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The Determinants of International Certification among Manufacturing Firms in Pakistan

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Abstract: *This study investigates the factors that influence international certification among Pakistani manufacturing firms. About a third of such firms in Pakistan hold one or more certificates related to management or technical processes. The existing literature suggests that this demand is influenced by factors such as sector of activity, market competition, human capital and information environment, ownership type, and available resources. By analyzing a large, random sample of Pakistani manufacturing firms, we find strong correlations between these factors and international certification. We also discover that owner attitude, an aspect overlooked in previous studies, plays a role in the certification decision. While our statistical model does not fully explain the determinants of certification for small firms, we do find that certification is associated with increased profitability among small enterprises. This implies that small enterprise development agencies can improve the effectiveness of their programs by considering certification status as an additional criterion for allocating support funds. The results of our study have policy implications related to exporting, staff training, diffusion of firm ownership, and enhanced information access facilitated by modern technology tools.*

Keywords: International certification, SME policy, product market competition, training, information environment, ownership diffusion.

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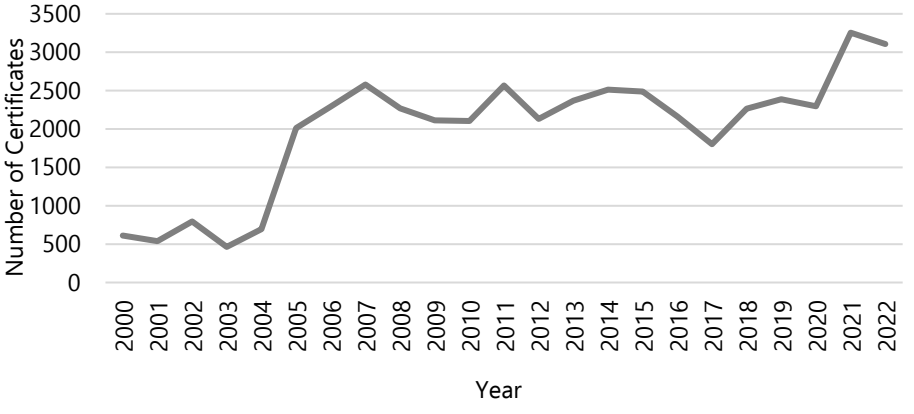
1. Introduction

International certification, or simply certification, is a significant feature of businesses operating in various industries and sectors (Medase & Abdul Basit, 2023). It provides stakeholders, including regulators, customers, employees, shareholders, and investors, with information about a certified business's adherence to specific standards in its operations and outputs (Cao & Prakash, 2011). Certification can be obtained for both technical and management processes. Technical certification is often required in sectors such as food, textile, leather, and chemicals, where adherence to particular processes and product safety protocols is necessary. In some cases, it may be mandatory, while in others, it is optional, such as the voluntary adoption of eco-labels in certain industries (Sharma & Rastogi, 2024).

On the other hand, management certification is available across a wide range of sectors and is typically voluntary. Over the past few decades, a management standard by the International Organization for Standardization (ISO) known as ISO 9001 has gained popularity. This standard focuses on aspects such as customer satisfaction, efficiency, evidence-based decision-making, and relationship management. Globally, the number of ISO 9001 certifications has doubled between 2000 and 2022, reaching over a million. In Pakistan, the number of certifications has quintupled during the same period, from 611 to 3,106 (see Figure 1).[1]

[1] Global and Pakistan-specific data are taken from the International Organization for Standardization (2022). The ISO family contains several management system standards, of which the most popular is the ISO 9001. This accounts for approximately 40 percent of the total number of certifications. Other standards pertain to the management of environmental impacts, information security, occupational health, financial risk, social responsibility, and other aspects of modern business operations.

Figure 1: Number of ISO 9001 Certifications in Pakistan



Source: International Organization for Standardization (2022).

Information regarding the broader significance of certifications among Pakistani firms is also available. A recent survey conducted by the World Bank revealed that nearly one-third of registered manufacturing firms in Pakistan hold at least one international certificate.[2] This indicates that certification is currently a significant characteristic of businesses in the country and warrants further investigation. The objective of this study is to analyze the factors driving Pakistani manufacturing firms to seek certification.

Broadly speaking, a relevant theoretical framework for analyzing these factors can be found in cost-benefit considerations (Adler & Posner, 2000). Firms will choose to become certified if they expect the benefits to outweigh the costs. However, firms usually do not have prior knowledge of all the financial costs and benefits associated with certification. In fact, some important costs and benefits may not be monetary in nature (Islam et al., 2015). Therefore, from an empirical standpoint, researchers need to associate various factors present in the firm's decision-making environment with the relevant costs and benefits, and then determine the statistical significance of these factors in the certification decision.

[2] This refers to the World Bank Enterprise Survey (WBES), which is carried out every few years for many developing and some developed countries. It is confined to registered establishments and our analysis is further confined to manufacturing firms. Any generalization from this sample should keep these restrictions in mind. Unregistered, informal enterprises are not included in the sampled by the WBES.

Other conceptual perspectives can also be found in the management science literature. For instance, the institutional theory perspective suggests that firms make decisions in order to conform to established business practices within their industry or sector (DiMaggio & Powell, 1983; Greenwood & Meyer, 2008). Another perspective considers firms to act based on the managerial and financial resources available to them, which is known as the resource-based perspective (Newbert, 2007). However, we find it useful to view managerial decisions within a cost-benefit framework. This is because many of the considerations highlighted by the institutional and resource-based perspectives can also be incorporated into the cost-benefit framework, especially if costs and benefits have both monetary and nonmonetary aspects.

Turning to costs, it is important to note that certification is not free. Firms that choose to become certified must not only pay for the relevant proprietary standards, consultant assistance, and assessor visits, but also allocate time and resources to modifying management or technical processes. This may result in work disruption while implementing the new protocols. In the case of technical certification, there may also be costs associated with purchasing new equipment and potentially redesigning certain processes (Biazzo & Bernardi, 2003). Furthermore, there may be nonmonetary costs involved. For instance, committing to a particular management quality standard means making decisions according to certain preset rules and protocols. Some owners and senior managers may be concerned about the loss of management control associated with this commitment. Therefore, firms must carefully consider the likely costs in relation to the expected benefits when deciding whether to pursue certification.

The benefits associated with certification can also be monetary or nonmonetary. For instance, decision-makers within firms may believe that certification will result in higher levels of approval from employees, customers, investors, and other relevant stakeholders. Additionally, compliance with industry norms and practices can lead to reputational benefits (Tarí et al., 2012). Firms may even seek certification simply to enhance their credentials if industry peers or market leaders possess it. On the other hand, monetary objectives are also significant. Decision-makers may believe that certification improves management practices, ultimately leading to higher profits, sales, and returns on assets and equity (Tarí et al., 2012). Monetary considerations also come into play if businesses require certification to participate in certain tenders and procurement contracts.

What determines why some firms obtain certification from an international body while others do not? The available literature on this topic in Pakistan is limited and has its own shortcomings. These include the use of nonrandom samples, focusing on specific sectors, and only considering a narrow range of firm sizes (Masakure et al., 2011; Fatima, 2014). These limitations make it difficult to generalize the findings for policy purposes. However, we address these shortcomings by utilizing data from the latest round of the World Bank Enterprise Survey (WBES) (World Bank, 2023). This approach offers three advantages over the existing empirical literature on Pakistan. First, it employs a random sampling methodology, allowing for the generalization of results. Second, it includes firms of varying sizes, enabling cross-scale comparisons. Third, it considers different industrial sectors, allowing for the control of sector effects in the analysis. Additionally, the WBES dataset provides detailed information that allows us to examine multiple aspects of the certification decision.

The study is organized as follows. Section 2 presents a literature review that focuses on studies examining different aspects of the decision to obtain certification. Section 3 describes the methodology used to assess the hypotheses developed from the literature review. Section 4 reports the empirical findings for the key hypotheses and provides extended analyses. Section 5 summarizes the results and discusses the policy implications, while also acknowledging certain limitations of the study.

2. Literature Review

When conducting the literature review, we took into account that the international certification types covered in the WBES dataset include both technical and management processes, some of which may be mandatory, while others are optional. One common feature is that the certification comes from an international source rather than a domestic one. The literature review reveals five broad categories of determinants of certification decisions. The first category relates to the industry or sector to which the firm belongs. The second focuses on the human capital and information available to the firm. The third section examines ownership characteristics. The fourth considers the resources available to the firm. The fifth category explores the potential productivity or profit gains that could be derived from certification.

2.1. Industry Characteristics

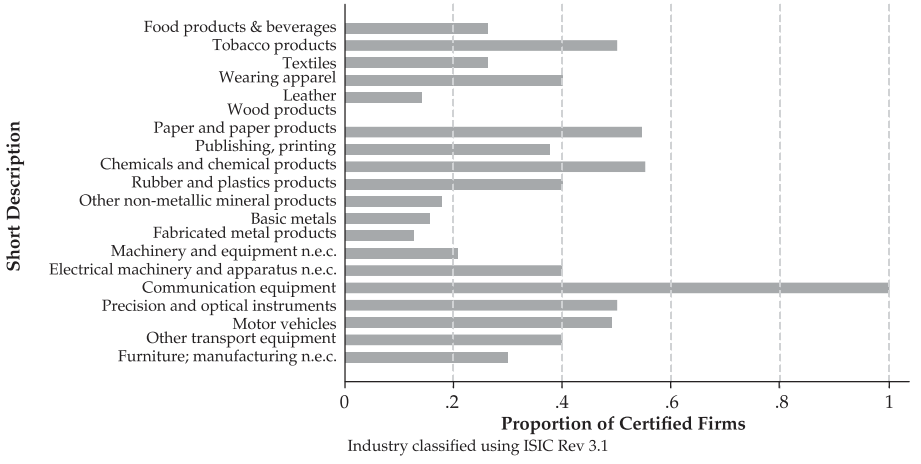
One key empirical observation is that the propensity to acquire international certification varies across industries. This is true not only in Pakistan but globally as well. Figure 2 provides cross-industry data for Pakistan, showing that five industries have certification rates greater than 50 percent, while five industries have rates less than or equal to 20 percent.[3] The certification rate is calculated by dividing the number of firms with any international certification by the total number of firms in that industry. So, why do these rates differ across industries?

The literature offers two main explanations. First, different industries exhibit varying degrees of competition in the product market (Pacheco et al., 2022). Firms facing intense competition may seek certification to enhance their marketing or competitive advantage. This motivation can be voluntary or due to pressure from business counterparts. For instance, firms engaged in exporting face international competition and may feel the need to signal to their business partners, especially importers, that they follow good business practices and are reliable suppliers. Certification can serve as a signal in such cases. Alternatively, importers may require certification from their suppliers for similar reasons. Masakure et al. (2011) find that the likelihood of certification among exporting firms in Pakistan, in specific sectors, is influenced by external pressure from importers.

Second, industries vary in terms of the requirements for technical regulations. Some industries are legally mandated to meet certain technical regulations, while others may require certification as a prerequisite for conducting business, particularly when dealing with important counterparties such as governments or large firms (Pacheco et al., 2022). For example, certain large firms may demand that subcontractors adhere to specific quality standards to maintain their business relationships. The institutional literature (Dos Santos et al., 2020) categorizes the pressures faced by firms as coercive (when certification is mandated by law or regulation), mimetic (when certification is pursued to emulate peers or market leaders), or normative (when certification is pursued because it is considered a norm in the industry or sector).

[3] The five industries with high certification rates are tobacco products; paper and paper products; chemicals and chemical products; communication equipment; and medical, precision and optical instruments. The five industries with low certification rates are tanning and dressing of leather; wood and wood products; nonmetallic mineral products; basic metals; and fabricated metals.

Figure 2: Rates of international certification among Pakistani firms by sector/industry



Source: World Bank Enterprise Survey for Pakistan (World Bank, 2023).

Bloom and Van Reenen (2010) highlight product market competition as a driver of good management practices, with certification being one such practice. Various studies have empirically confirmed a link between certification and exporting. For example, Hudson and Orviska (2013) find this association in a large sample of countries in Asia and Eastern Europe. Similarly, Fikru (2014) in Ethiopia, Pekovic (2010) in France, Hayat et al. (2018) in Pakistan, Goldor and Majumder (2022) in India, and Nguyen (2022) in ASEAN countries all support these findings.

Shen and Qin (2011) find that other competition measures, such as the number of rivals, also play a significant role in certification in China. Choudhary et al. (2018) observe a connection between management quality and exporting in Pakistan. However, the influence of industry classification extends beyond product market competition. Masakure et al. (2011) demonstrate that industry classification remains a crucial determinant of international certification in their study focused on exporting firms in Pakistan, even when controlling for market competition.

This situation may be attributed to specific regulations. In many countries, certain certifications are legally required. These certifications typically relate to the quality of a firm's product (such as processed foods) or the safety of specific processes (such as the disposal of chemical effluents). Additionally, certain government agencies or large companies may demand

international certifications for firms to participate in their procurement tenders. While this practice is more of a business requirement aimed at eliminating irrelevant bidders rather than a legal obligation, it is prevalent in certain industries. Consequently, firms wishing to bid on government or large corporate contracts within these industries would need to obtain the relevant certifications. Based on the preceding discussion, we propose the following hypotheses:

Hypothesis 1: Certification rates vary among firms in different industries.

Hypothesis 2: Product market competition has a positive impact on certification rates.

2.2. Human Capital and the Information Environment

The demand for certification may, in part, be due to an information issue: individuals who are more knowledgeable about the benefits of certification are more likely to obtain it. This is where the human capital and information environment within the firm become relevant. Firms with more educated staff and managers are likely to be better informed about certification. These firms have internal environments characterized by multiple sources of information and transparent sharing norms.[4] Fikru (2014) confirms a link between certification and the education levels of managers.

Similarly, Goldor and Majumder (2022) and Nguyen (2022) find that research and development (R&D) activity, which is closely linked to staff education levels, is an important determinant of certification. The significance of education in promoting the adoption of specific types of certification, such as halal food certification, is reported by Rafiki and Wahab (2014) for Indonesia. In the case of Pakistan, Choudhary et al. (2018) report a positive connection between the education of managers and nonmanagers and management quality, which is often associated with certification. A recent overview of multiple studies by Valero (2021) confirms that human capital generally encourages good management practices. Meanwhile, the relevance of open information environments, such as company websites, social media presence, and international connectivity, is supported by studies such as Fikru

[4] Note that some characteristics may fit more than one determinant category. For example, while we have considered exporting under the category of competition, it may also fit under that of information access and sharing. Exporting may expose firms to broader global networks of purchase agents, design specialists and marketing experts who may share information on a wide range of management and technical practices. Such information could well influence the decision to opt for certification.

(2014) for certification and Iqbal and Nakhoda (2024) for management practices. Based on the above discussion, the following hypotheses are formulated:

Hypothesis 3: Human capital has a positive impact on certification rates.

Hypothesis 4: An open information environment will have a positive impact on certification rates.

2.3. Ownership Characteristics

Certification may be more appealing to certain types of firms compared to others. For instance, firms with sole proprietors or a few partners may not be inclined to disrupt established management practices, which could be required if they were to adopt specific certification protocols. Family firms often have succession practices where sons follow fathers as chief executive officers without considering management ability. In such firms, there might be an attitude of 'owner knows best' that works against certification. Tsoutsoura (2021) provides evidence that firms with more concentrated ownership are less likely to adopt modern management practices. In the case of Pakistan, Choudhary et al. (2018) find better management quality among public limited companies compared to those owned by individuals or limited partnerships.

Some studies have found that foreign ownership plays a role similar to diffused ownership. For example, Lafuente et al. (2010) report a much higher likelihood of certification when multinational firms are the largest shareholders. Fikru (2014) does not find such an effect for foreign ownership among Ethiopian firms and notes that this may be due to the predominant source of foreign ownership in the sample being developing countries such as China, India, Lebanon, and Kenya. Owners and managers from these countries are less likely to be exposed to certification and modern management processes compared to those from developed countries, thus making them less likely to adopt them.

However, there may be cases where owners possess more progressive attitudes than one might imagine, based solely on ownership type. Such attitudes may be reflected in their approach to worker training, information sharing, or financial transparency. When information about these practices is available, it can help clarify the nuances in the relationship between ownership and certification. However, this topic has not been

extensively explored in the literature. One study indirectly explores this link: Gallego and Ramirez (2021) examine the association between workforce stability, which can indicate owner attitudes towards retaining workers, and the likelihood of certification. Based on the above discussion, we propose the following hypotheses:

Hypothesis 5: Diffused ownership will positively impact certification rates.

Hypothesis 6: Progressive attitudes towards management will positively impact certification rates.

2.4. Resources Available to the Firm

Even if firms do not expect financial gains from certification, some may still pursue it for reputational reasons, to signal their virtue, or to emulate prominent or respected firms, among other nonpecuniary objectives. It is reasonable to assume that firms with greater discretionary resources are more likely to engage in such preferences compared to those with fewer resources. Firm size and productivity can serve as indicators of the availability of discretionary resources. Therefore, we anticipate that larger or more productive firms are more likely to adopt certification compared to smaller or less productive firms. Several studies support this expectation. For example, Shen and Qin (2011) demonstrate a positive association between firm size and the voluntary implementation of environmental schemes in their sample of Chinese firms.

Similarly, Hudson and Orviska (2013) examine a large sample (almost 12,000 firms) from Asian and Eastern European countries and find that the likelihood of certification increases with firm size. Hayat et al. (2020) report similar results for both firm size and profitability as determinants of the adoption of eco-labels among their sample of textile firms in Pakistan. Choudhary et al. (2018) also observe a positive correlation between management scores (reflecting management quality) and firm size. However, Fikru (2014) notes that firm size does not have a significant influence once export orientation, international connectivity, credit availability, and managers' human capital are controlled for. This may be partly attributed to the collinearity often observed between firm size and the other included determinants. Based on the above discussion, we propose the following hypothesis:

Hypothesis 7: Greater discretionary resources will positively impact certification rates.

2.5. Pecuniary Benefits of Certification

The discussion above regarding the connection between resources and the decision to pursue certification raises concerns that resources and certification may be interrelated. In other words, while having more resources may increase the likelihood of certification, certification itself might also lead to outcomes that expand the available resources for the company. This would occur if certification has a positive impact on productivity and profitability. Therefore, the interpretation of any empirical results obtained regarding the link between resources and certification depends on the significance of the issue of endogeneity.

The literature on the pecuniary motivation for management certification presents two dilemmas. Firstly, it does not find consistent results supporting a positive link. A comprehensive meta-review (Sfreddo et al., 2021) reveals that less than half the studies in the sample show a statistically significant positive correlation between ISO 9001 certification and business performance.[5] Secondly, few studies have attempted to account for the possibility of endogeneity.[6] However, this issue is not further addressed in this research.

2.6. Hypotheses for Testing

The hypotheses tested in this study are summarized in Table 1 below:

[5] For Pakistan, Choudary et al. (2018) report a positive impact of management quality on firm-level productivity (from a large random-sample survey) but do not account for the possible reverse causation highlighted here. Another relevant study is Masakure et al. (2011), which finds export sales to be positively correlated with certification. Other studies, such as Fatima (2014), find positive links but are limited by small, nonrandom samples.

[6] Dick et al. (2008) investigate endogeneity and report that better-performing firms often select themselves into certification status. Similarly, using time-series data, Martínez-Costa and Martínez-Lorente (2007) find that better-performing firms opt for certification at higher rates than less well-performing firms. Goedhuys and Mohnen (2017) undertake a two-stage econometric procedure to address the endogeneity question for a large sample of African countries. They find a rather large impact of certification on productivity.

Table 1: Summary of hypotheses

Hypothesis 1	Certification rates vary across firms in different industries.
Hypothesis 2	Product market competition has a positive impact on certification rates.
Hypothesis 3	Human capital has a positive impact on certification rates.
Hypothesis 4	An open information environment will have a positive impact on certification rates.
Hypothesis 5	Diffused ownership will positively impact certification rates.
Hypothesis 6	Progressive attitudes toward management will positively impact certification rates.
Hypothesis 7	Greater discretionary resources will positively impact certification rates.

3. Empirical Methodology

3.1. Analytical Approach

The analysis in this study is conducted in four stages. First, we identify plausible independent variables that allow us to test the hypotheses mentioned above. Second, we perform a regression with a set of these variables and the firm's certification status, referring to this as our basic statistical model. Third, we perform a regression with an alternative set of independent variables and certification to determine the robustness of our basic model. Fourth, we disaggregate the sample by firm size to gain a better understanding of how our statistical model functions for large versus small firms. In all regressions, we incorporate fixed effects for industries and regions. This enables us to account for industry and regional variations caused by unobserved factors and obtain more precise estimates for the coefficients of the other variables.

Since the dependent variable, international certification, is binary, we employ the probit econometric procedure to estimate the relevant regressions.[7] We utilize Stata, a popular statistical application software, to conduct the regressions. Our approach effectively involves modeling the determinants of certification as a single equation that can be estimated through multiple regression techniques. We do not model a structural equation system involving additional endogenous variables due to insufficient information to identify each relationship separately.

[7] Probit regression is called for when the dependent or outcome variable is binary. In such cases, the more popular regression technique of ordinary least squares cannot be used because it generates residuals that violate the assumptions of heteroskedasticity and normal distribution of errors, thereby rendering invalid standard error calculations and conventional hypothesis tests.

3.2. WBES Dataset

The WBES dataset is suitable for our analytical objectives because it is based on a random sample survey of registered firms, covers a significant number of firms of different sizes, allowing for a deeper analysis of subsamples, and is stratified by industrial sector and geographical region, which enables control over industry-specific and region-specific effects. The survey cycle for Pakistan in 2022/23 covers both manufacturing and service firms, with the former coming from 22 sectors (see Appendix) and five regions.

We constructed a working sample of 751 observations by focusing only on manufacturing firms and using only firms for which data was available for all variables of interest. The WBES dataset contains information on various firm characteristics, including, but not limited to, the value of sales, total costs, the use of different types of labor, management practices, financial resources and relationships, interactions with foreign markets, technologies and investors, interactions with government agencies, access to infrastructure services such as electricity and the internet, the nature of competition faced, and the nature of ownership (World Bank, 2023).

3.3. Dependent Variable

The dependent variable in the study is international certification, which refers exclusively to internationally recognized certifications. Examples include the International Organization for Standardization (ISO) for manufacturing and services, Hazard Analysis and Critical Control Point (HACCP) for food (especially seafood and juices), and the American Association of Textiles, Chemists and Colorists (AATCC) for textiles. Certificates that are granted only at the national level and not recognized in international markets are not included.

3.4. Independent Variables

Competition. To assess the effects of competition on certification, some studies have used information about whether a firm exports its products and the number of competitors it faces. For an export proxy, we use direct exports, which refers to the sale of goods where the immediate recipient is outside the country's borders. We identify a firm as an exporter if it directly exports a certain fraction of its products. Additionally, as an alternative proxy, we use informal competition, which occurs when a firm

competes against informal and unregistered businesses. We expect positive signs for both variables, as both increase competition for the firm.

Human capital. Since we do not have sufficient information on the education levels of staff and managers in our database, we use the age of the firm as a measure of its accumulated human capital. Firms that have been operating for many years are likely to have built networks and communication channels with peers, customers, and stakeholders, allowing them to gain a better reputation or other benefits from certification. As an alternative proxy, we use manager experience, which refers to the number of years of experience the top manager has in the relevant sector where the firm currently operates. We expect positive signs for both the age of the firm and manager experience.

Information environment. Useful information about certification can be shared through business networks and other channels of contact with peers, customers, and even staff. In modern times, having a website and a social media presence could indicate the quality of a firm's information acquisition and sharing process. Therefore, we use the variable 'website' to differentiate between firms' information environments. We expect a positive relationship between having a website and certification.

Diffusion of ownership. The idea is to differentiate between different types of ownership that indicate the likelihood of owners adhering to traditional or modern management styles. Diffused forms of ownership, such as those found in companies with shareholders, are more open to modern management practices compared to concentrated forms found in sole proprietorships or partnerships. In our sample, we measure this through the variable 'shareholding,' which refers to firms with external shareholders, whether their shares are publicly or privately traded. Alternatively, we also consider the proportion of the firm owned by its largest shareholder. This largest owner could be an individual, company, government agency, domestic or foreign. If a shareholder has a dominant share, they are more likely to have a dominant role in decision-making and be resistant to adopting new management or technical processes. We expect a positive coefficient for shareholding and a negative coefficient for the largest owner share.

Attitudes of owners. Regardless of the level of control exerted, some owners may have progressive attitudes towards certification, viewing it as a way to enhance the firm's reputation or retain workers and customers. We

use two measures to determine which owners might have progressive attitudes: voluntary submission to external audits and offering formal training to workers. Most of the firms in our sample are not publicly listed or are composed of private shareholding companies, so they are not required to undergo mandatory audits. However, if they choose to have audits done (firm audited), it suggests that their owners have an interest in transparency.

As an alternative measure, we consider formal training. Formal training has a structured curriculum and may include classroom work, seminars, lectures, workshops, and audio-visual presentations and demonstrations. Firms that offer formal training to their workers demonstrate a positive attitude towards worker satisfaction and skill development, which should also translate into positive attitudes towards certification. We expect positive coefficients for both measures.

Resources available. Several variables can serve as proxies for the availability of discretionary resources. One such variable we use is firm size, which is measured by the number of permanent full-time workers employed by the establishment at the end of the last fiscal year, encompassing all staff, including managers, who have been contracted for one or more fiscal years or have a guaranteed renewal of employment or an open-ended contract. Even workers on third-party contracts are included if they work for a full year. As an alternative, we consider access to finance. This reflects whether a firm has access to overdraft facilities that can expand its pool of available resources.[8] An overdraft facility is a flexible account from which firms can automatically borrow if their account balance becomes negative. The firm incurs fees and pays interest on the amount borrowed. We expect both variables to have a positive relationship with certification.

Industry practice. Our database does not contain any information about specific regulations or practices that may be applicable to different industries. However, we account for variations between industries by using industry-fixed effects in our statistical model. Additionally, we consider whether the firm holds a foreign license. A foreign licensee is expected to adhere to the terms specified by the licensing company, which likely includes compliance with international standards for the relevant industry in order to protect the licensing company's reputation. The possession of an international certification may indicate that the firm will comply with

[8] Using data from a sample of 64 countries, Pietrovito (2020) shows that financially constrained firms are less likely to possess environmental and quality management certifications.

industry practices. We anticipate a positive coefficient for the variable indicating foreign licensees.[9]

Table 2 summarizes the variables used in the basic model, including both the dependent and independent variables.

Table 2: Variables used in Basic Model

Determinant category	Proxy used	Definition
International certification	Internationally recognized certifications	This variable is coded as a binary variable that takes the value 1 if any international certification is possessed and 0 otherwise.
Competition	Exporter	This is coded as a binary variable that takes the value 1 if the response for direct export is a positive number and 0 otherwise.
Human capital	Age of firm	This is calculated as the difference between the year of the survey (2022) and the year in which the company began operation.
Information environment	Owns a website	This item is coded as 1 if the establishment has its own website and maintains a social media account and 0 otherwise.
Diffusion of ownership	Shareholding	We coded public listed companies and private listed companies as 1, referring to diffused ownership, and sole proprietorship, partnership and limited partnership as 0, referring to concentrated ownership.
Owner attitude	Firm audited	This item is coded 1 if the firm's financial statements are checked and certified by an external auditor and 0 otherwise.
Resources available	Firm size	This refers to the number of permanent full-time workers employed by the establishment at the end of the last fiscal year, covering all staff (including managers) that are contracted for one or more fiscal years or have a guaranteed renewal of employment or an open-ended contract.
Industry practice	Foreign licensee	We code this item as 1 if the establishment formally licenses any technology from a foreign-owned company and 0 if the establishment does not license any foreign technology through a formal agreement.

[9] While we use foreign licensee status as an indicator of industry practice, it may also be used to denote other characteristics or outcomes. Thus, Goel and Nelson (2020) use it as an indicator of firm conduct, concluding that international certification promotes such licensing as well as R&D spending.

Table 3 summarizes the variables used in the alternative model, including both the dependent and independent variables.

Table 3: Variables used in Alternative Model

Determinant category	Proxy used	Definition
International certification	Internationally recognized certifications	This variable is coded as a binary variable that takes the value 1 if any international certification is possessed and 0 otherwise.
Competition	Informal competition	Respondents are asked to indicate whether their establishment competes against informal and unregistered businesses. We code this item as 1 if the answer is yes and 0 if the answer is no.
Human capital	Manager experience	This refers to the years of experience of the firm's top manager in the sector in which the establishment presently operates.
Information environment	Owns a website	This item is coded as 1 if the establishment has its own website and maintains a social media account and 0 otherwise.
Diffusion of ownership	Largest owner share	This refers to the percentage share of the largest owner of the firm.
Owner attitude	Formal training	This item is coded 1 if the firm offers formal training to its staff and 0 otherwise.
Resources available	Access to finance	Access to finance is coded 1 if the establishment has an overdraft facility.
Industry practice	Foreign licensee	We code this item as 1 if the establishment formally licenses any technology from a foreign-owned company and 0 if the establishment does not license any foreign technology through a formal agreement.

4. Results and Discussion

4.1. Summary Statistics

Table 4 presents descriptive statistics for the entire sample as well as subsamples of large and small firms. Large firms are defined as those with 20 or more workers, while small firms are defined as those with fewer than 20 workers. The following findings are noteworthy: (a) larger firms have a certification rate almost twice that of small firms, with 35 percent versus 19 percent, but even a 19 percent certification rate may be considered high for small firms in a low-income country like Pakistan; (b) the gap between large and small firms is significant for characteristics such as exporting, audits,

becoming shareholding companies, and offering formal training; and (c) even small firms operate websites, with an average rate of 35 percent.

The differences in means suggest that it would be valuable to analyze the behavior of these two groups separately. This is done after presenting the main results. Any observations with missing values for any of the listed variables are excluded from our final sample.

Table 4: Summary Statistics

	All firms	Large firms	Small firms
International certification	0.31	0.35	0.19
Exporter	0.14	0.18	0.02
Age of firm	26.86	28.03	23.42
Firm audited	0.29	0.34	0.12
Owns a website	0.54	0.60	0.35
Shareholding	0.05	0.07	0
Firm size (workers)	126	165	11
Informal competition	0.37	0.34	0.46
Manager experience (years)	17.53	17.60	17.29
Formal training	0.10	0.13	0
Largest owner share (%)	81	78	90
Access to finance	0.47	0.51	0.34
Foreign licensee	0.08	0.09	0.03

Note: Only means are shown in the table because most variables are binary. For nonbinary variables, standard deviations are as follows for the full sample: age of firm = 16, firm size = 348, manager experience = 10, largest owner share = 26.

4.2. Regression Results for Basic and Alternative Models

The first column of results in Table 5 corresponds to our basic statistical model. Every independent variable, which represents categories that the literature has shown to be important determinants of certification, is statistically significant and aligned with the expected signs. This provides strong support for our model, particularly considering that some variables are likely to be correlated with each other.

Table 5: Determinants of certification: Basic and Alternative Models

Determinant Category	Basic Model	Alternative Model
Dep. variable = international certification		
Competition	0.29***	-0.03
	(0.07)	(0.04)
Human capital	0.08**	0.06**
	(0.03)	(0.03)
Information environment	0.22***	0.30***
	(0.04)	(0.04)
Ownership diffusion	0.42***	0.001
	(0.13)	(0.04)
Owner attitude	0.08*	0.22***
	(0.05)	(0.07)
Resources available	0.05***	0.13***
	(0.02)	(0.04)
Industry practice	0.15**	0.22***
	(0.08)	(0.09)
Number of observations	728	751

Note: Specific empirical proxies used for the basic and alternative models are shown in Tables 2 and 3. The probit regression technique is employed, and marginal effects are reported with robust standard errors in parentheses. Levels of statistical significance are denoted by asterisks as follows: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Industry and region fixed effects are applied, but their results are not shown in the tables to conserve space. The goodness of fit is measured by pseudo-R-squared values of 0.38 for the basic model and 0.3 for the alternative model, both of which are higher than the standard reference value of 0.2.

The second column in Table 5 presents the results of analyzing an alternative set of empirical proxies (listed in Table 3). Five variables are now statistically significant, including three new proxies. This suggests that our model is reasonably robust when it comes to variable choices. However, not every alternative proxy is significant. For example, informal competition does not seem to provide sufficiently distinctive information about the competitive context of the firm, as also found by Nguyen (2022). Additionally, the share of the largest owner does not appear to convey adequate information about ownership diffusion.

Assessing the results across both models, the four largest marginal impacts come from whether the firm has shareholders ($\beta = 0.42$, $p < 0.01$), is an exporter ($\beta = 0.29$, $p < 0.01$), has a website presence ($\beta = 0.30$, $p < 0.01$), and offers training to its workers ($\beta = 0.22$, $p < 0.01$). This suggests that policies aimed at broadening ownership, promoting exporting, facilitating the use of social media and information technology, and encouraging staff

training are likely to have the most significant impact on the adoption of international certifications.

Some of our results align with those found in previous studies. For example, earlier studies commonly note ownership diffusion and exporting as drivers of certification (for example, Lafuente et al., 2010; Hudson & Orviska, 2013). Some results strengthen the existing evidence. For example, the results regarding the information environment (website and social media) contribute to the limited number of studies (for example, Fikru, 2014) that have previously reported on this topic. Some results open up new avenues for further research.

Our two proxies for capturing owner attitudes, firm audit, and training, are statistically significant. This holds true even in the presence of a variable reflecting ownership diffusion (shareholding), which suggests that it is useful to differentiate between ownership type and owner attitude. To the best of our knowledge, such a distinction has not been made in the existing literature. Our results suggest that this may prove a useful area for further inquiry.

4.3. Extension: Disaggregation by Firm Size

We now extend the analysis to consider the determinants of certification for two groups of firms based on size: small and large. We define small firms as those with fewer than 20 workers and large firms as those with 20 or more workers.[10] The results for the basic model are presented in Table 6. They indicate that our statistical model works well for large firms but not for small firms.[11] All included independent variables are statistically significant for large firms, while only two are significant for small firms.

Surprisingly, even within the subset of small firms, there is enough variation to make size an important factor in certification. Perhaps even more surprising is the finding that the information environment, represented here by the presence of a firm's website and social media, is

[10] We divide the sample into these categories because we are particularly interested in whether our model works for small firms. We have also tried a version in which small and medium firms are grouped together and larger firms are then defined as those with 100 workers or more. Adding medium firms to the smaller size category does not improve the fit of the model for that category.

[11] The ownership diffusion variable does not return a result for small firms because no small firm is classified as a shareholding company.

associated with a positive attitude toward certification. Both these results suggest that within the small firm subgroup, there exists a subset that has a more progressive and dynamic profile. We further explore this group by examining how profitability among small firms varies based on certification status.

Table 6: Determinants of Certification: Basic Model by Firm Size

Determinant Category	Large firms	Small firms
Dep. variable = international certification		
Competition	0.29***	0.05
	(0.08)	(0.11)
Human capital	0.11**	0.01
	(0.04)	(0.02)
Information environment	0.24***	0.08**
	(0.04)	(0.04)
Ownership diffusion	0.43***	-
	(0.12)	-
Owner attitude	0.10*	0.03
	(0.05)	(0.05)
Resources available	0.06**	0.04*
	(0.03)	(0.02)
Industry practice	0.19*	0.01
	(0.10)	(0.07)
Number of observations	543	138

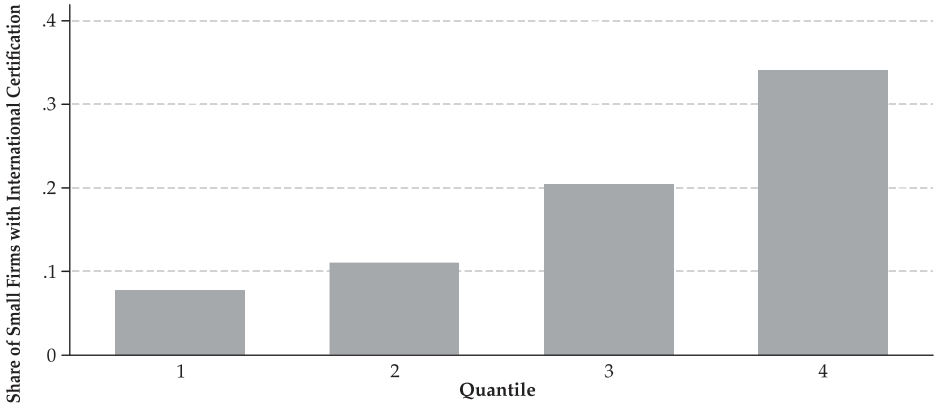
Note: The specific empirical proxies used for the basic model are shown in Table 2. The probit regression technique is applied, and marginal effects are reported with robust standard errors in parentheses. Levels of statistical confidence are represented by asterisks as follows: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Industry and region fixed effects are applied, but their results are not shown in the tables to save space. The goodness of fit is measured by pseudo-R-squared values of 0.35 for larger firms and 0.52 for small firms, both of which are higher than the standard reference value of 0.2.

4.4. Extension: Certification and Small Firm Support Policy

Close to one-fifth of small firms (19 percent) in our sample possess international certification (see Table 4). Although our statistical model cannot explain this well, some aspects may be explored through a nonparametric approach. For example, we can examine whether certified firms are concentrated among the best-performing small firms. To do so, we use value added per worker. This is calculated as the difference between revenues from sales and all costs incurred in production divided by the number of workers (World Bank, 2023).

Figure 3 shows how the rate of certification (on the vertical axis) varies among small firms ranked by the quantile of profitability as measured by value added per worker (on the horizontal axis). We observe that profitability and rates of certification rise together. The top quantile has a certification rate approximately five times that of the bottom quantile. Regardless of the direction of causality, that is, whether certification causes higher profits or vice versa, this finding provides guidance for policies aimed at small firms. Since higher profits improve the odds of firm survival, the above finding suggests that the chances of survival increase with certification among small firms. Thus, policymakers can use certification status as a marker to identify which firms are more likely to survive and which are more likely to fail. Consequently, policymakers can allocate government support funds and initiatives to firms that are more likely to survive.

Figure 3: Certification and Profitability among Small Firms



Source: Authors' calculations from the WBES dataset. Profitability is measured by value added per worker, with the bottom 25 percent of firms shown as Quantile 1 and the top 25 percent as Quantile 4.

This finding has important policy implications for how firms are selected for small-firm support programs. In Pakistan, such programs typically offer benefits such as subsidized credit, loan guarantees, and business development services. Small and medium firms are selected for these programs based on size, assets or turnover. However, the funds available for support are typically insufficient to cover all those who qualify. As a result, the available support funds are rationed by the designated agencies responsible for implementing the programs, such as commercial

banks, the Small and Medium Enterprise Development Authority, and, in some cases, the Ministry of Science and Technology.

Certification status offers a rational way to select among applicants. If certification status is included as an additional criterion for program eligibility, the number of eligible firms would decrease and the bulk of support funds would be allocated to firms that are more likely to survive. This would make the support programs more effective since support would be directed to firms that persist over time, creating jobs and incomes for a longer period.[12]

5. Conclusion

This study makes a unique contribution in terms of its topic and scope. While previous studies have focused mainly on the impact of certification on profits or business performance, only a few have explored why Pakistani firms choose to become certified. This study stands out as it uses a national random sample database that covers various industrial sectors and firm sizes. Previous studies have typically concentrated on specific sectors and firm sizes, often relying on nonrandom samples. In relation to the hypotheses, we can summarize our findings as follows. Firms are more inclined to seek international certification if they operate in competitive environments, have well-qualified human capital, and foster an open information-sharing culture. Moreover, firms are also more likely to pursue certification if their ownership is dispersed, their owners adopt a progressive management philosophy, and they have discretionary resources at their disposal. Some of these findings carry significant policy implications. For instance, promoting exports not only has macroeconomic advantages, such as generating foreign exchange, but also microeconomic benefits, such as fostering improved management and compliance with international production, marketing, and payment standards.

Similarly, promoting an open information-sharing culture yields comparable benefits. In this regard, the imposition of taxes on mobile phone and internet communications, as currently practiced in Pakistan, should be reconsidered. This becomes even more vital when considering that information technology tools drive even small firms to seek certification. Lastly, priority should be given to advancing professional management

[12] Note that while it is difficult for a small enterprise development agency to observe the true profit performance of small firms, it is much easier to determine if they possess international certification. If there is doubt, this can be further checked directly through the certificate issuing authority.

through dispersed ownership, such as encouraging companies to go public. Unfortunately, Pakistan has lagged behind in this area for many years, with limited and stagnant rates of public listing.[13]

When analyzing the distribution of international certification among small firms, we discover a strong correlation with profitability. The higher the certification rate, the higher is the value added per worker. This suggests that small firm development agencies can utilize certification status as an indicator of the potential success of their beneficiaries. By directing their limited funds towards small businesses that have achieved international certification, they can enhance the likelihood that their support will lead to job creation and sustained incomes.

However, it is important to consider the empirical results and their policy implications in light of potential statistical or conceptual limitations. We do not interpret our findings as asserting that specific variables are crucial in the decision to pursue certification, but rather that certain categories of determinants are significant. Each of these categories can be represented by various specific variables, and we have presented results for two sets of such variables, which are reflected in our basic and alternative models.

While the existing literature had guided our selection of specific variables, other variables could have been considered as well. Additionally, the chosen variables may fit into more than one category of determinants, and this should also be taken into account when assessing specific results. Finally, it is worth noting that we did not address the issue of endogeneity in this paper. Independent variables that reflect the pecuniary impact of certification on profits or productivity raise concerns about the direction of causality. These issues have not been definitively addressed in the literature so far, and therefore, future research can explore this issue further.

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[13] The website of the Pakistan Stock Exchange shows the total number of listed companies for each of the last five years as follows: 534 in 2019, 531 in 2020, 533 in 2021, 531 in 2022, and 523 in 2023. For a country with approximately 200,000 registered companies, this represents a very low rate of listing.

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Appendix

Annex 1: Industries and Regions covered in the WBES for Pakistan

Industries are defined using ISIC Rev. 3.1

Code	Description
15	Manufacture of food products and beverages
16	Manufacture of tobacco products
17	Manufacture of textiles
18	Manufacture of wearing apparel, except fur apparel
19	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear
20	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
21	Manufacture of paper and paper products
22	Publishing, printing and reproduction of recorded media
23	Manufacture of coke, refined petroleum products and nuclear fuel
24	Manufacture of chemicals and chemical products
25	Manufacture of rubber and plastics products
26	Manufacture of other nonmetallic mineral products
27	Manufacture of basic metals
28	Manufacture of fabricated metal products, except machinery and equipment
29	Manufacture of machinery and equipment n.e.c.
30	Manufacture of office, accounting and computing machinery
31	Manufacture of electrical machinery and apparatus n.e.c.
32	Manufacture of radio, television and communication equipment and apparatus
33	Manufacture of medical, precision and optical instruments, watches and clocks
34	Manufacture of motor vehicles, trailers and semitrailers
35	Manufacture of other transport equipment
36	Manufacture of furniture; manufacturing n.e.c.

Regions: Balochistan, Islamabad, Khyber Pakhtunkhwa, Punjab and Sindh.