facility, we incorporated companies with 95 percent or more of sales coming from ISO 9000 facilities, and then we tested for interrater response homogeneity (Rwg).

Results

The results of the OLS regressions appear in Table 3.

Results of step 1 of the hierarchical regression (models 1.1–5.1) demonstrated the expected curvilinear relationships between implementation and performance, thus confirming the first hypothesis. The squared term of implementation, which assesses the possibility of nonlinear relationships between implementation and performance, was significant in every instance. Results from step 2 (models 1.2–5.2) showed that the two interactions were significant, as was the change in R^2 from step 1. Hypothesis 2's predictions regarding operating performance (of the full sample and the publicly-held subsample),

Table 3 Results of regression analyses^a

	Model 1.1	Model 1.2	Model 2.1	Model 2.2	Model 3.1	Model 3.2	Model 4.1	Model 4.2	Model 5.1	Model 5.2
Sample	Full Sample		Publicly-held sub-sample (Compustat data)							
Dependent variable	Operating performance		Operating performance		ΔSales		ΔGross profit margin		ΔProfit	
Constant	-2.55** (0.33)	-8.42** (1.38)	-2.32** (0.42)	-8.23** (1.17)	5.26** (0.054)	-2.41** (1.04)	5.57** (0.05)	-2.60** (0.92)	4.96** (0.06)	-2.51** (0.06)
Implementation	0.27** (0.09)	0.25* (0.07)	0.31** (0.14)	0.29* (0.18)	0.18† (0.05)	0.07 (0.07)	0.17† (0.08)	0.07 (0.07)	0.20* (0.09)	0.07 (0.10)
Implementation squared	-0.25** (0.05)	-0.19** (0.04)	-0.23** (0.09)	-0.19** (0.11)	-0.24** (0.12)	-0.21* (0.13)	-0.21* (0.05)	-0.08 (0.13)	-0.25** (0.09)	-0.18* (0.11)
Adaptation-in-use	0.20* (0.08)	0.11 (0.08)	0.21* (0.11)	0.14 (0.13)	0.17† (0.08)	0.05 (0.07)	0.20* (0.08)	0.05 (0.09)	0.21* (0.11)	0.06 (0.11)
Change catalysis	0.29** (0.10)	0.25* (0.11)	0.25** (0.05)	0.26** (0.04)	0.21* (0.04)	0.08 (0.11)	0.17† (0.05)	0.06 (0.04)	0.22* (0.07)	0.08 (0.07)
Implementation × Adaptation-in-use		0.21** (0.05)		0.24** (0.06)		0.25* (0.10)		0.21* (0.08)		0.22** (0.06)
Implementation × Change catalysis		0.26** (0.06)		0.25** (0.07)		0.27* (0.13)		0.25* (0.13)		0.24** (0.07)
Time since registration	0.20* (0.09)	0.20* (0.09)	0.19* (0.05)	0.18* (0.07)						
Number of employees	0.08 (0.04)	0.08 (0.04)	0.09 (0.05)	0.09 (0.06)	0.08 (0.06)	0.09 (0.06)	0.08 (0.06)	0.07 (0.06)	0.07 (0.06)	0.07 (0.06)
Manufacturing / Service	0.05 (0.17)	0.05 (0.17)	0.05 (0.17)	0.05 (0.17)	0.05 (0.16)	0.05 (0.17)	0.05 (0.16)	0.05 (0.17)	0.05 (0.16)	0.05 (0.17)
External pressures	0.27** (0.12)	0.19* (0.10)	0.25** (0.14)	0.20* (0.12)	0.17 (0.10)	0.17 (0.11)	0.18† (0.08)	0.18† (0.06)	0.16† (0.06)	0.16† (0.08)
Technological uncertainty	-0.17* (0.12)	-0.19* (0.12)	-0.17* (0.08)	-0.19* (0.07)	-0.19† (0.13)	-0.18† (0.11)	-0.18† (0.10)	-0.17† (0.11)	-0.16† (0.08)	-0.15† (0.07)
N	1139	1139	304	304	304	304	304	304	304	304
F	5.85**	6.15**	4.95**	6.86**	2.43**	2.81**	3.05**	3.46**	3.32**	3.72**
R ²	0.28	0.49	0.32	0.45	0.21	0.32	0.23	0.33	0.24	0.35
ΔR ²		0.21		0.13		0.11		0.10		0.11
ΔF		8.86**		5.18**		3.89**		2.89*		3.01*

^a Standard errors are in parentheses.

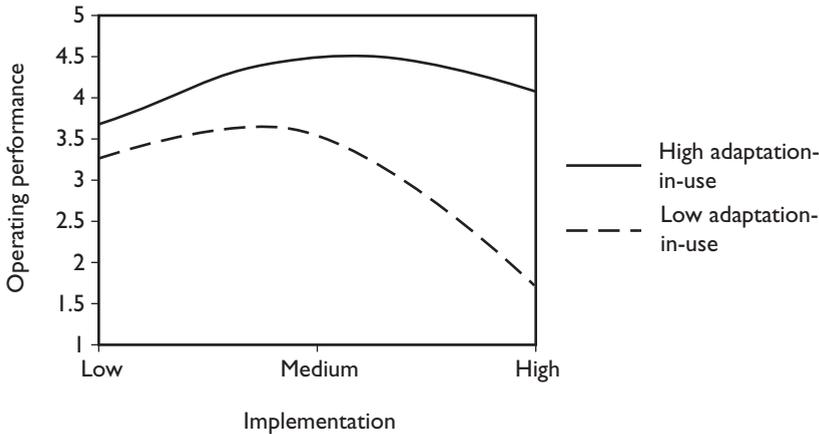
† $p < 0.1$

* $p < 0.05$

** $p < 0.01$

p -values are based on two-tailed t -tests.

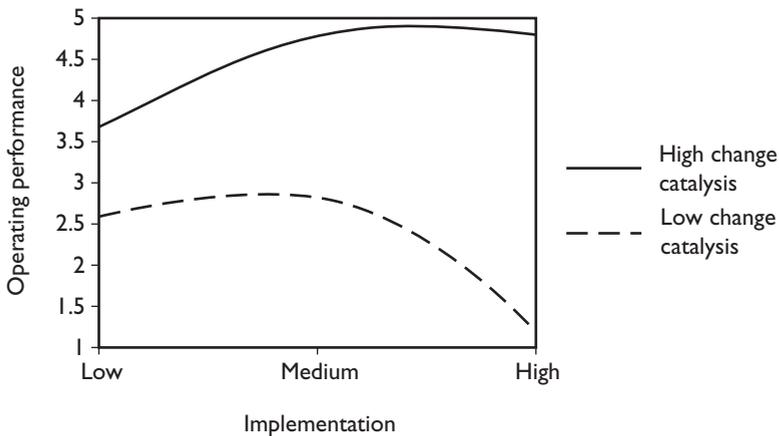
sales, gross profit margin and profit (models 1.2–5.2), were supported, as the interaction term of implementation and adaptation-in-use was significant. The interaction was slightly less significant for change in gross profit margin. Hypothesis 3 was supported for all performance measures (models 1.2–5.2),



Note

^a High and low levels were calculated at one standard deviation above and below the mean of the respective variables; the resulting operating performance is also shown in standard deviations.

Figure 2 Operating performance as a function of implementation and adaptation-in-use^a



Note

^a High and low levels were calculated at one standard deviation above and below the mean of the respective variables; the resulting operating performance is also shown in standard deviations.

Figure 3 Operating performance as a function of implementation and change catalysis^a

since the interaction term of implementation and change catalysis was significant in each instance.

To understand the nature of the interactions, we followed the graphing method outlined by Aiken and West (1991). Figure 2 shows that the curvilinear effect of implementation on operating performance depends on the level of adaptation-in-use, and Figure 3 shows that the curvilinear effect of implementation on operating performance depends on the level of change catalysis.

With regard to the control variables, we found the following. The number of employees and industrial sector had no significant effect on any of the performance measures. Time since registration had a significant positive effect on operating performance; external pressures had a significant positive effect on operating performance, gross profit margin and profit; and technological uncertainty had a negative significant effect on operating performance, sales, gross profit margin and profit.

Discussion

Earlier studies on implementation defined successful implementation in terms of routine use of administrative innovation, and in many cases, referred to routinization of administrative innovation as the aim itself (Klein et al., 2001). While the need for implementation of administrative innovation is well-documented, the curvilinear relationship between administrative innovation and performance has received little attention, if any. In line with our curvilinear claim, it is not surprising that many studies on administrative innovations (such as about TQM, ISO 9000 and re-engineering; Staw and Epstein, 2000) could not find a link between successful implementation and performance. Indeed, our findings suggest that intensive implementation of administrative innovations may not necessarily lead to the best results. Earlier studies did not examine these curvilinear relationships. We wonder what the results would have been had they been examined, an area that we believe is a fruitful one for future research.

Our study contributes to the theory of implementation by connecting learning and implementation. Learning research refers to incremental learning and more generative learning processes (March, 1991), which we explore in this article. It investigates which of these processes occurs under different conditions and when and if they do or do not have useful outcomes (Argote, 1999). However, prior learning research has not analyzed the implementation of administrative innovation. The main focus of our work, therefore, is not in understanding learning activity itself (Greve, 2002; Polley and Van de Ven, 1996), but rather the actionable effects of learning on performance. Our results suggest that the interaction between implementation and learning counteracts the detrimental effects of over-implementation. When learning (adaptation-in-use, change catalysis) is low, the curvilinear relationship between implementation and performance has a more pronounced peak, and an especially more pronounced drop as a result of over-implementation (see Figures 2 and 3). When learning (adaptation-in-use, change catalysis) is high, this peak is much less pronounced (see Figures 2 and 3). Therefore, we see that elevated levels of learning enable organizations to extend the benefits of implementation.

The application of prior learning theory (Adams et al., 1998; Miner et al., 2001; Szulanski and Cappetta, 2003) to our understanding of the implementation of administrative innovations suggests that the implementation of these

innovations is not static, that they can and do change in important ways during the process, and that these changes have important implications. These findings are compatible with Feldman's (2004) studies on organizational routines as they indicate why the performance results of the same administrative innovation implemented in different organizations differ. Nonaka (1994) argued that organizational knowledge is created through a continuous dialogue between what is explicitly known and what is tacitly understood (Matusik and Hill, 1998). In the case of the implementation of administrative innovations, the learning mechanisms of adaptation-in-use and change catalysis are likely to be the main supporters of the dialogue between explicit and tacit knowledge (Marcus and Naveh, 2005).

While similar ideas about learning have been analyzed in other contexts, they have not been examined in the context of the implementation of administrative innovations. Polley and Van de Ven (1996), Adams et al. (1998) and Miner et al. (2001) analyzed learning in product development. Polley and Van de Ven (1996) found learning in some parts of the process and not in others, Adams et al. (1998) identified barriers that hinder an organization's capacity for learning about its markets, and Miner et al. (2001) contributed the idea of improvisation and experimental learning as something that occurs off-line, which is then taken on-line. But the role of learning in the implementation of administrative innovation has not been previously studied in the way we do so here. The identification of two learning mechanisms in the context of the implementation of administrative innovations is unique. It sharpens our understanding of the process of learning in this context. Adaptation-in-use and change catalysis go beyond constructs found in prior studies such as first- and second-order learning and create a theory specific to the implementation of administrative innovation.

The claim of quality improvement advocates is that quality initiatives should improve operational business performance (Naveh and Erez, 2004), but we have found that this improvement depends on how these quality initiatives are implemented. For ISO 9000, the evidence points strongly to the beneficial effects of such initiatives on business performance if the implementation of these initiatives does not proceed too far and is modified through adaptation-in-use and change catalysis. Indeed, the impact of implementation on business performance was higher than the impact on operational performance (the higher R^2 of these models), and this is an unusual outcome for ISO 9000, which is expected to mainly enhance operations. For us, this result is not surprising as it is consistent with these other studies in which we have been involved (Naveh and Erez, 2004; Naveh et al., 1999). We must be cautious in this regard, however, as the better business performance undoubtedly is influenced by factors other than ISO 9000. Factors such as technological innovation and competitors' initiatives may be affecting the results as much as ISO 9000.

Our results also challenge the idea that exploitation and exploration are inherently at odds with each other. Adaptation and change catalysis do not

innately contradict each other. Both may make implementation more effective. Yet it is still unclear whether process management innovations such as ISO 9000 actually do lead to proximal innovation rather than path-breaking ones, as found by Benner and Tushman (2002).

Another perceived tension is between standardization and heterogeneity (Argote, 1999). Conceivably, compliance with a common standard (in our case, ISO 9000) should make organizations more homogenous. Yet, our study highlights competitive heterogeneity in the way organizations implement common administrative innovations. As Barney (1986) maintained, competitive advantage arises from the differences among firms. However, if all companies implement ISO 9000 in the same way, can a particular company derive a special benefit? We find that organizations do not all implement this administrative innovation in the same way; thus they obtain differential benefits. Some degree of competitive advantage can be gained from implementing a common management practice if implementation is understood not as a discrete and homogenous industry-wide phenomenon, but as variations in the implementation of a common management practice.

Interestingly, the control variable of external pressure was found to have a positive effect on performance. While this finding does not fit institutional theory's claims of the negative effects of such pressure (Staw and Epstein, 2000), it does conform to other research claims that external pressure stimulates beneficial results (Postrel and Rumelt, 1992; Naveh et al., 2004). Circumstances may force organizations to do something that ends up being for their own benefit, a phenomenon that needs to be better understood.

Our study, however, is not free of limitations. Though we took measures to reduce common method variance (for example, by triangulating performance data from our respondents and Compustat), we were unable to completely eliminate it. This study might also not present sufficient evidence to decisively rule out that causality flows from performance to implementation. One likely scenario is that firms that perform well have the means and resources to engage in extensive ISO 9000 implementation and in learning during implementation. Using performance improvement as a dependent variable as we have done might help rule this out, but it is not a perfect solution, as firms that do well likely experience consistent performance improvement regardless of the degree of ISO 9000 implementation. Another limitation is possible endogeneity; it might be somewhat relevant since managers' decisions on adapting ISO 9000 are not random, but are based on expectations of how these choices will affect performance (Hamilton and Nickerson, 2003).

Another limitation is that we examined the implementation of a single administrative innovation: ISO 9000. Future research may reveal that different innovations entail different implementation processes. Though we believe the concept of learning – in the forms of adaptation in use and change catalysis – is likely to be of importance in any context, an array of contingencies may change the balance between the two learning mechanisms as well as their relative

importance. Such contingencies may be related to the type of innovation, the novelty of the change (radical as opposed to incremental) and the cycle times of the innovations in particular settings.

Moreover, the administrative innovation we examined in this study, ISO 9000, has a built-in external auditing system. There might be a difference between audited and unaudited implementation efforts, as the audit may act as a self-reinforcing mechanism (Postrel and Rumelt, 1992). Additionally, due to our selection criteria, our publicly-held companies' subsample was biased against large, multi-facility firms. In large, diversified firms, facility-level data are detached from firm-level performance, and thus we cannot be certain what we would have found had we been able to investigate this phenomenon. To the extent that our survey data came from a single source per facility, it exposes our analyses to problems of causal inference and to some degree to halo effects. Some comfort, however, may be drawn from the substantial similarity in the analyses of the full (facility-level) sample and the public firms' subsample.

Implications for managers

This study tested the effects of the quality standard ISO 9000 on performance. ISO 9000 is one of the most common quality initiative practices that are implemented in organizations. The limited success of these initiatives has been attributed to superficial implementation (Anderson et al., 1994); lack of emphasis on the organizational cultural values – essential for quality improvement (Detert et al., 2000); responses to external pressures rather than to the real needs of the organization (Westphal et al., 1997); lack of true leadership with a vision towards quality improvement; rhetoric prevailing over substance (Zbaracki, 1998); and too much bureaucracy involved in quality initiatives (Hackman and Wageman, 1995). However, to date, there has been no integrative model for identifying the factors that differentiate between successful and unsuccessful implementation of quality initiatives such as ISO 9000. This study makes an important and serious contribution by bringing to light curvilinear effects, learning and the interactions of implementation with various learning mechanisms. Our study reveals how managers might increase their organizations' chances of benefiting from adopting an administrative innovation such as ISO 9000. The key to the success of such quality improvement initiatives is knowing how far to go with the innovations and supplementing implementation with learning. Therefore, managers must not blindly insist on compliance to the normative model in their heads. The interplay between exploiting the proximal benefits of the current change and more uncertain exploration must be recognized. In particular, the possibility that implementation opens the door for changes beyond the current one cannot be ignored.

Our focus on implementation and action does not make preparation activities redundant. Indeed, such planning activities may yield substantial dividends by preparing for in-process learning during implementation and thus making the implementation more productive. This study, therefore, is likely to be of

particular use for managers who contemplate the benefits of adopting ISO 9000 or other standards like it. As mentioned earlier, there exists much debate about the benefits of this quality standard and others of its nature. We found that not all ISO 9000 registrations are the same. Even within ISO 9000-certified facilities there are considerable differences in the extent of implementation of the standard. We have found that ISO 9000 implementation can lead to substantial performance gains when accompanied by reflection-in-action: adaptation and readiness to extend the change beyond installation of the standard.

Conclusions

Adaptation-in-use, a form of first-order learning, perfects the implementation of a planned change. Change catalysis, a form of second-order learning, uses the current implementation activities as a springboard for additional innovation. The combined effect of learning mechanisms and implementation suggests that implementation does not come to an end in perfecting an existing innovation, but is a part of an ongoing cycle of doing–reflecting–doing that leads to higher performance. As too much implementation can be negative, the effects of administrative innovation implementation on performance have to be moderated by these learning mechanisms.

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Notes

- 1 GCI Secor is a pseudonym for a well-known international corporation.
- 2 For similar reports on organizations that went too far in implementing administrative innovations see Naveh et al. (2004) and Naveh and Erez (2004).
- 3 Because we focus on action-based learning during implementation, we choose not to use prior nomenclature but there certainly are similarities between our concepts of learning and those of prior researchers. Our concepts are comparable with single- and double-loop learning (Argyris and Schön, 1978). The two types of learning we distinguish mirror March's (1991) distinction between exploitation and exploration (Levinthal and March, 1993).

Adaptation-in-use involves proximal search, while change catalysis embodies far-reaching search. Another way to understand the contrast is to think in terms of the differences between incremental learning and step-function learning, the latter involving 'fundamental changes to core or integrative knowledge' (Helfat and Raubitschek, 2000: 967). Still other ways to think of the contrast are in terms of evolutionary and revolutionary change (Tushman and O'Reilly, 1996), operative and strategic learning (Thomas et al., 2001), and adaptive and generative learning (Chelariu et al., 2001). Change catalysis also expands on Greve and Taylor's (2000) idea of technological innovation as being a catalyst for additional organizational changes. But while Greve (2002) analyzes aspiration-driven performance, our concern is with action rather than cognition.

- 4 Before the interviews, we constructed an interview guide that had open-ended questions about the company's experience with ISO 9000. During the site visit, we heard general presentations. We interviewed people who had the following functions: auditing (both internal and external), quality management, manufacturing, engineering, software development and documentation. Typically, the interviews lasted 1.0–1.5 hours and were taped. We also took handwritten notes, and while on-site, collected relevant documents. The interview team discussed its impressions with company representatives and held off-site debriefings.
- 5 In companies with more than one ISO 9000 registration, we ran the analyses with measures corresponding to their first registration. For the 55 public companies, on the date on which we finalized the survey, the mean and standard deviations of the time passed since first facility registration were 43.0 and 15.6 months, respectively. Time since last facility registration was 41.8 months (14.9 SD). We also ran analyses with measures relative to the most recent registration. Results were very similar to using the first registration timeframe.
- 6 This variable was incorporated only in the models predicting self-reported measures; it is constant for the Compustat performance measures.

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