Check for updates

Decertification in quality-management standards by incrementally and radically innovative organizations[☆]

Joseph A. Clougherty [a], Michał Grajek [b,*]

[a] *Gies College of Business, University of Illinois at Urbana-Champaign, 330 Wohlers Hall, 1206 S. 6th Street, MC-706, Champaign, IL 61820, USA*
[b] *ESMT Berlin, Schlossplatz 1, 10178 Berlin, Germany*

ARTICLE INFO

ABSTRACT

The literature on quality-management standards has generally focused on the drivers, motivations, and performance effects of adopting such standards. Yet the last decade has witnessed a substantial degree of decertification behavior, as organizations have increasingly decided to voluntarily withdraw from quality-management standards by not recertifying. While the drivers of the decision to initially adopt quality-management standards have been extensively studied, the drivers of the decision to decertify have received scant scholarly attention. We argue that innovative organizations are generally prone to retaining quality-management certification and thus exhibit a tendency to not abandon certification; however, radically-innovative organizations are more prone than incrementally-innovative organizations to discontinue quality-management standards and thereby exhibit a tendency to withdraw from quality certification. We compile World Bank data surveying facilities based in 50 countries and 103 industrial sectors across the 2003 to 2017 period. Taking advantage of the data's panel properties yields a dataset composed of up to 1755 facility-level observations of recertification decisions for empirical analysis. Our empirical testing employs a probit estimation technique that accounts for the appropriate fixed effects and generates results that support our theoretical priors regarding decertification behavior.

1. Introduction

Certification in internationally-recognized quality standards (e.g., ISO 9000, QS 9000, ISO 13485, and IATF 16949) across the globe by millions of firms and facilities over the last three decades has spurred a great deal of literature—see the reviews by Corbett and Yeung (2008), Heras-Saizarbitoria and Boiral (2013), and Castka and Corbett (2015). While many studies have focused on the internal and external performance effects of adopting these standards (e.g., Blind, 2001; Hendricks and Singhal, 2001; Corbett et al., 2005; Martínez-Costa et al., 2009; Levine and Toffel, 2010; Singh et al., 2011), Anderson et al.'s (1999) pioneering study established that deciphering the forces which lead to the adoption of quality-management standards represents a central research question within this literature. Factors such as organizational size, firm age, government mandates, customer pressure, supply chains, and export considerations (Corbett and Kirsch, 2001; Vastag, 2004;

Corbett, 2006; Delmas and Montiel, 2009) have all been considered instrumental in explaining the decision of a particular facility to incur the costs to seek and obtain a quality-management standard.

Yet to continue with quality-standard certification, adopters must undertake both annual surveillance audits and periodic recertification audits—where three years represents the common cycle (Blind, 2004). While many organizations decide to undertake these audits to ensure recertification and conformity to a quality standard, an increasing number of organizations have decided to terminate the auditing process and voluntarily abandon certification. Thus, a conspicuous trend over the last decade that potentially runs counter to the motivations behind quality-management adoption has been the increased prevalence of abandonment decisions where organizations decertify from quality standards. For perspective on the prevalence of the decertification phenomenon, Cândido et al. (2016, 2021) report that ISO 9001 – the most popular of the quality-management standards – has experienced an

---

average of 60,000 worldwide withdrawals per year and that this rate has picked up in recent years. Castka and Corbett (2015: 218) also conclude that "a growing number of firms are withdrawing from certification" to quality standards. These decertification decisions by individual organizations aggregate to detectable macro-level trends. For instance, worldwide certifications of ISO 9001 decreased for the first time in 2011 (Kafel and Simon, 2017). Mastrogiacomo et al. (2021) further highlight that the European diffusion of ISO 9001 reached its highpoint in 2010 at 530,039 certifications and has steadily decreased in subsequent years to only 387,836 certifications in 2017; in fact, 2017 exhibited a downward trend in certifications for all the world's regions except 'East Asia and the Pacific'.[1]

Despite the increased pervasiveness of organizations deciding to withdraw from quality-management certification, a common lament expressed by scholars over the last decade (e.g., Marimon et al., 2009; Alcala et al., 2013; Cândido et al., 2016, 2021; Cândido and Ferreira, 2021a; Kafel and Simon, 2017; Zimon and Dellana, 2020; Ferreira and Cândido, 2021) is that the decertification phenomenon has been largely understudied. Instead of studying the recertification decision and the factors behind decertification, the research on quality standards instead focuses on the initial adoption decision. As Simon and Kafel (2018: 70) underscore, "very few studies have raised the question of what happens when the costs of ISO 9001 outweigh the benefits and companies decide to withdraw from the standard". Castka and Corbett (2015: 218) echo this point when lamenting that "our understanding of this phenomenon is very limited". In support of these observations, Cândido and Ferreira's (2021b) recent literature review and investigation of decertification motivations only identifies nine studies that analyze the factors contributing to quality-standard abandonment—where many of these studies reside in practice-based journals.

While Ardiel (2008) and Cândido et al. (2016) indicate the relevance of organizational influences regarding decertification tendencies, noticeably absent from the literature attempting to explain quality-standard decertification is analysis factoring organizational characteristics. In fact, Castka and Corbett (2015: 218) conclude that the literature on quality-standard adoption shares this neglect of organizational characteristics when stating "we cannot draw firm conclusions about which internal characteristics of firms make them more likely to seek certification". Yet the degree to which an organization is characterized by innovativeness represents a particularly important factor to consider due to the complex nature of the relationship between standards and innovation (Manders et al., 2016; Foucart and Li, 2021). Indeed, Castka and Corbett (2015) point out that it is commonly understood that quality standards stifle innovation; however, mature scholarship that discerns between incremental and radical innovation (e.g., Benner and Tushman, 2002; Prester and Bozac, 2012; Terziovski and Guerrero, 2014; Foucart and Li, 2021) finds standardization to positively affect incremental innovation and negatively affect radical innovation. While the impact of standardization on innovation has received a great deal of attention, Manders et al. (2016) observe that the impact of innovation on standardization has received scant scholarly attention. Accordingly, a thorough study of how the degree of innovativeness influences organizational decertification tendencies involves some novelty by analyzing the impact of innovation on standardization – the reciprocal relationship from the norm in the standards-innovation literature – and by focusing on an organizational driver of decertification.

Our study is then motivated by the decade-long upsurge in decisions to withdraw from quality-management standards, the relative neglect of this contemporary topic in the scholarly literature, and the need to better understand the impact of organizational innovativeness on

decertification. With this background in mind, we contend that innovative organizations exhibit a proclivity to recertify in quality standards, yet radically-innovative organizations will exhibit a proclivity to decertify from quality standards. In formulating these priors, we first examine the underlying costs and benefits residing behind organizational recertification decisions in keeping with the cost-benefit approach typically employed in the literature on quality-standard abandonment. After setting out the relevant costs and benefits that have been highlighted as pertaining to recertification, we consider the characteristics of innovative organizations and how these characteristics might affect cost-benefit recertification calculations. With these foundations, we generate two theoretical priors: (1) innovative organizations – as compared to non-innovative organizations – generally face incentives that favor recertification; (2) radically-innovative organizations – as compared to incrementally-innovative organizations – generally face incentives that favor decertification in quality-management standards.

To test our priors, we compile data from the World Bank Enterprise Surveys that were intermittently undertaken over the 2003 through 2017 period. These surveys capture measures of quality certification and other premise-level characteristics for facilities based in 50 countries and 103 industrial sectors. We take advantage of the data's panel properties by lagging all explanatory constructs in our estimation model and strictly observing facility recertification decisions: the decision to decertify or not, after having previously been certified. This process yields a dataset for empirical analysis of up to 1755 facility-level observations of recertification decisions where a certified facility decides to either decertify or recertify in the subsequent period. We employ probit analysis while sequentially accounting for year-specific, country-specific and industry-specific fixed effects in estimating the impact of an organization's degree of innovativeness on a focal facility's probability of decertifying from a quality-management standard. The empirical results support our theoretical contentions as (1) innovative organizations – as compared to non-innovative organizations – are more likely to recertify, and (2) lower levels of innovation (representative of incremental innovation) favor recertification while higher levels of innovation (representative of radical innovation) favor decertification.

The rest of the paper is organized as follows to support our analysis. Section 2 reviews the relevant background literatures on 'standards and innovation' and 'decertification in quality-management standards' to set the conceptual framework. Section 3 generates our theoretical priors. Section 4 describes the data, explains the variable constructs, and sets out the probit estimation strategy. Section 5 presents the empirical results. Section 6 concludes.

2. Background literature

2.1. Innovative organizations and standardization

Prior to generating our predictions regarding the decertification tendencies of innovative organizations, we must frame our analysis within the greater literature on standards and innovation – see Castka and Corbett (2015) and Manders et al. (2016) for reviews – as our analysis involves some distinctions. For one, the vast majority of scholarship on the standards-innovation relationship endogenizes innovation as the construct of interest. Manders et al. (2016: 43) underscore this point as their "review of the literature [on standards and innovation] shows that almost all of the studies focus on the impact **of** ISO 9001 … rather than **on** ISO 9001". Indeed, Llach et al.'s (2012) finding that structural innovation positively impacts ISO 14000 certification represents the only study we have been able to identify that considers the impact of innovation on standards. Thus, our study departs from the norm to consider how standardization affects innovation to instead analyze the impact of an organization's innovative status on standardization (specifically, decertification in quality standards).

It is also important to convey that the literature on the impact of standardization on innovation involves mixed empirical findings. The

---

[1] Podrecca et al. (2021) report that decertification in corporate-social-responsibility standards has also recently picked up to such a degree that the number of firms decertifying per year now equals the number of firms initially certifying.

Manders et al. (2016) review of the literature observes that half of the studies find an insignificant relationship, while the other half of studies are split between those detecting a negative and those detecting a positive relationship. This sobering empirical reality is important to highlight as many observers falsely presume that standards unambiguously involve a negative effect on innovation. Castka and Corbett (2015: 196) underscore this point well when they state that there is a "view … heard anecdotally that standards such as ISO 9000 and ISO 14000 stifle innovations". More promisingly, studies which distinguish between incremental and radical innovation (e.g., Benner and Tushman, 2002; Prester and Bozac, 2012; Terziovski and Guerrero, 2014; Foucart and Li, 2021) potentially resolve the mixed empirical findings, as they often find standardization to positively affect incremental innovation and negatively affect radical innovation. This distinction between incremental and radical innovation is relevant for our analysis; thus, we will base our conceptual framework on distinguishing between incrementally-innovative and radically-innovative organizations. Accordingly, we are mindful that generating richer theoretical and empirical analysis requires differentiating between organizations that have not attained innovation, have attained an incremental innovation, and have attained a radical innovation.

As such, we should briefly review the nature of organizational innovativeness. The OECD (2005) holds that an innovative organization is generally considered to be one that has recently implemented an innovation where the innovation can be either developed or adopted. This definition sets up a contrast between innovative and non-innovative organizations that is agnostic with respect to the traditional distinction between process and product innovations (Amendola and Bruno, 1990). Instead, such a definition centers on the ability of an organization to successfully navigate the arduous process of moving an invention – may it be process or product oriented – from inception to implementation (Ansoff, 1968). For instance, Baldwin (2020) focuses on the realization of steps in a multi-step process when considering how technology shapes an organization. Other observers (e.g., Glynn, 1996; Amendola and Bruno, 1990; Lazonick, 2005, 2010; Lam, 2011) underscore that an organization's commitment to learning resides behind an ability to translate inventions into realized product and process innovations.

While our conceptual framework begins by distinguishing between establishments that have attained a base level of innovativeness by implementing an innovation (i.e., innovative organizations) and non-innovative organizations, we extend our analysis to consider the decertification tendencies of organizations committed to radical-innovation and incremental-innovation endeavors. In order to clarify terms, incrementally-innovative organizations generally undertake small changes to their technological trajectory that are based on their current technical capabilities, while radically-innovative organizations attempt to substantially alter their current technological trajectory to generate fundamentally new technical competencies (Manders et al., 2016). Foucart and Li (2021) add to the distinction between incrementally- and radically-innovative organizations by respectively highlighting the difference between innovations taking place within a technology life cycle and innovations beyond the present technology cycle. Accordingly, our analysis will follow through on the calls by Benner and Tushman (2002, 2003), Manders et al. (2016) and others for scholarship that distinguishes between incrementally-innovative and radically-innovative organizations.

2.2. Decertification in quality-management standards

Briefly characterizing the limited literature on quality-management decertification also helps with respect to setting the foundations and situating our conceptual analysis. In particular, Ferreira and Cândido (2021) observe that existing studies can be broken down into those considering the performance consequences of decertification and those considering the drivers of decertification. The literature focusing on performance consequences indicates a lack of consensus as some studies find a decline in business performance after decertification (e.g., Alič, 2014) while others find no decline after decertification (e.g., Cândido et al., 2016, 2021). The literature focusing on decertification drivers is also characterized by a lack of consensus with a variety of decertification rationales and motivations having been posited—see Cândido and Ferreira (2021b) for a comprehensive review. Yet noticeably absent from the literature attempting to explain quality-standard decertification is analysis that factors the organizational characteristics which might influence decertification. Ardiel (2008) represents an exception to this observation as she finds an organization's place within a network of affiliated organizations to determine recertification behavior. Cândido et al. (2016) also hint at the relevance of organizational factors when observing that decertified Portuguese firms have more employees, assets, risk, cash, profits, and limited size as compared to their counterparts.

Our focus resides on the propensity for innovative organizations to abandon quality-management standards, thus it is instructive to consider the primary motivations and rationales for withdrawal that have been set out in the decertification literature. The most common framework employed to consider the decision to withdraw from quality-management certification involves a cost-benefit analysis where the evident costs of recertification potentially outweigh constrained benefits (e.g., Lo and Chang, 2007; Alcala et al., 2013; Simon and Kafel, 2018; Cândido et al., 2021; Zimon and Dellana, 2020). Alcala et al. (2013: 232) support this approach when stating that "obviously, the reason why organizations decide not to renew the certification is because the costs associated with keeping outweigh the benefits". In fact, a cost-benefit approach is potentially more applicable to recertification decisions than to initial certification decisions since recertifying organizations can draw from actual experiences with the standard while initially certifying organizations must draw from expectations. We accordingly set out here the relevant costs and benefits that have been considered in the literature to reside behind the decision to withdraw from a quality-management standard.

First, recertification in a quality-management standard involves certain costs in terms of financial resources and managerial time. For instance, Simon and Kafel (2018) make clear that recertification involves more than just a financial cost, but also a substantial commitment of human resources and an aligning of the organization to the quality standard. In a similar vein, Alcala et al. (2013) highlight the considerable amount of paperwork involved with recertification and how this contributes to decertification. Accordingly, the direct and indirect costs of recertifying can be broken down into the internal costs for documentation, internal audits and system review, the costs involved with hiring consultants, the costs involved with recertification auditors, the costs involved with post-recertification surveillance audits, and finally the costs involved with ongoing quality-system maintenance. Moreover, these direct and indirect costs are reported to vary depending on organizational size and complexity, the sector of operation, the number of employees, and the pre-audit status of the quality-management system.[2]

The difficulties involved with summing these various costs and attaching a weight to the heterogenous characteristics of organizations has led to scholars generally citing a relatively wide range within which total certification costs may fall: e.g., Delmas and Montiel (2009)

---

[2] For an example of this breakdown, see https://reciprocity.com/resources/what-does-iso-certification-cost/. Cândido and Ferreira (2021b) manifest an alternative means to breaking down recertification costs by focusing on the relevant internal and external barriers—i.e., costs. Furthermore, Cândido and Ferreira (2021b:4) point out that "the persistence of these barriers *after certification* can act by itself as a set of internal motivations for subsequent decertification" which suggests that recertification barriers (both internal and external) and cost-based decertification motives represents yet another means to breaking down the overall costs involved with recertification.

provide a range from fifty-thousand up to one-million dollars; Bansal and Bogner (2002) provide a range of $10,000 to $200,000; and Zutshi and Sohal (2004) provide a range of $5000 to $100,000. In addition, Castka and Corbett (2015) provide an overview of the practitioner literature that focuses on the costs (both direct and indirect) involved with certification in ISO 9000 and the related ISO 14000. While the exact costs involved with recertification are difficult to quantify, recertifying and retaining a quality standard represents a non-trivial task for organizations that ultimately requires a sizeable amount of capital and labor (e.g., Blind, 2004; Potoski and Prakash, 2005; Delmas and Montiel, 2009). It is no surprise then that the cost of recertification is cited as the most common rationale behind the decision to withdraw from a quality-management standard (e.g., Lo and Chang, 2007; Kafel and Nowicki, 2014; Kafel and Simon, 2017; Zimon and Dellana, 2020). In fact, Alič (2014) finds that decertifying organizations are more likely to experience insolvency in subsequent years, thus suggesting that decertification is a harbinger of fundamental business issues. Accordingly, if the costs of retaining a quality-standard certificate are particularly salient for an organization, then rational-minded managers will be less likely to recertify when these costs begin to outweigh any recertification benefits.

Second, recertification in a quality-management standard would certainly be supported by the presence of internal benefits for the organization. Quality-management standards are intended to promote an organizational culture dedicated to quality that yields internal benefits with respect to improved product quality, cost control, and production efficiency (Hudson and Jones, 2003). Zimon and Dellana (2020) further highlight how improvements in the organization of work, the division of responsibilities, and the unification of documentation represent pertinent internal benefits to the continuance of a quality standard. That said, many firms have reported substantial obstacles with respect to properly implementing these standards (Gray et al., 2015; Cândido et al., 2021; Zimon and Dellana, 2020), and as a result the internal benefits of these standards are often not fully realized (Gallivan, 2001; David, 2020). In particular, the scarcity of time and human resources to actively participate in developing, improving, and implementing the quality standard represent frequently cited obstacles.

With the above as a backdrop, Kafel and Nowicki (2014) set out that the inappropriate adoption and implementation of quality standards can contribute to decertification as the internal benefits of the standard will simply not manifest when implemented poorly. In line with these priors, Kafel and Simon's (2017) analysis of managerial motivations found that the lack of internal benefits represented the second – where the cost implications represented the first – most-important rationale behind the decision to withdraw from quality standards. In addition to the above, some scholars (e.g., Ardiel, 2008; Kafel and Nowicki, 2014; Ferreira and Cândido, 2021) hold that a thorough and complete initial adoption of the quality standard may yield a substantial complement of internal benefits; thus, future internal benefits are partially irrespective of the recertification decision. If the internal benefits of quality standards are separated from recertification, then a milk-for-free decertification rationale manifests due to the presence of non-trivial recertification costs. Accordingly, if the internal benefits of retaining a quality-standard certificate are limited for an organization, then rational-minded managers will be less likely to recertify as the recertification costs become more salient.

Third, recertification in a quality-management standard would also be supported by the presence of external benefits for the organization. In fact, Anderson et al. (1999) point out that quality-management standards represent a credible signal of process quality that distinguishes the adopter from uncertified competitors. Scholars have followed this seminal insight by contending that quality standards reduce the transaction costs and information asymmetries faced by customers (e.g., Blind, 2004; Terlaak and King, 2006; Clougherty and Grajek, 2008, 2014; Delmas and Montiel, 2009; Gopal and Gao, 2009; King and Toffel, 2009; Singh et al., 2011) which in turn ultimately leads to increased

sales and improved performance (Hendricks and Singhal, 1997) for those organizations maintaining certification. The above said, many firms have complained that the external benefits of certification fail to manifest (Kafel and Nowicki, 2014; Simon and Kafel, 2018; David, 2020; Ferreira and Cândido, 2021). Specifically, certified organizations do not always perceive substantial reductions in transaction costs and information asymmetries, as neither their stakeholder image nor their customer satisfaction improves by retaining a quality-management standard.

Ardiel (2008) illustrates these issues well in her interview-based study of 38 British Columbian cherry growers experiencing the introduction of the Globalgap standard in 2004. The Globalgap for good agricultural practices is a business-to-business standard that involves third-party certification and surpasses Codex's food safety and quality standards; moreover, this retailer-driven standard is considered beneficial with respect to penetrating the European market. Ardiel (2008) found that more than half of the 24 growers who initially adopted Globalgap in 2004 had dropped the quality standard by 2008. She attributes this high rate of decertification to the fact that the 14 cherry growers that did not initially certify were still able to sell to European markets that supposedly required the standard; i.e., certified growers failed to reap external advantages as compared to non-certified growers. Indeed, the failure by customers to require certification in a standard resides behind the lack of external benefits for recertification in many contexts beyond cherry growing (e.g., Kafel and Nowicki, 2014; Ferreira and Cândido, 2021). In addition to failed external differentiation, Kafel and Simon (2017) point out that there also exist substitutes for quality-management standards that do not require formal certification. Accordingly, if the external benefits of retaining a quality-standard certificate are not extensively present for an organization, then rational-minded managers will be less likely to recertify as the recertification costs become more salient.

Summarizing the above, the limited literature attempting to explain decertification from quality management standards has focused on three primary rationales to explain certification abandonment: time and financial costs, lack of internal benefits, and lack of external benefits. With these primary rationales in mind, we turn now to considering the nature of innovative enterprises to generate priors with respect to the proclivity of these organizations to withdraw from quality-management standards.

3. Theoretical framework

We move forward here to generate predictions with respect to the decertification proclivities of organizations characterized by different levels of innovativeness. Specifically, we first discern the characteristics of innovative – as compared to non-innovative – organizations and then consider how innovative organizations might generally fare with respect to the three primary rationales explaining certification abandonment: time and financial costs, lack of internal benefits, and lack of external benefits. Second, we consider the differences between radically-innovative and incrementally-innovative organizations and set out three specific downsides – inhibited investment, reduced exploration, and static lock-in – which particularly pertain to radically-innovative organizations and thus affect recertification calculations by favoring decertification in quality standards.

3.1. Innovative organizations versus non-innovative organizations

First, engaging in innovation activities requires both financial funds and human resources to develop inventions and sustain the processes that ultimately generate realized product and process competencies (Lam, 2011). Indeed, it has been long recognized (e.g., Schumpeter, 1934, 1939; Amendola and Bruno, 1990) that sufficient capital and labor resources within an organization must be present for innovation to come about. Accordingly, innovative organizations are seemingly

characterized by adequate funds and labor resources, thus indicating less focus on the potential cost savings from dropping quality-standard certification. Beyond the evident contrast between innovative and non-innovative organizations in terms of available resources – particularly financial – is the reality that these organization types approach the concept of cost efficiency in a fundamentally different manner. Specifically, many observers (e.g., Klein, 1988; Favereau, 1989; Foray, 1991) claim that innovative organizations focus on technical efficiencies (altering production functions in profitable directions) in lieu of common efficiencies (combining production inputs in an optimal manner). This logic points to organizations being willing to underwrite certain costs (e.g., quality standards) that support the goals of establishing learning capacities and profitable directions. Accordingly, the tendency for innovative organizations to be characterized by ample capital and labor resources, combined with a proclivity to incur any necessary costs in pursuit of innovation, indicates that innovative organizations will be relatively less incentivized to withdraw from quality-management standards, as they are less fixated on the recertification costs that often drive decertification.

Second, the ability to internally integrate resources represents an additional organizational trait that is necessary to engage in innovation activities (Foray, 1991). Lam (2011) points out that innovative organizations require coordination across specialist functions, knowledge domains, and application contexts. Foray (1991) specifies some of these necessary linkages when pointing out that research, analytical design, testing, redesign, and marketing functions are all complementary to the innovation-creation process. In a similar vein, Lazonick (2005, 2010) highlights how the internal control, allocation, and coordination of resources are essential when an organization prioritizes innovation. The strategy literature also views organizational and managerial processes that support integration, learning, and reconfiguration as representing the core elements behind innovative firms (e.g., Teece et al., 1997; Teece, 2007). These realities point to innovative organizations attaching a particularly high value to investments that assist in the organization of work, the division of responsibilities, and the unification of documentation; i.e., the internal benefits of quality standards highlighted by Zimon and Dellana (2020). Moreover, if learning and knowledge integration represent the foundation of innovation as noted by many scholars (e.g., Glynn, 1996; Lazonick, 2005, 2010; Lam, 2011), then the language-codification properties associated with quality-management standards (e.g., Bénézech et al., 2001) will be quite helpful in aiding internal communication and learning. As such, innovative organizations stand to lose more internal benefits as compared to non-innovative organizations when decertifying.[3] Accordingly, the tendency for innovative organizations to highly value processes that abet learning, internal coordination, and knowledge sharing indicates that these organizations will be relatively less incentivized to withdraw from quality-management standards as they are less likely to experience the deficient internal benefits that often drive decertification.

Third, innovative organizations may also highly value the external benefits of recertification, as supporting inter-firm – not just intra-firm – cooperation may be quite important when engaging in innovative activities. The creation of supply-chain linkages at a global scale requires fidelity to cross-firm connections and a conception of inter-firm organizational architectures that are appropriate for effective interactions (Foray, 1991). As already noted, quality-management standards have been widely considered to be effective in reducing the transaction costs and information asymmetries which endanger such business-to-business interactions (e.g., Blind, 2004; Terlaak and King, 2006; King and Toffel, 2009). Recall that the major sources of transaction costs are uncertainty,

the frequency of interaction updates, and the presence of asset specificity (Williamson, 1985); thus, innovative organizations naturally face business contexts with high transactions costs (Teece, 1998; Wolter and Veloso, 2008). Accordingly, innovative organizations may place a particularly high value on the external benefits that are entwined with quality-management standards due to the inherently high transaction costs and information asymmetries that are involved with innovation. More generally, Adler (1999) points to how complex and innovative organizations require formalized procedures to assure efficiency, quality conformance, and timeliness to customers. Manders et al. (2016: 46) apply this logic when noting that "standards can create a quality compliance culture in which any risks of disturbing existing customers are eliminated" via the signaling effect of quality standards. As such, the buyers of products from innovative organizations are likely to attach a sizeable value on standards that reduce transactions costs and information asymmetries; thus, these buyers of innovative products are likely to require recertification in quality standards to secure future business transactions.

In addition to innovative organizations valuing quality standards more so than non-innovative organizations, it is worth revisiting formal signaling theory as set out by Spence (1973, 1974, 2002). For innovative organizations to reap the external benefits of quality standards, a separating equilibrium must exist as this represents the primary predictive mechanism in signaling theory. Simply put, buyers must be able to separate high-quality from low-quality organizations based on the observable signal as otherwise the explanatory insights from the theory may not realize (Bergh et al., 2014). As Spence (2002: 448) laid out in his Nobel laureate lecture, "the standard case of signaling in which the signal has the capacity to survive and retain its informational content occurs when there is an unobservable attribute that is valuable to buyers … and the costs of undertaking some activity that is observable are negatively correlated with the valued attribute". In essence, differences in signaling costs – where low-quality organizations face higher certification costs as compared to high-quality organizations – provide the basis for a selection process characterized by a separating equilibrium (Delmas and Montiel, 2009; Bergh et al., 2014). Moreover, the conjecture here is that innovative organizations are better able to establish such separating equilibriums as compared to non-innovative organizations. Accordingly, the tendency for innovative organizations to highly value the external benefits of quality-management standards and their ability to sustain a separating equilibrium indicates that innovative organizations will be relatively less incentivized to withdraw from quality-management standards, as they are less likely to experience the deficient external benefits that often drive decertification.

Evident throughout the above discussion is that the common drivers of quality-standard decertification – time and financial costs, lack of internal benefits, and lack of external benefits – are less germane for innovative organizations as compared to non-innovative organizations. Organizations with a base level of innovation are generally characterized by adequate labor and capital resources and will generally value the internal and external benefits that quality-management standards can convey.[4] Accordingly, we expect innovative organizations to robustly value the healthy properties of quality standards and to consequently engage in cost-benefit analyses that favor recertification. In other words, we hypothesize that innovative organizations exhibit a tendency to refrain from dropping certification when facing a recertification decision, as compared to non-innovative organizations. Based on the above reasoning, we set out the following a priori expectation:

H1. Innovative organizations are less likely than non-innovative organizations to withdraw from quality-management standards.

---

[3] In unreported auxiliary testing, we provide some evidence that innovative organizations generally experience larger internal benefits – as measured by changes in labor productivity – due to quality certification as compared to non-innovative organizations. These tests are available upon request.

[4] Indeed, Cândido and Ferreira (2021a) find the internal and external benefits of standardization are generally entwined.

3.2. Radically-innovative versus incrementally-innovative organizations

The received wisdom in the standards-innovation literature is that quality-management standards are consistent and supportive of incremental innovation. In fact, quality-management standards have been found to positively influence the process innovations (e.g., Terziovski and Guerrero, 2014), exploitative innovations (e.g., Benner and Tushman, 2002), and new product launches (e.g., Prester and Bozac, 2012) which reside behind incremental innovation. For instance, Foucart and Li (2021) illustrate how standards foster the incremental innovation that allows firms to narrow the gap between themselves and the existing technological frontier. In such a context, standards can aid the development, commercialization, and diffusion of technologies within a particular life cycle. Accordingly, the additive learning along a given technological trajectory that is characteristic of incrementally-innovative organizations suggests that such organizations will fail to experience any additional negative effects with respect to their modest innovation aims when undertaking quality-management recertification.

The standards-innovation literature has, however, long held the concern that quality-management standards are incompatible with radical innovation. Swann (2010) notes that standards constrain the activities inherent to radically-innovative organizations that are pushing through the existing technological boundaries. Indeed, a number of scholars (e.g., Conti, 1999; Blind, 2002, 2004; Mendel, 2002) have expressed the concern that standards may stifle radical innovation. Benner and Tushman (2003: 238) succinctly make this point when stating that standards "are fundamentally inconsistent with all but incremental innovation". Accordingly, the exponential learning driving new technological trajectories that is characteristic of radically-innovative organizations suggests that such organizations will experience additional negative effects with respect to their ambitious innovation aims when undertaking quality-management recertification. We focus here on three specific downsides – inhibited investment, reduced exploration, and static lock-in – which might particularly pertain to radically-innovative organizations that retain quality certification. Moreover, these downsides may overshadow the cost-benefit calculation for recertification – akin to Cândido et al.'s (2021) assessment – and thereby favor decertification in quality standards by radically-innovative organizations.

First, the concern that quality standards inhibit direct investments in the technologies which underpin radical innovation has long been manifest in the literature focusing on the nexus between standards and innovation (e.g., Tassey, 2000). Within this discourse, Naveh and Erez (2004) conjecture that the attention to detail which is habitual of quality standards promotes conformity to precision, procedures, and rules which in turn negatively affects investment decisions. In addition, the process approach elements to quality standards have also been considered to discourage investments in radical innovations (Benner and Tushman, 2002; Terziovski and Guerrero, 2014). In essence, certification in a quality standard influences the intra-organizational selection of investment types by shrinking radical investments. Indeed, Foucart and Li (2021) formalize the intuition that the use of a standard lowers the marginal benefit of technological investment. As a result, the organizations which are most able to invest in radical innovation are less willing to incur the certification costs involved with standards. The use of quality-management standards may then decrease the gains from investing in radical innovations and thereby inhibit such investments.

Second, the concern that quality standards drive out the exploratory learning which leads to radical innovation has been expressed by a number of scholars (e.g., Conti, 1999; Benner and Tushman, 2002, 2003; Naveh and Erez, 2004). For instance, Benner and Tushman (2002) argue that quality standards decrease variance in organizational routines, and that this homogeneity in routines reduces the explorative activities which generate radical innovation. Pekovic and Galia (2009) point to quality standards involving lowered flexibility, reduced openness to change, and less ambiguity in task design; hence, the rigidities which are

synonymous with standardization potentially reduce the exploration which is essential for radical innovation. Similarly, Mangiarotti and Riillo (2010) highlight the fact that standards increase the bureaucratization of business processes, thus forming an obstacle to exploring for new and more radical technological opportunities. Naveh and Erez (2004: 1577) encapsulate these arguments well when stating that exploration and radical innovation require "a culture that encourages responsiveness to new opportunities, breaking existing paradigms, autonomy, risk taking, and tolerance for mistakes". Indeed, if activities associated with uncertainty, improvisation, and brainstorming are inconsistent with quality-management standards, then the exploration which leads to radical innovation may be substantially reduced as a result of continued quality certification.

Third, certification in quality standards has been associated with a lock-in danger where organizations settle for the technological status quo and fail to leap to a new technological trajectory (e.g., Blind, 2002, 2004). For instance, Terziovski and Guerrero (2014) point to stalling effects on innovation adoption and time to market due to quality-management standards. In a similar vein, Benner and Tushman (2002) observe that the reduced experimentation characteristic of standardization exacerbates inertia and impedes organizational adaptation and responsiveness to shifts in the environmental context. Indeed, Conti (1999) and Benner and Tushman (2003) both hold that quality management is compatible with stable industry environments, but fundamentally inconsistent with contexts that are characterized as dynamic. Moreover, radical innovation that leaps to the next frontier becomes impossible when an organization is resistant to change and accepting of a competency trap. Foucart and Li's (2021) analysis also highlights how standardization can excessively prolong existing technological lifecycles and delay the transition to the next technological platform. Recertification in quality-management standards may then lead to static lock-in effects where radical innovation that pushes past the technological frontier fails to manifest.

Evident throughout the above discussion is that certification in quality-management standards involves three specific downsides – inhibited investment, reduced exploration, and static lock-in – which might particularly pertain to radically-innovative organizations. That is, radically-innovative organizations are likely to place a high value on the reaping of gains from technological investments, the ability to engage in exploratory-learning activities, and the opportunity to innovate beyond the current production possibility frontier. As such, organizations aiming for radical innovation will experience additional negative effects that interfere with their ambitious innovation aims if they retain quality certification. These negative effects may overshadow recertification cost-benefit calculation as the relevant decision-making paradigm for radically-innovative organizations, thereby favoring decertification in quality-management standards. In other words, we hypothesize that radically-innovative organizations contrast with incrementally-innovative organizations by exhibiting a tendency to drop certification when facing a recertification decision. Based on the above reasoning, we set out the following a priori expectation:

H2. Radically-innovative organizations are more likely than incrementally-innovative organizations to withdraw from quality-management standards.

4. Data and methods

4.1. Data coverage

Our data derive from the World Bank's Enterprise Surveys for business operations which provide detailed facility-level information on a representative sample of commercial enterprises in participating countries. The World Bank surveys include the necessary data to create variable constructs that identify the predictions from our theoretical priors: i) whether an organization is certified in a quality-management

standard; and ii) whether an organization has implemented a breadth of innovation activities (i.e., licensed a foreign technology, engaged in R&D spending, developed a new product or service, and received a patent). The World Bank surveys also provide detailed data on the economic activities of these organizations allowing for the creation of control constructs. Details of the sampling procedures can be found in the survey implementation notes published by the World Bank.[5] To the best of our knowledge, the World Bank surveys represent the best facility-level data source to comprehensively study our questions of interest. That said, the usual disclaimers apply with respect to response biases potentially introducing measurement error when creating variable constructs. While the World Bank represents a reputable institution with the expertise, experience, and resources to undertake appropriate survey methods, the biases of respondents – particularly prestige bias – should be acknowledged.

While the World Bank engaged in a myriad of country surveys throughout the cross-national context from 2003 through 2017, we restrict our initial sample to the 50 countries that experienced two or more surveys at different points in time over this period. We do this to introduce panel elements to the data by capturing the certification status of focal facilities across time. Table 1 lists the 50 countries and the country-specific survey years; and organizes the survey years into the four-specific time periods we construct for analysis. The creation of the four time periods (period 1: 2003; period 2: 2006; period 3: 2007–2011; period 4: 2012–2017) was necessary as the World Bank did not consistently survey all 50 countries at regular intervals. For instance, the Dominican Republic was surveyed in 2010 and 2016, while Bulgaria was surveyed in 2009 and 2013. Importantly, the time gaps between two consecutive survey years almost always involve at least three years and typically involve five years. These time gaps correspond reasonably well to the frequency – three-year cycles – with which quality-management certification decisions are made by organizations. As already alluded to, this is quite important as we must observe a facility over at least two consecutive time periods to condition current certification on past certification and make meaningful inferences regarding recertification decisions—the focus of our study. To provide further perspective on the data, our initial compilation efforts yielded a dataset composed of 9585 facilities and 19,954 facility-period observations. The estimation sample, however, drops to a high of 1755 observations as we seek to employ the data's panel properties to make stronger causal inferences (Wooldridge, 2002).

4.2. Variable constructs

Since we aim to make statistical inferences with respect to decertifying quality-management standards, the recertification decisions of focal facilities regarding quality standards represents our dependent variable of interest. We build this dependent construct based upon the responses to the World Bank survey question of "Does this establishment have an internationally recognized quality certification?". By looking at the responses to this question in a sub-sample of facilities that previously answered in an affirmative manner – i.e., facilities that were quality-management certified in the previous period – we can empirically capture recertification decisions. This conditioning on previous-period certification is largely responsible for the drop in observation numbers from the initial dataset to the estimation sample. While the survey allows for different responses concerning the organization's certification status (see Table 2 for the breakdown in answers), we follow Hudson and Orviska's (2013) precedent – as they also employ World Bank survey data – by considering 'yes' and 'Still in process' as responses which affirmatively indicate a facility's certification in a quality-management system, while 'No' is the unique response indicating a lack of

Table 1

Countries in the sample, year of the survey, and panel structure of the data.

Country	Period 1 (2003)	Period 2 (2006)	Period 3 (2007–2011)	Period 4 (2012–2017)
Albania			2009	2013
Bangladesh			2007	2013
Belarus			2008	2013
Bosnia and Herzegovina			2009	2013
Bolivia		2006	2010	2017
Bulgaria			2009	2013
Cameroon		2006	2009	2016
Chile		2006	2010	
Cote d'Ivoire			2009	2016
Croatia			2009	2013
Dominican Republic			2010	2016
DR Congo			2010	2013
Ecuador	2003	2006	2010	2017
El Salvador		2006	2010	2016
Ethiopia			2011	2015
Georgia			2008	2013
Ghana			2007	2013
Honduras	2003	2006	2010	2016
Indonesia			2009	2015
Kazakhstan			2009	2013
Kyrgyzstan			2009	2013
Laos[a]		2009	2012	2016
Latvia			2009	2013
Lithuania			2009	2013
Mexico		2006	2010	
Moldova			2009	2013
Mongolia			2009	2013
Montenegro			2009	2013
Myanmar[a]			2014	2016
Nepal			2009	2013
Nicaragua	2003	2006	2010	2016
Pakistan			2007	2013
Panama		2006	2010	
Paraguay		2006	2010	2017
Peru		2006	2010	2017
Philippines			2009	2015
Romania			2009	2013
Senegal			2007	2014
Serbia			2009	2013
Tajikistan			2008	2013
Timor			2009	2015
Turkey			2008	2013
Ukraine			2008	2013
Uruguay		2006	2010	2017
Uzbekistan			2008	2013
Venezuela		2006	2010	
Vietnam			2009	2015
Yemen			2010	2013
Zambia			2007	2013
Zimbabwe			2011	2016

[a] Laos & Myanmar represent exceptions for time-period placement due to relatively tight times gaps between surveys.

Table 2

Survey responses and number of certified facilities by period.

Response	Period 1	Period 2	Period 3	Period 4	Total
No	589	2502	6999	5477	15,567
Don't know	0	38	70	166	274
Still in process	0	67	204	69	340
Yes	50	582	1772	1369	3773
Total	639	3189	9045	7081	19,954
Adoption rate	7.8 %	20.4 %	21.8 %	20.3 %	20.7 %

certification. While Cândido et al. (2021: 632) observe that "decertification may result from the loss of interest in certification or from the inability of the firm to comply with the standards", we are unfortunately unable to differentiate voluntary abandonment from failed recertification audits with this data.

The ISO 9000 series of quality standards will certainly be well

represented in our survey results, as this series represents the most popular quality certification accepted globally.[6] Many survey respondents, however, will view other approaches to quality-management control (e.g., ISO 13485, IATF 16949, and QS 9000) as fitting the surveyed criteria. Thus, while we see the potential for the standards referred to in the World Bank survey as being ISO 9000 standards to a considerable extent, it is best to conservatively refer to these standards in line with the survey question; i.e., it is simply the respondents determination as to whether the facility has "an internationally recognized quality certification". Table 2 shows 4113 (3773 'Yes', and 340 'Still in the process') instances of certification amongst the 19,954 facility-period observations in our initial sample according to this definition. Furthermore, inspecting certification trends across time reveals that decertification outpaces new certifications leading to a decline in the adoption rate in the last period of our sample. Accordingly, the worldwide trend toward increased decertification from quality-management standards is reflected in our data.

We require categorical information on the innovative nature of our sampled facilities – innovative versus non-innovative organizations – to directly test our first theoretical prior. Recall that innovative organizations are ones that have recently implemented an innovation via development or adoption (OECD, 2005). We follow Balsmeier et al. (2014) by considering internal R&D activities and patents as indicators of internally developed and implemented innovations; and we use technology licenses and the introduction of a new product/service to capture the implementation of adopted innovations. Specifically, our variable construct is based on four indicators of the focal facility employing an innovative technology in a given period: (i) employing a licensed technology from a foreign-owned firm, (ii) owning a technology that has been patented, (iii) undertaking R&D activities (other than just market research), and (iv) introducing a new product or service to the market over the past three years. We set this construct equal to one if any of the four innovative technology indicators equals one; however, if all four indicators equal zero or return missing values, then we set this construct equal to zero (hereafter referred to as Innovative-Organization). Defined in this manner, 948 of the 1755 observations in our estimation sample involve innovative organizations.[7] In line with the first hypothesis, we expect a negative relationship between innovative organization and the decertification probability.

We require continuous information on the innovative nature of our sampled facilities to distinguish between incrementally-innovative and radically-innovative organizations and test our second theoretical prior. To do so, we construct an index based on the same four indicators from above reflecting the focal facility's innovation status. We set this construct equal to the number of innovation indicators that equal one; however, if all four indicators equal zero or return missing values, then we set this construct equal to zero (hereafter referred to as Organizational-Innovativeness). Defined in this manner, there are 422, 369, 140, and 17 observations in our estimation sample that respectively take the values one, two, three, and four in our innovation index.[8] We employ the linear and quadratic terms for organizational innovativeness as regressors in the estimation equation to test our second hypothesis. For incrementally-innovative organizations, the organizational-innovativeness measure will involve a relatively-smaller value such that the overall effect of innovation breadth on decertification will principally manifest through the linear term. As such, the estimated coefficient for the linear term also represents an additional indirect test of our first hypothesis. Yet for radically-innovative organizations, the organizational-innovativeness measure will involve a relatively-larger value such that the overall effect of organizational innovativeness on decertification will principally manifest through the quadratic term. Thus in line with the second hypothesis, we expect the quadratic-term for organizational innovativeness to positively impact the probability of decertification.

This means of empirical testing is silent with respect to the actual levels of organizational innovativeness which equate to incrementally-innovative and radically-innovative organizations. Instead, our sample of organizations must provide sufficient variation in the breadth of innovation activities such that higher scores on the innovation measure represent the presence of an organization that is more-radically innovative. Foucart and Li (2021: 2) support such a variable operationalization when they observe that "a firm investing substantially … [and widely] … is ex ante, more likely to deliver radical innovation". Indeed, our World Bank data involves surveys of organizations that are largely present in emerging and transition nations; hence, it is fair to assume that radically-innovative organizations may not present at substantial frequencies in our sample. In addition then to Delmas's (2002) observation that the institutions in emerging markets might negatively affect the diffusion of international standards, these institutions might also negatively affect the diffusion of radical innovation. An important caveat to our empirical analysis is then that narrow populations that overwhelmingly consist of radically-innovative organizations (e.g., the bio-tech firms along Route 128) might be characterized by average tendencies that reflect decertification behavior. Yet the relevance of this point would only pertain to small samples, as Foucart and Li (2021) support the fact that incremental innovation tends to dwarf radical innovation even in developed-nation populations.

Nevertheless, if our measure of organizational innovativeness manifests a negative coefficient estimate for the linear-term and a positive coefficient estimate for the quadratic-term, then the potential exists for organizations with low values of innovativeness to be characterized by a net-negative effect on decertification probabilities and for organizations with higher values of innovativeness to be characterized by a net-positive effect on decertification probabilities. If our hypotheses are empirically supported, then an empirical means that allows detecting the manifestation of incrementally- and radically-innovative organizations in our data would be to calculate the net impact of organizational innovativeness on the probability of decertification at each level of the index. Under such an approach, the values of the organizational-innovativeness index for which the net-effect of the linear and quadratic terms is negative (positive) will be consistent with what is an incrementally-innovative (radically-innovative) organization.

While the above represent our explanatory variables of principal interest, it behooves us to factor control constructs that conform to the preexisting literature concerning what drives organizational certification – and decertification – in quality-management standards to yield

---

[6] For a sub-sample of our estimation sample, we have information on the quality standard held by the organization. There, we find that ISO 9000 is indeed the most popular quality-management standard, as it is listed as the relevant standard in some 82 % of the cases when the organization claims to having an internationally-recognized quality certification.

[7] By treating missing observations in the four innovation indicators as zeros, we falsely treat some innovative organizations as non-innovative. This increases the number of usable observations for statistical inferences, but introduces an attenuation bias in our empirical model. Accordingly, we underestimate the true effect of being an innovative organization. The advantages to this approach involve (i) conservative hypothesis testing, and (ii) the ability to fully employ the information in control variables – observations which would otherwise be dropped – and thereby increase estimation efficiency. This is particularly the case with respect to the questions regarding the 'licensing of foreign technologies' and the 'introducing of new product/services' as they were not included in every national survey.

[8] The relatively small number of observations with scores of 4 is due to a few reasons. First, missing values are treated as zeros. Second, our sample is drawn from emerging and transition nations where the innovation efforts of organizations are likely to be more modest in nature. Furthermore, the indicators reflecting R&D and patenting activities overwhelmingly present when organizational-innovativeness equals 3; thus, these activities appear to be strongly associated with higher degrees of radicalness.

stronger causal inferences. First, older organizations have been found to be less (e.g., Delmas and Montiel, 2009) and more (e.g., Hudson and Orviska, 2013; Ullah et al., 2014) likely to be certified in standards; thus, we control for the focal facility's age via the number of years since its establishment (hereafter referred to as Organizational-Age). Second, larger organizations more readily taking up quality-management systems is arguably the most dominant empirical finding in the adoption literature (Terlaak and King, 2007; Levine and Toffel, 2010; Castka and Corbett, 2015); thus, we control for the focal facility's size via its number of permanent employees and total sales (hereafter respectively referred to as Permanent-Employment and Total-Sales). By extension, we expect that the relationship between organizational size and decertification probability to be negative. Third, a focal organization may benefit from being part of a larger firm, as the quality standard could provide a price premium across multiple products. There may also be efficiencies involved with retaining standards across a set of facilities within a larger firm; thus, we control for whether the focal facility is part of a multi-facility organization (hereafter referred to as Multi-Facility-Organization). We expect that multi-facility efficiencies make it less likely for the focal facility to decertify, hence the impact of Multi-Facility-Organization on the probability of decertification is expected to be negative. Fourth, exporters are generally the first to seek certification due to the extensive benefits of quality-management standards in foreign markets (Anderson et al., 1999; Christmann and Taylor, 2001; Corbett, 2006). As argued in the preexisting literature, international buyers face greater transactions costs and information asymmetries, and quality-management certification can alleviate these barriers and be conducive to trading relationships (e.g., Blind, 2001; Hudson and Jones, 2003; Terlaak and King, 2007; Clougherty and Grajek, 2008, 2014). Thus, we control for whether the organization is an exporter (hereafter referred to as Exporter) and expect this construct to negatively impact decertification probability.

In addition to the above, we were able to employ the World Bank survey data to yield an additional control construct that might affect organizational decertification from quality-management standards. A number of studies (e.g., Desai, 2018) point to the pool of certified firms affecting focal firm certification behavior. To this end, we measure the adoption rate of the appropriate competitor reference group for our focal facilities. Specifically, we use the most common conceptualization in the literature (e.g., Delmas and Toffel, 2004; King et al., 2005; Terlaak and King, 2007) as to what is the appropriate reference group: the proportion of domestic organizations in the same industry that have adopted a quality-management standard.[9] This rate for domestic-industry adoption (hereafter referred to as Domestic-Industry-Adoption) essentially captures how far along is a focal organization's domestic industry in the adoption of quality-management standards. The adoption literature generally finds a positive coefficient estimate for this variable construct – what can be referred to as an imitation parameter – in support of mimetic and/or contagion processes driving the initial certification decisions of organizations. We instead consider decertification, thus the expectation is for a prevailing negative relationship. That said, we acknowledge that this imitation parameter may not involve substantial weight in the decertification context, as recertifying organizations will have had direct experience with the quality standard and be less susceptible to peer effects.

Finally, certification in standards has been considered to be sensitive to the general level of regulatory governance and corruption in a society (e.g., Montiel et al., 2012; Berliner and Prakash, 2013), thus, we

---

[9] We use 3-digit ISIC code to define the industry. All organizations in our panel data fall into one of 103 different 3-digit ISIC sectors. Examples include "manufacture of dairy products" (152), "manufacture of beverages" (155), "publishing" (221), "manufacture of railway and tramway locomotives and rolling stock" (352), "sales of motor vehicles" (501), and "telecommunications" (642).

gathered a country-level corruption measure from Transparency International to control for such effects (hereafter referred to as Country-Corruption). For all the variables above, Table 3 provides short definitions and descriptive statistics, while Table 4 reports pairwise correlation coefficients for all variable constructs based on the estimation sample.

4.3. Estimation strategy

We wish to identify the causal link between our explanatory variables of interest, Innovative-Organization and Organizational-Innovativeness, and the probability that a particular facility will decertify a quality-management standard. Empirically, we cast the probability of decertification in the form of a probit model:

$$Prob(C(t) = 0 \,|\, C(t-1) = 1, X(t-1)\,) = \Phi(\theta' X(t-1)\,). \tag{1}$$

Here, an organization can decide to adopt a quality-management standard ($C = 1$) or to not adopt the quality standard ($C = 0$). Furthermore, t stands for the time period, vector X contains all of the variables affecting the incentive to decertify the standard, and θ represents a vector of parameters to be estimated. To establish a causal link, the variables of principal interest – conditional on the other covariates in X – must be independent of the focal organization's recertification decision. If conditional independence is violated, then the variables will be endogenous and the probit model will yield inconsistent coefficient estimates. Endogeneity may arise via two principal means: reverse causality and omitted-variable bias. We surmise that reverse causality is of less concern in our empirical context due to our variables of interest being determined prior to the dependent variable: the focal organization's recertification decision. Recognizing the time lag between the decision not to extend certification in the standard and the actual expiration of certification, we lag the values of all covariates in the model by one period. This effectively renders the innovativeness variables predetermined since the constructs derive from an earlier survey of the same organization—at least three years prior to the recertification decision. It is thus unlikely that a future decision regarding quality-management recertification affects past decisions regarding the degree of organizational innovativeness.

Omitted-variable bias, however, poses a more serious challenge to our empirical approach. Despite controlling for relevant characteristics of a focal facility by including variables in the covariate vector X, additional characteristics remain unobservable. These unobserved characteristics could affect the focal facility's recertification decision and organizational innovativeness. For instance, if a given country happened to have domestic institutions that encourage quality-management standards (and discourage decertification) but also encourage the presence of innovative organizations, then a spurious negative relationship between decertification and innovativeness may manifest. It is well known, for instance, that certain countries provide extensive institutional support that make it relatively easier for organizations to obtain and maintain quality-management standards (e.g., Corbett, 2006) and to engage in innovation (e.g., Autio et al., 2014). Furthermore, the export destinations for certain industries may also represent omitted constructs that lead to spurious causal inferences, as the firms within national industries often compete to secure export markets in third countries (Guler et al., 2002; Delmas and Montes-Sancho, 2011). For instance, the presence of the EU as a principal export market for competing firms might generate a common-coercive push for all organizations in the national industry to adopt and maintain quality-management standards to be eligible to export to the EU (Anderson et al., 1999; Guler et al., 2002). Finally, the quality-management decertification phenomenon has been shown to exhibit a clear time trend – see for example Table 2 – and our variables of interest may also exhibit a time trend. For instance, the global financial crisis may well precipitate increased decertification. Such country-level and

Table 3
Variable definitions and descriptive statistics for estimation sample.

Variable	Definition	Obs.	Mean	Std. dev.	Min.	Max.
Facility-Decertification	Facility dropped quality certification (0/1)	1755	0.44	0.50	0	1
Innovative-Organization	Facility has at least one innovation activity (0/1)	1755	0.54	0.50	0	1
Organizational-Innovativeness	Index capturing the facility's breadth of innovation activities	1755	0.94	1.04	0	4
Organizational-Age	Years since the establishment of the facility	1755	24.2	20.3	0	165
Permanent-Employment	Permanent full-time employees at end of fiscal year (thousands)	1755	0.25	0.65	0.002	11
Total-Sales	Total sales in fiscal year (millions of 2008 USD)	1755	18.3	71.3	0.0005	1817
Multi-Facility-Organization	Facility part of a larger firm with multiple facilities (0/1)	1755	0.23	0.42	0	1
Exporter	Facility has positive value for exports in fiscal year (0/1)	1755	0.50	0.50	0	1
Domestic-Industry-Adoption	Share of domestic facilities in same industry that are certified	1755	0.33	0.24	0.02	1
Country-Corruption	Transparency international's perceived corruption score (0–100)	1755	33.1	14.2	18	73

industry-level omitted constructs, as well as a time trend, pose a threat to causal inferences (Wooldridge, 2002). To control for these potential sources of endogeneity, we introduce a series of fixed effects into our probit-regression model. In particular, we successively control for year-specific, country-specific, and industry-specific fixed effects in our probit estimations.[10] We should underscore that the year-specific effects are calendar year based and thus more exacting than the four time periods employed for dataset compilation.

We should highlight here the exact nature of the variation employed in our estimations. Recall that our sample for empirical estimations is reduced by our conditioning the facility recertification decision on past certification; i.e., we strictly employ facility observations for analysis when the particular facility was certified in the previous period. Accordingly, we must observe an organization over at least two consecutive periods and the organization must be certified in the first period for it to manifest in our estimation sample. In this sense, our empirical analysis is longitudinal in nature and involves chronological antecedence as the recertification decision manifests in the t period while the explanatory constructs are all measured in the t-1 period. Indeed, our estimation sample involves 1637 organizations where we have observations for two consecutive periods, and where each one of these organizations provides us with one observation. Our estimation sample also involves 59 organizations where we have observations for three consecutive periods, and where each one of these organizations provides us with two observations (leading to 118 observations). This means that 1637 observations (93.28 % of the estimation sample) provide only cross-sectional variation, while 118 observations (6.72 % of the estimation sample) provide both cross-sectional and time-series variation in the estimations. Accordingly, the sample for our probit estimations (a max of 1755 observations) effectively provides (mostly) cross-sectional variation to be analyzed, but where the longitudinal properties of our panel data allow for chronological antecedence—see Cândido and Ferreira (2021b) for a discussion of similar issues.

5. Empirical results

We estimate the probit model – as reflected by Eq. (1) – via the standard maximum likelihood approach. To directly test our first hypothesis, we employ the dichotomous innovative-organization construct in three different regression estimations reported in Table 5. To test our second hypothesis, we employ the continuous organizational-innovativeness construct (both the linear and the quadratic terms) in three different regression estimations reported in Table 6. The three regressions reflect the fact that we undertook three different estimations of the probit model, as we sequentially add year-specific, country-specific, and industry-specific fixed effects in both Tables 5 and 6. When considering the six estimations in Tables 5 and 6 as a whole, the regression model appears to be well specified. The tables report the log-

likelihood functions for the three probit estimations and these diagnostics indicate that the models better fit the data when additional fixed effects are added. McFadden's Pseudo r-square statistics also indicate substantial increases when moving from estimations (1) to estimations (3); i.e., when the estimations become more-fully specified. We also report a Log-likelihood ratio chi-square test that rejects the null hypothesis that all the coefficient estimates are equal to zero.

Since the three probit estimations in both Tables 5 and 6 are quite similar in structure and substance – outside of alternations in the employment of fixed effects and the replacement of the dichotomous measure with a continuous measure of organizational innovativeness – we discuss the results for the control variables as a whole before analyzing our variables of principal interest: i.e., Innovative-Organization in Table 5, and Organizational-Innovativeness in Table 6. First, our measure of an organization's age (Organizational-Age) yields a negative coefficient in all three specifications in both tables that is significant at the 5 % level in estimation (1), the 10 % level in estimation (2), and insignificant in estimation (3) when the additional fixed-effects are added.[11] Thus, we provide some evidence that the older organizations are less likely to decertify, but the effect is not statistically significant in our most stringent estimation (3).[12] Second, our measures of an organization's size (Permanent-Employment and Total-Sales) both yield negative and mostly significant coefficient estimates. Permanent-Employment is significant at the 1 % level in all three probit estimations in both tables. Total-Sales indicates insignificance in estimation (1), but significance at the 10 % level in estimation (2) and at the 5 % level in estimation (3) in both tables.[13] The empirical results from the two size constructs thus align with our expectations based on the findings in the quality-standard adoption literature. Third, our measure of whether an organization is part of a larger firm with multiple facilities (Multi-Facility-Organization) yields a negative, but insignificant, coefficient estimate in all three estimations in both tables. While statistically insignificant, facilities embedded within larger firms appear to be somewhat less likely to decertify quality-management standards. Fourth, our measure of whether an organization exports (Exporter) is negative and significant at the 1 % level in all three specifications in both tables—a result in line with expectations that exporters exhibit lower probabilities of decertification.

---

[10] Consistent with our definition of the Domestic-Industry-Adoption variable, we employ the 3-digit ISIC classification for the industry-specific fixed effects.

[11] While organizational-age is simply a control in this analysis, this construct could correlate with the amount of time since the initial adoption of the quality certificate by the organization. In auxiliary estimations, we controlled for a crude measure of time-since-adoption which yielded virtually identical results to those reported in the manuscript. These estimations are available upon request.

[12] As a robustness check, we added a quadratic-term to the linear-term for organizational age and re-estimated the model. The coefficient estimates for the quadratic-term were insignificant and the results were otherwise substantively similar. These results are available from the authors upon request.

[13] As a robustness check, we re-estimated the model using total employment instead of permanent employment and do not find statistically different results (available from the authors upon request).

Table 4
Pairwise correlation coefficients.

Variable	Facility-Decertification	Innovative-Organization	Organizational-Innovativeness	Organizational-Age	Permanent-Employment	Total-Sales	Multi-Facility-Organization	Exporter	Domestic-Industry-Adoption	Country-Corruption
Facility-Decertification	1									
Innovative-Organization	-0.139	1								
Organizational-Innovativeness	-0.125	0.837	1							
Organizational-Age	-0.110	0.102	0.157	1						
Permanent-Employment	-0.140	0.106	0.102	0.105	1					
Total-Sales	-0.104	0.109	0.118	0.094	0.407	1				
Multi-Facility-Organization	-0.019	-0.081	-0.045	0.081	0.107	0.105	1			
Exporter	-0.167	0.234	0.227	0.105	0.151	0.063	-0.064	1		
Domestic-Industry-Adoption	-0.089	0.173	0.189	-0.005	0.003	0.094	-0.023	0.126	1	
Country-Corruption	-0.139	0.085	0.106	0.150	-0.042	0.034	-0.010	0.046	0.085	1

Correlations based on 1755 observations from the estimation sample.

Table 5
Probability of focal-facility decertification: probit estimation results employing dichotomous 'innovative-organization' construct.

Dependent variable	(1)	(2)	(3)
	Facility-Decertification (t)	Facility-Decertification (t)	Facility-Decertification (t)
Innovative-Organization (t-1)	-0.20*** (0.07)	-0.34*** (0.08)	-0.29*** (0.09)
Organizational-Age (t-1)	-0.004** (0.002)	-0.003* (0.002)	-0.001 (0.002)
Permanent-Employment (t-1)	-0.32*** (0.08)	-0.34*** (0.09)	-0.34*** (0.09)
Total-Sales (t-1)	-0.001 (0.001)	-0.001* (0.001)	-0.002** (0.001)
Multi-Facility-Organization (t-1)	-0.07 (0.08)	-0.10 (0.08)	-0.10 (0.09)
Exporter (t-1)	-0.30*** (0.07)	-0.25*** (0.07)	-0.28*** (0.08)
Domestic-Industry-Adoption (t-1)	-0.34** (0.14)	-0.39** (0.16)	-0.16 (0.19)
Country-Corruption (t-1)	-0.01*** (0.003)	-0.08 (0.06)	-0.05 (0.07)
Year-specific fixed effects	Yes	Yes	Yes
Country-specific fixed effects	No	Yes	Yes
Industry-specific fixed effects	No	No	Yes
Log-likelihood	-1103.7	-1048.9	-975.4
Pseudo r-square	0.085	0.130	0.168
LR chi-square	203.9***	312.2***	392.9***
DF	(16)	(60)	(130)
Observations	1755	1754	1704

Standard errors in parentheses
LR is the Likelihood ratio; and DF is the degrees of freedom in the likelihood ratio chi-square test.
Coefficient estimates for year, country, and industry fixed effects not reported for brevity.
* Significant at 10 %.
** Significant at 5 %.
*** Significant at 1 %.

Moving beyond our control constructs at the organizational level, we now consider our industry and country level controls. First, the impact of the domestic industry peer group (Domestic-Industry-Adoption) has triggered substantial interest in the quality-standard adoption literature. The coefficient estimate for this construct is both negative and significant at the 5 % level in estimations (1) and (2) in both tables, thus suggesting that focal facilities are less likely to decertify the more their domestic-industry peer group has adopted quality-management standards. This result is akin to the prevailing finding in the adoption literature where the evidence customarily supports the existence of contagion- and mimicry-type processes. Interestingly, the coefficient estimate for this variable drops by half and becomes insignificant in estimation (3) in both tables—i.e., when industry-specific fixed effects are added. This statistical insignificance casts doubt on the relevance of peer effects on the decertification decisions of organizations. Moreover, the tendency for this construct to manifest declining significance as the appropriate fixed effects are added suggests that the fixed effects are salient and control for a significant portion of the heterogeneity in our econometric model.

Finally, our measure of the perceived corruption in the focal organization's country (Country-Corruption) yields a negative coefficient estimate in all three specifications in both tables—a coefficient estimate that is only significant in estimation (1) when country-specific fixed effects are not specified. It stands to reason that the statistical significance of this country-level control vanishes in estimations (2) and (3)

Table 6

Probability of focal-facility decertification: probit estimation results employing continuous 'Organizational-Innovativeness' construct.

Dependent variable:	(1)	(2)	(3)
	Facility-Decertification (*t*)	Facility-Decertification (*t*)	Facility-Decertification (*t*)
Organizational-Innovativeness (*t*-1)	−0.24*** (0.09)	−0.36*** (0.10)	−0.37*** (0.11)
Organizational-Innovativeness squared (*t*-1)	0.07** (0.03)	0.09*** (0.03)	0.11*** (0.04)
Organizational-Age (*t*-1)	−0.004** (0.002)	−0.003* (0.002)	−0.002 (0.002)
Permanent-Employment (*t*-1)	−0.32*** (0.08)	−0.34*** (0.09)	−0.34*** (0.09)
Total-Sales (*t*-1)	−0.001 (0.001)	−0.001* (0.001)	−0.002** (0.001)
Multi-Facility-Organization (*t*-1)	−0.07 (0.08)	−0.10 (0.08)	−0.09 (0.09)
Exporter (*t*-1)	−0.30*** (0.07)	−0.25*** (0.05)	−0.28*** (0.08)
Domestic-Industry-Adoption (*t*-1)	−0.35** (0.14)	−0.40** (0.16)	−0.17 (0.19)
Country-Corruption (*t*-1)	−0.01*** (0.003)	−0.08 (0.06)	−0.05 (0.07)
Year-specific fixed effects	Yes	Yes	Yes
Country-specific fixed effects	No	Yes	Yes
Industry-specific fixed effects	No	No	Yes
Log-likelihood	−1104.0	−1050.4	−975.2
Pseudo r-square	0.084	0.128	0.168
LR chi-square	203.2***	309.3***	393.3***
DF	(17)	(61)	(131)
Observations	1755	1754	1704

Standard errors in parentheses.

LR is the Likelihood ratio; and DF is the degrees of freedom in the likelihood ratio chi-square test.

Coefficient estimates for year, country, and industry fixed effects not reported for brevity.

* Significant at 10 %.

** Significant at 5 %.

*** Significant at 1 %.

once the appropriate country-level fixed effects are invoked. Nevertheless, this result tentatively indicates that organizations located in less corrupt countries (i.e., countries with higher scores from Transparency International) are less likely to decertify.

Turning to our variable of principal interest – Innovative-Organization – in Table 5, we see that the relevant coefficient estimates are negative and indicate statistical significance at the 1 % level in all three estimations. These empirical results provide statistical evidence in support of our first hypothesis, as innovative organizations exhibit a lower likelihood of withdrawing from quality-management standards as compared to non-innovative organizations. In terms of the magnitude of this effect, the average partial effects calculated via the delta method

based on the coefficients in estimations (1) through (3) range from −0.07 (for the estimated coefficient equal to −0.20) to −0.12 (for the estimated coefficient equal to −0.34). In other words, innovative organizations are 7 % to 12 % less likely to decertify in a quality-management standard as compared to non-innovative organizations. It should also be noted that these estimated magnitudes are not trivial given that the decertification probability in a subsequent period is equal to 44.4 % across all the facilities in the estimation sample.[14] Accordingly, innovative organizations appear to be generally less likely to withdraw from quality management standards as compared to non-innovative organizations.

Turning to our variables of principal interest – the linear and quadratic terms for Organizational-Innovativeness – in Table 6, we see that the relevant coefficient estimates indicate high statistical significance in all three estimations. The coefficient estimates for the linear term are negative and statistically significant at the 1 % level in estimations (1) through (3). These results provide some additional indirect empirical support for our first hypothesis, as organizations characterized by lower levels of positive innovation activities exhibit a lower likelihood of withdrawing from quality-management standards.[15] Furthermore, the coefficient estimates for the quadratic term are positive and statistically significant in estimations (1) through (3) at the respective 5 %, 1 %, and 1 % levels. These results provide empirical support for our second hypothesis, as radically-inclined organizations characterized by more extensive innovation breadth exhibit a relatively higher likelihood of withdrawing from quality-management standards.

An additional means to interpreting the empirical results in Table 6 involves calculating the net effect on decertification probabilities for each level of organizational innovativeness: where the index ranges from 0 to 4. To provide a magnitude for this net effect, we can calculate the average partial effects for the linear and quadratic terms of organizational innovativeness via the delta method based on the coefficients in estimation (3)—the most-conservative estimation with the fullest set of fixed effects. Fig. 1 presents the average partial effects for the four relevant levels of organizational innovativeness. There, we see that organizations characterized by an innovativeness index equal to one are less likely than non-innovative organizations to decertify in quality-management standards by an order of 8.5 percentage points on average, while organizations characterized by an innovativeness index equal to two are less likely than non-innovative organizations to decertify in a quality-management standards by 9.8 percentage points on average. Furthermore, organizations characterized by an

---

[14] To calculate this 44.4 % benchmark, we took the number of observations in the estimation sample where the organization was non-certified in period t (so 780 observations) and then divided this by the total number of observations in the estimation sample (those 1755 observations). This approach takes advantage of the fact that the estimation-sample observations all involve the facility being certified in period t-1; thus, being non-certified in period t means that a decertification has taken place. This provides a reasonable decertification-probability benchmark. We should note, however, that the ultimate magnitude of the innovative effects for an individual organization will involve more than just the probabilities but also the costs involved with an initial certification that leads to a decertification.

[15] A more-correct and formal test of the first hypothesis based on these empirical results would involve a combination of the linear and quadratic terms for Organizational-Innovativeness that was weighted by the frequency of the observations belonging to each of the four values, 1 through 4, that characterize an innovative organization. In essence, such a test would calculate the weighed sum of the partial effects of the Organizational-Innovativeness measure across the values of 1 through 4 on decertification probabilities. A *t*-test could then ensure that that the weighted sum yields a statistically significant difference in QMS abandonment tendencies as compared to organizations characterized by zero values. We engaged in such a test and found empirical results that conform to those presented in Table 5. But since such an auxiliary test is a bit complicated to convey, it appeared best to simply report the results from Table 5 as this more directly tests the first hypothesis.
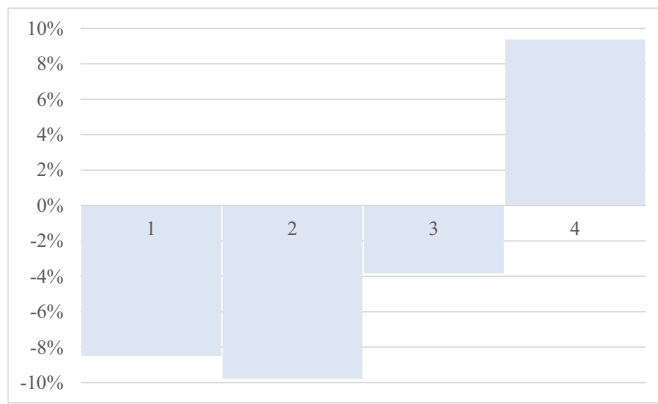
Fig. 1. Partial effects of organizational-innovativeness (values 1–4) on decertification probabilities (in percentage points).

innovativeness index equal to three are only less likely than non-innovative organizations to decertify in quality-management standards by 3.8 percentage points on average. And finally, organizations characterized by an innovativeness index equal to four are more likely than non-innovative organizations to decertify in quality-management standards by an order of 9.4 percentage points on average. It appears then that the organizations in our sample with innovativeness levels from one to three are broadly consistent with organizations that are largely engaged in incremental innovation, while the organizations in our sample with innovativeness levels of four are consistent with organizations that are largely engaged in radical innovation. Moreover, it appears that higher levels of innovativeness – in particular, levels beyond an index score of 2 – are associated with relatively higher decertification tendencies.

6. Discussion and conclusions

While a healthy amount of scholarship exists regarding the factors influencing organizational adoption of quality-management standards, Castka and Corbett (2015), Cândido and Ferreira (2021b) and others have pointed out the share scarcity of scholarship focusing on the decision to voluntarily withdraw and decertify from quality standards. This relative neglect with respect to the drivers of decertification is somewhat out of step with a contemporary reality where organizations have been increasingly abandoning quality standards over the last decade (Castka and Corbett, 2015; Cândido et al., 2016, 2021; Kafel and Simon, 2017; Mastrogiacomo et al., 2021). By neglecting the potential for withdrawal from quality-management standards, the certification literature has made incorrect inferences regarding the universal presence of continued adoption behavior. That is, the quality-certification literature has essentially assumed that adoption pressures unequivocally build for a focal organization when in fact these pressures can be alleviated to such a degree that organizations will begin to withdraw from quality standards.

The sparse literature considering the determinants of quality-standard decertification (e.g., Lo and Chang, 2007; Alcala et al., 2013; Simon and Kafel, 2018; Cândido et al., 2016, 2021; Zimon and Dellana, 2020) has been heavily influenced by a cost-benefit approach: where time and financial costs, lack of internal benefits, and lack of external benefits represent the primary rationales explaining decertification. Yet that literature on decertification drivers has neglected the relevance of organizational characteristics—a neglect that is shared by the literature on quality-standard adoption according to Castka and Corbett (2015). Moreover, the degree to which an organization is characterized by innovativeness represents a particularly salient organizational characteristic to factor in light of the fact that the standards-innovation relationship has been considered to be particularly complex (Manders et al.,

2016). Indeed, Foucart and Li (2021: 1) highlight the intricacies of the standards-innovation relationship when referring to the "multifaceted role on standards in incremental versus radical product innovation".

Motivated then by the needs to (i) better understand the complex relationship between standards and innovation and to (ii) deeply investigate the drivers of quality-standard decertification in a structured manner, we set out to analyze the impact of organizational innovativeness on decertification tendencies. As such, we respond to the call for scholarship by Manders et al. (2016) to more-fully factor the relationship between standards and innovation by focusing on the decertification tendencies of innovative organizations. Our implicit contention is that the innovative nature of the organizations undertaking recertification decisions matters when considering the determinants of quality-standard decertification. Specifically, we conjecture that (i) innovative organizations are generally less likely than non-innovative organizations to withdraw from quality-management standards; (ii) radically-innovative organizations are more likely than incrementally-innovative organizations to withdraw from quality-management standards. Thus, we take the next step in this small – but growing – literature on decertification drivers by considering how the relevant costs, benefits, and downsides involved with the recertification decision interact with the innovativeness of the organization.

To empirically test our priors, we compiled data from the World Bank Enterprise Surveys of facilities in 50 countries and 103 industrial sectors across the 2003 to 2017 period. We make full use of the data's panel properties and build a dataset for empirical analysis composed of up to 1755 facility-level observations of recertification decisions: where facilities certified in one period either decertify or recertify in the subsequent period. Furthermore, we build an index measure of organizational innovativeness that reflects the degree to which our sampled organizations manifest breadth in innovative activities. Our empirical testing employs a probit estimation technique that accounts for common controls and the appropriate fixed effects. Specifically, we sequentially introduce a series of fixed effects (year-specific, country-specific, and industry-specific) into our probit estimations to capture common causes of certification when analyzing the impact of an organization's innovativeness on a focal facility's probability of abandoning a quality standard. The empirical estimations consistently support our theoretical priors: innovative organizations are generally prone to retaining quality-management standards; however, radically-innovative organizations are prone to discontinuing quality-management standards when facing recertification decisions. This employment of panel-data econometric techniques on a large-scale database composed of organization-level observations throughout the global economy allows generating relatively-robust causal inferences.

While the distinction between incrementally-innovative and radically-innovative organizations is central to our contribution, our analysis yields auxiliary findings regarding additional organizational characteristics that affect decertification tendencies: i.e., organizational age, organizational size, and exporter status. Our finding exporters to be far less likely to decertify as compared to domestic-orientated organizations merits some attention. This result suggests that exporters are not only first to seek quality certification due to the extensive benefits in foreign markets (e.g., Anderson et al., 1999; Christmann and Taylor, 2001; Corbett, 2006), but are also last – or better said, more reluctant – to drop quality certification. This finding is in line with international buyers facing greater transaction costs and information asymmetries; accordingly, quality standards – which can alleviate these barriers and are conducive to trading relationships (e.g., Blind, 2001; Hudson and Jones, 2003; Terlaak and King, 2007; Clougherty and Grajek, 2008, 2014) – may be retained by exporter organizations to secure international markets.

Most importantly, our analysis involves implications with respect to the greater literature on standards and innovation—see Castka and Corbett (2015) and Manders et al. (2016) for reviews. That literature on the standards-innovation relationship is overwhelmingly characterized

by one-way analysis: where the impact of standardization on innovation represents the relationship of interest (e.g., Benner and Tushman, 2002; Prester and Bozac, 2012; Terziovski and Guerrero, 2014; Foucart and Li, 2021). The review by Manders et al. (2016) underscores this point, as they find that almost all studies in this literature focus on the impact of quality standards on innovation. Indeed, Llach et al.'s (2012) finding that structural innovation positively impacts ISO 14000 certification represents a rare exception by considering the impact of innovation on standards. This one-way tendency in terms of the direction of analysis is simply incongruent with a literature that refers to the standards-innovation relationship as being a 'nexus' (e.g., Hawkins and Blind, 2017; Foucart and Li, 2021).[16] Our study departs then from the norm in the standards-innovation literature to consider how standardization affects innovation to instead analyze the impact of organizational innovativeness on standardization (specifically, decertification in quality standards). As such, we contend that it is not only important to endogenize innovation, but it is also important to endogenize standardization. Specifically, analyzing quality-standard decertification requires considering the innovative status of the organization as a relevant contributing factor. Future scholarship on the standards-innovation analysis must accordingly factor that innovativeness can influence standardization if we are to fully comprehend the 'nexus' between standards and innovation.

Beyond our call for scholarship that considers the two-way relationship between standards and innovation, our analysis also contributes to the mainstream literature focusing on how standards influence innovation. In particular, the literature focusing on the impact of standards on innovation output has appreciated that it is essential to discern between incremental and radical innovation (e.g., Benner and Tushman, 2002; Prester and Bozac, 2012; Terziovski and Guerrero, 2014; Manders et al., 2016; Foucart and Li, 2021). This distinction is key as it is increasingly well understood that standardization positively affects incremental innovation and negatively affects radical innovation (e.g., Benner and Tushman, 2002; Manders et al., 2016; Foucart and Li, 2021). Moreover, our empirical results are consistent with this evolving understanding of how quality certification impacts the innovativeness of organizations. For one, our finding innovative organizations to be prone to recertifying quality-management standards is in line with the idea that standards support the modest innovation aims of firms located far from the technological frontier. Furthermore, our finding radically-innovative organizations to be prone to decertifying quality-management standards is in line with the idea that standards conflict with the ambitious innovation aims of firms located close to the technological frontier. In essence, the decertification tendencies that we elicit represent an additional dimension to the multifaceted role that standards play with respect to innovation (Foucart and Li, 2021).

From a normative perspective, the literature on quality-management standards has consistently cautioned managers to be judicious and deliberative when deciding whether to adopt these standards. A number of these cautions derive from the fact that later adopters do not generally reap substantial benefits from quality-management certification (e.g., Marimon Viadiu et al., 2006; Lo and Chang, 2007; Benner and Veloso, 2008). For instance, Singh et al. (2011) caution managers to be careful when evaluating the utility of adopting a quality standard since performance benefits do not always manifest. However, the fact that recertification decisions are generally more informed (relying on direct focal-firm experiences) than initial certification decisions (relying on indirect third-party experiences) allows formulating strong normative conclusions regarding possible initial-certification mistakes. Indeed, our

empirical results indicate that the managers of radically-innovative organizations should be particularly wary with respect to the initial certification decision, as the proclivity for those organizations to drop quality-management standards at relatively high rates suggests that these initial decisions to seek certification might have been mistaken.

The above said, radically-innovative organizations do at least manifest the flexibility to potentially rectify an imprudent initial-certification decision by decertifying in subsequent periods. Corbett (2006) also observes that many governments provide extensive institutional support for national firms to seek quality-management standards; thus, from a policymaker's perspective, our findings indicate that policy support should be dedicated toward incrementally-innovative organizations where standards appear to be supportive of more-modest innovation aims. This will be particularly the case in emerging and transition economies where incrementally-innovative organizations will frequently populate. Furthermore, policy support for the adoption of standards by radically-innovative organizations would appear to be less optimal, as quality management seemingly conflicts with the ambitious innovation aims of these organizations.

Our study, nevertheless, involves limitations which provide scope for future research. First, we recognize that research which provides estimates with respect to the weight of the primary rationales – time and financial costs, lack of internal benefits, lack of external benefits, and innovation downsides – invoked in explaining quality-certification abandonment can yield more precise analysis that yields information with respect to which mechanisms robustly link the innovative status of organizations to decertification tendencies. Second, our empirical approach involves employing breadth in innovation activities to capture more-radically innovative organizations; however, we would encourage future work that employs alternative approaches to differentiating incrementally-innovative from radically-innovative organizations. Third, our empirical results indicate a strong statistical relationship between an organization's exporter status and the proclivity to recertify in a quality standard, yet we do not extensively consider the theoretical underpinnings and practical implications of this relationship. Future scholarship which delves deeper into this – and other – organizational characteristics in moving beyond the generic costs, benefits and downsides involved with recertification would seem to be merited. Fourth, our empirical analysis is unable to differentiate between organizations that primarily sell intermediate products within a supply chain, and organizations that primarily sell finished products to end consumers. It is possible that organizations selling intermediate products will be relatively subject to certification pressures by downstream buyers and thus not exhibit the same proclivity to decertify as compared to organizations selling finished products. Such differences in recertification tendencies may also be enhanced by the relative age of the organization; thus, future scholarship which differentiates between an organization's primary sales context (intermediate-product versus finished-product) and organizational youth is called for. Fifth, the distinction between voluntary and forced certification may not be as stark for decertification decisions as it is for initial certification decisions; nevertheless, future work which empirically differentiates between not undertaking a recertification audit and failing a recertification audit is certainly called for.

The literature on quality-standard adoption has made substantial progress over the last two decades in understanding what drives organizational adoption of these standards. Despite this progress, the relative neglect in the literature regarding what determines decertification is quite notable. The quality-certification literature will therefore need to move beyond strict notions regarding adoption as the behavior of interest to also consider the growing phenomenon of quality-standard decertification. Moreover, the literature must also fully factor the innovative nature of the organizations making these recertification decisions. Accordingly, the main contention of this manuscript is simple but important: to begin to understand the forces behind decertification in quality-management standards, one must consider the degree of

---

[16] With respect to the use of the adjective 'nexus' – or "intersection" – to qualify the standards-innovation literature, the character Inigo Montoya from the movie "The Princess Bride" summarizes our concern well when he states: "You keep using that word. I do not think it means what you think it means". See https://www.youtube.com/watch?v=YIP6EwqMEoE.

innovativeness of the organization undertaking these recertification decisions.

CRediT authorship contribution statement

Joseph A. Clougherty: Conceptualization, Methodology, Investigation, Writing – original draft, Writing – review & editing. **Michał Grajek:** Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Data curation, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

References

Adler, P.S., 1999. Building better bureaucracies. Acad. Manag. Exec. 12 (4), 1–36.

Alcala, M., Marimon, F., Casadesus, M., 2013. Quality management systems: one step forward on the paper industry. Int. J. Qual. Res. 7 (2), 231–238.

Alić, M., 2014. Impact of ISO 9001 certification cancellation on business performance: a case study in slovenian organisations. Total Qual. Manag. Bus. Excell. 25 (5), 1–22.

Amendola, M., Bruno, S., 1990. The behaviour of the innovative firm: relations to the environment. Res. Policy 19, 419–433.

Anderson, S., Daly, D., Johnson, M., 1999. Why firms seek ISO 9000 certification: regulatory compliance or competitive advantage? Prod. Oper. Manag. 8 (1), 28–43.

Ansoff, H.I., 1968. The innovative firm. Long Range Plan. 1 (2), 26–27.

Ardiel, J., 2008. The Introduction of Safe and Sustainable Agriculture Certification: A Case Study of Cherry Growers in the Southern Interior of British Columbia. University of British Columbia. Thesis.

Autio, E., Kenney, M., Mustar, P., Siegel, D., Wright, M., 2014. Entrepreneurial innovation: the importance of context. Res. Policy 43, 1097–1108.

Baldwin, C.Y., 2020. Rationalizing Flow Processes. In: Harvard Business School Working Paper (October 2020).

Balsmeier, B., Buchwald, A., Stiebale, J., 2014. Outside directors on the board and innovative firm performance. Res. Policy 43, 1800–1815.

Bansal, P., Bogner, W.C., 2002. Deciding on ISO 14001: economics, institutions and context. Long Range Plan. 35 (3), 269–290.

Bénézech, D., Lambert, G., Lanoux, B., Lerch, C., Loos-Baroin, J., 2001. Completion of knowledge codification: an illustration through the ISO 9000 standards implementation process. Res. Policy 30, 1395–1407.

Benner, M.J., Veloso, F.M., 2008. ISO 9000 practices and financial performance: a technology coherence perspective. J. Oper. Manag. 26 (5), 611–629.

Benner, M.J., Tushman, M.L., 2002. Process management and technological innovation: a longitudinal study of the photography and paint industries. Adm. Sci. Q. 47 (4), 676–707.

Benner, M.J., Tushman, M.L., 2003. Exploitation, exploration, and process management: the productivity dilemma revisited. Acad. Manag. Rev. 28 (2), 238–256.

Bergh, D.D., Connelly, B.L., Ketchen, D.J., Shannon, L.M., 2014. Signalling theory and equilibrium in strategic management research: an assessment and a research agenda. J. Manag. Stud. 51 (8), 1334–1360.

Berliner, D., Prakash, A., 2013. Signaling environmental stewardship in the shadow of weak governance: the global diffusion of ISO 14001. Law Soc. Rev. 47 (2), 345–373.

Blind, K., 2001. The impact of innovations and standards on trade of measurement and testing products: empirical results of Switzerland's bilateral trade flows with Germany, France and the UK. Inf. Econ. Policy 13, 439–460.

Blind, K., 2002. Driving forces for standardization at standardization development organizations. Appl. Econ. 34, 1985–1998.

Blind, K., 2004. The economics of standards: Theory, evidence, policy. Edward Elgar, Northampton, MA.

Cândido, C.J.F., Coelho, L.M.S., Peixinho, R.M.T., 2016. The financial impact of a withdrawn ISO 9001 certificate. Int. J. Oper. Prod. Manag. 36 (1), 23–41.

Cândido, C.J.F., Coelho, L.M.S., Peixinho, R.M.T., 2021. Why firms lose their ISO 9001 certification: evidence from Portugal. Total Qual. Manag. Bus. Excell. 32 (5–6), 632–651.

Cândido, C.J.F., Ferreira, L.M.F.R., 2021. Determinants of expected performance after ISO 9001 certification withdrawal. Total Quality Management. https://doi.org/10.1080/14783363.2021.1997142.

Cândido, C.J.F., Ferreira, L.M.F.R., 2021. ISO 9001 internal decertification motivations: exploring barriers and benefits of certification as withdrawal antecedents. Prod. Plann. Control. https://doi.org/10.1080/09537287.2021.1916638.

Castka, P., Corbett, C.J., 2015. Management systems standards: diffusion, impact and governance of ISO 9000, ISO 14000, and other management standards. Found.

Trends Technol. Information Oper. Manag. 7 (3–4), 161–379. https://doi.org/10.1561/0200000042.

Christmann, P., Taylor, G., 2001. Globalization and the environment: determinants of firm self-regulation in China. J. Int. Bus. Stud. 32 (3), 439–458.

Clougherty, J., Grajek, M., 2008. The impact of ISO 9000 diffusion on trade and FDI: a new institutional analysis. J. Int. Bus. Stud. 39 (4), 613–633.

Clougherty, J., Grajek, M., 2014. International standards and international trade: empirical evidence from ISO 9000 diffusion. Int. J. Ind. Organ. 36 (4), 70–82.

Conti, T., 1999. Vision 2000: positioning the new ISO 9000 standards with respect to total quality management models. Total Qual. Manag. 10 (4, 5), 454–464.

Corbett, C.J., Kirsch, D.A., 2001. International diffusion of ISO 14000 certification. Prod. Oper. Manag. 10 (3), 327–342.

Corbett, C.J., Montes-Sancho, M.J., Kirsch, D.A., 2005. The financial impact of ISO 9000 certification in the United States: an empirical analysis. Manag. Sci. 51 (7), 1046–1059.

Corbett, C.J., 2006. Global diffusion of ISO 9000 certification through supply chains. Manuf. Serv. Oper. Manag. 8 (4), 330–350.

Corbett, C.J., Yeung, A.C., 2008. Special issue on meta-standards in operations management: cross-disciplinary perspectives. Int. J. Prod. Econ. 113 (1), 1–2.

David, P., 2020. How Is the B Corp Movement Influencing the Future of Capitalism? An Analysis of the Motivations and the Factors Impacting the B Corp Certification and Decertification. Louvain School of Management, Université Catholique de Louvain. Thesis.

Delmas, M.A., 2002. The diffusion of environmental management standards in Europe and in the United States: an institutional perspective. Policy. Sci. 35 (1), 91–119.

Delmas, M.A., Toffel, M.W., 2004. Stakeholders and environmental management practices: an institutional framework. Bus. Strateg. Environ. 13 (4), 209–222.

Delmas, M.A., Montiel, I., 2009. Greening the supply chain: when is customer pressure effective? J. Econ. Manag. Strateg. 18 (1), 171–201.

Delmas, M.A., Montes-Sancho, M.J., 2011. An institutional perspective on the diffusion of international management system standards: the case of the environmental management standard ISO 14001. Bus. Ethics Q. 21 (1), 103–132.

Desai, V.M., 2018. Third-party certifications as an organizational performance liability. J. Manag. 44 (8), 3096–3123.

Favereau, O., 1989. Organisation et marché. In: Revue francaise d'économie, 1, pp. 65–96.

Ferreira, L.M.F.R., Cândido, C.J.F., 2021. Factors influencing firm propensity for ISO 9001 withdrawal: evidence on decertification tendency and antecedents. Int. J. Prod. Econ. 233 https://doi.org/10.1016/j.ijpe.2020.108024.

Foray, D., 1991. The secrets of industry are in the air: industrial cooperation and the organizational dynamics of the innovative firm. Res. Policy 20, 393–405.

Foucart, R., Li, Q.C., 2021. The role of technology standards in product innovation: theory and evidence from UK manufacturing firms. Res. Policy 50 (2), 1–14.

Gallivan, M.J., 2001. Organizational adoption and assimilation of complex technological innovations: development and application of a new framework. ACM SIGMIS Database 32 (3), 51–85.

Glynn, M.A., 1996. Innovative genius: a framework for relating individual and organizational intelligence to innovation. Acad. Manag. Rev. 21, 1081–1111.

Gopal, A., Gao, G., 2009. Certification in the Indian offshore IT services industry. Manuf. Serv. Oper. Manag. 11 (3), 471–492.

Gray, J.V., Anand, G., Roth, A.V., 2015. The influence of ISO 9000 certification on process compliance. Prod. Oper. Manag. 24 (3), 369–382.

Guler, I., Guilen, M.F., Macpherson, J.M., 2002. Global competition, institutions, and the diffusion of organizational practices: the international spread of ISO 9000 quality certificates. Adm. Sci. Q. 47 (2), 207–232.

Hawkins, R., Blind, K., 2017. Introduction: unravelling the relationship between standards and innovation. In: Hawkins, R., Blind, K., Page, R. (Eds.), Handbook of Innovation and Standards. Edward Elgar Publishing, Northampton, MA, pp. 1–18.

Hendricks, K.B., Singhal, V.R., 1997. Does implementing an effective TQM program actually improve operating performance? Empirical evidence from firms that have won quality awards. Manag. Sci. 43 (9), 1258–1274.

Hendricks, K.B., Singhal, V.R., 2001. The long-run stock price performance of firms with effective TQM programs. Manag. Sci. 47 (3), 359–368.

Heras-Saizarbitoria, I., Boiral, O., 2013. ISO 9001 and ISO 14001: towards a research agenda on management system standards. Int. J. Manag. Rev. 15 (1), 47–65.

Hudson, J., Jones, P., 2003. International trade in 'quality goods': signalling problems for developing countries. J. Int. Dev. 15 (8), 999–1013.

Hudson, J., Orviska, M., 2013. Firms' adoption of international standards: one size fits all? J. Policy Model 35 (2), 289–306.

Kafel, P., Simon, A., 2017. The reasons for decertification of ISO 9001: financial aspects. Qual. Innov. Prosperity 21 (3), 173–184.

Kafel, P., Nowicki, P., 2014. Functioning of environmental and quality management systems after resignation of management standard certifications: case study of a polish organizations. Int. J. Qual. Res. 8 (4), 505–516.

King, A.A., Lenox, M.J., Terlaak, A., 2005. The strategic use of decentralized institutions: exploring certification with the ISO 14001 management standard. Acad. Manag. J. 48 (6), 1091–1106.

King, A.A., Toffel, M.W., 2009. Self-regulatory Institutions for Solving Environmental Problems: Perspectives and Contributions From the Management Literature. Cambridge University Press, Cambridge, UK.

Klein, B., 1988. Luck, necessity and dynamic flexibility. In: Evolutionary Economics. Cambridge University Press, Cambridge, pp. 95–127.

Lam, A., 2011. Innovative organizations: structure, learning, and adaptation. In: Carlson, C. (Ed.), Innovative Perspectives for the 21st Century. BBVA Group, Madrid, Spain, pp. 163–175.

Lazonick, W., 2005. The innovative firm. In: Fagerberg, J., Mowery, D., Nelson, R. (Eds.), The Oxford Handbook of Innovation. Oxford University Press, Oxford, pp. 29–55.

Lazonick, W., 2010. The chandlerian corporation and the theory of innovative enterprise. Ind. Corp. Chang. 1, 317–349.

Levine, D.I., Toffel, M.W., 2010. Quality management and job quality: how the ISO 9001 standard for quality management systems affects employees and employers. Manag. Sci. 56 (6), 978–996.

Llach, J., de Castro, R., Bikfalvi, A., Marimon, F., 2012. The relationship between environmental management systems and organizational innovations. Hum. Factors Ergon. Manuf. Serv. Ind. 22 (4), 307–316.

Lo, L.K., Chang, D.S., 2007. The difference in the perceived benefits between firms that maintain ISO certification and those that do not. Int. J. Prod. Res. 45 (8), 1881–1897.

Manders, B., de Vries, H.J., Blind, K., 2016. ISO 9001 and product innovation: a literature review and research. Technovation 48–49, 41–55.

Mangiarotti, G., Riillo, C.A.F., 2010. Determinants of ISO9000:2000 certification in services and manufacturing: an empirical analysis for Luxembourg. In: Proc. 4ème Colloque Luxembourgeois sur l'économie de la Connaissance Dans une Perspective Européenne, pp. 7–9.

Marimon Viadiu, F., Casadesús Fa, M., Heras Saizarbitoria, I., 2006. ISO 9000 and ISO 14000 standards: an international diffusion model. Int. J. Oper. Prod. Manag. 26 (2), 141–165.

Marimon, F., Heras, I., Casadesús, M., 2009. ISO 9000 and ISO 14000 standards: a projection model for the decline phase. Total Qual. Manag. Bus. Excell. 20 (1), 1–21.

Martínez-Costa, M., Choi, T.Y., Martínez, J.A., Martínez-Lorente, A.R., 2009. ISO 9000/1994, ISO 9001/2000 and TQM: the performance debate revisited. J. Oper. Manag. 27 (6), 495–511.

Mastrogiacomo, L., Carrozza, A., Maisano, D.A., Franceschini, F., 2021. Is 'post-decline' the next phase of the diffusion of ISO 9001 certifications? New empirical evidence from European countries. Total Qual. Manag. Bus. Excell. 32 (11–12), 1384–1403.

Mendel, P.J., 2002. International standardization and global governance: the spread of quality and environmental management standards. In: Hoffman, A.J., Ventresca, M.J. (Eds.), Organizations, Policy and the Natural Environment: Institutional and Strategic Perspectives. Stanford University Press, Stanford, pp. 407–424.

Montiel, I., Husted, B.W., Christmann, P., 2012. Using private management standard certification to reduce information asymmetries in corrupt environments. Strateg. Manag. J. 33, 1103–1113.

Naveh, E., Erez, M., 2004. Innovation and attention to detail in the quality improvement paradigm. Manag. Sci. 50 (11), 1576–1586.

OECD, 2005. Oslo Manual: The Measurement of Scientific and Technological Activities: Guidelines for Collecting and Interpreting Innovation Data, Third edition. OECD Publishing, Paris.

Pekovic, S., Galia, F., 2009. From quality to innovation: evidence from two french employer surveys. Technovation 29, 829–842.

Podrecca, M., Orzes, G., Sartor, M., Nassimbeni, G., 2021. The impact of abandoning social responsibility certifications: evidence from the decertification of SA9000 standard. Int. J. Oper. Prod. Manag. 41 (13), 100–126.

Potoski, M., Prakash, A., 2005. Green clubs and voluntary governance: ISO 14001 and firms' regulatory compliance. Am. J. Polit. Sci. 49 (2), 235–248.

Prester, J., Bozac, M.G., 2012. Are innovative organizational concepts enough for fostering innovation? Int. J. Innov. Manag. 16 (1), 1–23.

Schumpeter, J., 1934. The Theory of Economic Development. Harvard University Press, Cambridge MA.

Schumpeter, J., 1939. Business Cycles. McGraw Hill, New York.

Simon, A., Kafel, P., 2018. Reasons for decertification of ISO 9001: an empirical study. Innovar 28 (70), 69–80.

Singh, P.J., Power, D., Chuong, S.C., 2011. A resource dependence theory perspective of ISO 9000 in managing organizational environment. J. Oper. Manag. 29 (1), 49–64.

Spence, M., 1973. Job market signaling. Q. J. Econ. 87, 355–379.

Spence, M., 1974. Market Signaling: Informational Transfer in Hiring and Related Processes. Harvard University Press, Cambridge MA.

Spence, M., 2002. Signaling in retrospect and the informational structure of markets. Am. Econ. Rev. 92, 434–459.

Swann, G.P., 2010. The economics of standardization: an update. In: Report for the UK Department of Business, Innovation and Skills (BIS).

Tassey, G., 2000. Standardization in technology-based markets. Res. Policy 29 (4–5), 587–602.

Teece, D.J., Pisano, G., Shuen, A., 1997. Dynamic capabilities and strategic management. Strateg. Manag. J. 18, 509–533.

Teece, D.J., 1998. Design issues for innovative firms: bureaucracy, incentives and industrial structure. In: Chandler Jr., A.D., Hagstrom, P., Solvell, O. (Eds.), The Dynamic Firm: The Role of Technology. Strategy, Organization and Regions, Oxford University Press, Oxford, pp. 134–165.

Teece, D.J., 2007. Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance. Strateg. Manag. J. 28, 1319–1350.

Terlaak, A., King, A.A., 2006. The effect of certification with the ISO 9000 quality management standard: a signaling approach. J. Econ. Behav. Organ. 60 (4), 579–602.

Terlaak, A., King, A.A., 2007. Follow the small? Information-revealing adoption bandwagons when observers expect larger firms to benefit more from adoption. Strateg. Manag. J. 28 (12), 1167–1185.

Terziovski, M., Guerrero, J.-L., 2014. ISO 9000 quality system certification and its impact on product and process innovation performance. Int. J. Prod. Econ. 158, 197–207.

Ullah, B., Wei, Z., Xie, F., 2014. ISO certification, financial constraints, and firm performance in Latin American and Caribbean countries. Glob. Financ. J. 25 (3), 203–228.

Vastag, G., 2004. Revisiting ISO 14000 diffusion: a new "look" at the drivers of certification. Prod. Oper. Manag. 13 (3), 260–267.

Williamson, O.E., 1985. The Economic Institutions of Capitalism. The Free Press, New York.

Wolter, C., Veloso, F.M., 2008. The effects of innovation on vertical structure: perspectives on transaction costs and competences. Acad. Manag. Rev. 33 (3), 586–605.

Wooldridge, J.M., 2002. Econometric Analysis of Cross Section and Panel Data. MIT Press, Cambridge MA.

Zimon, D., Dellana, S., 2020. A longitudinal exploratory study of ISO 9001 certification abandonment in small- and medium-sized enterprises. Int. J. Qual. Reliabil. Manag. 37 (1), 53–67.

Zutshi, A., Sohal, A., 2004. A study of the environmental management system (EMS) adoption process within Australasian organisations — 2. Role of stakeholders. Technovation 24 (5), 371–386.