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Performance from the Perspectives of Environment, Social and Governance in Agri-food Industries: Focusing on Top-Ranked Corporates by the Korea Corporate Governance Service from 2011 to 2025

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Abstract: Environmental, social, and governance (ESG) evaluations have increasingly been adopted within the Korean agri-food industry in line with global sustainability trends. Although several agri-food companies have achieved high rankings in domestic ESG assessments, relatively little attention has been paid to potential differences among ESG recognized firms across industries. The aim of this study is to investigate whether industry specific differences exist among firms demonstrating superior ESG performance. Companies recognized in ESG ratings by the Korea Institute of Corporate Governance and Sustainability from 2011 to 2025 were classified into agri-food and non-agri-food groups. Financial performance was assessed using return on equity (ROE), return on assets (ROA), and return on sales (ROS), while corporate value was evaluated using the price-to-book ratio (PBR) and Tobin's Q. The results revealed no statistically significant differences between the two groups across any of the financial performance and corporate value indicators. These findings suggest that ESG recognized firms may have established comparable sustainability-oriented management systems and practices regardless of industry classification. Therefore, this study contributes to the ESG literature by moving beyond the traditional ESG performance framework and examining industry specific differences among ESG recognized firms. Additionally, it provides empirical evidence from the relatively underrepresented agri-food sector in Korea and offers practical implications for ESG evaluation, disclosure systems, and sustainability oriented corporate policies.

Keywords: Agri-food industries, ESG Ratings, PBR, ROS, Tobin's Q

https://doi.org/10.5338/KJEA.2026.45.18

Agric. Environ. Sci. 2026, 45, 210-220

Received: September 7, 2026
Revised: September 21, 2026
Accepted: October 6, 2026
Published: October 27, 2026

Online ISSN: 2233-4173
Print ISSN: 1225-3537

Check for updates

ⓒ The Korean Society of Environmental Agriculture 2026

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Introduction

Agricultural products obtained from safe agricultural environments have long been used as a basic source of food for humans. Furthermore, agricultural products have various effects as natural products and are used as raw materials for food and medicine, and countless research results are still being published today as food and medicine materials. Agricultural products, as well as food and medicinal or pharmaceutical products developed from these materials, are manufactured, sold, and distributed in various forms by agricultural, food and pharmaceutical companies, and then reached finally consumers. One of the factors that is equally im-

portant as the development of food and pharmaceutical materials is the commercialization of the developed food and pharmaceutical materials, and the management mindset of related companies in commercialization has recently become an important factor in determining corporate management value. In particular, as the recognition that non-financial indicators among the factors determining a company's management value have a significant impact on the actual value assessment of a company has expanded, the focus has been on the company's non-financial factors, such as the environment, society, and governance (ESG) [1]. Companies that are good at ESG management are more profitable, and ESG management capabilities, although non-financial information, have become an important factor affecting corporate value.In other words, the awareness has expanded that in order for a company to operate, it must consider the environment, take social responsibility into account, and improve governance in order to reduce financial risks and enable sustainable development [2,3].

ESG evaluation has emerged as an important concept for sustainable investment and corporate management, but it can be seen as a concept strictly differentiated from corporate social responsibility (CSR) and creating shared value (CSV) [4-8]. The concept of CSR is known to have begun to be mentioned in Mr. Bowen's book 'Social Responsibilities of the Businessman' published in 1953, and it reported that in studying the relationship between businesses and society, the 'ethical' aspects are likely to have a positive impact on both financial and non-financial performance of companies [4,5,7]. While CSR focuses on a company's ethical social responsibility, CSV is known to focus on the company's overall management and direct economic benefits as a corporate value chain [6,8]. Unlike CSR and CSV, ESG began to be defined in International Finance Corporation (IFC) reports between 2004 and 2006, as a new value creation element focused on investors to enhance the sustainability of capital markets [9]. It has been used as a tool to communicate a company's non-financial performance, such as sustainability reports or board reports, to investors, and it is known for viewing environmental, social, and governance factors as social value from the perspective of the capital market and investors, rather than the company itself [2,3].

In addition, ESG evaluations have been institutionally mandated and made mandatory by advanced countries such as the united nations (UN), the european union (EU), and the united states, and are becoming a management condition that cannot be avoided no matter how difficult or challenging the corporate reality is [3]. In other words, ESG is a management strategy to achieve corporate sustainability and a non-financial indicator to evaluate companies, and ESG management has become a keyword that affects the present and future of the entire world beyond individual companies. Therefore, since the pursuit of ESG values has become an opportunity and challenge that must be considered in the process of corporate management, this study analyzed the ESG performance centered on the current Korean agricultural and food industry by utilizing publicly available data, and based on these studies, it is believed that more in-depth research on ESG should be conducted in the domestic agricultural and food industry in line with global trends.

Results and Discussion

ESG evaluation

As shown in Table 1, only four Korean agri-food companies received awards from the Korea Institute of Corporate Governance and Sustainability (KCGS) in the integrated, ESG integrated, and ESG general categories between 2011 and 2025. This finding suggests that the agri-food industry has been substantially underrepresented among firms recognized for outstanding ESG performance. Among the award-winning companies identified between 2011 and 2025, the final sample of non-agri-food firms consisted of twenty-eight firms after excluding financial companies, holding companies, and companies for which relevant corporate data were unavailable from the Financial Supervisory Service and the KCGS. To avoid duplication, firms that received awards in multiple years were counted only once in the final sample.

Recent studies related to ESG in agriculture have primarily focused on issues such as the sources, degradation processes, and environmental impacts of biodegradable plastics in soil, as well as the upcycling of agricultural products, including carrots,

https://doi.org/10.5338/KJEA.2026.45.18
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Table 1. ESG grade ratings by the Korea Institute of Corporate Governance and Sustainability (KCGS) from 2011 to 2025[1)]

Assessment year	Integrated		ESG Integrated		Agri-food Company (Yes or No)	ESG General		Agri-food Company (Yes or No)
	Type of company or code	Grade	Type of company or code	Grade		Type of company or code	Grade	
2025	-	-	-	-	-	[004170] [018670] [052260] -	Excellent Good Good Improvement	No No Yes -
2024	Finance Corporate	Honorary	-	-	-	[090850] [402340] [195940] [003670]	Excellent Good Good Improvement	No No No No
2023	Finance Corporate	Honorary	-	-	-	[004000] [018670] [090850] [267270]	Excellent Good Good Improvement	No No No No
2022	Finance Corporate	Honorary	Finance Corporate	Very excellent	No	[071320] [011070] [052260] [108320]	Excellent Good Good Improvement	No No Yes No
2021	-	-	[017810]	Very excellent	Yes	[010950] [000270] [036490] [052260]	Excellent Good Good Improvement	No No No Yes
2020	-	-	[047050]	Very excellent	No	[017810] [010950] [051500] [001120]	Excellent Good Good Improvement	Yes No Yes No
2019	-	-	[047050]	Very excellent	No	[001740] [017810] [051500] -	Excellent Good Good Improvement	No Yes Yes -
2018	-	-	[034730]	Very excellent	No	[028260] [002790] [286940]	Excellent Good Improvement	No No No
2017	-	-	[010950] [053800] Holding Corporate [051500]	Very excellent Excellent Good Good	No No No Yes	-	-	-
2016	-	-	Finance Corporate [010950] [051500] [009150] [053800]	Very excellent Excellent Excellent Good Good	No No Yes No No	-	-	-
2015	-	-	Finance Corporate [010950] [053800] [011070] [051500]	Very excellent Excellent Excellent Good Good	No No No No Yes	-	-	-
2014	-	-	[010950] [009150] [035720] Finance Corporate [011170] [053800]	Very excellent Excellent Excellent Good Good Good	No No No No No No	-	-	-
2013	-	-	[034020] [010950] [035720] [009150] [030200] Finance Corporate [053800]	Very excellent Excellent Excellent Good Good Good Good	No No No No No No No	-	-	-

https://doi.org/10.5338/KJEA.2026.45.18
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Assessment year	Integrated		ESG Integrated		Agri-food Company (Yes or No)	ESG General		Agri-food Company (Yes or No)
	Type of company or code	Grade	Type of company or code	Grade		Type of company or code	Grade	
2012	-	-	Finance Corporate	Very excellent	No	-	-	-
			[042670]	Excellent	No			
			[035720]	Excellent	No			
			[000660]	Good	No			
			[009150]	Good	No			
			[010950]	Good	No			
			[056190]	Good	No			
			[003670]	Good	No			
			[102940]	Good	No			
2011	-	-	Unlisted Corporate	Very excellent	No	-	-	-
			[033780]	Excellent	Yes			
			[035720]	Excellent	No			
			Finance Corporate	Good	No			
			[000660]	Good	No			
			[053800]	Good	No			
			[056190]	Good	No			

[1] By the introduction of environmental and social assessments, the term ESG has emerged since 2011. With the introduction of governance evaluation in the financial corporates from 2018, general listed corporates and financial corporates have been evaluated separately. Also, the ESG and governance sectors have been awarded separately.

pomegranates, broccoli, green onions, onions, garlic, rice, and various by-products derived from agricultural resources [10,11]. In addition, considerable attention has been devoted to strategies for corporate carbon neutrality (net zero) through natural climate solutions like carbon emission reduction and biodiversity conservation [12]. However, empirical evidence on ESG management as a non-financial performance indicator in Korea's agri-food industry remains limited. A recent study of European agri-food firms found significant differences in ESG performance across ownership structures, including investor-owned firms (IOFs), family firms, and cooperatives [13]. Gega et al. reported that IOFs outperformed family firms and cooperatives in terms of ESG performance, while family firms exhibited a stronger long-term orientation. These results highlight the importance of firm-level characteristics as determinants of ESG performance within the agri-food sector. In several industry-level ESG studies, the agricultural sector has been excluded from analysis due to insufficient sample sizes [14]. As previously described, out of the thirty-two companies analyzed in this study, four were classified as agri-food companies, representing 12.5% of the total sample.

Among the four companies, one firm received a Good rating in the “ESG General” category in 2019, an Excellent rating in the “ESG General” category in 2020, and a Very Excellent rating in the “ESG Integrated” category in 2021, demonstrating a year-by-year improvement in its ESG rating over three consecutive years. Another company received an Improvement rating in 2021 and subsequently achieved Excellent ratings in the “ESG General” category in 2022 and 2025. A third company was recognized five times, receiving Good ratings in the “ESG Integrated” category in 2015 and 2017, and an Excellent rating in 2016. The same company also received Good ratings in the “ESG General” category in both 2019 and 2020. The remaining agri-food company received an Excellent rating in the “ESG Integrated” category in 2011. The term ESG was first officially incorporated into the KCGS evaluation framework in 2011, when environmental and social criteria were formally integrated into the assessment system. Although the KCGS has recognized highly rated companies through its annual award program since 2003, the present study focuses on award companies from 2011 onward, reflecting the formal adoption of ESG-related evaluation criteria. From 2011 to 2016, no company received the Honorary award, and the award category was reinstated in 2017 by the KCGS. Since 2018, a separate corporate governance evaluation system was introduced for financial companies, so awards were given separately to general listed companies and financial companies. Accordingly, this study examined award-winning companies in the “Integrated”, “ESG Integrated”, and “ESG General” categories, excluding award categories designated for financial companies. The award grades were classified, in descending order, as “Honorary”, “Very Excellent”, “Excellent”, “Good”, and “Improvement”. When no company met the criteria for a specific award category, no award was granted by the KCGS, and such cases are indicated

https://doi.org/10.5338/KJEA.2026.45.18
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by a dash ("-") in Table 1. The findings of this study should be interpreted within the broader context of the growing emphasis on ESG disclosure and sustainability-oriented initiatives across the agri-food industry. Previous research in the European food industry has demonstrated that higher ESG ratings are positively associated with superior financial performance [15]. Taken together, these results suggest that ESG recognition may be linked to enhanced corporate competitiveness and long-term value creation. Beyond company-level ESG performance, it is also important to consider the broader institutional and regulatory environment in which ESG evaluations and disclosures are conducted [16]. These findings are particularly noteworthy in light of the growing importance of ESG disclosure and sustainability reporting frameworks at both national and international levels. In Korea, ESG evaluations and related disclosures are primarily conducted by the KCGS. Globally, major ESG disclosure frameworks include the Securities and Exchange Commission (SEC) disclosure requirements in the United States (U.S.) [17], the European Sustainability Reporting Standards (ESRS) in the European Union [17-19], and the International Sustainability Standards Board (ISSB) S1 and S2 standards. Recent studies have increasingly examined the ISSB S1 and S2 standards, SEC disclosure requirements, and the ESRS framework, reflecting ongoing efforts to improve the interoperability and harmonization of global sustainability reporting systems [18,20].

Furthermore, recent research has emphasized the importance of ESG practices within the agricultural sector [21]. A study reported that integrating ESG-based public-private-academic partnerships (PPPs) into agromining commercialization initiatives in Brazil could generate more than US$1.2 billion in annual environmental value [21]. In February 2025, the European Commission presented a long-term vision for the agri-food sector emphasizing sustainability, resilience, and ESG-related objectives, with the aim of ensuring that farmers, food enterprises, and stakeholders throughout the value chain remain competitive and sustainable through 2040 [22].

Evaluation of ROS, ROE, ROA in Agri-food Companies

To further investigate the financial performance of agri-food companies included in the ESG ratings published by KCGS from 2011 to 2025, this study analyzed three widely used profitability indicators, namely return on sales (ROS), return on equity (ROE), and return on assets (ROA), based on data from the two most recently disclosed fiscal years. These indicators provide complementary insights into firms' operational efficiency, shareholder value creation, and asset utilization. The descriptive statistics and year-to-year changes in these profitability measures are presented in Table 2. Analysis of the ROS values reported for the two most recently disclosed fiscal years indicated that all agri-food companies, except for Company B, experienced a decline relative to the previous year. Additionally, ROE and ROA were respectively calculated as net income divided by total capitalization and net income divided by total assets. A previous research encompassing 1,141 peer-reviewed papers and 27 meta-analysis studies published from 2015 to 2020 on the relationship between ESG performance and corporate financial indicators, such as ROE, ROA and stock price, found that 58% reported a positive association between ESG and financial performance [23]. In contrast, 13% reported neutral effects, 21% yielded mixed findings including positive, negative, and neutral relationships, and only 8%

Table 2. Return on sales (ROS), return on equity (ROE) and return on assets (ROA) of Agri-food Companies listed on ESG grade ratings

	Agri-food Companies			
	A	B	C	D
Return on sales (ROS)				
2024	20.806818	3.318090	26.498995	13.787883
2025	13.352064	3.563726	24.139983	9.983855
Return on equity (ROE)				
2024	3.284825	11.284847	12.185763	-2.348754
2025	0.203810	12.708977	13.015446	6.257174
Return on assets (ROA)				
2024	2.223208	2.644166	8.093975	-1.690776
2025	0.141844	3.615342	9.036353	5.155006

https://doi.org/10.5338/KJEA.2026.45.18
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identified a negative association [23]. Consistent with these studies, evidence from european food companies suggests that ESG ratings are positively associated with corporate financial performance [15]. Specifically, under a robust random-effects model, ESG ratings exhibited significant positive relationships with both ROA ($p=0.013$, $\beta=0.012$, $R^2=0.077$) and ROE ($p<0.001$, $\beta=0.127$, $R^2=0.855$), indicating that stronger ESG performance may contribute to improved corporate profitability [15]. Compared with 2024, Companies B and C exhibited improvements in both ROE and ROA in 2025, whereas Company A showed declines in both profitability indicators. Notably, Company D recorded ROE and ROA values of approximately -2.348 and -1.690, respectively, in 2024, suggesting substantial financial losses and weakened operational performance during that period.

ROS, calculated as net profit divided by sales, is widely used as a measure of operating profitability rather than as a direct ESG evaluation metric. Since successful ESG practices can contribute to cost reduction, improved resource efficiency, and enhanced stakeholder management, they may ultimately lead to higher profitability and improved ROS [24]. In addition, ROS is considered particularly useful for industry-level comparisons because it is based on sales and is therefore less influenced by differences in firm size, asset intensity, and capital structure [24]. As such, ROS provides a relevant indicator for examining whether ESG-related management practices are associated with enhanced operational performance. Unlike most previous ESG studies in the agri-food sector, which have primarily relied on ROA, ROE, and market-based indicators, the present study additionally examined ROS as a measure of operational profitability, thereby providing a more comprehensive assessment of the financial implications of ESG performance.

Evaluation of PBR and Tobin's Q value in Agri-food Companies

Corporate value was investigated using price-to-book value ratio (PBR) and Tobin's Q, which are widely regarded as proxies of short-term and long-term corporate value, respectively. PBR is generally calculated as the market price per share divided by the book value per share and reflects the relationship between firms' market valuation and accounting book value [25,26]. Accordingly, it is widely used as a market-based measure of corporate value from an investor perspective. In the present study, PBR values as of January 26, 2026, were examined as this date marked the first occasion on which the Korea composite stock price index exceeded the 5,000 point level, for reference purposes. On the day, the PBR values of the agri-food companies included in this study were 1.58, 0.79, 1.69 and 0.94 for Companies A, B, C, and D, respectively. Analysis of the three observation periods revealed a consistent increase in PBR among Companies A, B, and C from 2024 to 2026, suggesting that the market increasingly valued these firms above their book value. By contrast Company D recorded PBR values of 1.00, 0.93, and 0.94, indicating a relatively weaker market valuation and a lack of sustained improvement over time.

Following previous studies [27,28], Tobin's Q value was calculated as the sum of market capitalization and book value of total debt divided by the book value of total assets in the current study. Tobin's Q reflects the expectations of investors regarding future growth opportunities and value creation potential and is therefore widely used as a market-based indicator of firm value [29]. As shown in Table 3, Tobin's Q values for Company A and C among the four agri-food firms were approximately 1.016 and 1.181, and 1.515 and 1.810 in 2024 and 2025, respectively. Company B represented Tobin's Q values of 0.915 and 0.922 in 2024 and 2025, respectively, suggesting that the market valuations of the firm remained below the book value of its assets throughout the study period. Company D exhibited a Tobin's Q values of 1.028 in 2024 but experienced a decline to 0.953 in 2025, indicating a shift from a slightly favorable market valuation to a valuation below the book value of its assets. The Tobin's Q values observed for Company A and C, both exceeding 1 during the study period, indicate that the market valued these firms above the book value of their assets. Especially, Company C consistently exhibited the highest Tobin's Q values among the four agri-food firms, indicating particularly strong market expectations regarding its future value creation potential. Taken together, these finding suggests that investors maintained relatively favorable expectations regarding the future growth opportunities and value creation potential of Companies A and C, both of which were recognized for their ESG performance.

https://doi.org/10.5338/KJEA.2026.45.18
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Table 3. Short-term and long-term value analysis of Agri-food Companies listed on ESG grade ratings

Agri-food Companies	Price-to-Book Value Ratio (PBR)			Tobin's Q	
	30 Dec 2024	30 Dec 2025	27 Jan 2026	2024	2025
A	1.24	1.57	1.58	1.016888	1.181521
B	0.72	0.76	0.79	0.915979	0.922873
C	1.32	1.66	1.69	1.515143	1.810974
D	1.00	0.93	0.94	1.028800	0.953719

Corporate evaluation between Agri-food Companies and Non-Agri-food Companies listed on ESG grade ratings

In order to examine whether financial performance and corporate value differ between agri-food and non-agri-food companies, we analyzed the companies included in the ESG ratings announced by the KCGS from 2011 to 2025 and classified them into agri-food and non-agri-food groups. The results indicated that no statistically significant differences were observed between the four agri-food companies and non-agri-food companies in any of the analyzed variables (Table 4). Although comparable evidence remains limited in the Korean context, previous studies have reported relationships between ESG disclosures and firm performance in the agri-food sector [15,30]. According to a study of 57 publicly listed European agri-food companies (EU28) during the period 2010 to 2018, environmental and social disclosures were positively associated with corporate profitability, whereas governance disclosure was negatively associated with firm value, suggesting that different dimensions of ESG disclosure may exert heterogeneous effects on corporate performance [30]. To the best of our knowledge, few empirical studies have compared agri-food and non-agri-food firms within Korea's non-financial sector in the context of ESG evaluation and disclosure systems. The absence of statistically significant differences may suggest that firms demonstrating strong ESG performance have established comparable sustainability-related management systems, regardless of industry classification [31]. Additionally, to account for the small sample size and potential non-normality, non-parametric tests, specifically the Mann-Whitney U test, were conducted alongside standard parametric tests. Furthermore, all statistical analyses were independently performed using both Python and SPSS to verify the consistency of the results. The results were consistent across the two platforms, lending additional support to the interpretation

Table 4. Corporate evaluation between Agri-food Companies and Non-Agri-food Companies listed on ESG grade ratings[1)]

Variables	Non-Agri-food Companies	Agri-food Companies	Levene's F	P	Mann-Whitney U	p value
Return on sales (ROS)						
2024	10.561459 ± 16.735516 (3.162715)	16.102947 ± 9.983591 (4.991795)	0.431	0.527	31.000	0.154
2025	13.372336 ± 19.013690 (3.593249)	12.759907 ± 8.604901 (4.302450)	0.625	0.950	42.000	0.425
Return on equity (ROE)						
2024	1.700257 ± 15.134871 (2.860221)	6.309091 ± 7.160954 (3.580477)	0.213	0.558	42.000	0.425
2025	7.029294 ± 8.217876 (1.553032)	7.838931 ± 5.871096 (2.935548)	0.057	0.851	47.000	0.608
Return on assets (ROA)						
2024	1.611134 ± 6.880091 (1.300215)	3.053238 ± 4.440706 (2.220353)	0.309	0.689	52.000	0.820
2025	4.157240 ± 5.452852 (1.030492)	4.251542 ± 3.310332 (1.655166)	0.168	0.974	47.000	0.608
Price-to-Book Value Ratio (PBR)						
2024	1.0286 ± 0.9102 (0.172020)	1.0700 ± 0.2700 (0.135030)	1.459	0.929	36.500	0.266
2025	1.6718 ± 1.7139 (0.323900)	1.2300 ± 0.4514 (0.225720)	2.206	0.616	47.500	0.628
2026[2)]	1.9621 ± 2.1270 (0.401970)	1.2500 ± 0.4510 (0.225500)	2.411	0.515	52.500	0.842
Tobin's Q						
2024	1.072800 ± 0.411710 (0.077810)	1.091000 ± 0.288290 (0.144140)	0.694	0.933	42.000	0.425
2025	1.556600 ± 1.399640 (0.264510)	1.115100 ± 0.470570 (0.235280)	1.021	0.541	42.000	0.425

[1)] The results are presented as the mean ± standard deviation, and the standard error of the mean is indicated in parentheses.
[2)] Based on the closing price on the day when the Korea composite stock price index broke through 5,000 for the first time in history.

https://doi.org/10.5338/KJEA.2026.45.18
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of the findings.

Nevertheless, the findings should be interpreted with caution because of the limited sample size and the relatively short observation period. In particular, the limited number of ESG-recognized agri-food firms may have reduced the statistical power of the analysis and constrained the identification of potential differences between the two groups. It is worth noting that this small sample size reflects the strict selection criteria of the KCGS evaluation system, under which only four agri-food companies received ESG recognition during the study period, rather than an intentional sampling decision. Although integrating additional ESG datasets could potentially expand the sample size, doing so risks introducing methodological inconsistencies due to differing evaluation metrics and scoring systems across providers. Thus, this study relied strictly on the KCGS framework to maintain analytical consistency. Previous ESG-related studies in the agri-food sector have primarily been conducted in European firms [13,15,30]. Sandberg et al. analyzed data from a final sample of 83 food firms across 14 countries listed in the CSRHub ESG Ratings during the period from 2017 to 2020 [15]. In addition, considering the sample size used in previous studies, such as the analysis of ESG data from 57 publicly listed agri-food companies across 28 EU countries during the 2010-2018 period conducted by Conca et al., the current results may, at least in part, be attributable to the limited number of agri-food companies included in the analysis [13,30].

Although longitudinal analyses could offer insight into performance trajectories over time, this study focused specifically on characterizing the recent ESG and financial profiles of award-winning firms using 2024-2025 data to reflect their current status while minimizing potential bias from repeated observations. Nevertheless, future studies employing larger samples and longer observation periods may provide a more comprehensive understanding of whether industry-specific differences exist among ESG-recognized firms with respect to financial performance and corporate value. This study extends the existing ESG literature by shifting the focus from the conventional examination of ESG-performance relationships toward the assessment of industry-specific differences among ESG-recognized firms. In particular, it provides empirical evidence from the agri-food sector in Korea, which remains relatively underrepresented in the ESG literature, and contributes to a better understanding of whether ESG-recognized firms exhibit distinct financial and corporate value characteristics across industries. Furthermore, this study contributes to the emerging literature on ESG management in Korea's agri-food industry by utilizing the most recent publicly available data and examining both short-term and long-term performance indicators. Beyond its academic contribution, the findings offer practical implications for policymakers and may serve as a useful foundation for the continued development of ESG evaluation and disclosure systems. Although the present findings do not allow a direct evaluation of the effectiveness of ESG disclosure frameworks, they highlight the importance of continuing to assess both ESG reporting systems and their practical outcomes. Given the evolving nature of ESG regulations and disclosure standards across countries, future research should examine not only the institutional characteristics of disclosure systems but also the economic, social, and environmental impacts associated with their implementation at both national and global levels.

The policy implications of these findings are particularly relevant in the context of growing concerns regarding climate change and global food security. As concerns regarding climate change and global food security continue to intensify, governments around the world are increasingly placing emphasis on the development of sustainable agricultural and food systems to ensure stable food supplies. In line with these trends, ESG management is likely to become an increasingly important driver of competitiveness and sustainability within the global agri-food sector. From a policy perspective, continued policy and regulatory efforts may be needed to establish effective frameworks that encourage firms in Korea's agri-food industry to maintain high ESG performance while promoting the sustainable production of agri-food products. Strengthening ESG-related governance and disclosure practices may contribute not only to the long-term competitiveness of individual firms but also to enhancing the resilience, sustainability, and global competitiveness of the agri-food industry in Korea.

https://doi.org/10.5338/KJEA.2026.45.18
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Materials and Methods

Classification of Agri-food industries

As cutting-edge technologies are applied to the agricultural sector, new concepts of agriculture and agriculture-related industries that did not exist in the past are emerging. The category of the domestic Agri industry is defined as agriculture and agricultural-related industries (Agri business) according to the 'Framework Act on Agriculture, Rural Community and Food Industry (Acted on October 22, 2024)' [32]. Agricultural-related industries include agri-food-related manufacturing industries and so on [32]. Therefore, in this study, agriculture and agricultural-related industries were the main analysis subjects and were denoted as Agri-food industries. To explain in more detail, initially, the "Agri-food industries" category was selected for analysis if the words 'agricultural', 'farm', or 'crops' were included in the business items of each company. Secondly, it was defined as "Agri-food industries" when companies corresponding to the classification system of Agriculture (#01) and Growing of Crops (#011), Manufacture of Food Product (#10), Beverages (#11), and Tobacco Products (#12) according to the Korean Standard Industrial Classification (KSIC)-11 (Issued January, 2024) published by Statistics Korea, and whose business contents include the word 'food' in the business description of timely disclosure items from electronic disclosure system of the Financial Supervisory Service.

ESG evaluation

The ESG evaluation grades were used data from 2011 to 2025 announced by the KCGS. Additionally, the name of companies analyzed in the present study including Agri-food companies was represented using corporate codes provided by the KCGS.

Data collection for management performance

We investigated the indicators related to financial performance and corporate value for analyzing management performance in Agri-food companies announced on KCGS in 2024 and 2025. In order to examine financial performance of each Agri-food company, ROS, ROE and ROA were investigated through the public datasets of the Financial Supervisory Service (first accessed on May 2, 2025 and last accessed on July 6, 2026). ROS, ROE and ROA were respectively calculated as net profit divided by sales, net income divided by total capitalization, and net income divided by total assets. In addition, corporate value was investigated using PBR and Tobin's Q value, which are known as short-term and long-term corporate value indices, respectively. The PBR values used the data disclosed by the Korea Exchange's information data system (first accessed on May 2, 2025 and last accessed on July 6, 2026). In particular, January 27, 2026, was historically the first time the Korea composite stock price index surpassed 5000, so we also investigated the PBR at that point in the current study. Tobin's Q value was calculated by dividing the sum of market capitalization and book value of debt by the book value of total assets. To maintain high analytical precision and capture subtle numerical distinctions across variables, all values except for PBR are presented up to six decimal places. Since KRX provides PBR data only to two decimal places, values with six decmal precision could not be computed, and therefore PBR was reported to four decmal places in this study. In addition, all decimal values were truncated without rounding. All the variables used in this study were obtained from the Financial Supervisory Service's electronic disclosure system and the Korea Exchange's information data system. Among them listed on ESG grade ratings and announced by the KCGS from 2011 to 2025, companies that were not disclosed in both systems, holding companies, or those with missing values at the time of analysis were excluded. In the case of Agri-food companies, since corporate information can be publicly disclosed when representing the financial performance and corporate value of each company, we have expressed them with capital letters like A, B, C and D on behalf of corporate codes regardless of order.

Statistical analysis

Data were analyzed using Python 3.14.7 functions (Python Software Foundation, released on June 10, 2026) and the IBM

https://doi.org/10.5338/KJEA.2026.45.18
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SPSS Statistics 27.0 analysis program (IBM Corporation, Armonk, NY, USA). Results were presented as mean ± standard deviation or standard error of the mean, respectively. Equality of variance between the two groups was verified using Levene's test, with the test statistic reported as an F-statistic. When the assumption of equal variance was $p>0.05$, the student's t-test was performed. In addition, the non-parametric Mann-Whitney U test was conducted to complement the parametric analysis. A p value < 0.05 was considered statistically significant.

Data Availability: All the public data analyzed in the current study can be available at https://dart.fss.or.kr and https://www.krx.co.kr.

Author Contributions: Kim N-H and Kim Y-K: designed, conducted the experiments, software, data analysis, data curation and edited all daft. Kim N-H: wrote original draft. Kim Y-K: supervised and financed the research.

Notes: The authors declare no conflict of interest

Acknowledgments: This work was supported by development fund foundation, Gyeongsang National University in 2024.

Additional Information:

Supplementary information The online version contains supplementary material available at https://doi.org/10.5338/KJEA.2026.45.18

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Peer review information Agricultural and Environmental Sciences thanks the anonymous reviewers for their contribution to the peer review of this work.

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