Title

Is There a Trade-off Between Health Management and Environmental Engagement Among Japanese Small and Medium-sized Enterprises?

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Abstract

This study examines how firms balanced health management and environmental engagement under health-related government initiatives by focusing on Japanese small and medium-sized enterprises. Using official lists of Health and Productivity Management certified organizations provided by the Ministry of Economy, Trade, and Industry and information from Toyo Keizai Kaisha Shikiho, we constructed a novel firm-level panel dataset of 1,706 small and medium-sized enterprises from 2019 to 2024. To quantify environmental engagement, a text-mining approach was employed to count the frequency of distinct environment-related keywords appearing in each firm's report. Using a two-way fixed effects estimation model, we found that the number of distinct environment-related keywords was positively and significantly associated with the likelihood of obtaining H&PM certification, suggesting a general complementary relationship. To address potential industry-level endogeneity, we further employed an instrumental variables two-stage least squares approach. The results showed no significant causal effect of environmental engagement for the overall sample and for unlisted small and medium-sized enterprises, but a positive and statistically significant effect for listed ones. Finally, additional heterogeneity analysis through two-way fixed effects estimations revealed that the complementarity vanished when environmental engagement becomes intensive, and the relationship in some cases even reversed across ownership structures and industry types. Overall, the findings suggest the need for designing differentiated policies that account for contextual heterogeneity in order to mitigate the trade-offs and foster balanced sustainable development practices.

Keywords

Health management, environmental engagement, small and medium-sized enterprises, government initiatives, trade-offs

Statements and Declarations

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1. Introduction

The demographic shift in Japan has imposed significant pressure on maintaining a healthy and productive workforce since older employees are often perceived to be less productive and less innovative as compared to the younger ones, owing to their age-related declines in physical and cognitive capacities, which constrains economic growth in the long run (Lee et al., 2020). In response to these demographic challenges, it is essential to invest in the health of the working population and to foster healthy lifestyles from an early stage, in addition to expand employment opportunities for older employees (Mori et al., 2020).

Over time, as global awareness of the importance of employee health has grown, governments word widely have introduced corresponding policies, such as the Total Worker Health approach in the U.S., local government-backed workplace charters in the U.K., and Employee Assistance Programmes in China (Celebi, 2023; Leso et al., 2024; Long & Cooke, 2022). Reflecting this growing global recognition and responding to domestic challenges, Japan introduced the Health and Productivity Management (H&PM) initiative in 2014 under the Ministry of Economy, Trade and Industry (METI), based on the idea that efforts to maintain and improve the health of employees are investments to enhance future profitability. Unlike comparable initiatives abroad mentioned above, Japan's H&PM initiative represents a government-led and nationally standardized system. To enhance the visibility and recognition of such efforts, the METI and Nippon Kenko Kaigi launched the Certified H&PM Organization Recognition Program in 2016, which motivates firms to engage in comprehensive health management (METI, 2025; METI, n.d.; Nippon Kenko Kaigi, n.d.). To obtain certification, firms must complete the Health and Productivity Survey, and such certification can enhance social recognition from various stakeholders, thereby improving corporate reputation and competitiveness (Watanabe et al., 2024; Yao and Johanson, 2022).

In parallel, since environmental performance has become an essential dimension of the Environmental, Social, and Governance (ESG) evaluation, firms have progressively strengthened their environmental engagement, such as reducing resource use and emissions, in response to growing stakeholders' expectations (Hardcopf et al., 2024). Against this backdrop, a question arises as to how firms balanced between the health-related dimension within the social (herewith S) pillar and environmental engagement within the environmental (herewith E) pillar under the broader ESG framework. While a large body of research has examined firms' overall ESG performance (e.g., Biju et al., 2025; Wang et al., 2025; Zhang et al., 2025), empirical studies investigated such balance remain limited.

This issue is particularly crucial for small and medium-sized enterprises (SMEs), given the stark disparities that exist in the institutional environment and organizational resources from large enterprises. Due to a stronger influence of owner-manager preferences, ESG engagement within SMEs is often less formalized than in large enterprises (Garrido-Ruso et al., 2024). Additionally, implementing sustainability practices often takes substantial costs and resource commitments (Oduro & Haylemariam, 2025). Thus, resource scarcity may constrain SMEs' ability to pursue multiple sustainability objectives, thereby increasing the likelihood of trade-offs emerging between health management and environmental engagement. At the same time, SMEs account for around 99.7% of Japanese firms and employ approximately 70% of the national workforce (Hirasawa et al., 2018). As the backbone of Japan's economy, SMEs serve as key diffusion channels for sustainable management practices, and their behavior is crucial to Japan's long-term transition to sustainable growth. Despite this importance, SMEs frequently face resource challenges towards ESG disclosure (Gholami et al., 2022), generally lack awareness of ESG principles and disclosure requirements (Shalhoob & Hussainey, 2022), and often tend to view ESG

practices as peripheral to core business operations and hesitate to engage due to additional financial and administrative burdens (Yip et al., 2024). These factors collectively make ESG-related data on SMEs more difficult to obtain, leading to relatively scarcities of empirical evidence centered on SMEs.

To address the gap, this study empirically examined how firms balanced health management and environmental engagement under health-related government initiatives by focusing on Japanese SMEs. Japan provides an ideal context for examining the questions for the following two reasons. First, the uniquely H&PM program provides official lists of certified H&PM organizations, which can be used as measurable indicators for firms' health management. Second, an annual report named Toyo Keizai Kaisha Shikiho provides detailed information about both unlisted and listed firms across Japan. From this source, we collected several firm-level variables such as firm capital, the number of employees, and, importantly, the number of distinct environment-related keywords that serves as a proxy for the intensity of environmental engagement.

To conduct the analysis, first, we employed a two-way fixed effects (TWFE) model to examine how Japanese SMEs balanced health management and environmental engagement. Moreover, to address industry-level endogeneity, we employed an instrumental variables two-stage least squares (IV-2SLS) approach. Last, we further explored whether the relationship between health management and environmental engagement varied across two different levels of environmental engagement (i.e., modest and intensive levels), and whether it differed across ownership structures (i.e., unlisted and listed SMEs) and industry types (i.e., manufacturing, information and communications, wholesale trade, construction, and real estate) through TWFE estimations. Such heterogeneity is expected to arise not only from the resource constraints commonly faced by SMEs but also from differences in ownership structures and industry-specific conditions that shape their strategic orientations.

We found that the number of distinct environment-related keywords in firms' reports was positively and significantly associated with the likelihood of obtaining H&PM certification, indicating that health management and environmental engagement were generally complementary among Japanese SMEs. Subsequently, the IV-2SLS estimates showed that while the causal effect of environmental engagement was insignificant for the overall sample and unlisted SMEs, it was significantly positive for listed SMEs, which may reflect their greater sensitivity to industry norms and external pressures. When distinguishing between modest and intensive levels of environmental engagement, the results from TWFE estimation revealed a non-linear pattern. Specifically, the positive association vanished as environmental engagement becomes intensive, which suggests a potential trade-off between health management and environmental engagement among Japanese SMEs. Moreover, further heterogeneity analysis through TWFE estimations revealed that the complementary relationship undergone different changes (i.e., diminishing, vanishing or reversing) across ownership structures and industries, suggesting that the trade-offs is not uniform but conditional on contextual heterogeneity. Overall, the findings suggest that policymakers should design differentiated policies tailored to SMEs with different characteristics, thereby promoting a more balanced alignment between health management with other sustainability objectives.

The remainder of the paper is organized as follows: Section 2 reviews the relevant literature. Section 3 outlines the empirical model, and Section 4 describes the data employed in the empirical analysis. Section 5 reports the estimation results and robustness checks. Finally, Section 6 concludes the paper and discusses the main implications of the findings.

2. Theoretical background and hypotheses

To date, empirical evidence has consistently demonstrated the multidimensional benefits of health management. For example, Foncubierta-Rodríguez et al. (2024) found that health promotion programs could enhance corporate reputation. Evidence also suggested that such programs generated positive financial returns, providing employers with measurable cost savings and favorable expected returns on investment (Boyce et al., 2024; Dement et al., 2015). Regarding productivity, Gubler et al. (2017) provided firm-level evidence that corporate wellness programs led to measurable productivity gains, with improved health increasing individual output by approximately 10%. Similar evidence has also been observed in Japan. Yano et al. (2022) analyzed data from the Health and Productivity Survey and identified key factors within the H&PM framework that were associated with firm profitability. Their findings showed that firms with healthier workforces, characterized by lower smoking rates, better sleep quality, and more regular exercises, tended to be more profitable.

Collectively, both international and specific evidence from Japan suggested that health management is a strategic investment that can generate multiple benefits. It can be regarded as a key intangible resource that supports sustainable performance and may interact with other dimensions of corporate sustainability such as environmental engagement, within the broader ESG framework. Over the past few decades, research on ESG performance has expanded rapidly. Numerous studies have examined the relationship between overall ESG performance and various firm-level outcomes, such as financial performance (Wang & Shimokawa, 2025), risk mitigation (Nian & Said, 2025), and innovation capability (Feng et al., 2024). In addition to research focusing on comprehensive ESG frameworks, a significant body of literature has also explored the individual pillars of ESG. For instance, as discussed above, research on the health-related dimension within S pillar has highlighted the strategic value of health management in enhancing overall performance. Similarly, studies focusing on the E pillar have examined how environmental management and sustainability-oriented practices contributed to firm competitiveness and financial outcomes (e.g., Ali et al., 2022; Do & Nguyen, 2020; Yeon et al., 2021). In particular, focusing on SMEs, White et al. (2026) investigated sustainability orientation as a strategic resource, showing that it enhances both performance and stability.

However, despite the rapid expansion of ESG-related research, relatively few studies have examined how firms balanced their sustainability strategies across different ESG pillars. One notable exception is (Yusifzada et al., 2025), who analyzed potential trade-offs between the S and E pillars within the ESG framework., and found a negative correlation across industries. However, they examined the S pillar as a whole, rather than focusing specifically on its health-related dimension. This leaves a research gap in understanding firms' balance between health management within the S pillar and environmental engagement within the E pillar. Investigating this gap is particularly important for resource-constrained SMEs, whose investments in environment engagement may directly constrain their ability to maintain health management.

From the perspective of Creating Shared Value (CSV) proposed by Porter and Kramer (2011), firms can enhance economic and social performance by integrating social value creation into their core business strategy. Investments in areas such as employee health and environmental protection can be interpreted as forms of shared-value creation, as they both contribute to productivity, innovation, and long-term competitiveness. Such initiatives may function not as isolated actions but part of an integrated sustainability orientation, where internal (employee health) and external (environmental responsibility) dimensions reinforce each other. This perspective suggests that firms that actively engage in environmental initiatives may also be likely to invest in health management. Accordingly, we proposed

the following

Hypothesis 1 (H1: Complementarity Hypothesis): Among Japanese SMEs, the health management and environmental engagement will reflect a complementary relationship.

However, while the CSV supports mutual promotion between health-related and environmental dimensions, the ability to maintain this complementary relationship depends on the firms' resource availability. Prior studies have shown that environmental engagement often required substantial financial investment (Lu et al., 2025; Xia et al., 2024), which may limit the resources available for maintaining health-related programs, especially in SMEs. Consequently, the level of environmental engagement may shift the balance between internal and external commitments. At modest levels of environmental engagement, firms may retain sufficient flexibility to invest in both dimensions, thereby achieving a complementary relationship. However, as environmental engagement becomes more intensive, limited resources may crowd out health-related investments. Based on this argument, we formulated

Hypothesis 2 (H2: Non-linearity Hypothesis): The complementary relationship between SMEs' health management and environmental engagement will diminish, vanish or even reverse when environmental engagement becomes intensive, indicating a potential trade-off under resource constraints.

Lastly, building on prior research suggesting that firms' sustainability orientations differed systematically across ownership structures and industrial contexts (D'Amore et al., 2024; Lei et al., 2019), we proposed

Hypothesis 3 (H3: Heterogeneity Hypothesis): The complementary relationship between SMEs' health management and environmental engagement will be contingent on ownership structures and industry types, and may diminish, vanish, or even reverse under certain conditions.

3. Methods

3.1. Relationship Between Environmental Engagement Intensity and Obtaining H&PM Certification

To examine H1, we employed a TWFE model shown below:

$$Certification_{it} = \alpha_0 + \alpha_1 EnvKeyword_num_{it} + \alpha_2 Logcapital_{it} + \alpha_3 Employees_{it} + \alpha_4 Listed_{it} + \varphi_i + \omega_t + \varepsilon_{it} \quad (1)$$

where $Certification_{it}$ equals 1 if firm *i* received H&PM certification in year *t*, and 0 otherwise. The key explanatory variable, $EnvKeyword_num_{it}$, represents the number of distinct environment-related keywords appearing in firm *i*'s annual report in year *t*, serving as a proxy for the intensity of environmental engagement.

The control variables include the logarithm form of firm capital ($Logcapital_{it}$), the number of employees ($Employees_{it}$), and a dummy variable indicating whether the firm is listed ($Listed_{it}$).

The model incorporates firm fixed effects (φ_i) and year fixed effects (ω_t) to control for time-invariant firm-specific characteristics and to capture macro-level influences, respectively. The standard errors clustered at the firm level to account for serial correlation within firms. The coefficient of primary interest, α_1, measures the association between firms' environmental engagement intensity and their likelihood of

obtaining H&PM certification.

3.2. Addressing Endogeneity Using an Instrumental Variable Strategy

To address the concern about industry-level endogeneity, we constructed an instrumental variable that isolates exogenous variation in the $EnvKeyword_num_{it}$. Specifically, for each firm *i*, we defined a leave-one-out peer average of environmental keyword usage, measured as the mean number of distinct environment-related keywords in all other firms belonging to the same industry, ownership structure, and year.

Using this instrument, we estimated the model via two-stage least squares. In the first stage, the number of distinct environment-related keywords for each firm was regressed on the leave-one-out peer average and control variables, along with firm and year fixed effects, as follow:

$$EnvKeyword_num_{it} = \beta_0 + \beta_1 IV_{it} + \beta_2 Logcapital_{it} + \beta_3 Employees_{it} + \beta_4 Listed_{it} + \varphi_i + \omega_t + \varepsilon_{it} \quad (2)$$

The predicted values from this regression, $\widehat{EnvKeyword_num_{it}}$ capture exogenous variation in environmental engagement induced by peer effects.

The second stage replaced the endogenous variable with its fitted values from the first stage to identify the causal effect of environmental engagement on the likelihood of obtaining H&PM certification, as shown in the equation below:

$$Certification_{it} = \gamma_0 + \gamma_1 \widehat{EnvKeyword_num_{it}} + \gamma_2 Logcapital_{it} + \gamma_3 Employees_{it} + \gamma_4 Listed_{it} + \varphi_i + \omega_t + \varepsilon_{it} \quad (3)$$

This IV-2SLS approach allows γ_1 to be interpreted as the causal effect of environmental engagement intensity on the likelihood of obtaining H&PM certification for firms whose behavior is influenced by their peers.

3.3. Heterogeneous Effects Across Moderate and Intensive Engagement Levels

To examine H2, we replaced $EnvKeyword_num_{it}$ with two dummy variables, $EnvKeyword_1_{it}$ and $EnvKeyword_more1_{it}$, that distinguish between modest and intensive levels of environmental engagement:

$$Certification_{it} = \delta_0 + \delta_1 EnvKeyword_1_{it} + \delta_2 EnvKeyword_more1_{it} + \delta_3 Logcapital_{it} + \delta_4 Employees_{it} + \delta_5 Listed_{it} + \varphi_i + \omega_t + \varepsilon_{it} \quad (4)$$

Here, $EnvKeyword_1_{it}$ equals 1 if the distinct environment-related keyword was mentioned exactly once in firm *i*'s report in year *t*, and 0 otherwise, while $EnvKeyword_more1_{it}$ equals 1 if such keywords appeared two or more times, and 0 otherwise. The same set of control variables, firm fixed effects, and year fixed effects were included as in the baseline model, and standard errors were clustered at the firm level. The coefficients δ_1 and δ_2 represent the effects of modest and intensive environmental engagement, respectively.

3.4. Heterogeneous Effects Between Unlisted and Listed SMEs

To investigate whether firms' balance between health management and environmental engagement differed by firms' ownership structure, we extended the estimation in equation (4) by conducting estimation for unlisted and listed SMEs separately as follows:

$$\begin{aligned} Certification_{it,m} &= \eta_0 + \eta_1 EnvKeyword_1_{it,m} + \eta_2 Keyword_more1_{it,m} \\ &+ \eta_3 Logcapital_{it,m} + \eta_4 Employees_{it,m} + \varphi_i + \omega_t + \varepsilon_{it,m} \end{aligned} \quad (5)$$

where all variables are defined as in equation (4), except for m $= \{Unlisted\ SMEs,\ Listed\ SMEs\}$ denoting the ownership structures. The same set of control variables excluding $Listed_{it,n}$, firm and year fixed effects, and clustered standard errors were used as in the baseline model.

The coefficient η_1 and η_2 capture the effects of mentioning distinct environmental keywords once and two or more times, respectively.

3.5. Heterogeneous Effects Across Industries

To further examine heterogeneity across industries, we extended the estimation in equation (4) by conducting industry-specific regressions for each of the five major industry categories that collectively comprise approximately 93.02% of SMEs in the dataset. Specifically, the industry-specific equation is given as follows:

$$\begin{aligned} Certification_{it,n} &= \theta_0 + \theta_1 EnvKeyword_1_{it,n} + \theta_2 Keyword_more1_{it,n} \\ &+ \theta_3 Logcapital_{it,n} + \theta_4 Employees_{it,n} + \varphi_i + \omega_t + \varepsilon_{it,n} \end{aligned} \quad (6)$$

Similarly, all variables are defined as in equation (4), except for except for n $= \{Manufacturing, Information\ and\ Communication, Wholesale, Construction, Real\ Estate\}$ denoting the industry categories. The same set of control variables, firm and year fixed effects, and clustered standard errors were used as in the baseline model.

The coefficients θ_1 and θ_2 capture the effects of modest and intensive levels of environmental engagement, respectively, within each industry.

4. Data Construction

The data were obtained from two sources. The first source is the Toyo Keizai Kaisha Shikiho annual reports from 2019 to 2024, which include both unlisted and listed firm editions. These reports provide detailed information on approximately 13,000 unlisted firms and 3,890 listed firms in Japan, including numerical variables such as firm capital and the number of employees, along with textual descriptions of firms' management strategies and operational characteristics.

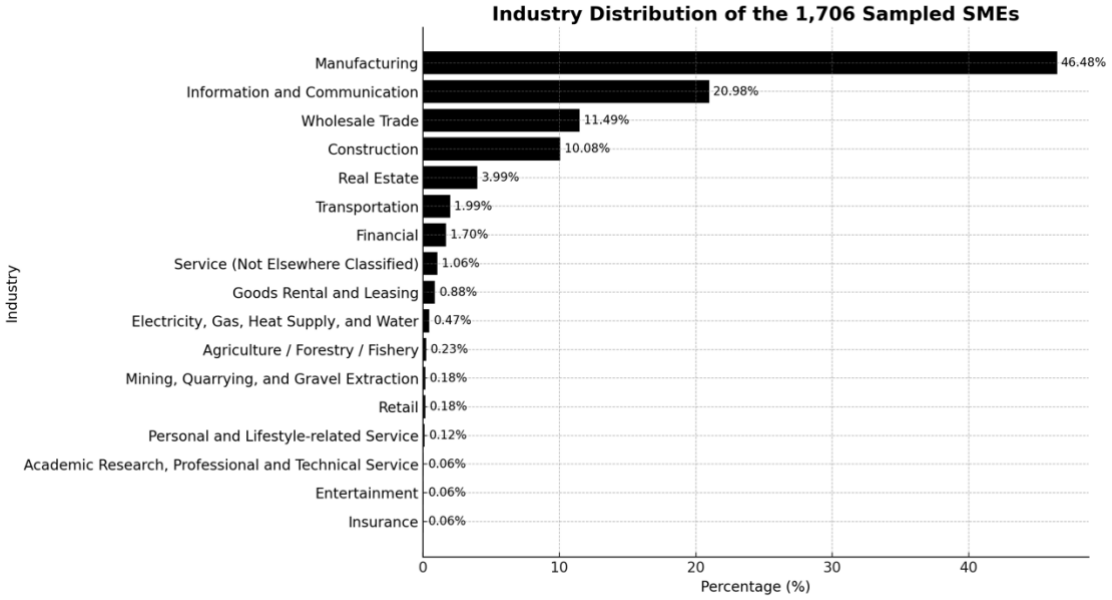
Using these textual contents in the "Features and Recent Developments" section of each unlisted firm's report, and in the "Features" and text description sections of each listed firm's report, we quantified firms' environmental engagement through a text-mining approach to extract environment-related keywords. The keyword set includes "CO2 (emissions) reduction", "CO2-free", "carbon neutral", "carbon zero", "decarbonization", "ESG", "SDG(s)", "environment", "eco", "clean energy", "recycling", "sustainable strategies", "recycling", "reuse", "energy conservation", "resource conservation", "power conservation",

"plastic conservation", "new energy", "zero energy", "zero emissions", "solar power generation", "offshore wind power generation", "geothermal power generation", "(small-scale) hydropower generation", "biomass power generation", "solar panels", "recycling (energy)", "(industrial waste/wastewater/exhaust gas/sludge/contaminated soil) treatment", "water conservation", "purification", "water conservation", "soil conservation", and "plastic-free". The frequency of these keywords, with identical keywords counted only once per report, may not perfectly reflect the actual extent of a firm's environmental engagement, but given data limitations, it provides a reasonable proxy. To enhance accuracy, we manually verified the contextual usage of each keyword to ensure that it conveys the meaning of environmental protection within the surrounding text.

Using this text-based information, we constructed the independent variables $EnvKeyword_num_{it}$, $EnvKeyword_1_{it}$, and $EnvKeyword_more1_{it}$ for the empirical analysis. In addition, I created $EnvKeyword_any_{it}$, a binary variable that equals 1 if at least one distinct environment-related keyword was mentioned in firm *i*'s report in year *t*, and 0 otherwise, for a robustness check. As control variables, we included firm capital, the number of employees, and an indicator for whether the firm is listed, while the average employee age was additionally included in the robustness check.

Based on these variables, we constructed a panel dataset from 2019 to 2024 with 7,471 firm-year observations across 1,706 firms. Figure 1 shows that the sample is dominated by five industries: manufacturing (46.48%), information and communication (20.98%), wholesale trade (11.49%), construction (10.08%), and real estate (3.99%).

Figure 1. Industry Distribution of the 1,706 Sampled SMEs

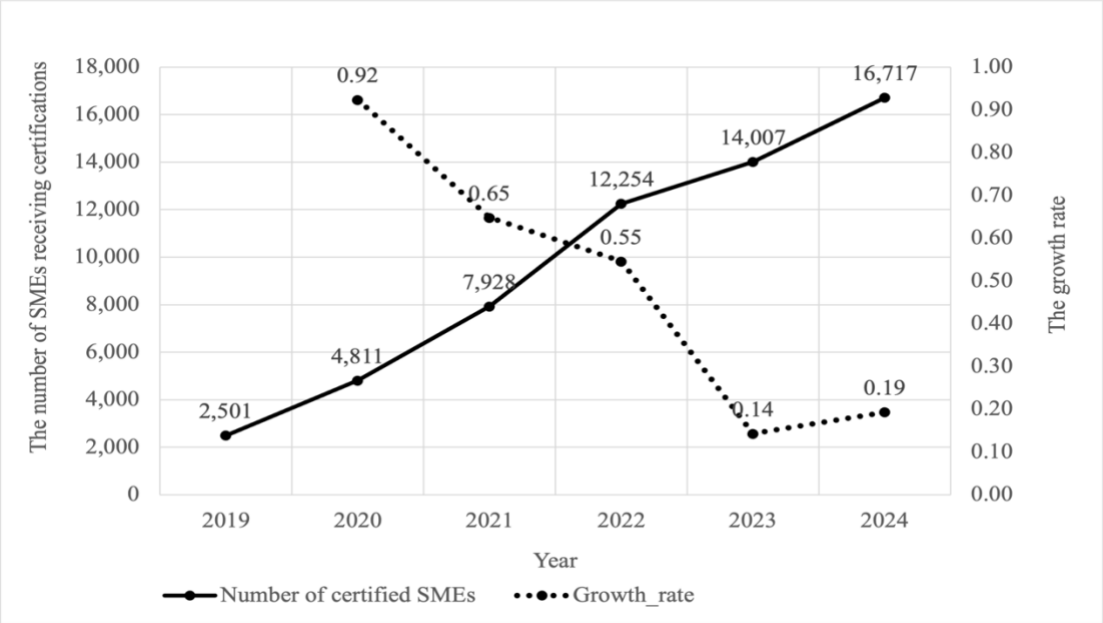


Notes: This figure presents the distribution of 1,706 SMEs across 17 industries. Percentages are based on firm counts, and the industry classification follows the categories provided in the official lists of certified H&PM organizations among SMEs.

The second source of data is the official lists of certified H&PM organizations published annually by METI. As shown in figure 2, the number of certified SMEs increased steadily from 2,501 in 2019 to 16,717 in 2024, indicating the growing diffusion of health and productivity management practices across Japan's corporate sector. However, after 2020, the annual growth rate of newly certified firms declined

sharply, from 0.92 in 2020 to 0.14 in 2023, before rebounding slightly to 0.19 in 2024. This pattern indicates that although there has been a continuous rise in the number of SMEs obtaining H&PM certification, the growth rate appears to have slowed, suggesting a potential market saturation effect or a stabilization of the certification process.

Figure 2. The number and growth rate of SMEs certified as H&PM organizations



Notes: This figure illustrates the annual number of certified SMEs under Certified H&PM Organization Recognition Program from 2019 to 2024, as published by the METI. The solid line represents the total number of certified SMEs, while the dotted line indicates the annual growth rate of certified firms.

By matching firms' names and addresses from the official lists of certified H&PM organizations with those in the SMEs' panel dataset constructed from the Toyo Keizai Kaisha Shikiho annual reports, we identified the firms that obtained H&PM certification. Using this information, we constructed the dependent variable, $Certification_{it}$, a binary indicator that equals 1 if firm *i* obtained the certification in year *t*, and 0 otherwise.

To provide an overview of the analytical sample, table 1 summarizes the descriptive statistics. On average, 7.5% of firms obtained H&PM certification during the study period, with the proportion increasing from 2.74% in 2019 to 11.57% in 2024, which showed that participation in the program among SMEs listed in Toyo Keizai Kaisha Shikiho remains relatively selective.

With respect to the main independent variables, the average number of distinct environment-related keywords mentioned in firms' annual reports is approximately 0.18, with a maximum of 5. This indicates that most firms had limited environmental engagement. Overall, 12.9% of firms mentioned at least one distinct environment-related keyword, with the proportion increased from 11.13% in 2019 to 14.05% in 2024. This reflects the generally low but notable level of environmental engagement among SMEs. Approximately 9% of firms mentioned distinct environment-related keywords exactly once, while 4% mentioned them two or more times, implying that intensive environmental engagement is relatively uncommon.

Regarding firm characteristics, the average logarithm of capital is about 4.38, corresponding to roughly

80 million yen in capital. The mean number of employees is approximately 122, with considerable variation across firms, indicating substantial heterogeneity in firm size. Additionally, the average employee age is around 41 years, suggesting a relatively mature workforce among SMEs. Finally, only about 12% of firms in the sample are listed ones, implying that the vast majority of SMEs are unlisted.

Table 1. Descriptive statistics of analytical sample

Variable	Mean	SD	Min.	Max.
$Certification_{it}$	0.075	0.264	0	1
$EnvKeyword_num_{it}$	0.177	0.519	0	5
$EnvKeyword_1_{it}$	0.090	0.287	0	1
$EnvKeyword_more1_{it}$	0.038	0.192	0	1
$EnvKeyword_any_{it}$	0.129	0.335	0	1
$Logcapital_{it}$	4.375	0.781	0	5.704
$Employees_{it}$	121.878	78.151	0	300
$Listed_{it}$	0.122	0.327	0	1
Avg_age_{it}	41.213	4.423	20.4	67

Notes: This table presents descriptive statistics for all variables included in the analysis. SD = standard deviation.

5. Results

5.1. Baseline Estimates of the Relationship Between Environmental Engagement Intensity and H&PM Certification

Table 2 presents the results for estimating equation (1). The coefficient of interest, α_1, was significantly positive at the 5% level. This implied that when the distinct number of environment-related keywords in a firm's annual report increased by one unit, the probability of obtaining H&PM certification rose by approximately 2.5 percentage points, holding other factors constant. The finding indicates that among SMEs, health management and environmental engagement complement each other, which is consistent with H1.

Table 2. The relationship of environmental engagement and the likelihood of obtaining H&PM certification

	(1)
$EnvKeyword_num_{it}$	0.025*
	(0.014)
$Logcapital_{it}$	0.022*
	(0.013)
$Employees_{it}$	0.000
	(0.000)
$Listed_{it}$	-0.342**
	(0.158)
Firm FEs	Yes
Year FEs	Yes

Observations	7,239
Adj. R-squared	0.632

Notes: This table presents TWFE regression estimates examining the relationship between firms' environmental engagement and the likelihood of obtaining H&PM certification. FEs = fixed effects. SEs are clustered at the firm level with *** p<0.01, **p<0.05, *p<0.1 and reported in parentheses.

5.2. IV-2SLS Estimates of the Relationship Between Environmental Engagement Intensity and H&PM Certification

Table 3 reports the results using the IV-2SLS approach. For the overall sample, the IV-2SLS estimate of the coefficient on environmental engagement remained positive but became statistically insignificant. This is contrary to the significant TWFE estimate reported in table 2, and suggests that once the peer-induced variation in environmental engagement intensity is isolated, the causal impact on the likelihood of obtaining H&PM certification becomes substantially weaker. A similar pattern appears in the subsample of unlisted SMEs, where the coefficient remained positive but insignificant.

In contrast, the IV-2SLS estimate for listed firms was significantly positive at 10% level. A one-unit increase in the instrumented number of distinct environment-related keywords raised the probability of obtaining H&PM certification by approximately 68.7 percentage points, holding other factors constant. This result suggests that, among listed SMEs, peer-induced increases in environmental engagement were associated with a substantially higher likelihood of obtaining H&PM certification. A plausible explanation is that listed SMEs may be more sensitive to industry norms and external pressures, such that peer-induced increases in environmental engagement may trigger constructive changes in internal management systems to strengthen the capability to obtain certification.

Table 3. IV-2SLS estimates for the relationship of environmental engagement and the likelihood of obtaining H&PM certification

	(1) Overall	(2) Unlisted	(3) Listed
$\widehat{EnvKeyword_num}_{it}$	0.838	0.539	0.687*
	(0.884)	(0.980)	(0.411)
$Logcapital_{it}$	0.013	0.046	-0.011
	(0.021)	(0.072)	(0.012)
$Employees_{it}$	-0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)
$Listed_{it}$	0.198		
	(0.587)		
Firm FEs	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes
Observations	7,180	6,397	781

Notes: This table reports IV-2SLS regression results examining the relationship between firms' environmental engagement and the likelihood of obtaining H&PM certification. FEs = fixed effects. SEs are heteroskedasticity-robust standard errors with *** p<0.01, **p<0.05, *p<0.1 and reported in

parentheses.

5.3. Estimated Heterogeneous Effects Across Modest and Intensive Engagement Levels

Table 4 presents the results for estimating equation (4), which differentiates between modest and intensive environmental engagement. The coefficient for $EnvKeyword_1_{it}$ was positive and marginally significant at 10% level. This indicated that firms with reports mentioning distinct environment-related keywords exactly once were, on average, 3.2 percentage points more likely to obtain H&PM certification than those that did not. In contrast, the coefficient for $EnvKeyword_more1_{it}$ was positive but statistically insignificant, indicating that when distinct environment-related keywords are mentioned two or more times, the additional effect on the likelihood of obtaining H&PM certification became negligible. This result suggests that while the complementary relationship still persists at modest level of environmental engagement, this positive association does not hold as environmental engagement becomes intensive. In other words, additional emphasis on environmental initiatives tends to crowd out resources available for health management, supporting H2 and revealing a potential trade-off between the two dimensions.

Table 4. Heterogenous effects of modest and intensive levels of environmental engagement on the likelihood of obtaining H&PM certification

	(1)
$EnvKeyword_1_{it}$	0.032*
	(0.017)
$EnvKeyword_more1_{it}$	0.005
	(0.022)
$Logcapital_{it}$	0.022
	(0.014)
$Employees_{it}$	0.000
	(0.000)
$Listed_{it}$	-0.354**
	(0.166)
Firm FEs	Yes
Year FEs	Yes
Observations	7,239
Adj. R-squared	0.632

Notes: This table reports TWFE regression results examining the heterogeneous effects of environmental engagement on the likelihood of obtaining H&PM certification between modest and intensive levels of environmental engagement. FEs = fixed effects. SEs are clustered at the firm level with *** p<0.01, **p<0.05, *p<0.1 and reported in parentheses.

5.4. Estimated Heterogeneous Effects Between Unlisted and Listed SMEs

Table 5 presents the estimation results for equation (5). For unlisted SMEs, the coefficient of $EnvKeyword_1_{it,m}$ was positive and statistically significant at 10% level, denoting that firms with reports mentioning distinct environment-related keywords exactly once were, on average, 3.1 percentage

points more likely to obtain H&PM certification than those that did not, while the coefficient of $EnvKeyword_more1_{it,m}$ remained statistically insignificant. This pattern mirrors the results observed in Section 5.3, suggesting that for unlisted firms, health management and environmental engagement continued to exhibit a complementary relationship only at modest levels of environmental engagement.

In contrast, for listed firms, both coefficients for $EnvKeyword_1_{it}$ and $EnvKeyword_more1_{it}$ were statistically negative, showing that firms mentioning distinct environment-related keywords exactly once and two or more times were, on average, 1.1 and 1.2 percentage points respectively, less likely to obtain H&PM certification. These results indicated that, for listed SMEs, the complementary relationship reversed. Even modest level of environmental engagement was associated with a lower likelihood of obtaining H&PM certification, and this negative association persisted as environmental engagement intensifies.

Table 5. Heterogenous effects of environmental engagement on the likelihood of obtaining H&PM certification by ownership structure

	(1)	(2)
	Unlisted	Listed
$EnvKeyword_1_{it,m}$	0.031*	-0.011*
	(0.018)	(0.006)
$EnvKeyword_more1_{it,m}$	-0.006	-0.012*
	(0.024)	(0.007)
$Logcapital_{it,m}$	0.010	-0.000
	(0.022)	(0,003)
$Employees_{it,m}$	-0.000	0.000
	(0.000)	(0.000)
Firm FEs	Yes	Yes
Year FEs	Yes	Yes
Observations	6,442	794
Adj. R-squared	0.628	0.725

Notes: This table reports TWFE regression results examining the heterogeneous effects of environmental engagement on the likelihood of obtaining H&PM certification across listed and unlisted SMEs. FEs = fixed effects. SEs are clustered at the firm level with *** p<0.01, **p<0.05, *p<0.1 and reported in parentheses.

5.5. Estimated Heterogeneous Effects Across Industries

Table 6 presents the results of the industry-specific estimations based on equation (6). Once the sample is segmented by industry, the baseline complementary relationship documented in Section 5.1 was no longer held.

Only in the information and communication industry, the coefficient for $EnvKeyword_1_{it,n}$ was significantly negative at 10% level, showing that firms with reports mentioning distinct environment-related keywords exactly once were, on average, 1.9 percentage points less likely to obtain H&PM certification than those that did not. In contrast, the coefficients for both $EnvKeyword_1_{its}$ and $EnvKeyword_more1_{it,n}$ were statistically insignificant in manufacturing, wholesale trade,

construction, and real estate, implying that the complementary relationship observed in the full sample did not generalize to these industries.

Combining the results from the preceding section, the observed variations in the complementary relationship across ownership structures and industry types provide empirical support for H3.

Table 6. Heterogenous effects of environmental engagement on the likelihood of obtaining H&PM certification across industries

	(1) Manufacturing	(2) Information and Communications	(3) Wholesale Trade	(4) Construction	(5) Real Estate
$EnvKeyword_1_{it,n}$	0.033	-0.019*	0.007	0.017	-0.019
	(0.026)	(0.011)	(0.024)	(0.035)	(0.026)
$EnvKeyword_more1_{i,n}$	-0.004	0.063	0.020	-0.097	-0.038
	(0.035)	(0.065)	(0.023)	(0.060)	(0.044)
$Logcapital_{it,n}$	0.013	0.002	-0.025*	-0.027	0.017
	(0.021)	(0.013)	(0.015)	(0.063)	(0.015)
$Employees_{it,n}$	-0.000	-0.000	0.001	0.000	0.000
	(0.000)	(0.000)	(0.002)	(0.001)	(0.001)
$Listed_{it,n}$	-0.028	(omitted)	(omitted)	(omitted)	(omitted)
	(0.040)				
Firm FEs	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes
Observations	3,558	1,297	845	807	310
Adj. R-squared	0.565	0.741	0.562	0.738	0.687

Notes: This table reports TWFE regression results examining the heterogeneous effects of environmental engagement on the likelihood of obtaining H&PM certification across industries. FEs = fixed effects. SEs are clustered at the firm level with *** p<0.01, **p<0.05, *p<0.1 and reported in parentheses.

5.6. Robustness Check

First, to assess the robustness of the baseline findings, we re-estimated the model by replacing the continuous measure of environmental engagement with a binary variable, $EnvKeyword_any_{it}$. The following equation represents the robustness specification:

$$Certification_{it} = \lambda_0 + \lambda_1 EnvKeyword_any_{it} + \lambda_2 Logcapital_{it} + \lambda_3 Employees_{it} + \lambda_4 Avg_age_{it} + \lambda_5 Listed_{it} + \varphi_i + \omega_t + \varepsilon_{it} \quad (7)$$

This helps verify whether the positive association between environmental engagement and the likelihood of obtaining H&PM certification persisted when using a less granular indicator.

The estimation results in table A1 showed that the coefficient on $EnvKeyword_any_{it}$ was significantly positive at 10% level. The direction and magnitude of the effect are consistent with the baseline findings, confirming that the observed relationship is not sensitive to the specific measurement of environmental engagement. Therefore, the results reinforce the robustness and reliability of the

baseline conclusions.

Second, to further verify the robustness of the heterogeneous results across modest and intensive levels of environmental engagement, we adopted a model specification robustness test by incorporating an extra control variable, the average age of employees (Avg_age_{it}), into equations (4), (5), and (6). This variable captures potential differences in workforce composition that may influence firms' propensity to obtain H&PM certification.

The estimation results are summarized in tables A2 to A4. When additional control variables are included, the coefficients of the main independent variables remained consistent in both sign and significance across specifications, except that the coefficient of $EnvKeyword_1_{it,n}$ in the construction sector became statistically significant while retaining its positive sign. This suggests that the model captured the correct direction of the effect, and incorporating further firm-level controls reduced residual noise and enhanced estimation precision. Overall, the findings remain robust in both direction and economic interpretation.

6. Conclusion

Drawing on the official list of certified H&PM organizations and firm-level data from Toyo Keizai Kaisha's Shikiho, we constructed a unique panel dataset of 1,706 SMEs in Japan from 2019 to 2024, we empirically investigated how Japanese SMEs balanced health management and environmental engagement under health-related government initiatives, an area that remains underexplored in the existing literature due to data constraints.

First, we employed a TWFE model, and the results indicated that health management and environmental engagement generally exhibited a complementary relationship among Japanese SMEs. To address potential industry-level endogeneity, we subsequently implemented an IV-2SLS approach, and the results revealed that the causal effect of environmental engagement was insignificant for the overall sample and unlisted SMEs, but significantly positive for listed SMEs. This suggest that the causal response to peer-driven environmental engagement within same industry is concentrated only among listed SMEs, potentially due to their heightened exposure to industry norms and external pressures. Moreover, further TWFE estimations showed that the complementary relationship vanished when environmental engagement becomes intensive, and varied additionally across ownership structures and industry types. These findings suggest that the trade-off between health management and environmental engagement is not uniform but conditional on firms' environmental engagement intensity and contextual heterogeneity.

One important limitation of this study lies in the measurement of both health management and environmental engagement. Health management was proxied by a binary indicator denoting whether a firm was certified under Japan's Certified H&PM Organization Recognition Program, which may not capture variations in the intensity of firms' health-related activities beyond certification status. Similarly, in the absence of direct quantitative indicators, environmental engagement was approximated by counting the number of distinct environment-related keywords in each firm's report from Toyo Keizai Kaisha's Shikiho, which may not fully capture the scope or depth of firms' environmental activities. Taken together, these measurement limitations suggest that both health management and environmental engagement may be underestimated.

Despite data limitations, these findings may still offer valuable insights for policymakers seeking to improve corporate sustainability and labor market resilience. As results revealing a potential trade-off between firms' health management and environmental engagement when the latter becomes intensive,

such unbalanced sustainability investment may undermine firms' overall social performance. Addressing this challenge requires policy tools that promote balanced sustainability strategies, rather than narrowly targeting either health-related or environmental dimension. First, drawing on the work of Li et al. (2024), who demonstrated effectiveness of a strategic combination of punishment and subsidies for promoting firms' environmental performance, government should take dual-dimensional incentive system to help prevent excessive promotion of environmental engagement at the expense of health management by rewarding firms who achieved a good balance while punish those who drastically favors investment in one dimension and neglects the other. Second, while governmental intervention remains crucial in guiding firms toward balanced sustainability investment, achieving this balance also relies on the active participation of multiple stakeholders beyond top-down regulation. As highlighted by Kruse et al. (2019), the expectations from both external and internal stakeholders played a key role in motivating firms to adopt integrated environment, safety, and health management systems. Building on this insight, policymakers should supplement traditional regulatory tools with collaborative governance mechanisms, such as promoting the participation of local communities and industry associations in monitoring and evaluation to enhance transparency and accountability.

Furthermore, the observed heterogeneity between unlisted and listed SMEs also highlights an important policy consideration. For listed SMEs, policy initiatives could shift from encouraging to mandating firms to integrate health management indicators into their ESG disclosure frameworks and reputational responsibilities. In contrast, for unlisted SMEs, policy supports should prioritize capacity building through technical assistance, targeted training programs, and simplified reporting mechanisms, in order to enhance their ability to participate multiple sustainability objectives simultaneously. This logic of differentiated policy design can also be extended across industries.

Finally, these policy implications can extend beyond Japan and are particularly relevant for other aging countries where SMEs represent the major employers but face similar resource constraints as they strive to simultaneously pursue health management with other sustainability objectives.

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Appendix

Table A1. Robustness check: Using a binary measure of environmental engagement

	(1)
$EnvKeyword_any_{it}$	0.030**
	(0.017)
$Logcapital_{it}$	0.022
	(0.014)
$Employees_{it}$	0.000
	(0.000)
Avg_age_{it}	-0.001
	(0.002)
$Listed_{it}$	-0.353**
	(0.167)
Firm FEs	Yes
Year FEs	Yes
Observations	6,790
Adj. R-squared	0.631

Notes: This table presents the results of the robustness test using a binary measure of environmental engagement. FEs = fixed effects. SEs are clustered at the firm level with *** p<0.01, **p<0.05, *p<0.1 and reported in parentheses.

Table A2. Robustness check: Heterogenous effects of modest and intensive environmental engagement on the likelihood of obtaining H&PM certification

	(1)
$EnvKeyword_1_{it}$	0.034*
	(0.017)
$EnvKeyword_more1_{it}$	0.012
	(0.022)
$Logcapital_{it}$	0.022
	(0.014)
$Employees_{it}$	0.000
	(0.000)
Avg_age_{it}	-0.001
	(0.002)
$Listed_{it}$	-0.357**
	(0.170)
Firm FEs	Yes
Year FEs	Yes
Observations	6,790

Adj. R-squared	0.631

Notes: This table presents the results of the robustness test controlling for the average age of employees, based on TWFE estimations distinguishing between modest and intensive levels of environmental engagement. FEs = fixed effects. SEs are clustered at the firm level with *** p<0.01, **p<0.05, *p<0.1 and reported in parentheses.

Table A3. Robustness check: Heterogenous effects of environmental engagement on the likelihood of obtaining H&PM certification by ownership structure

	(1) Unlisted	(2) Listed
$EnvKeyword_1_{it,m}$	0.033*	-0.012*
	(0.019)	(0.007)
$EnvKeyword_more1_{it,m}$	0.001	-0.012*
	(0.024)	(0.007)
$Logcapital_{it,m}$	0.008	0.000
	(0.023)	(0,003)
$Employees_{it,m}$	-0.000	-0.000
	(0.000)	(0.000)
$Avg_age_{it,m}$	-0.002	-0.002
	(0.002)	(0.002)
Firm FEs	Yes	Yes
Year FEs	Yes	Yes
Observations	6,006	781
Adj. R-squared	0.626	0.723

Notes: This table reports the robustness results controlling for the average age of employees, based on TWFE estimations across unlisted and listed SMEs. FEs = fixed effects. SEs are clustered at the firm level with *** p<0.01, **p<0.05, *p<0.1 and reported in parentheses.

Table A4-4. Robustness check: Heterogenous effects of environmental engagement on H&PM certification across industries

	(1) Manufacturing	(2) Information and Communications	(3) Wholesale trade	(4) Construction	(5) Real Estate
$EnvKeyword_1_{it,n}$	0.031	-0.019*	0.010	0.022	-0.009
	(0.026)	(0.011)	(0.027)	(0.038)	(0.025)
$EnvKeyword_more1_{it,n}$	0.007	0.065	0.024	-0.112*	-0.037
	(0.033)	(0.065)	(0.025)	(0.064)	(0.046)
$Logcapital_{it,n}$	0.011	0.002	-0.021*	-0.000	0.001
	(0.022)	(0.013)	(0.013)	(0.069)	(0.030)
$Employees_{it,n}$	-0.000	0.000	0.001	-0.000	0.000
	(0.000)	(0.000)	(0.002)	(0.001)	(0.001)

$Avg_age_{it,n}$	-0.002	0.001	0.006	-0.026***	0.011
	(0.003)	(0.003)	(0.004)	(0.008)	(0.008)
$Listed_{it,n}$	-0.015	(omitted)	(omitted)	(omitted)	(omitted)
	(0.043)				
Firm FEs	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes
Observations	3,344	1,222	792	775	275
Adj. R-squared	0.556	0.750	0.561	0.738	0.687

Notes: This table presents the robustness results controlling for the average age of employees, based on TWFE estimations across industry categories. FEs = fixed effects. SEs are clustered at the firm level with *** p<0.01, **p<0.05, *p<0.1 and reported in parentheses.