The influence of digital information and technological advancement on firms' ethical practices

Accepted for publication in the Journal of International Accounting, Auditing and Taxation

https://doi.org/10.1016/j.intaccaudtax.2026.100748

The Influence of Digital Information and Technological Advancement on Firms' Ethical Practices

Marika Carboni
Roma Tre University, Italy

Marta Degl'Innocenti
Università degli Studi di Milano, Italy

Franco Fiordelisi
University of Essex, United Kingdom

Davide Salvatore Mare*
World Bank, United States; University of Edinburgh, United Kingdom

This version: July 7th, 2025

Abstract

While technology has the potential to enhance ethical practices, its impact is complex and poorly understood. This paper examines corporate ethical standards in digital tech–oriented firms to explore this dynamic. Using data from the World Bank Enterprise Surveys spanning 2006 through 2023, we find that technology and digitalization positively influence the adoption of environmental and social standards. However, digital tech–oriented firms exhibit lower governance standards. These results are shaped by country culture, the burden of business regulation, and the perception of the courts as obstacles to business activity. Our findings highlight the significance of broader societal influences and the quality of the business environment in determining how digital-oriented technological firms adopt ethical standards.

***JEL Classification*:** Q56, G30, O14

Keywords: Technology, Ethics, ESG, Sustainability, Culture, Corporate Governance

The Influence of Digital Information and Technological Advancement on Firms' Ethical Practices

This version: July 7th, 2025

Abstract

While technology has the potential to enhance ethical practices, its impact is complex and poorly understood. This paper examines corporate ethical standards in digital tech–oriented firms to explore this dynamic. Using data from the World Bank Enterprise Surveys spanning 2006 through 2023, we find that technology and digitalization positively influence the adoption of environmental and social standards. However, digital tech–oriented firms exhibit lower governance standards. These results are shaped by country culture, the burden of business regulation, and the perception of the courts as obstacles to business activity. Our findings highlight the significance of broader societal influences and the quality of the business environment in determining how digital-oriented technological firms adopt ethical standards.

***JEL Classification*:** Q56, G30, O14

Keywords: Technology, Ethics, ESG, Sustainability, Culture, Corporate Governance

1 Introduction

Interest in ethics and sustainability in firm management has grown globally in recent decades, and these concepts are intrinsically linked (Crane et al., 2019; Torelli, 2021). Unsurprisingly, the relationship between technology and sustainability has also received considerable attention in recent years, given the crucial role that technological progress can play in sustainable development (United Nations, 2019). On the one hand, technological change can accelerate the achievement of the Sustainable Development Goals (SDGs) by substituting environmentally damaging modes of production with more sustainable alternatives, boosting incomes through higher productivity and lower costs of goods and services, and promoting more inclusive participation in social and economic life. On the other hand, technology can also pose health and environmental risks, such as pollution from electronic waste[1] that contains non-biodegradable materials and toxic substances (Dwivedi et al., 2022). Additionally, technology may generate negative socioeconomic effects by increasing unemployment and deepening economic inequality (Miedzinski et al., 2020; Prettner & Strulik, 2020). Therefore, the relationship between technology and ethical practices is multifaceted, as technological development propels sustainable development but can also lead to environmental and socioeconomic challenges (Hutson, 2021; Stahl & Eke, 2024).

This paper examines how digital tech–oriented companies adopt ethical practices, namely environmental, social, and governance (ESG) principles. We are especially interested in studying this relationship because it is unclear to what extent such firms focus on ethical issues, and what the outcomes are. Analyzing high-tech firms in the context of digitalization is crucial for assessing ESG performance, as digital technologies enhance transparency, enabling real-time monitoring of

[1] See, for example, "Waste from Electrical and Electronic Equipment (WEEE). EU rules on treating waste electrical and electronic equipment to contribute towards a circular economy," available at the following link: https://environment.ec.europa.eu/topics/waste-and-recycling/waste-electrical-and-electronic-equipment-weee_en (last accessed: February, 2025).

environmental impacts, governance practices, and social commitments (Asif et al., 2023). Notably, social media – a digital technology that facilitates the sharing of ideas and information – allows companies to communicate their mission and ethical principles to the public without relying on the news media's gatekeeping function (Vogler & Eisenegger, 2021). However, digitalization also presents ethical challenges, such as job displacement, cybersecurity risks, and widening gender disparities in leadership. In any case, in today's digital age, an online presence is essential if firms are to enhance their competitive advantage (Dolan et al., 2015; Chaffey, 2014).

Our paper addresses the following main research question: *Are digital tech–oriented firms more ethically oriented than other firms?* To answer this question, we gather firm-level data from the World Bank Enterprise Surveys (ES). The data come from 192,132 observations across 158 countries between 2006 and 2023. We consider three main dimensions of firms' ethical behavior in capturing environmental, social, and governance (ESG) standards: monitoring CO_2 emissions (the environmental dimension, or "E"), implementing formal training programs for employees (the social dimension, or "S"), and having female top managers (the governance dimension, or "G"). The selection of these ESG dimensions is motivated by past papers that emphasize the importance of technology in reducing CO_2 emissions (Jaffe et al., 2003) and highlight how technological advancements enhance the effectiveness of training programs and employee performance (Bhattacherjee & Premkumar, 2004). Furthermore, the appointment of women directors to corporate boards has been a longstanding and widely debated topic in corporate governance research. The existing literature provides evidence of a potential link between diverse boards and innovation (see, for example, the literature review in Kirsch, 2018). We extend this literature by investigating whether digital tech–oriented firms hire women for managerial roles.

Our findings indicate that digital tech–oriented firms are more likely to monitor CO_2 emissions and provide formal employee training programs. However, we find that these firms are less likely to employ female top managers. As in many other sectors, women are underrepresented in managerial roles, potentially due to stereotypes against women or other barriers to entering the labor market. This issue may be more pronounced in technology firms due to the historical gender gap in STEM (Science, Technology, Engineering, and Mathematics) education and career paths that have restricted the number of qualified female candidates for managerial positions within digital tech–oriented firms.

Country-specific traits can significantly influence corporate practices, including ethical practices (Kostova & Roth, 2002). To account for this heterogeneity, we consider both cultural factors and the quality of the business environment. Accordingly, we further formulate the following two sub-questions: *Do cultural factors moderate the relationship between digital-tech firms and the adoption of ethical practices? Does the business environment moderate the relationship between digital-tech firms and the adoption of ethical practices?*

We capture cultural influences using the five dimensions of national culture proposed by Hofstede et al. (2010). We observe that digital tech–oriented firms show a stronger negative relationship with the employment of female top managers in countries characterized by strong masculine preferences and short-term orientation.

To investigate the role of the quality of critical public services, we examine regulatory burden and businesses' perception of the courts. Both factors relate to the literature on the need for and impact of regulation on sustainability (Li et al., 2021; Behera & Sethi, 2022). Regulatory and bureaucratic burdens may challenge the flexibility and adaptability necessary for proactive ethical strategies. One possible explanation is that heavier bureaucratic processes, while time-consuming, rely more on formal procedures, which may reduce opportunities for gender-based discrimination and reliance on informal networks that often exclude women (Baron et al., 2007). In contrast, when regulations are lightened, informal channels and discretionary decision-making may become more prevalent, disproportionately disadvantaging women, who tend to face greater barriers to accessing these networks. As a result, lower regulatory burden can unintentionally exacerbate gender disparities in leadership roles.

Finally, we consider how to what extent courts of justice are viewed as an obstacle to business activity. We find that digital tech–oriented firms hire fewer female top managers when courts are not regarded as a significant barrier to conducting business. This finding prompts a closer examination of the mechanisms by which the quality of the business environment affects the gender gap in digital tech–oriented firms.

Our paper relates to various strands of literature. First, it contributes to existing knowledge of the relationship between technology and sustainability (e.g., Higón et al., 2017; Bekhet & Latif, 2018; Sun et al., 2019; de Vries et al., 2020; Omri, 2020; Tyrowicz et al., 2020; Sharif et al., 2022; Yang et al., 2022; Zakari et al., 2022; Zhang et al., 2022), confirming that this relationship is ambiguous. Our study also provides nuanced evidence relevant to papers examining the impact of technology firms' ethical behavior (Boulouta & Pitelis, 2014; Bernal-Conesa et al., 2017; Lin et al., 2020; Okafor et al., 2021). Unlike these studies, we focus on the effect of technology on firms' ESG practices while considering country-specific factors and heterogeneity in the business environment. Consequently, our findings may have significant implications for policies that aim to simultaneously advance technological progress and sustainability goals.

Additionally, we contribute to the corporate social responsibility (CSR) literature (e.g., Angelidis & Ibrahim, 2004; Arnold & Valentin, 2013; Mahoney et al., 2013; Ferrell et al., 2019; Chantziaras et al., 2020) by investigating whether the findings on the relationship between digital tech–oriented firms and ethical practices vary across cultural dimensions. Consequently, we also contribute to the body of research examining the connection between cultural dimensions and sustainability (Husted, 2005; Vachon, 2010; Parboteeah et al., 2012; Onel and Mukherjee, 2014;

Gallego-Álvarez & Ortas, 2017; Lahuerta-Otero & González-Bravo, 2018; Kucharska and Kowalczyk, 2019; Sedita et al., 2022) and to studies addressing the issue of regulation in sustainability (Li et al., 2021; Behera and Sethi, 2022) by exploring how regulatory burdens and perceptions of courts as obstacles to business activity relate to firms' ethical behavior.

The remainder of the paper is organized as follows. In Section 2, we describe the sample and the methodology; in Section 3, we present our empirical findings. Section 4 concludes the paper.

2 Sample and methodology

2.1 Data sources

We collect data from various sources to analyze the correlation between firms' technology and their ethical practices. First, we gather firm-level data from the World Bank Enterprise Surveys (ES), covering 158 countries from 2006 to 2023, with a total of 192,132 observations.[2] We consider firms in the manufacturing and non-manufacturing industries according to the ISIC Code Revision 4 classification.[3] Additionally, we obtain GDP per capita from the World Bank's World Development Indicators[4] and cultural dimensions data from Geert Hofstede's website.[5]

Table 1 lists the countries in our sample, which represent various world regions: Africa (AFR), East Asia and the Pacific (EAP), Europe and Central Asia (ECA), Latin America and the Caribbean (LAC), Middle East and North Africa (MNA), and South Asia (SAR).

---

[2] The Enterprise Surveys are firm-level surveys of representative samples of the private sector around the world. Data are publicly available and can be retrieved at the following link: https://www.enterprisesurveys.org (last accessed: November, 2024).

[3] The United Nations Statistical Commission produces a standard classification of economic activities: the International Standard Industrial Classification of all economic activities (ISIC).

[4] Data can be retrieved from the following link: https://databank.worldbank.org/source/world-development-indicators (last accessed: November, 2024).

[5] See: Dimension data matrix, version 2015 12 08 0-100, available at the following link: https://geerthofstede.com/research-and-vsm/dimension-data-matrix/ (last accessed: June, 2024). In our database, cultural data begin in 2015.

[Insert Table 1 about here]

2.2 Empirical approach

For our analysis, we employ a conditional model where a variable capturing firms' digital orientation interacts with a variable measuring firms' technological focus. This approach allows us to investigate the combined effect of these two dimensions, providing a nuanced understanding of their influence on the desired outcomes. Our model takes the following form:

$$\begin{aligned} \text{ethical\_orientation}_{ict} &= \beta_0 + \beta_1 \text{digital orientation}_{ict} + \beta_2 \text{tech orientation}_{ict} \\ &+ \beta_3 \text{digital orientation}_{ict} * \text{tech orientation}_{ict} + \beta_4 X_{ict} \\ &+ \alpha_c + \alpha_t + \varepsilon_{ict} \end{aligned} \quad (1)$$

where the subscripts *i*, *c*, and *t* stand for firm, country, and survey year, respectively. The dependent variables (*ethical_orientation*) are binary variables that capture each ESG ethical dimension (*mon_emi*, *training*, and *top_man_fem*). Specifically, the environmental dimension is captured by a binary variable that takes the value of one if the firm has monitored its CO_2 emissions over the past three years (*mon_emi*), and zero otherwise.[6] We capture the social dimension by using a binary variable that takes the value of one if the firm offered formal training programs for permanent, full-time employees (*training*) in the last fiscal year, and zero otherwise. The governance dimension, related to the employment of female top managers (a gender issue), is measured using a binary variable that takes the value of one if a company employs female top managers (*top_man_fem*), and zero otherwise.

To identify digital tech–oriented firms, we build two binary variables. First, we exploit the R&D intensity classification at the two-digit level as in Galindo-Rueda and Verger (2016). We

[6] CO_2 emissions monitoring data are available for the years 2020-2023 for 49 countries.

construct a first binary variable that takes the value of one for firms in sectors with at least medium technology adoption as implied by their R&D intensity classification, and zero otherwise (*tech orientation*).[7] Second, we compute a binary variable that takes the value of one if the establishment has a website or a social media page, and zero otherwise (*digital orientation*). The main variable of interest is the interaction between digital orientation and technological focus ($\text{digital orientation}_{\text{ict}} * \text{tech orientation}_{\text{ict}}$), which we refer to as *digital-tech orientation* in the tables.

We also consider various factors that could impact the relationship between the adoption of ethical practices and digital tech–oriented firms, such as the firm size (*large*), the presence of a line of credit or loan from a financial institution (*fin_ins*), the actual annual sales growth in percent (*sal_gro*), the logarithm of GDP per capita (*log (GDPpercapita)*)[8] and the firm's age, calculated as the difference between the year of the survey and the year the firm began operations (*age*). All variables are defined in the Appendix (Table A1).

In our additional analysis, we control for cultural dimensions. We gathered data on six cultural dimensions from Geert Hofstede's website: long-term orientation, individualism, power distance, uncertainty avoidance, masculinity, and indulgence. We focus on five dimensions, exploring their influence on the relationship between technology and ethical practices. Specifically, we examine whether (i) long-term orientation and individualism affect the relationship between digital tech–oriented firms and emissions monitoring; (ii) power distance and uncertainty avoidance modify the relationship between digital tech–oriented firms and training;

[7] See Galindo-Rueda & Verger (2016).

[8] For GDP per capita, we used the following data adjustments: for Bhutan, we input the data for 2022 as a proxy for 2023; for Djibouti, we complemented the data for 2012 with data for 2023; for Kosovo, we replaced the unavailable data for 2007 with the value from 2008. These adjustments involved a total of 667 observations.

(iii) masculinity and long-term orientation influence the relationship between digital tech–oriented firms and the presence of female top managers.

While indulgence may relate to environmental issues (Gallego-Álvarez and Ortas, 2017), we believe that long-term orientation (*ltowvs*) and individualism (*idv*) more effectively influence the relationship between digitally oriented firms and emissions monitoring. According to Geert Hofstede's website, long-term orientation (*ltowvs*), expressed on a scale from 0 (least long-term oriented) to 100 (most long-term oriented), pertains to change. In cultures with a long-term orientation, there is a fundamental belief that the world is changing, necessitating preparation for the future. Conversely, in cultures with a short-term orientation, the world is perceived as static, with the past serving as a moral compass that should be followed. The second dimension is individualism (*idv*), where 100 represents the most individualistic country and zero the least. Individualism measures the degree to which people feel independent as opposed to interdependent as members of a larger whole. For the social dimension, we use power distance (*pdi*), which ranges from 0 (lowest) to 100 (highest). This indicator measures the degree to which the less powerful members of organizations and institutions accept and expect power to be distributed unequally. Additionally, we use uncertainty avoidance (*uai*), which addresses a society's tolerance for uncertainty and ambiguity. This measure also ranges from 0 (lowest) to 100 (highest). For the governance dimension, we apply long-term orientation (*ltowvs*) and masculinity (*mas*). Masculinity measures the extent to which the use of force is socially endorsed, with higher scores (closer to 100) indicating more masculine societies.

Table 2 presents the summary statistics, including the number of observations, the mean, the standard deviation, and the minimum and maximum values for the variables included in the analyses.

[Insert Tables 2 about here]

The mean value of *top_man_fem* is low (0.1548), indicating a low number of female top managers in the sample. The mean of the variable *tim_spe* is also relatively low (0.0640), indicating that senior managers generally spend less than 50% of their time dealing with regulations.

Table 3 presents the correlation matrix. The pairwise correlation coefficients are quite low, which alleviates concerns about multicollinearity in the estimates.

[Insert Table 3 about here]

3 Empirical findings

3.1 Baseline results

This section presents the baseline results demonstrating the connection between digital tech–oriented firms and ethical practices. Table 4 examines whether companies have monitored their CO_2 emissions over the past three years (*mon_emi*). The table reveals that the variable *digital-tech orientation* is positively and significantly correlated with monitoring CO_2 emissions (*mon_emi*), indicating virtuous behavior from digital tech–oriented firms concerning environmental responsibility. In the most conservative estimate (Table 4, column 4), the probability of monitoring CO_2 emissions increases by approximately 9 percentage points relative to that of non-technology firms lacking a digital presence. This finding shows that companies with a strong digital and technological focus are more likely to systematically track and manage their carbon emissions, providing evidence of their commitment to sustainability.

This relationship supports the argument that digital technologies bolster firms' ability to monitor environmental impacts and enhance energy efficiency. These findings also underscore the potential of digitalization as a strategic tool for advancing corporate sustainability initiatives. Concerning the control variables, firm size and sales growth are both positively and statistically significantly correlated (at least at the 10 per cent level) with the monitoring of CO_2 emissions.

This indicates that larger firms and those experiencing revenue growth are more likely to participate in environmental monitoring practices. Larger firms generally possess greater resources and face more regulatory scrutiny, which may motivate them to implement formal environmental monitoring systems. Furthermore, firms with growing revenues may have stronger incentives to improve their sustainability practices in order to comply with environmental regulations, to enhance their corporate reputation, or to meet stakeholder expectations.

These findings indicate that financial stability and business expansion are important in driving corporate environmental responsibility, particularly in tracking and managing carbon emissions.

[Insert Tables 4-6 about here]

Table 5 indicates that digital tech–oriented firms offer more formal training programs to employees than other firms do. The likelihood of providing training increases by about 20 percentage points if a firm is digital tech oriented (Table 5, column 4). Likewise, digital orientation (approximately 13 percentage points) and tech orientation (approximately 9 percentage points) make firms more inclined to provide training. These estimates suggest that such companies prioritize continuous skills development due to the rapidly changing nature of technology. The strong correlation between digitalization and training programs can be attributed to the need for a highly skilled workforce capable of adapting to new technologies and data-driven processes. Overall, these findings support the role of digitalization in shaping workforce development strategies. By investing in employee training, digital-tech firms enhance their competitive advantage and ensure long-term sustainability in an innovation-driven economy.

Regarding the relation between the control variables and firms' provision of training programs, firm size, access to credit from financial institutions, and sales growth are positively and statistically significant at least at the 5 per cent level. This indicates that larger firms, those with improved financial access, and those experiencing revenue growth are more inclined to invest in employee training. These findings support the significance of financial capacity and business growth in determining a firm's ability to invest in human capital development.

Table 6 indicates a negative relationship between digital-tech orientation and the presence of women in top managerial positions within firms. The negative coefficient for the *digital-tech orientation* variable indicates that firms in the digital-tech sector are less likely to have female executives than those in other industries. A key reason for this trend may be the persistent gender gap in STEM (Science, Technology, Engineering, and Mathematics) education and careers, which has resulted in a limited pool of qualified female candidates for leadership positions in technology-driven firms. The underrepresentation of women in STEM fields restricts their career advancement opportunities, ultimately diminishing their presence in top management positions.

These findings emphasize the ongoing gender disparity in the tech sector and indicate that tackling the structural barriers in STEM education and career development is essential for enhancing gender diversity in leadership roles within digital tech firms.

3.2 Heterogeneity effect

We explore here whether country heterogeneity affects our results by focusing on national cultures (Section 3.2.1), regulatory burden (Section 3.2.2), and perceptions of courts as barriers to business (Section 3.2.3).

3.2.1 National culture

In this section, we explore how cross-country cultural differences influence the relationship between technology and ethical behavior, particularly in corporate environmental, social, and governance (ESG) practices. We focus on long-term orientation associated with sustainable development, environmental responsibility, and gender equality in corporate governance. However, countries with a short-term focus may still prioritize reducing pollution to maintain their current quality of life. Next, we consider collectivism versus individualism regarding climate action. While collectivist societies emphasize group well-being and may support environmental efforts, previous research has linked individualism to green corporatism and environmental innovation, making the relationship between collectivism and emissions control uncertain. Next, we control for societies with high power distance because hierarchical structures may reduce training opportunities, but deference to authority might also encourage participation in training programs. Similarly, uncertainty avoidance plays a role in training incentives. A strong aversion to uncertainty and risk may increase training initiatives but could also discourage participation, ultimately reducing training levels within organizations. Lastly, we examine the level of a country's masculinity as a factor that may influence the employment of female top managers and thereby affect governance dynamics in firms. The study underscores the complex ways in which cultural dimensions shape corporate ethical behavior and the sustainability efforts in technology firms.

To test whether national culture influences the corporate ethical behaviors of digital tech–oriented firms, we utilize Hofstede's national culture measures. For each cultural dimension, we categorize the sample into those above and below the median value to investigate whether (i) long-term orientation (*ltowvs*) and individualism (*idv*) affect the relationship between digital tech–oriented firms and emissions monitoring; (ii) power distance (*pdi*) and uncertainty avoidance (*uai*) influence the relationship between digital tech–oriented firms and training; (iii) masculinity (*mas*) and long-term orientation (*ltowvs*) modify the relationship between digital tech–oriented firms and the presence of a female top manager.

Our analysis includes specifications with year-by-country fixed effects. Tables 7 and 8 show that cultural factors are positively associated with monitoring emissions and training, but the intensity of these factors does not appear to be a discriminant. Specifically, the *digital-tech orientation* variable is consistently positively and significantly correlated with CO_2 emissions monitoring (*mon_emi)* and the training variable, regardless of whether we examine countries above or below the median value of the cultural trait. Conversely, national culture influences our results on the employment of female top managers. Table 9 presents a negative and statistically significant relationship between the *digital-tech orientation* variable and the *top_man_fem* variable only in countries characterized by high masculinity scores and short-term orientation.

This finding highlights the influence of cultural dimensions on gender diversity policies within digital tech–oriented firms. In highly masculine cultures, leadership roles are often male dominated, making it more challenging for women to reach top managerial positions. Additionally, short term–oriented societies may prioritize immediate business performance and profitability over long-term structural changes, such as fostering gender diversity and inclusion in leadership roles.

The results suggest that companies operating in these cultural contexts may require more targeted policies to improve gender diversity at the senior management level.

[Insert Tables 7-9 about here]

3.2.2 Regulatory burden (heterogeneity in the business environment)

This section examines the influence of regulatory burdens on the connection between technology and sustainability.

We hypothesize that digital tech–oriented firms are more likely to monitor CO_2 emissions when the regulatory burden is low, as they are less concerned about potential legal repercussions related to their measurement methodology and emission levels. Additionally, these firms may provide more training programs under conditions of low regulatory burden since higher regulatory burdens increase the costs of offering training, which may lead to a reduction in such programs. Finally, a lower regulatory burden may correlate with an increase in the gender gap. Reduced time spent on regulatory compliance may negatively impact the presence of female top managers as gender-based discrimination may increase due to reliance on informal networks that exclude women.

Table 10 presents the results for monitoring CO_2 emissions, providing training, and hiring female top managers. When the regulatory burden is low, the *digital-tech orientation* variable is positively and significantly related to the variable indicating the monitoring of CO_2 emissions (*mon_emi*), as well as to the variable for *training*. In other words, our findings suggest that a reduced regulatory burden positively influences both the monitoring of CO_2 emissions and the implementation of training programs for digital tech–oriented firms. This positive effect on emissions monitoring may stem from the increased freedom of digital tech–oriented firms to choose the methodology and scope of their emission-level measures. Similarly, the positive effect on training may be due to the fact that higher regulatory burdens raise the cost of providing training, potentially diminishing the likelihood of offering such programs. Finally, the results in Table 10, columns 5 and 6 indicate that the *digital-tech orientation* variable is negatively and significantly related to *top_man_fem* when the regulatory burden is low, suggesting that a lighter regulatory burden exacerbates the gender gap in digital tech–oriented firms.

In conclusion, our results suggest that a reduced regulatory burden positively influences the adoption of social and environmental ethical practices among digital tech–oriented firms. However, a diminished regulatory burden negatively affects the representation of women in top management positions, thereby widening the gender gap.

[Insert Table 10 here]

3.2.3 Perception of courts (heterogeneity in the business environment)

This section examines whether courts are seen as a relevant barrier to business activity. Digital tech–oriented firms may be less concerned about gender diversity in top management if they do not view courts as a significant obstacle to their operations, despite global recommendations advocating diversity. Therefore, businesses' perception of the court's work may influence how digital tech–oriented firms adopt ESG standards. Table 11 presents the results concerning the relationship between our variable of interest, *digital-tech orientation*, and the three dependent variables indicating ethical orientation. We divide the sample based on whether the variable *courts* is equal to 1 (indicating "*Courts are a major/very severe obstacle*") or zero (indicating "*Courts are not an obstacle; are a minor/moderate obstacle*"). The question on courts is drawn from the World Bank Enterprise Surveys and captures respondents' perceptions of how the court system poses an obstacle to their business operations.

Table 11 indicates that the variable *digital-tech orientation* has a positive and significant relationship with the variable *mon_emi* (columns 1 and 2) and with the variable *training* (columns 3 and 4). This suggests that the functioning of courts is not a critical factor in the relationship between digital tech–oriented firms, emissions monitoring, and training provision. In contrast, the finding regarding the employment of female top managers (Table 11, column 6) seems to imply that digital tech–oriented firms, which are less constrained by the functioning of courts, have fewer female top managers. This may highlight a potential mechanism through which fewer constraints could reinforce the existing gender gap.

[Insert Table 11]

4 Conclusion

The relationship between technology and firms' ethical behavior is multifaceted and complex. On the one hand, the widespread use of technology can negatively impact ethical practices, contributing to increased pollution and potential unemployment. On the other hand, technology can enable firms to better monitor their CO_2 emissions, improve management systems, and foster collaboration, potentially strengthening their ethical orientation.

To address this ambiguity, this paper examines the ethical behavior of digital tech–focused firms. Our baseline empirical findings reflect the dual nature of the relationship between technology and ethics. Specifically, digital tech–focused firms demonstrate a significant and positive association with monitoring CO_2 emissions and employee training programs. However, we also find a significant negative correlation between these firms and the employment of female top managers, perhaps because men continue to dominate top positions in tech-focused firms. This suggests that the gender gap in top management positions may be widening as technology-oriented sectors evolve.

We also examine how national culture influences these dynamics using Hofstede's cultural dimensions. The strength of national cultures does not significantly explain the results of emissions monitoring and employee training programs. Conversely, in countries characterized by high levels of masculinity and short-term orientation, there is a negative relationship between digital tech–oriented firms and the employment of female top managers. These results highlight the challenges women face in reaching top management positions in countries with less favorable cultural environments.

Further tests examine the heterogeneity in the business environment by considering whether regulatory burdens and perceptions of the courts are relevant factors in whether digital tech–oriented firms monitor CO_2 emissions, provide training, and hire female top managers. We find contrasting results associated with a low regulatory burden. On the one hand, when the regulatory burden is low, we confirm the existence of a positive relationship between digital tech–oriented firms and both monitoring emissions and providing training. These results may suggest that other factors are more effective in promoting the adoption of these standards. On the other hand, we find that a lower regulatory burden increases the gender gap, possibly because women are most needed when the regulatory burden is heavy. Again, our findings reflect the dual nature of the relationship between technology firms and the adoption of ethical practices.

Finally, we examine whether courts are perceived as a barrier to doing business. We find that digital tech–oriented firms are less likely to hire a female top manager when courts are not seen as a significant obstacle. Like our results on cultural dimensions, this finding underscores the challenges women face in reaching top management positions in environments where legal constraints are not perceived as limiting business decisions. In such cases, there may be a greater perceived freedom in selecting management personnel, potentially reinforcing existing biases.

This paper provides valuable insights for policymakers seeking to promote the adoption of ethical business practices. In particular, it highlights the importance of advancing gender diversity in leadership through targeted initiatives such as gender quotas, mentorship programs, and leadership training tailored to women in tech-oriented sectors. Policymakers can also foster inclusivity and long-term sustainability in leadership by incentivizing ethical technology adoption—such as CO_2 emissions monitoring and employee training — through subsidies, tax breaks, or recognition programs. Additionally, regulatory measures that promote transparency and accountability in corporate decision-making can further support firms in adhering to ethical standards.

This paper has some limitations that could be addressed in future research. One limitation is the reliance on cross-sectional data, which restricts the ability to observe changes over time.

Incorporating panel data in future studies could enable the analysis of time variation and provide a better understanding of dynamic relationships. Additionally, the study does not fully examine expanded metrics for digitalization, such as digital transaction volumes, adoption of digital technologies, investment in ICT (information, communication, and technology), and digital connectivity. Including these metrics in future research could offer deeper insights into the role of technology in shaping ethical practices within firms.

Overall, the study emphasizes the necessity of considering firm- and country-specific factors when designing policies to promote ethical business practices. Ongoing challenges, such as gender inequality in leadership, require focused efforts to tackle both organizational and societal barriers. Country-level determinants, including cultural norms and regulatory frameworks, significantly influence firms' adoption of ethical behaviors. This underscores the important role of society in policy-making, particularly in fostering multi-stakeholder perspectives that support inclusive and ethical business practices.

References

Angelidis, J., & Ibrahim, N. (2004). An exploratory study of the impact of degree of religiousness upon an individual's corporate social responsiveness orientation. *Journal of Business Ethics*, *51*, 119–128. https://doi.org/10.1023/B:BUSI.0000033606.27489.bf

Arnold, D. G., & Valentin, A. (2013). Corporate social responsibility at the base of the pyramid. *Journal of Business Research*, *66*, 1904–1914. https://doi.org/10.1016/j.jbusres.2013.02.012

Asif, M., Searcy, C., & Castka, P. (2023). ESG and Industry 5.0: The role of technologies in enhancing ESG disclosure. *Technological Forecasting and Social Change*, *195*, 122806. https://doi.org/10.1016/j.techfore.2023.122806

Baron, J. N., Hannan, M. T., Hsu, G., & Koçak, Ö. (2007). In the company of women: Gender inequality and the logic of bureaucracy in start-up firms. *Work and Occupations*, *34*, 35–66. https://doi.org/10.1177/0730888406296945

Behera, P., & Sethi, N. (2022). Nexus between environment regulation, FDI, and green technology innovation in OECD countries. *Environmental Science and Pollution Research*, *29*, 52940–52953. https://doi.org/10.1007/s11356-022-19458-7

Bekhet, H. A., & Latif, N. W. A. (2018). The impact of technological innovation and governance institution quality on Malaysia's sustainable growth: Evidence from a dynamic relationship. *Technology in Society*, *54*, 27–40. https://doi.org/10.1016/j.techsoc.2018.01.014

Bernal-Conesa, J. A., de Nieves Nieto, C., & Briones-Peñalver, A. J. (2017). CSR strategy in technology companies: Its influence on performance, competitiveness and sustainability. *Corporate Social Responsibility and Environmental Management*, *24*, 96–107. https://doi.org/10.1002/csr.1393

Bhattacherjee, A., & Premkumar, G. (2004). Understanding changes in belief and attitude toward information technology usage: A theoretical model and longitudinal test. *MIS Quarterly*, *28*, 229–254. https://doi.org/10.2307/25148634

Boulouta, I., & Pitelis, C. N. (2014). Who needs CSR? The impact of corporate social responsibility on national competitiveness, *Journal of Business Ethics*, *119*, 349–364. https://doi.org/10.1007/s10551-013-1633-2

Chaffey, D. (2014). *Digital business and e-commerce management: Strategy, implementation and practice* (6th ed.). Pearson Education.

Chantziaras, A., Dedoulis, E., Grougiou, V., & Leventis, S. (2020). The impact of religiosity and corruption on CSR reporting: The case of U.S. banks. *Journal of Business Research*, *109*, 362–374. https://doi.org/10.1016/j.jbusres.2019.12.025

Crane, A., Matten, D., Glozer, S., & Spence, L. (2019). *Business ethics: Managing corporate citizenship and sustainability in the age of globalization*. Oxford University Press.

de Vries, G. J., Gentile, E., Miroudot, S., & Wacker, K. M. (2020). The rise of robots and the fall of routine jobs. *Labour Economics*, *66*, 101885. https://doi.org/10.1016/j.labeco.2020.101885

Dolan, R., Conduit, J., Fahy, J., & Goodman, S. (2015). Social media engagement behaviour: A uses and gratifications perspective. *Journal of Strategic Marketing*, *24*, 261–277. https://doi.org/10.1080/0965254X.2015.1095222

Dwivedi, Y. K., Hughes, L., Kar, A. K., Baabdullah, A. M., Grover, P., Abbas, R., Andreini, D., Abumoghli, I., Barlette, Y., Bunker, D., Kruse, L. C., Constantiou, I., Davison, R. M., De', R., Dubey, R., Fenby-Taylor, H., Gupta, B., He, W., Kodama, … & Wade, M. (2022). Climate change and COP26: Are digital technologies and information management part of the problem or the solution? An editorial reflection and call to action. *International Journal of Information Management*, *63*, 102456. https://doi.org/10.1016/j.ijinfomgt.2021.102456

Ferrell, O. C., Harrison, D. E., Ferrell, L., & Hair, J. F. (2019). Business ethics, corporate social responsibility, and brand attitudes: An exploratory study. *Journal of Business Research*, *95*, 491–501. https://doi.org/10.1016/j.jbusres.2018.07.039

Galindo-Rueda, F., & Verger, F. (2016). OECD taxonomy of economic activities based on R&D intensity. OECD Science, Technology and Industry Working Papers 2016/04. https://doi.org/10.1787/5jlv73sqqp8r-en

Gallego-Álvarez, I., & Ortas, E. (2017). Corporate environmental sustainability reporting in the context of national cultures: A quantile regression approach. *International Business Review*, *26*, 337–353. https://doi.org/10.1016/j.ibusrev.2016.09.003

Higón, D. A., Gholami, R., & Shirazi, F. (2017). ICT and environmental sustainability: A global perspective. *Telematics and Informatics*, *34*, 85–95. https://doi.org/10.1016/j.tele.2017.01.001

Hofstede, G., Hofstede, G. J., & Minkov, M. (2010). *Cultures and organizations: Software of the mind* (3rd ed.). McGraw-Hill.

Husted, B. W. (2005). Culture and ecology: A cross-national study of the determinants of environmental sustainability. *Management International Review*, *45*, 349–371. https://www.jstor.org/stable/40836056

Hutson, M. (2021). Robo-writers: The rise and risks of language-generating AI. *Nature*, *591*, 22–25. https://doi.org/10.1038/d41586-021-00530-0

Jaffe, A. B., Newell, R. G., & Stavins, R. N. (2003). Technological change and the environment. In K.-G. Mäler & J. R. Vincent (Eds.), *Handbook of environmental economics* (vol. 1) (pp. 461–516). Elsevier Science B.V.

Kirsch, A. (2018). The gender composition of corporate boards: A review and research agenda. *The Leadership Quarterly*, *29*, 346–364. https://doi.org/10.1016/j.leaqua.2017.06.001

Kostova, T., & Roth, K. (2002). Adoption of an organizational practice by subsidiaries of multinational corporations: Institutional and relational effects. *The Academy Management Journal*, *45*, 215–233.

Kucharska, W., & Kowalczyk, R. (2019). How to achieve sustainability? – Employee's point of view on company's culture and CSR practice. *Corporate Social Responsibility and Environmental Management*, *26*, 453–467. https://doi.org/10.1002/csr.1696

Lahuerta-Otero, E., & González-Bravo, M. I. (2018). Can national culture affect the implementation of common sustainable policies? A European response. *Cross-Cultural Research*, *52*, 468–495. https://doi.org/10.1177/1069397117739849

Li, X., Hu, Z., & Zhang, Q. (2021). Environmental regulation, economic policy uncertainty, and green technology innovation. *Clean Technologies and Environmental Policy*, *23*, 2975–2988. https://doi.org/10.1007/s10098-021-02219-4

Lin, W. L., Yip, N., Ho, J. A., & Sambasivan, M. (2020). The adoption of technological innovations in a B2B context and its impact on firm performance: An ethical leadership perspective. *Industrial Marketing Management*, *89*, 61–71. https://doi.org/10.1016/j.indmarman.2019.12.009

Mahoney L. S., Thorne, L., Cecil, L., & LaGore, W. (2013). A research note on standalone corporate social responsibility reports: Signaling or greenwashing? *Critical Perspectives on Accounting*, *24*, 350–359. https://doi.org/10.1016/j.cpa.2012.09.008

Miedzinski, M., Kanehira, N., Cervantes, M., Mealy, S., Kotani, R., & Bollati, E. (2020). Science, Technology and Innovation (STI) for SDGs Roadmaps. Background paper: International STI Collaboration and Investment for Sustainable Development Goals, June 2020.

Okafor, A., Adeleye, B. N., & Adusei, M. (2021). Corporate social responsibility and financial performance: Evidence from U.S tech firms. *Journal of Cleaner Production*, *292*, 126078. https://doi.org/10.1016/j.jclepro.2021.126078

Omri, A. (2020). Technological innovation and sustainable development: Does the stage of development matter? *Environmental Impact Assessment Review*, *83*, 106398. https://doi.org/10.1016/j.eiar.2020.106398

Onel, N., & Mukherjee, A. (2014). The effects of national culture and human development on environmental health. *Environment, Development and Sustainability*, *16*, 79–101. https://doi.org/10.1007/s10668-013-9464-y

Parboteeah, K. P., Addae, H. M., & Cullen, J. B. (2012). Propensity to support sustainability initiatives: A cross-national model. *Journal of Business Ethics*, *105*, 403–413. https://doi.org/10.1007/s10551-011-0979-6

Prettner, K., & Strulik, H. (2020). Innovation, automation, and inequality: Policy challenges in the race against the machine. *Journal of Monetary Economics*, *116*, 249–265. https://doi.org/10.1016/j.jmoneco.2019.10.012

Sedita, S. R., Blasi, S., & Yang, J. (2022). The cultural dimensions of sustainable development: A cross-country configurational analysis. *Sustainable Development*, *30*, 1838–1849. https://doi.org/10.1002/sd.2351

Sharif, A., Saqib, N., Dong, K., & Khan, S. A. R. (2022). Nexus between green technology innovation, green financing, and CO_2 emissions in the G7 countries: The moderating role of social globalisation. *Sustainable Development*, *30*, 1934–1946. https://doi.org/10.1002/sd.2360

Stahl, B. C., & Eke, D. (2024). The ethics of ChatGPT – Exploring the ethical issues of an emerging technology. *International Journal of Information Management*, *74*, 102700. https://doi.org/10.1016/j.ijinfomgt.2023.102700

Sun, H., Edziah, B. K., Sun, C., & Kporsu, A. K. (2019). Institutional quality, green innovation, and energy efficiency. *Energy Policy*, *135*, 111002. https://doi.org/10.1016/j.enpol.2019.111002

Torelli, R. (2021). Sustainability, responsibility and ethics: Different concepts for a single path. *Social Responsibility Journal*, *17*, 719–739. https://doi.org/10.1108/SRJ-03-2020-0081

Tyrowicz, J., Terjesen, S., & Mazurek, J. (2020). All on board? New evidence on board gender diversity from a large panel of European firms. *European Management Journal*, *38*, 634–645. https://doi.org/10.1016/j.emj.2020.01.001

United Nations, Economic and Social Council. (2019). The impact of rapid technological change on sustainable development. Report of the Secretary-General, Commission on Science and Technology for Development Twenty-second session Geneva, 13-17 May 2019.

Vachon, S. (2010). International operations and sustainable development: Should national culture matter? *Sustainable Development*, *18*, 350–361. https://doi.org/10.1002/sd.398

Vogler, D., & Eisenegger, M. (2021). CSR communication, corporate reputation, and the role of the news media as an agenda-setter in the digital age. *Business & Society*, *60*, 1957–1986. https://doi.org/10.1177/0007650320928969

Yang, X., Huang, Y., & Gao, M. (2022). Can digital financial inclusion promote female entrepreneurship? Evidence and mechanisms. *The North American Journal of Economics and Finance*, *63*, 101800. https://doi.org/10.1016/j.najef.2022.101800

Zakari, A., Khan, I., Tan, D., Alvarado, R., & Dagar, V. (2022). Energy efficiency and sustainable development goals (SDGs). *Energy*, *239*, 122365. https://doi.org/10.1016/j.energy.2021.122365

Zhang, C., Khan, I., Dagar, V., Saeed, A., & Zafar, M. W. (2022). Environmental impact of information and communication technology: Unveiling the role of education in developing countries. *Technological Forecasting and Social Change*, *178*, 121570. https://doi.org/10.1016/j.techfore.2022.121570

Tables

Table 1
List of countries in our sample.

Country	N. Obs	Country	N. Obs	Country	N. Obs
Afghanistan	924	Georgia	1,643	North Macedonia	1,182
Albania	821	Germany	1,678	Pakistan	2,462
Angola	496	Ghana	1,709	Panama	598
Antigua and Barbuda	150	Greece	1,196	Papua New Guinea	65
Argentina	2,673	Grenada	152	Paraguay	1,470
Armenia	1,016	Guatemala	1,240	Peru	3,336
Austria	598	Guinea	278	Philippines	3,251
Azerbaijan	722	Guinea Bissau	50	Poland	2,015
Bahamas	148	Guyana	163	Portugal	2,065
Bangladesh	2,429	Honduras	943	Romania	2,458
Barbados	293	Hong Kong SAR China	591	Russia	6,074
Belarus	1,039	Hungary	2,043	Rwanda	1,016
Belgium	611	India	18,577	Samoa	166
Belize	150	Indonesia	5,152	Saudi Arabia	1,556
Benin	221	Iraq	1,754	Senegal	849
Bhutan	652	Ireland	604	Serbia	848
Bolivia	1,083	Israel	482	Seychelles	103
Bosnia and Herzegovina	1,188	Italy	755	Sierra Leone	360
Botswana	1,001	Jamaica	356	Singapore	623
Brazil	1,309	Jordan	1,159	Slovak Republic	1,068
Bulgaria	2,399	Kazakhstan	2,190	Slovenia	777
Burkina Faso	93	Kenya	1,771	Solomon Islands	150
Burundi	259	Kosovo	562	South Africa	1,768
Cambodia	857	Kyrgyz Republic	1,074	South Sudan	732
Cameroon	465	LaoPDR	1,180	Spain	1,049
Cape Verde	75	Latvia	765	Sri Lanka	609
Central African Republic	294	Lebanon	1,088	St. Kitts and Nevis	147
Chad	375	Lesotho	297	St. Lucia	150
Chile	1,668	Liberia	151	St. Vincent and Grenadines	151
China	2,695	Lithuania	705	Sudan	646
Colombia	3,476	Luxembourg	168	Suriname	382
Congo	363	Madagascar	1,198	Sweden	1,187
Costa Rica	894	Malawi	579	Tajikistan	797
Croatia	1,565	Malaysia	2,182	Tanzania	1,657
Cyprus	240	Mali	818	Thailand	967
Czechia	842	Malta	242	Timor-Leste	404
Côte d'Ivoire	1,158	Mauritania	229	Togo	343
DRC	1,017	Mauritius	559	Tonga	30
Denmark	992	Mexico	3,881	Trinidad and Tobago	367
Djibouti	265	Micronesia	5	Tunisia	1,206
Dominica	150	Moldova	961	Türkiye	3,777
Dominican Republic	707	Mongolia	850	Uganda	1,054
Ecuador	1,084	Montenegro	484	Ukraine	2,785
Egypt	7,745	Morocco	1,982	Uruguay	1,307

Country	N. Obs	Country	N. Obs	Country	N. Obs
El Salvador	2,236	Mozambique	942	Uzbekistan	1,732
Eritrea	72	Myanmar	1,233	Vanuatu	126
Estonia	1,070	Namibia	672	Venezuela	312
Eswatini	218	Nepal	1,201	Viet Nam	2,775
Ethiopia	1,479	Netherlands	806	West Bank and Gaza	1,149
Fiji	32	New Zealand	357	Yemen	825
Finland	753	Nicaragua	1,015	Zambia	1,615
France	1,557	Niger	202	Zimbabwe	1,194
Gambia	342	Nigeria	2562		
Total					**192,132**

Notes: This table lists countries considered in our sample, including the number of observations (N. obs).

Table 2
Descriptive statistics.

Variables	Obs	Mean	SD	Min	Max
mon_emi	24,072	0.1698	0.3754	0	1
training	192,132	0.3526	0.4778	0	1
top_man_fem	179,032	0.1548	0.3617	0	1
tech orientation	192,132	0.2320	0.4221	0	1
digital orientation	192,132	0.5535	0.4971	0	1
large	192,132	0.2013	0.4010	0	1
fin_ins	187,430	0.3568	0.4790	0	1
sal_gro	149,939	1.5194	25.2919	-99.9997	100
age	189,499	19.5899	17.3405	0	340
log (GDPpercapita)	190,191	9.4326	0.9289	6.8814	11.8064
ltowvs	84,592	42.6878	22.0788	3.5264	86.3980
idv	65,848	39.1018	19.8762	6	80
pdi	65,848	66.8568	17.9149	11	100
uai	65,848	64.9892	22.5166	8	100
mas	65,848	49.0303	15.581	5	100
tim_spe	177,750	0.0640	0.2448	0	1
courts	178,891	0.1247	0.3303	0	1

Notes: This table shows descriptive statistics. We report the number of observations (Obs), mean (Mean), standard deviation (SD), minimum (Min), and maximum (Max) for the variables we use.

Table 3
Pairwise correlation coefficients.

	mon_emi	*training*	*top_man_fem*	*tech orientation*	*digital orientation*	*large*	*fin_ins*	*sal_gro*	*age*
mon_emi	1								
training	0.1569	1							
top_man_fem	-0.0360	0.0077	1						
tech orientation	0.1102	0.0583	-0.0781	1					
digital orientation	0.1055	0.2499	-0.0154	0.0825	1				
large	0.2493	0.2238	-0.0533	0.0999	0.2414	1			
fin_ins	0.0602	0.1991	-0.0000	-0.0046	0.1888	0.1420	1		
sal_gro	0.0257	0.0624	0.0101	-0.0053	0.0454	0.0252	0.0612	1	
age	0.1026	0.1074	-0.0382	0.0589	0.1680	0.2002	0.1091	-0.0457	1

Notes: This table reports the pairwise correlation coefficients of our variables.

Table 4
Digital-tech orientation and monitoring emissions.

	(1) mon_emi	(2) mon_emi	(3) mon_emi	(4) mon_emi
digital-tech orientation	0.1617***	0.1320***	0.1315***	0.0923**
	(0.0260)	(0.0288)	(0.0288)	(0.0454)
digital orientation	0.0446***	0.0360***	0.0360***	0.0392***
	(0.0086)	(0.0098)	(0.0098)	(0.0129)
tech orientation	0.0814**	0.0837**	0.0839**	0.0150
	(0.0363)	(0.0420)	(0.0420)	(0.0634)
large		0.2223***	0.2221***	0.1863***
		(0.0298)	(0.0299)	(0.0268)
fin_ins		0.0124	0.0123	0.0066
		(0.0111)	(0.0111)	(0.0107)
sal_gro		0.0004*	0.0005*	0.0004*
		(0.0003)	(0.0003)	(0.0002)
age		0.0003	0.0003	0.0003
		(0.0004)	(0.0004)	(0.0004)
log (GDPpercapita)				-0.0151
				(0.0193)
constant	0.0589***	0.0432***	0.0428***	0.2000
	(0.0060)	(0.0111)	(0.0112)	(0.1898)
Observations	24,188	20,333	20,331	20,115
R-squared	0.0553	0.0874	0.0885	0.2041
Year FE	Yes	Yes	No	No
Country FE	Yes	Yes	No	No
Year*Country FE	No	No	Yes	No
Industry*Country FE	No	No	No	Yes

Notes: This table reports the results of model (1). We use *mon_emi* as the dependent variable and *digital-tech orientation* as our test variable. Columns 1-2 include year and country fixed effects (FE); column 3 includes year*country FE; column 4 includes industry*country FE. Standard errors are clustered at the industry*country level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 5
Digital-tech orientation and training.

	(1) training	(2) training	(3) training	(4) training
digital-tech orientation	0.1792***	0.1320***	0.1323***	0.2036***
	(0.0153)	(0.0140)	(0.0140)	(0.0371)
digital orientation	0.1547***	0.1214***	0.1205***	0.1251***
	(0.0095)	(0.0102)	(0.0103)	(0.0096)
tech orientation	0.0199	0.0049	0.0086	0.0857**
	(0.0136)	(0.0110)	(0.0107)	(0.0352)
large		0.1846***	0.1802***	0.1999***
		(0.0126)	(0.0124)	(0.0125)
fin_ins		0.0749***	0.0719***	0.0796***
		(0.0104)	(0.0105)	(0.0106)
sal_gro		0.0006***	0.0005**	0.0005**
		(0.0002)	(0.0002)	(0.0002)
age		-0.0001	-0.0001	-0.0001
		(0.0003)	(0.0003)	(0.0003)
log (GDPpercapita)				-0.0041
				(0.0166)
constant	0.2041***	0.1997***	0.2010***	0.2244
	(0.0060)	(0.0088)	(0.0090)	(0.1610)
Observations	192,132	146,287	146,267	144,966
R-squared	0.2479	0.2888	0.2995	0.3183
Year FE	Yes	Yes	No	No
Country FE	Yes	Yes	No	No
Year*Country FE	No	No	Yes	No
Industry*Country FE	No	No	No	Yes

Notes: This table reports the results of model (1). We use *training* as the dependent variable and *digital-tech orientation* as our test variable. Columns 1-2 include year and country fixed effects (FE); column 3 includes year*country FE; column 4 includes industry*country FE. Standard errors are clustered at the industry*country level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 6
Digital-tech orientation and female top managers.

	(1)	(2)	(3)	(4)
	top_man_fem	top_man_fem	top_man_fem	top_man_fem
digital-tech orientation	-0.0513***	-0.0490***	-0.0494***	-0.0725***
	(0.0151)	(0.0150)	(0.0151)	(0.0197)
digital orientation	-0.0023	0.0025	0.0023	0.0150
	(0.0114)	(0.0110)	(0.0111)	(0.0107)
tech orientation	-0.0411*	-0.0520**	-0.0515**	-0.0703***
	(0.0221)	(0.0214)	(0.0213)	(0.0253)
large		-0.0235	-0.0229	-0.0139
		(0.0147)	(0.0148)	(0.0141)
fin_ins		-0.0241***	-0.0245***	-0.0174**
		(0.0085)	(0.0087)	(0.0085)
sal_gro		-0.0002	-0.0002	-0.0002
		(0.0002)	(0.0002)	(0.0002)
age		-0.0004	-0.0003	-0.0003
		(0.0002)	(0.0002)	(0.0002)
log (GDPpercapita)				-0.0124
				(0.0110)
constant	0.1897***	0.1898***	0.1897***	0.3059***
	(0.0100)	(0.0125)	(0.0127)	(0.1067)
Observations	189,771	143,455	143,437	142,098
R-squared	0.0591	0.0622	0.0687	0.1303
Year FE	Yes	Yes	No	No
Country FE	Yes	Yes	No	No
Year*Country FE	No	No	Yes	No
Industry*Country FE	No	No	No	Yes

Notes: This table reports the results of model (1). We use *top_man_fem* as the dependent variable and *digital-tech orientation* as our test variable. Columns 1-2 include year and country fixed effects (FE); column 3 includes year*country FE; column 4 includes industry*country FE. Standard errors are clustered at the industry*country level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 7
National cultures, digital-tech orientation, and monitoring emissions.

Dimensions of culture	*Long-term orientation*		*Individualism*	
	Above (and equal to) the median	*Below the median*	*Above (and equal to) the median*	*Below the median*
	(1)	(2)	(3)	(4)
	mon_emi	mon_emi	mon_emi	mon_emi
digital-tech orientation	0.1249***	0.1371**	0.1171***	0.1558***
	(0.0326)	(0.0539)	(0.0450)	(0.0387)
digital orientation	0.0384***	0.0364**	0.0321**	0.0415**
	(0.0135)	(0.0166)	(0.0146)	(0.0170)
tech orientation	0.0518*	0.2125	0.1804	0.0609*
	(0.0304)	(0.1456)	(0.1353)	(0.0333)
large	0.2124***	0.2256***	0.2285***	0.2193***
	(0.0383)	(0.0456)	(0.0457)	(0.0414)
fin_ins	-0.0177	0.0311**	0.0292**	-0.0337
	(0.0197)	(0.0134)	(0.0120)	(0.0252)
sal_gro	0.0004	0.0003	0.0004	0.0005
	(0.0003)	(0.0005)	(0.0005)	(0.0004)
age	0.0007	0.0001	0.0002	0.0006
	(0.0007)	(0.0006)	(0.0006)	(0.0008)
constant	0.0699***	0.0141	0.0226	0.0684***
	(0.0166)	(0.0199)	(0.0176)	(0.0204)
Observations	9,015	8,780	8,187	6,856
R-squared	0.0670	0.0971	0.0969	0.0706
Year*Country FE	Yes	Yes	Yes	Yes

Notes: The table reports the results of different versions of model (1). *Mon_emi* is the dependent variable, and *digital-tech orientation* is our main test variable. Columns 1-2 consider long-term orientation (above and below the median value of *ltowvs*); columns 3-4 consider individualism (above and below the median value of *idv*). All specifications include year*country fixed effects (FE). Standard errors are clustered at the industry*country level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 8
National cultures, digital-tech orientation, and training.

Dimensions of culture	*Power distance*		*Uncertainty avoidance*	
	Above (and equal to) the median	*Below the median*	*Above (and equal to) the median*	*Below the median*
	(1)	(2)	(3)	(4)
	training	training	training	training
digital-tech orientation	0.1009***	0.1455***	0.1631***	0.0698***
	(0.0248)	(0.0302)	(0.0296)	(0.0175)
digital orientation	0.1023***	0.0998***	0.1272***	0.0728***
	(0.0179)	(0.0233)	(0.0233)	(0.0091)
tech orientation	0.0091	0.0352	0.0239	0.0033
	(0.0153)	(0.0405)	(0.0314)	(0.0140)
large	0.1833***	0.1979***	0.1699***	0.2220***
	(0.0298)	(0.0299)	(0.0319)	(0.0213)
fin_ins	0.0948***	0.0576***	0.0813***	0.0744***
	(0.0199)	(0.0162)	(0.0191)	(0.0161)
sal_gro	0.0005*	0.0019***	0.0015***	0.0004*
	(0.0003)	(0.0005)	(0.0004)	(0.0003)
age	0.0002	0.0001	0.0001	0.0000
	(0.0005)	(0.0005)	(0.0005)	(0.0003)
constant	0.1182***	0.2563***	0.2061***	0.0986***
	(0.0141)	(0.0233)	(0.0199)	(0.0080)
Observations	29,041	26,068	28,182	26,927
R-squared	0.2510	0.1639	0.1857	0.2471
Year*Country FE	Yes	Yes	Yes	Yes

Notes: This table reports the results of different versions of model (1). *Training* is the dependent variable, and *digital-tech orientation* is our main test variable. Columns 1-2 consider power distance (above and below the median value of *pdi*); columns 3-4 consider uncertainty avoidance (above and below the median value of *uai*). All specifications include year*country fixed effects (FE). Standard errors are clustered at the industry*country level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 9
National cultures, digital-tech orientation, and female top managers.

Dimensions of culture	*Masculinity*		*Long-term orientation*	
	Above (and equal to) the median	*Below the median*	*Above (and equal to) the median*	*Below the median*
	(1)	(2)	(3)	(4)
	top_man_fem	top_man_fem	top_man_fem	top_man_fem
digital-tech orientation	-0.0567**	-0.0320	-0.0222	-0.0975***
	(0.0228)	(0.0302)	(0.0160)	(0.0368)
digital orientation	-0.0067	0.0091	0.0016	0.0056
	(0.0190)	(0.0274)	(0.0127)	(0.0336)
tech orientation	-0.0168	-0.0892**	-0.0239	-0.0466
	(0.0231)	(0.0419)	(0.0207)	(0.0430)
large	-0.0007	-0.0413	-0.0201	-0.0083
	(0.0335)	(0.0263)	(0.0169)	(0.0500)
fin_ins	-0.0098	-0.0283*	-0.0035	-0.0386**
	(0.0140)	(0.0161)	(0.0121)	(0.0193)
sal_gro	-0.0006	0.0000	-0.0003	-0.0006
	(0.0005)	(0.0003)	(0.0003)	(0.0006)
age	-0.0003	-0.0002	-0.0000	-0.0012*
	(0.0004)	(0.0006)	(0.0003)	(0.0006)
constant	0.1664***	0.2133***	0.1451***	0.2391***
	(0.0205)	(0.0339)	(0.0140)	(0.0392)
Observations	31,845	23,421	35,613	34,343
R-squared	0.0740	0.0535	0.0554	0.1014
Year*Country FE	Yes	Yes	Yes	Yes

Notes: This table reports the results of different versions of model (1). *Top_man_fem* is the dependent variable, and *digital-tech orientation* is our main test variable. Columns 1-2 consider masculinity (above and below the median value of *mas*); columns 3-4 consider long-term orientation (above and below the median value of *ltowvs*). All specifications include year*country fixed effects (FE). Standard errors are clustered at the industry*country level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 10
Bureaucracy burden, digital-tech orientation, and ESG standards.

	mon_emi		training		top_man_fem	
Senior management's time spent dealing with regulations	>=50%	<50%	>=50%	<50%	>=50%	<50%
digital-tech orientation	0.1189	0.1320***	0.0496	0.1338***	0.0059	-0.0538***
	(0.0793)	(0.0303)	(0.0448)	(0.0146)	(0.0378)	(0.0162)
digital orientation	0.0814	0.0375***	0.0409*	0.1235***	-0.0153	0.0011
	(0.0509)	(0.0108)	(0.0244)	(0.0104)	(0.0243)	(0.0113)
tech orientation	0.3052**	0.0818*	-0.0496	0.0150	0.0005	-0.0535**
	(0.1379)	(0.0441)	(0.0351)	(0.0116)	(0.0479)	(0.0226)
large	0.2118***	0.2260***	0.2576***	0.1752***	0.0834**	-0.0292*
	(0.0606)	(0.0316)	(0.0499)	(0.0129)	(0.0419)	(0.0157)
fin_ins	-0.0875**	0.0126	0.1332***	0.0708***	-0.0365	-0.0240**
	(0.0373)	(0.0113)	(0.0370)	(0.0116)	(0.0274)	(0.0100)
sal_gro	0.0005	0.0005	0.0018***	0.0002	-0.0001	-0.0002
	(0.0006)	(0.0003)	(0.0005)	(0.0002)	(0.0005)	(0.0002)
age	0.0033**	0.0002	-0.0002	-0.0002	-0.0017**	-0.0002
	(0.0017)	(0.0004)	(0.0008)	(0.0003)	(0.0007)	(0.0003)
constant	0.0214	0.0447***	0.2284***	0.2030***	0.2053***	0.1863***
	(0.0555)	(0.0112)	(0.0213)	(0.0097)	(0.0248)	(0.0129)
Observations	964	18,205	8,552	129,902	8,516	126,568
R-squared	0.3464	0.0896	0.4131	0.3095	0.1660	0.0698
Year*Country FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table reports the results of different versions of model (1). *Mon_emi*, *Training*, and *Top_man_fem* are the dependent variables, and *digital-tech orientation* is our main variable of interest. Columns 1, 3, and 5 consider firms whose senior managers spend 50% or more of their time dealing with regulations. Columns 2, 4, and 6 consider firms whose senior managers spend less than 50% of their time dealing with regulations. All specifications include year*country fixed effects (FE). Standard errors are clustered at the industry*country level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 11
Courts as an obstacle, digital-tech orientation, and ESG standards.

	mon_emi		training		top_man_fem	
Courts perceived as an obstacle	*major/very severe*	*minor/ moderate (or not an obstacle)*	*major/very severe*	*minor/ moderate (or not an obstacle)*	*major/very severe*	*minor/ moderate (or not an obstacle)*
digital-tech orientation	0.1547*	0.1364***	0.1122**	0.1305***	0.0265	-0.0548***
	(0.0813)	(0.0295)	(0.0508)	(0.0157)	(0.0415)	(0.0156)
digital orientation	0.0526	0.0421***	0.1182***	0.1180***	0.0238	-0.0020
	(0.0497)	(0.0095)	(0.0275)	(0.0107)	(0.0333)	(0.0129)
tech orientation	0.0441	0.1021**	0.0206	0.0010	-0.0408	-0.0448**
	(0.0973)	(0.0474)	(0.0466)	(0.0108)	(0.0267)	(0.0223)
large	0.0392	0.2515***	0.2070***	0.1736***	-0.0658***	-0.0170
	(0.0424)	(0.0314)	(0.0391)	(0.0136)	(0.0235)	(0.0162)
fin_ins	-0.0225	0.0225*	0.0834**	0.0725***	-0.0475	-0.0173*
	(0.0333)	(0.0124)	(0.0383)	(0.0109)	(0.0310)	(0.0091)
sal_gro	0.0018	0.0002	0.0009	0.0007***	-0.0007*	-0.0004*
	(0.0014)	(0.0003)	(0.0006)	(0.0002)	(0.0004)	(0.0002)
age	0.0007	0.0003	-0.0012*	0.0001	0.0012**	-0.0006**
	(0.0014)	(0.0005)	(0.0007)	(0.0003)	(0.0005)	(0.0003)
constant	0.0545*	0.0325***	0.2090***	0.2064***	0.1278***	0.1931***
	(0.0301)	(0.0115)	(0.0284)	(0.0096)	(0.0213)	(0.0145)
Observations	1,867	17,251	16,837	120,343	17,105	117,106
R-squared	0.1293	0.1056	0.2834	0.3124	0.1560	0.0683
Year*Country FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table reports the results of different versions of model (1). *Mon_emi*, *training*, and *top_man_fem* are the dependent variables, and *digital-tech orientation* is our main test variable. Columns 1, 3, and 5 consider firms for which courts are perceived as a major/very severe obstacle. Columns 2, 4, and 6 consider firms for which courts are perceived to be either a minor/moderate obstacle or not an obstacle. All specifications include year*country fixed effects (FE). Standard errors are clustered at the industry*country level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Appendix

Table A1: Definition of variables.

Variable	*Symbol*	Description
Dependent variables		
Monitoring CO_2 emissions over the past three years	*mon_emi*	A binary variable that takes the value of one if the establishment has monitored its CO_2 emissions over the past three years, and zero otherwise
Availability of formal training programs in the last fiscal year	*training*	A binary variable that takes the value of one if there was a formal training programs for permanent full-time employees in the last fiscal year, and zero otherwise
Female top manager	*top_man_fem*	A binary variable that takes the value of one if the top manager is female, and zero otherwise
Main independent variables		
R&D intensity classification at a two-digit level	*tech orientation*	A binary variable that takes the value of one if the firm is classified as having high, medium-high, or medium R&D intensity at the 2-digit level of ISIC Rev 4, and zero if the firm is classified as having medium-low or low R&D intensity. This classification is based on Galindo-Rueda and Verger (2016).
Website or social media page availability	*digital orientation*	A binary variable that takes the value of one if the establishment has its own website or social media page, and zero otherwise
High, medium-high or medium R&D intensity firms at the 2-digit level of ISIC Rev 4 with their own website or a social media page	*digital-tech orientation*	A binary variable that takes the value of one if the firm is classified as having high, medium-high or medium R&D intensity at the 2-digit level of ISIC Rev 4 and has its own website or social media page, and zero otherwise
Firm-level variables		
Firm size	*large*	A binary variable that takes the value of one if a firm is classified as large (100 or more employees), and zero if a firm is classified as medium (20-99 employees) or small (<20 employees)
Availability of a credit line or loan from a financial institution	*fin_ins*	A binary variable that takes the value of one if the establishment has a line of credit or loan from a financial institution, and zero otherwise
Real annual sales growth	*sal_gro*	A variable indicating the real annual sales growth at the firm level (%)
Age	*age*	A variable that is given by the difference between the year of the survey and the year in which a firm began operations
Country-level variables		
GDP per capita (constant 2021 international $)	*log (GDPpercapita)*	GDP per capita based on purchasing power parity (PPP). PPP GDP is gross domestic product converted to international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GDP as the U.S. dollar has in the United States. GDP at purchaser's prices is the sum of gross value added by all resident producers in the country plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and

Variable	*Symbol*	Description
		degradation of natural resources. Data are in constant 2021 international dollars.[9]
Long-term orientation	*ltowvs*	Long-term orientation deals with change. As with the other dimensions of culture, it is expressed on a scale from 0 (the most short term–oriented country) to 100 (the most long term–oriented country).[10]
Individualism	*idv*	Individualism is the degree to which people feel independent as opposed to interdependent as members of a larger whole. As with the other dimensions of culture, it is expressed on a scale of 0 (the least individualistic country) to 100 (the most individualistic country).
Power distance	*pdi*	Power distance is the degree to which the less powerful members of organizations and institutions expect and accept an unequal distribution of power. As with the other dimensions of culture, it is expressed on a scale from 0 (lowest power distance) to 100 (highest power distance).
Uncertainty avoidance	*uai*	Uncertainty avoidance deals with a society's tolerance for uncertainty and ambiguity. As with the other dimensions of culture, it is expressed on a scale from 0 (the most uncertainty-tolerant country) to 100 (the most uncertainty-averse country).
Masculinity	*mas*	Masculinity is the degree to which the use of force is socially endorsed. As with the other dimensions of culture, it is expressed on a scale from 0 (the least masculine country) to 100 (the most masculine country).
Obstacles		
Senior management's time spent on dealing with regulations	*tim_spe*	A binary variable that takes the value of one if the percentage of time spent by all senior managers (managers, directors, and officers above the level of direct supervisor of production or sales workers) in a typical week during the past year dealing with requirements imposed by government regulations is greater than or equal to 50%, and zero otherwise
Courts perceived as a major or very severe obstacle	*courts*	A binary variable that takes the value of one if the courts are perceived as a major/very severe obstacle to the current operations of the firm, and zero if the courts are perceived as either a minor/moderate obstacle or not perceived as an obstacle

[9] Data are collected from: GDP per capita (constant 2021 international $), The World Bank, available at the following link: https://data.worldbank.org/indicator/NY.GDP.PCAP.PP.KD (last accessed: November, 2024).
[10] Dimension data matrix, version 2015 12 08 0-100, available at the following link: https://geerthofstede.com/research-and-vsm/dimension-data-matrix/ (last accessed: June, 2024). In our database, cultural data begin in 2015.