

Research Article

The Effectiveness of ESG Strategies in Building Intangible Capital: The Moderating Role of National Intellectual Property Intensity and Firm Age

Somut Olmayan Sermaye Oluşturmada ESG Stratejilerinin Etkinliği: Ulusal Fikri Mülkiyet Yoğunluğunun ve Şirket Yaşının Düzenleyici Rolü

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Abstract

This study examines the relationship between ESG performance and intangible asset accumulation using firm-level panel data from 201 telecommunications companies over the period 2013-2023. While ESG strategies are widely believed to enhance firm value by enhancing brand equity, reputation, and stakeholder trust, their impact on intangible assets remains empirically unclear. Drawing on insights from institutional theory and organizational learning theory, this paper examines how this relationship varies with firm age and the strength of the intellectual property (IP) environment. Using random-effects panel regressions with Driscoll-Kraay standard errors, the study finds that ESG scores have an overall negative effect on intangible assets, but this turns positive when moderated by strong intellectual property (IP) regimes. Firm age significantly shapes this relationship. ESG alone has no impact for young firms, yet becomes effective under strong IP protection. For middle-aged firms, ESG is detrimental unless supported by IP environments. In older firms, ESG is slightly beneficial, but the marginal benefit of IP declines. These results highlight that ESG strategies require supportive institutional contexts, especially in early stages, and that firm maturity alters their effectiveness. The study enriches ESG–intangible asset literature through institutional and organizational learning lenses.

Key Words: Sustainability, ESG, Intangible assets, Intellectual property, Firm age

Öz

Bu çalışma, 201 telekomünikasyon şirketinden alınan 2013-2023 dönemi firma düzeyi panel verilerini kullanarak ESG performansı ile maddi olmayan varlık birikimi arasındaki ilişkiyi incelemektedir. ESG stratejilerinin marka değerini, itibarı ve paydaş güvenini artırarak firma değerini artırdığına yaygın olarak inanılsa da, maddi olmayan varlıklar üzerindeki etkileri ampirik olarak belirsizliğini korumaktadır. Kurumsal teori ve örgütsel öğrenme teorisinden yararlanan bu makale, bu ilişkinin firma yaşı ve fikri mülkiyet (FM) ortamının gücüyle nasıl değiştiğini incelemektedir. Driscoll-Kraay standart hatalarına sahip rastgele etkili panel regresyonlarını kullanan çalışma, ESG puanlarının maddi olmayan varlıklar üzerinde genel olarak olumsuz bir etkiye sahip olduğunu, ancak güçlü fikri mülkiyet (FM) rejimleri tarafından yumuşatıldığında olumluya döndüğünü bulmuştur. Firma yaşı bu ilişkiyi önemli ölçüde şekillendirmektedir. ESG'nin genç firmalar için tek başına bir etkisi yoktur, ancak güçlü FM koruması altında etkili hale gelir. Orta yaşlı firmalar için ESG, FM ortamları tarafından desteklenmediği sürece zararlıdır. Daha yaşlı firmalarda ESG biraz faydalıdır, ancak FM'nin marjinal faydası azalır. Bu sonuçlar, ESG stratejilerinin, özellikle erken aşamalarda, destekleyici kurumsal bağlamlar gerektirdiğini ve şirket olgunluğunun bu stratejilerin etkinliğini değiştirdiğini vurgulamaktadır. Çalışma, kurumsal ve örgütsel öğrenme perspektifleri aracılığıyla ESG-maddi olmayan varlık literatürünü zenginleştirmektedir.

Anahtar Kelimeler: Sürdürülebilirlik, ESG, Maddi olmayan varlıklar, Fikri mülkiyet, Şirket yaşı

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1.Introduction

In an era of intensifying global challenges—ranging from climate change and resource scarcity to social inequality and governance failures—Environmental, Social, and Governance (ESG) performance has emerged as a strategic imperative for firms across industries. ESG scores provide a standardized mechanism through which companies can assess and communicate the sustainability and ethical dimensions of their operations. While ESG initiatives were initially evaluated in relation to traditional financial metrics such as profitability, cost of capital, and stock returns (Friede, Busch & Bassen, 2015), recent studies have begun to explore how these practices affect non-financial, strategic assets, particularly intangible assets.

The shift towards a knowledge-based economy, accelerated by digitalization, automation, and innovation, has dramatically altered the structure of corporate value. In high-tech, service-oriented sectors such as telecommunications, software, and biotechnology, intangible assets—including intellectual property, brand equity, human capital, and organizational culture—now represent the dominant share of firm valuation (Corrado, Hulten & Sichel, 2005, p.16; WIPO, 2022). As Vodák (2011, p.104) estimates, such assets account for up to 80% of firm value, highlighting their increasing strategic importance.

These intangible assets are pivotal to a firm's ability to innovate, differentiate, and adapt in dynamic environments. According to Sicoli (2018), they contribute to long-term value creation by:

- Enabling responsiveness to environmental change,
- Supporting opportunity recognition and competitive advantage, and
- Facilitating organizational transformation and resource efficiency.

As ESG practices become more deeply embedded in corporate strategy, scholars have turned their attention to whether and how ESG performance can influence the accumulation and deployment of intangible assets. Theoretically, strong ESG engagement is believed to foster stakeholder trust, enhance reputational capital, and attract and retain talented employees—all of which are considered building blocks of intangible value (Lourenço, Branco, Curto & Eugénio, 2012, p. 420; García-Sánchez, Aibar-Guzmán, Aibar-Guzmán & Somohano-Rodríguez, 2021, p. 515).

Yet, empirical findings remain mixed. Some studies highlight positive associations between ESG and innovation outputs, employee productivity, and brand strength (Jing, 2023, p. 213; Fatemi, Glaum & Kaiser, 2018, p. 46), while others find insignificant or even negative relationships, especially in cases where ESG investments are poorly aligned with firm capabilities or lack institutional support (Servaes & Tamayo, 2013; Krüger, 2015). These discrepancies suggest that the impact of ESG on intangible asset formation may be contingent upon specific contextual factors, including firm-level characteristics and institutional settings.

In response to these ambiguities, this study introduces a moderated framework that examines how two key contextual variables—firm age and the national intellectual property (IP) environment—influence the ESG–intangible asset nexus.

Firm age reflects an organization's experiential learning, path dependence, and ability to absorb and integrate sustainability practices into its long-term strategy (Çevik & Miryugin, 2020, p. 11-12; Li & Zahra, 2012, p. 97).

The IP environment, on the other hand, represents the strength of formal institutions and legal protections that enable firms to secure and leverage the value of intangible assets (World Bank, 2023; Peng, Wang & Jiang, 2008, p. 921).

This leads to the study's central research question:

To what extent does ESG performance contribute to the development of intangible assets, and how do firm age and the intellectual property environment moderate this relationship?

Using a panel dataset of 201 telecommunications firms over the period 2013–2023, this study investigates whether ESG investments correlate with increases in intangible asset intensity and whether

this relationship is moderated by firms' maturity and the national-level IP protection capacity. The telecommunications sector presents a particularly suitable context, given its high dependency on innovation, intellectual capital, and reputation.

The contributions of this research are threefold:

- It extends the ESG literature by considering intangible assets as a non-financial performance outcome, addressing a relatively underexplored yet strategically vital domain.
- It integrates both internal (firm age) and external (IP environment) moderating factors into a unified empirical model, offering a more granular and context-sensitive understanding of how ESG translates into long-term value.
- It applies a moderated panel data approach, enabling comparisons across different firm age groups and institutional settings, thereby enhancing the generalizability and robustness of the findings.

The remainder of the paper is organized as follows:

Section 2 reviews theoretical frameworks and existing empirical studies on ESG and intangible assets.

Section 3 describes the data, variables, and econometric methodology.

Section 4 presents the empirical findings.

Section 5 discusses implications for managers and policymakers.

Section 6 concludes with key insights, limitations, and directions for future research.

2.Literature review and theoretical framework

2.1. Literature review

This section reviews the relevant literature in three strands: (1) the relationship between ESG performance and intangible assets, (2) the link between intellectual property (IP) and ESG, and (3) the role of firm age as a moderating factor in ESG-related outcomes.

In recent years, Environmental, Social, and Governance (ESG) performance has become a critical measure of corporate behavior, increasingly recognized not only for its alignment with sustainability goals but also for its strategic relevance to long-term value creation. While early literature predominantly explored ESG's connection to tangible, financial outcomes—such as profitability and market capitalization—contemporary studies have expanded the scope toward more abstract corporate assets, including brand equity, reputation, and innovation capability.

Intangible assets (IA), often recorded under non-physical items in corporate balance sheets, represent strategic resources such as brand value, intellectual property, organizational capital, and innovation. These assets, despite their accounting treatment, are increasingly recognized as core drivers of firm competitiveness. In this regard, recent studies have begun to explore the intersection of ESG and IA, positing that ESG may function similarly to other intangible value drivers such as management quality, corporate culture, and innovation capability (Edmans, 2022, p. 5). This new line of inquiry moves beyond conventional firm performance metrics and draws attention to changes in stakeholder trust, customer loyalty, and brand strength—elements not easily quantifiable yet vital to sustained performance.

However, empirical results in this domain remain inconclusive. Some studies report a positive association between ESG performance and intangible asset accumulation, while others identify negative or statistically insignificant relationships. These mixed findings underscore the need to explore boundary conditions and contextual moderators. For example, Bai, Wang, Huang & Ding (2025) argue that ESG performance enhances brand value and the accumulation of intangible capital, thereby boosting investor appeal and market competitiveness. Their study also identifies the moderating effect of policy environments on this relationship.

In a more nuanced approach, Jun, Shiyong & Yi (2022) show that the marginal effect of ESG investment on intangible capital diminishes beyond a certain threshold. Initially, ESG disclosure reduces

information asymmetry and enhances investor communication; however, excessive ESG expenditures may yield diminishing returns on intangible capital accumulation.

Lapinskaite, Stasytyt & Skvarciany (2025) provide evidence from the financial sector, highlighting the value of integrating ESG into long-term strategic planning to effectively convert sustainability practices into intangible assets. Conversely, Rammavas (2022) found that higher ESG scores and intangible capital levels did not result in reduced debt costs, suggesting that creditors may perceive sustainability-related expenditures as excessive.

In line with these findings and in consideration of the role of intangible assets as essential, yet often overlooked, indicators of value creation, we hypothesize the following:

H1: Firms with higher ESG scores tend to have a greater share of intangible assets relative to total assets.

Alongside intangible assets broadly defined, intellectual property (IP)—as a distinct and often more legally protected form of intangible capital—has gained increasing importance in ESG-related research. IP assets such as patents, trademarks, and copyrights often signal a firm's innovation potential and strategic orientation. They also represent measurable outputs of R&D processes and are commonly linked to green innovation efforts, which are closely tied to ESG performance metrics.

A growing body of research explores the interaction between ESG performance and IP policy environments, especially in the context of government-led innovation programs. For instance, Nie, Luo, Chen & Feng (2025) demonstrate how China's Intellectual Property Demonstration Cities (IPDC) initiative positively affects firms' ESG outcomes by encouraging knowledge-based assets and supporting green technological advancement. Similarly, Ma, Li & Liu (2025) show that intellectual property strategies contribute to ESG success by reducing information asymmetry, alleviating financing constraints, and improving innovation efficiency.

At a more conceptual level, Eriany a& Widyawati (2024) argue that intellectual capital—encompassing human, structural, and relational dimensions—plays a crucial role in amplifying the long-term benefits of ESG investments. These contributions suggest that the quality of a firm's IP infrastructure may significantly influence the strength and direction of ESG–IA dynamics.

Building upon these insights, we propose the following hypothesis:

H2: The relationship between ESG performance and intangible assets is stronger in countries with more developed intellectual property frameworks.

While the institutional environment serves as a macro-level moderator, firm-specific characteristics—particularly firm age—may also affect how ESG translates into intangible value. According to Organizational Learning Theory (Argyris & Schön, 1997), firms accumulate knowledge and strategic learning over time, which enhances their ability to adapt and implement complex initiatives such as ESG strategies. In this light, firm age serves as a proxy for organizational maturity and learning capacity, both of which are necessary to transform ESG efforts into lasting intangible capital.

Empirical studies provide mixed evidence. D'Amato & Falivena (2020) argue that younger firms face greater barriers in converting ESG efforts into tangible or intangible performance due to limited resources and experience. Conversely, Korkmaz & Nur (2023) show that in the Turkish banking sector, older firms are more successful in aligning ESG activities with strategic goals, reflecting greater organizational resilience and adaptability. Abdi, Li & Camara-Turull (2022), however, emphasize firm size over age as a moderator but acknowledge that younger firms may face greater ESG-related uncertainty.

Given these findings, we suggest that firm age may condition the ESG–IA relationship by shaping internal capabilities and absorptive capacity. This leads us to our third hypothesis:

H3: The relationship between ESG performance and intangible assets varies depending on firm age.

2.2. Theoretical framework

This study investigates how firm age and the intellectual property environment influence the relationship between ESG performance and intangible asset accumulation. Two theoretical lenses—Institutional Theory and Organizational Learning Theory—provide the conceptual foundation.

Institutional Theory suggests that firm behavior is shaped by external institutional pressures, including legal frameworks, norms, stakeholder expectations, and cultural context (Campbell, 2007). According to this view, firms adopt ESG practices not only to enhance performance but also to gain legitimacy and comply with institutional demands. Liu, Lu, Liu, Wang, Yang & Fang (2025, p. 169) argue that managerial strategies and ESG performance are co-determined by these environmental influences, with government incentives and societal norms playing key roles.

Kim, Shin, Lee & Noh (2024, p. 395-397) support this idea by showing that ESG scores serve as legitimacy signals that help ensure organizational survival and growth. Coercive pressures from governments, regulatory bodies, and stakeholder coalitions are central to shaping corporate ESG behavior. Maama (2021, p. 1315) further reinforces the relevance of institutional environments by demonstrating how macro-level political and economic factors influence firms' ESG activities.

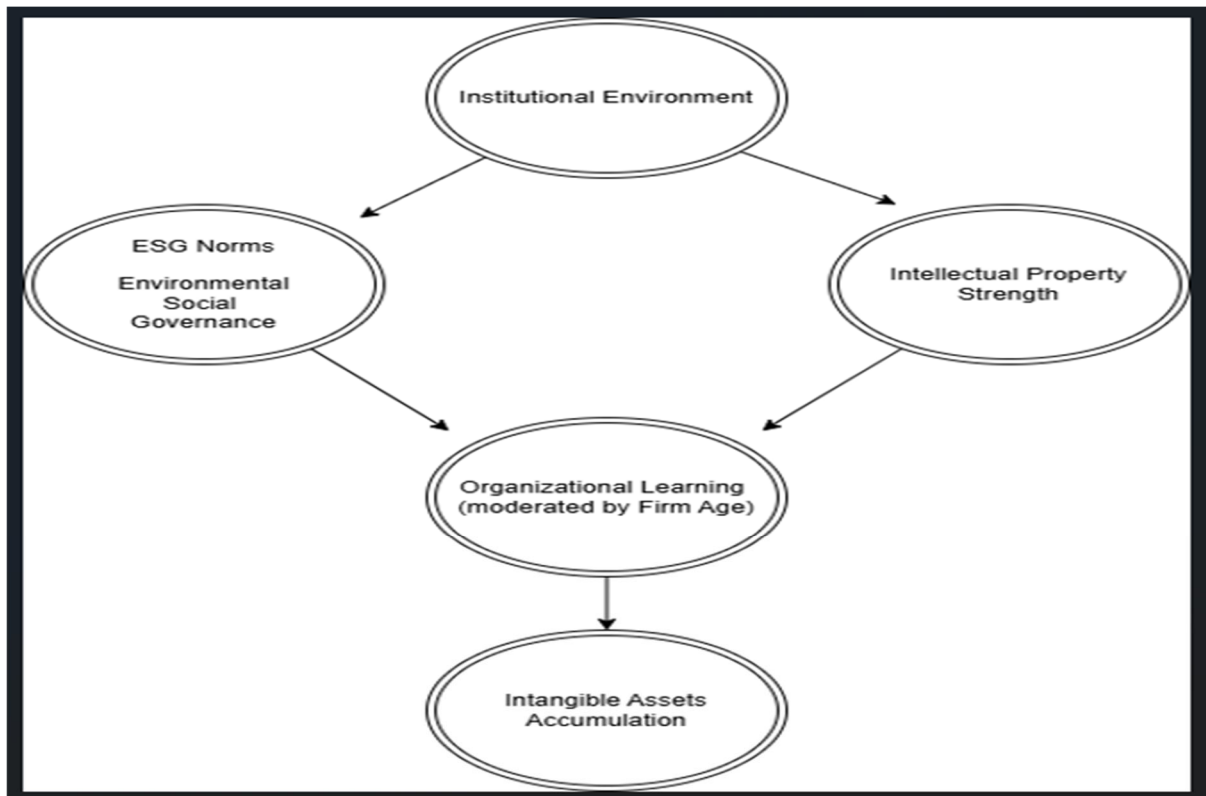
In this context, countries with advanced IP protection regimes and supportive innovation policies are more likely to encourage ESG-aligned investments that simultaneously enhance a firm's intangible capital. Thus, the relationship between ESG and IA may be contingent on the institutional ecosystem in which the firm operates.

Organizational Learning Theory offers complementary insights, especially regarding the moderating role of firm age. As proposed by Argyris & Schön (1997), organizational learning involves the continuous adaptation of strategies in response to environmental changes. Older firms, having accumulated more experience and institutional memory, may be better equipped to implement and sustain ESG strategies that contribute to intangible value creation. Conversely, younger firms may lack the strategic flexibility, knowledge infrastructure, and stakeholder relationships necessary to reap long-term benefits from ESG investments.

Baumgartner (2009, p. 102) emphasizes that for sustainability practices to be successful, they must be compatible with a firm's culture and supported by continuous learning and openness to change. Firm age influences this adaptability, shaping the effectiveness of ESG implementation and its translation into intangible value.

In sum, this study posits that both institutional (macro) and organizational (micro) dynamics moderate the ESG–IA relationship. By integrating these two theories, the research offers a multifaceted understanding of how ESG strategies contribute to value creation under varying conditions of firm maturity and intellectual property infrastructure.

The research framework of the study are summarized with the figure below.

Figure 1: Research Framework

Source: own elaboration

3. Methodology

3.1. Sample

This study investigates the impact of Environmental, Social, and Governance (ESG) strategies on firms' intangible asset ratios—a critical component of firm value—by considering the roles of innovation intensity and firm age across countries. Firm-level data were obtained from Thomson Reuters DataStream, while country-level indicators were sourced from the World Bank. The analysis covers an unbalanced panel of 201 telecommunications companies with available data spanning 2013 to 2023. A panel data model was employed to assess these relationships.

The telecommunications sector was specifically chosen due to its reliance on intangible assets such as innovation, patents, software, and brand value, which comprise a substantial portion of firm value in this industry. Moreover, this sector is characterized by high innovation activity and intense competition, making it a suitable context for examining how ESG performance and institutional environments—particularly intellectual property (IP) regimes—relate to intangible asset development.

In the empirical model, the intangible asset ratio serves as the dependent variable. The primary independent variables are ESG scores and countries' intellectual property levels. Control variables include return on assets (ROA), return on equity (ROE), current assets ratio (CA), and debt-to-equity ratio (DE). Table 1 presents all variables and their data sources.

Table 1: Definitions of the Variables

Variable Name	Variable	Definition	Source
Intangible Assets /Assets	ia – Dependent variable	Intangible assets are the company's assets, such as brand equity, goodwill, patents, and franchises. The ratio of these assets to total assets is included in the analysis.	Thomson Reuters' DataStream
ESG	esg – Explanatory variable	Environmental, Social, Governance Score for firms.	Thomson Reuters' DataStream
IP	ip – Explanatory variable	Intellectual Property/GDP represents a country's intangible assets, such as patent applications, copyrights, and trademarks, as a percentage of GDP.	World Bank
ESG-IP	esg_ip – Moderator variable	It is a moderator variable that demonstrates the interaction between a company's ESG score and the country's intellectual property.	Thomson Reuters' DataStream – World Bank
ROA	roa – Control variable	Returns on Assets	Thomson Reuters' DataStream
ROE	roe – Control variable	Returns on Equity	Thomson Reuters' DataStream
CA	ca - Control variable	Current Assets/Assets	Thomson Reuters' DataStream
DE	de - Control variable	Debt/Equity	Thomson Reuters' DataStream

Source: own elaboration

3.2.Procedure and analysis

The main research question of this study is how Environmental, Social, and Governance (ESG) performance and intellectual property (IP) capacity affect firms' intangible assets, and what role the interaction between ESG and IP plays in this relationship. To address this question, a panel data model was constructed using data from 201 telecommunications companies over the period 2013–2023. The telecommunications sector was selected due to its strong dependence on intangible assets and its dynamic environment characterized by intense innovation and competition. The dependent variable in the model is the intangible asset ratio, which is explained by the key independent variables: ESG performance and intellectual property capacity. To enhance the reliability of the model, control variables including return on assets (ROA), return on equity (ROE), current assets ratio (CA), and debt-to-equity ratio (DE) were included in the analysis.

The moderating variables of the model were analyzed using two complementary approaches. First, countries' intellectual property levels were incorporated into the analysis both as a stand-alone variable and through an interaction term with ESG. This allowed for an evaluation of the joint influence of ESG and the national IP environment on firms' intangible assets. Second, firm age was introduced through separate panel datasets representing different age groups: young, middle-aged, and old firms. The age classification follows the approach proposed by Çevik & Miryugin (2020, p.12), where young firms are those below the 25th percentile of firm age, old firms are those above the 75th percentile, and the remainder are categorized as middle-aged firms. Based on this classification, four separate panel data regressions were conducted: one for the full sample and three for each age cohort.

The general form of the model is specified as follows:

$$ia_{it} = \beta_0 + \beta_1 esg_{it} + \beta_2 ip_{it} + \beta_3 esg_ip_{it} + \beta_4 roa_{it} + \beta_5 roe_{it} + \beta_6 ca_{it} + \beta_7 de_{it} + \mu_{it}$$

To ensure the validity of the panel data model, several diagnostic tests were conducted. These included the multicollinearity and endogeneity test, the cross-sectional dependence and slope homogeneity test, the autocorrelation and heteroskedasticity test. After verifying that the underlying assumptions were met, the panel regression analysis was carried out.

4.Results

The purpose of this article is to demonstrate how firms' intangible assets are influenced by their ESG scores and the environment surrounding their intellectual capital accumulation. A panel data analysis was conducted with a dataset comprising 2,211 firm-year observations. Table 2 presents descriptive statistics for the variables used in the analysis.

Table 2: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
ia	2211	.223	.199	0	.83
esg	2211	48.111	19.006	3	95
ip	2211	.008	.01	0	.059
esg ip	2211	.41	.598	0	5.167
roa	2211	6.432	5.278	-18.51	51.79
roe	2211	14.995	48.485	-443.26	612.07
ca	2211	2.345	2.355	.31	63.98
de	2211	.619	11.641	-266.52	432.2

Source: own elaboration

The mean value of intangible assets (ia) is 0.223, ranging from 0 to 0.83. The ESG score has a mean of 48.11, with a wide range from 3 to 95. While the intellectual property-to-GDP ratio (ip) is relatively low (mean = 0.008), the interaction term (esg_ip) has a mean of 0.41, reaching up to 5.17. Profitability measures such as ROA and ROE vary, with ROE ranging from -443.26 to 612.07. The current assets ratio (CA) and debt-to-equity ratio (DE) exhibit substantial variation across observations.

Table 3: Matrix of correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) ia	1.000							
(2) esg	0.076	1.000						
(3) ip	0.052	0.031	1.000					
(4) esg_ip	0.105	0.474	0.725	1.000				
(5) roa	-0.073	-0.095	-0.006	-0.059	1.000			
(6) roe	0.019	0.008	-0.069	-0.059	0.700	1.000		
(7) ca	-0.418	-0.241	0.192	0.038	0.202	-0.015	1.000	
(8) de	0.390	0.224	-0.123	0.013	-0.185	0.118	-0.543	1.000

Source: own elaboration

Table 3 shows the Spearman correlation coefficients between the variables included in the empirical analysis. The correlation between intangible assets (ia) and the ESG score (esg) is positive but weak (0.076), while the correlation with intellectual property (ip) is similarly low (0.052). However, the interaction term esg_ip, which reflects the combined effect of ESG and IP, correlates somewhat higher

(0.105) with intangible assets. As expected, this term exhibits a moderate correlation with *esg* (0.474) and a strong correlation with *ip* (0.725). These values confirm the successful construction of the interaction term and indicate significant covariation. However, since the variance inflation factor (VIF) values were controlled and remained within acceptable limits, multicollinearity is not considered a significant concern. The financial performance measures return on assets (*roa*) and return on equity (*roe*) are weakly correlated with the explanatory variables *ESG* and *IP*. The fact that they have a strong and positive correlation (0.700) is understandable because both indicate firm performance as a measure of profitability. This is believed to demonstrate the consistency of the model. A strong negative correlation is observed between the control variables, the current assets ratio (*ca*) (-0.418), and the dependent variable, intangible assets (*ia*), while a positive correlation is observed with the debt/equity ratio (*de*) (0.390). It is also noteworthy that there is a strong negative correlation among them (-0.543). However, all the results obtained with the Spearman correlation matrix are within the accepted limits (less than 80%) (Gujarati & Porter, 2008). This reduces concerns about multicollinearity and supports the appropriateness of including these variables simultaneously in the multivariate regression framework. Furthermore, the VIF test was conducted to prove that there is no multicollinearity problem in the model.

Table 4: Variance inflation factor

	VIF	1/VIF
<i>esg ip</i>	7.783	.128
<i>ip</i>	6.957	.144
<i>esg</i>	1.65	.606
<i>roe</i>	1.171	.854
<i>roa</i>	1.145	.874
<i>ca</i>	1.059	.944
<i>de</i>	1.043	.959
Mean VIF	2.973	.

Source: own elaboration

The results show that the *esg_ip* interaction term exhibits the highest VIF (7.783), followed by *ip* (6.957). While these values are relatively high compared to the other variables, they fall below the traditional threshold of 10, which is frequently cited in the literature as an upper limit indicating problematic multicollinearity (Gujarati & Porter, 2008; Kim, 2019). The VIF values for the other variables, including *esg*, *roe*, *roa*, *ca*, and *d*, are all well below 2.0, indicating a low degree of collinearity. The average VIF for the model is 2.973, supporting the conclusion that multicollinearity is not a serious concern in this specification.

Due to the small time dimension of the panel ($T=11$), unit root tests were omitted, following Cameron & Trivedi (2005) and Baltagi (2008)'s assertion that such tests are underpowered in short panels. Instead, the F Test, LM Test, and Hausman Test were used to estimate which panel data analysis should be used, and the presence of heteroskedasticity, serial correlation, and cross-sectional dependence in the model was assessed.

Table 5: Model Selection

	(1)	(2)	(3)	(4)
	All firms	Young firms	Middle-aged firms	Old firms
	P-value	P-value	P-value	P-value
F Test				
Individual effect	0.0000	0.0000	0.0000	0.0000
Time effect	0.9754	0.9699	0.9144	0.9499
Breusch-Pagan LM Test				
Individual effect	0.0000	0.0000	0.0000	0.0000
Time effect	0.9512	0.9699	0.9133	0.9342
Cluster-Robust Hausman Test	0.4672	0.8099	0.8524	0.366

Source: own elaboration

To determine the most appropriate panel data model for the analysis, the F test, the Breusch-Pagan Lagrange Multiplier (LM) test, and the Hausman test were used. Four different evaluations were conducted on four different models (all firms, young firms, middle-aged firms, and older firms). In all models, the F test results indicated statistically significant individual (unit) effects, while time effects were not statistically significant. The LM test also supported these results. The M test confirmed the presence of significant unit effects, while time effects were again found to be insignificant. These findings indicate that a one-way panel model that accounts for unit-specific effects is preferable to the pooled OLS model. The Cluster-Robust Hausman test was used to select between fixed effects and random effects models. The results yielded a p value greater than 0.05 in all models. These results led to the conclusion that the random effects model is the more appropriate model for all panel data models.

After applying the random panel data model, diagnostic tests were conducted to assess the reliability of the results. The modified Wald test for group-based heteroskedasticity produced p-values of 0.0000-0.0000-0.0000-0.0000 for all models, respectively, indicating the presence of heteroskedasticity among panel units. The Pesaran test for cross-sectional dependence was applied, and different results were observed across models (0.0000-0.9383-0.0649-0.0320). Accordingly, the results confirmed the presence of cross-sectional dependence among panel units in all firms and older firms, but not in young and middle-aged firms. The Durbin-Watson statistic was used to assess serial correlation. Durbin-Watson statistics (0.6865-0.68802-0.7359-0.5881) indicate the presence of positive first-order autocorrelation in the residuals. Since DW values close to 2 suggest no autocorrelation, and values substantially below 2 indicate positive autocorrelation, the results here raise concerns about serial correlation in the error terms.

Driscoll-Kraay (1998) regression analysis was used to overcome heteroskedasticity, autocorrelation, and cross-sectional dependence issues in the models. The regression results are presented in Table 6. These results shed light on the main objective of this article: the relationship between ESG performance and the share of intangible assets across different intellectual property (IP) environments and firms at different stages of their corporate life cycles.

Table 6: Driscoll-Kraay Regression Results

	(1)	(2)	(3)	(4)
	All firms	Young firms	Middle-aged firms	Old firms
esg	-0.0004**	-0.0001	-0.0007**	0.0006*
	(0.0312)	(0.7878)	(0.0172)	(0.0768)
ip	-4.2970*	-6.0241**	-3.5544**	4.8198
	(0.0667)	(0.0379)	(0.0281)	(0.1678)
esg_ip	0.0506**	0.0651**	0.0508***	-0.0680*
	(0.0253)	(0.0361)	(0.0006)	(0.0573)
roa	-0.0019***	-0.0011	-0.0031***	-0.0009
	(0.0000)	(0.3609)	(0.0035)	(0.3646)
roe	-0.0001*	-0.0002	-0.0001	-0.0001
	(0.0961)	(0.1476)	(0.1619)	(0.1549)
ca	-0.0091*	-0.0124**	-0.0080	-0.0236***
	(0.0827)	(0.0255)	(0.1064)	(0.0000)
de	0.0000	0.0011	0.0000	0.0000
	(0.5541)	(0.5599)	(0.7054)	(0.9160)
_cons	0.2944***	0.3051***	0.3159***	0.2094***
	(0.0000)	(0.0000)	(0.0000)	(0.0004)
N	2211	550	1111	550

p-values in parentheses

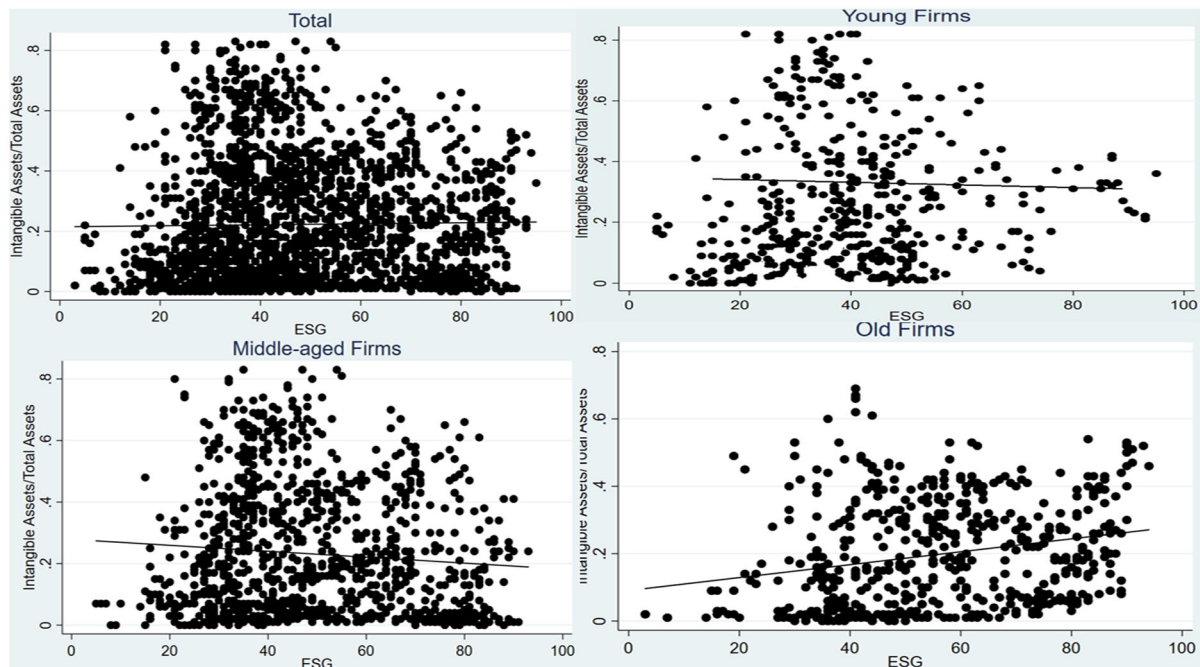
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: own elaboration

To further evaluate the results presented in Table 6, first the relationship between ESG scores and intangible assets are considered. The relationship between ESG scores and intangible assets differs across models and varies with age. Looking at the results for all firms in Model 1, a weak but statistically significant negative relationship between ESG scores and intangible assets is observed (coefficient = -0.0004, $p < 0.05$). This suggests that, on average, ESG practices do not strongly support the accumulation of intangible assets across the entire sample. The relationship becomes statistically insignificant for the younger firms in Model 2. This suggests that ESG activities alone may not be sufficient to increase intangible asset production in the early stages of a firm's development. A statistically significant negative relationship was observed for the middle-aged firms in Model 3, similar to all firms ($p < 0.05$). This suggests that ESG efforts may not be compatible with developing intangible assets in this group, or that these firms may be directing their resources toward more tangible or short-term assets. This may also be indicative of a resource dilution effect, where ESG activities, in the absence

of strong institutional or strategic support, divert limited resources away from the development of intangible assets. The older firms in Model 4 stand out with their interesting results. Interestingly, the coefficient was found to be positive and marginally significant ($p < 0.1$). This is thought to reflect that ESG policies are more easily integrated into intangible asset development (e.g., brand equity, reputation, reputation, and innovation capabilities) when they are more strategic and mature.

Graphic 1: ESG vs Intangible Assets Across Firm Age Groups



Source: own elaboration

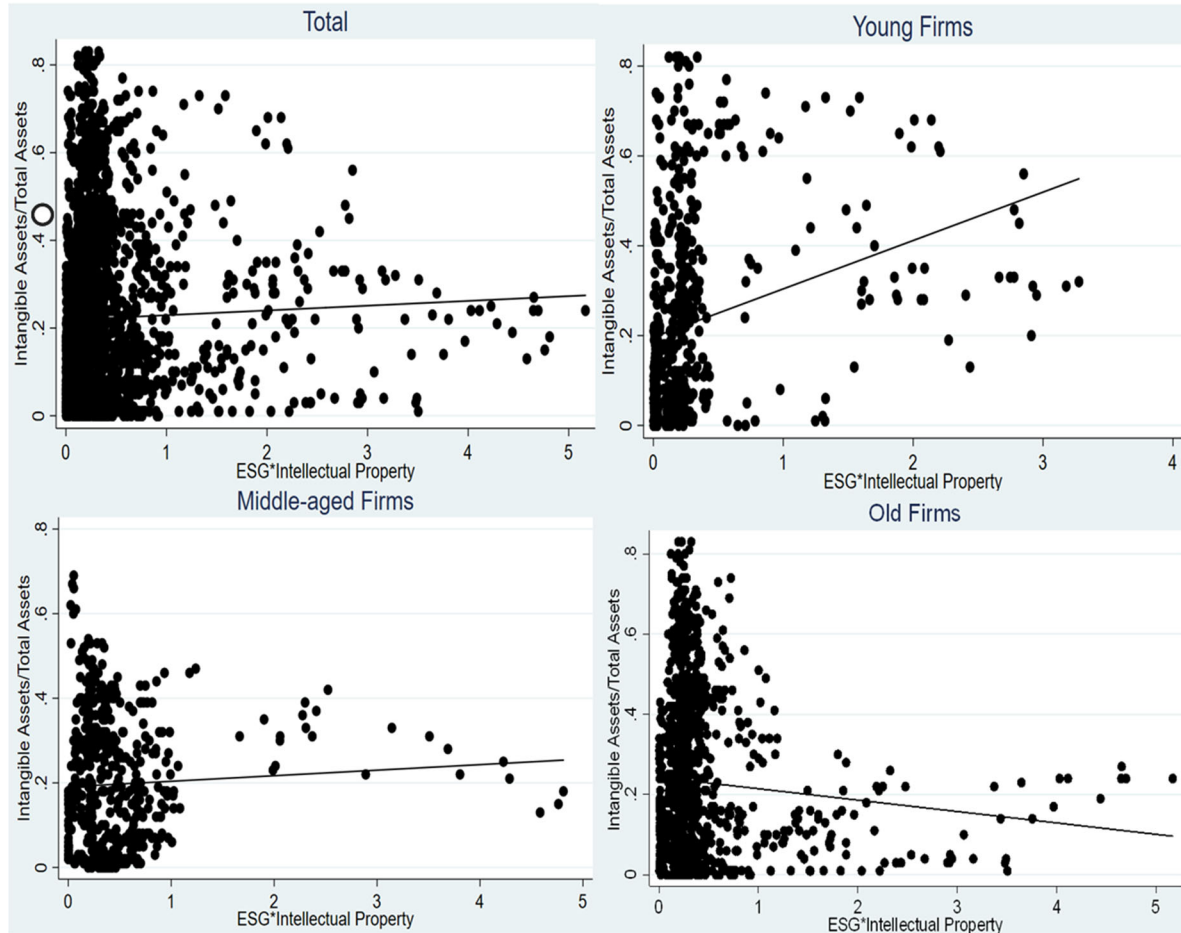
This scatter plot (Graphic 1) illustrates the relationship between firms' ESG scores and the ratio of intangible assets to total assets, segmented by firm age. The combined sample in Model 1 displays only a modest association between ESG performance and intangible asset intensity, underscoring the importance of age-specific analysis. In Model 2, the regression results for young firms indicate a negative but statistically insignificant association between ESG scores and intangible asset intensity. This suggests that in the early stages of firm development, ESG practices do not significantly contribute to the accumulation of intangible assets such as intellectual property or brand capital. Model 3, covering middle-aged firms, shows a statistically significant negative relationship between ESG and intangible assets, which is consistent with the downward trend observed in the corresponding scatter plot. This may indicate structural or strategic transitions during mid-life stages that dilute ESG's effectiveness in intangible asset building. For older firms (Model 4), both the regression results and the scatter plot reveal a mild positive association, suggesting that more established companies may be better positioned to leverage ESG initiatives for sustaining or enhancing their intangible asset base. The lower dispersion in the data points for these firms also reflects more stable patterns, possibly due to stronger institutional frameworks and mature innovation processes.

Another explanatory variable in assessing companies' intangible assets is their intellectual property (IP) environment. This variable, which reflects the institutional strength of IP protection in the firm's home country, is generally statistically significant and negative in the regression results (except for statistically insignificant results in older firms). Stronger IP regimes are thought to be negatively associated with intangible asset ratios, likely due to reporting, classification, or structural investment behavior.

The interaction term, which allows for the joint evaluation of ESG and IP variables, provides deeper insight into the ESG * Intellectual Property model. The regression results indicate a statistically significant and positive relationship for all firms and young firms. These results suggest that in countries with stronger intellectual property environments, firms with ESG performance (especially young ones)

are better positioned to translate these policies into intangible asset creation. The results for middle-aged firms in Model 3 show a strong positive coefficient, supporting the idea that ESG efforts can increase intangible capital in an institutional environment supportive of intellectual property. The results for older firms in Model 4 are surprising. Interestingly, the coefficient turns negative and reaches significance at the 10% level. This may indicate diminishing marginal returns or a strategic shift in older firms, where ESG efforts in high intellectual property environments may be geared towards maintaining rather than expanding intangible assets.

Graphic 2: ESG_IP vs Intangible Assets Across Firm Age Groups



Source: own elaboration

This set of scatter plots (Graphic 2) focuses on the interaction term (ESG * IP) and its relationship to intangible asset concentration. A modest positive trend is observed across all firms in Model 1, supporting the conclusion that the ESG * IP interaction is positively correlated with intangible asset levels; however, this relationship is primarily driven by young and middle-aged firms. Chart 2 shows that in countries with stronger intellectual property holdings, young ESG-active firms tend to hold a higher proportion of intangible assets. This effect is also positive and statistically significant for middle-aged firms, as expected. Only for older firms in Model 4 does the plot appear to flatten or turn slightly negative. This surprising result may be due to firms experiencing a saturation of these assets. These firms may already have established intangible asset portfolios and no longer rely heavily on ESG-IP alignment to expand them.

5. Discussion

The empirical findings of this study underscore the nuanced and contingent nature of the relationship between ESG performance and intangible asset accumulation. Contrary to the conventional view that ESG engagement unilaterally enhances firm value through intangible mechanisms, our results suggest

that this relationship is conditional on both firm-level characteristics and the institutional environment in which firms operate.

Specifically, the direct negative effect of ESG performance on intangible assets highlights the potential inefficiencies or unintended consequences of ESG investments in the absence of conducive external institutions or sufficient internal absorptive capacity. This finding resonates with prior literature (Jun et al., 2022; Rammavas, 2022), which cautions that excessive or poorly targeted ESG spending may not yield proportional intangible benefits, and may even divert resources from more impactful innovation or brand-building efforts.

However, when ESG is considered in interaction with intellectual property regimes, a more complex dynamic emerges. Among younger firms, the isolated effect of ESG remains insufficient to generate intangible asset accumulation. Yet, when these firms operate within robust IP environments, ESG performance translates more effectively into intangible value. This aligns with arguments by Nie et al. (2025) and Ma et al. (2025), who emphasize the role of institutional infrastructures—such as IP incentives and innovation policies—in unlocking the value-creation potential of ESG, particularly in agile and adaptive firms.

For middle-aged firms, our results show that ESG performance has a negative standalone effect on intangible assets, possibly due to structural rigidity, implementation inefficiencies, or resource misallocation. However, the presence of strong IP institutions appears to offset this effect, suggesting that external institutional support can revitalize ESG's value contribution even in firms that may otherwise be less strategically flexible. This echoes the propositions of Institutional Theory, where regulatory and normative structures act as enablers of organizational transformation (Campbell, 2007; Liu et al., 2025).

Older firms, in contrast, exhibit a slightly positive direct relationship between ESG and intangible assets, reflecting accumulated experience, more formalized ESG practices, and greater stakeholder alignment. Yet, the marginal negative interaction with IP regimes may suggest that these firms reach a saturation point in their ability to convert institutional support into incremental intangible value—a pattern consistent with the diminishing returns discussed in Organizational Learning Theory (Argyris & Schön, 1997; Baumgartner, 2009). These firms may also face challenges of strategic inertia or overembedded routines that constrain their responsiveness to evolving policy landscapes.

Overall, the findings lend support to both Institutional Theory and Organizational Learning Theory. IP regimes, as critical elements of the institutional ecosystem, either constrain or catalyze ESG's translation into intangible value. Simultaneously, firm age influences absorptive capacity, strategic flexibility, and internal learning mechanisms—shaping how ESG strategies are integrated into long-term value creation processes. These insights advance the literature by offering a multi-level perspective that incorporates both macro-institutional structures and micro-organizational dynamics in the ESG–intangible asset nexus.

6.Limitations and suggestions for future

This study, while novel in integrating firm-level ESG strategies with macro-level institutional environments, has several limitations. First, the analysis is limited to the telecommunications sector. Although this sector is highly relevant due to its intangible asset intensity and innovation focus, the generalizability of the findings to other industries—such as manufacturing, finance, or consumer goods—remains uncertain. Future research could replicate the model across diverse sectors to validate and expand upon the observed dynamics. Second, the study uses a single measure of intangible assets based on balance sheet data. While useful for comparability, it may not fully capture components such as human capital, knowledge creation, or relational capital. Future research may consider complementing financial data with survey-based or qualitative indicators of intangible value. By addressing these limitations, future work can further enhance our understanding of when and how ESG strategies translate into intangible value and how internal capabilities and external environments jointly shape these outcomes.

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Araştırma Makalesi

The Effectiveness of ESG Strategies in Building Intangible Capital: The Moderating Role of National Intellectual Property Intensity and Firm Age

Somut Olmayan Sermaye Oluşturmada ESG Stratejilerinin Etkinliği: Ulusal Fikri Mülkiyet Yoğunluğunun ve Şirket Yaşının Düzenleyici Rolü

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Genişletilmiş Özet

Bu çalışma, firmaların Çevresel, Sosyal ve Yönetişim (ESG) stratejilerinin, somut olmayan varlıkları (intangible assets, IA) üzerindeki etkisini, firmanın yaşı ve faaliyet gösterdiği ülkenin fikri mülkiyet (intellectual property, IP) rejimi çerçevesinde incelemektedir. Günümüz bilgi ekonomisinde somut olmayan varlıklar, özellikle telekomünikasyon gibi bilgi yoğun sektörlerde firma değerinin büyük bir kısmını oluşturmaktadır. Markalaşma, patentler, yazılım, kurumsal bilgi ve insan sermayesi gibi unsurlar, doğrudan finansal tablolarla ölçülememekle birlikte, firmanın sürdürülebilir rekabet gücünü belirlemektedir.

Araştırmanın temel amacı, ESG stratejilerinin bu tür varlıkların oluşumuna ne ölçüde katkı sağladığını ve bu ilişkinin firmanın yaşı ve IP ortamı tarafından nasıl şekillendiğini ortaya koymaktır. ESG performansı genellikle olumlu itibar, yatırımcı güveni ve müşteri sadakati gibi sonuçlarla ilişkilendirilse de, bu etkilerin somut olmayan varlıklar üzerindeki yönü ve büyüklüğü konusunda literatürde net bir görüş birliği bulunmamaktadır. Özellikle firmanın gelişim evresi (yaşı) ve faaliyet gösterdiği ülkenin yasal ve kurumsal altyapısı (örneğin IP birikim düzeyi) bu ilişkiyi belirgin şekilde değiştirebilir. Bu bağlamda, çalışmanın özgün katkısı; ESG-IA ilişkisinin çok düzeyli bir analizini yaparak, firma içi (yaş) ve dışı (kurumsal ortam) faktörleri birlikte değerlendirmesidir. Bu çalışmada özellikle firmanın yaşı ve içinde bulunduğu fikri mülkiyet rejimi dikkate alınmıştır; çünkü bu iki unsur, ESG uygulamalarının etkinliğini belirlemede temel rol oynamaktadır. Firmaların yaşam döngüsünün farklı aşamalarında kaynaklara erişimi, stratejik öncelikleri ve esneklik düzeyleri değişmekte; dolayısıyla aynı ESG stratejisi farklı yaş gruplarında farklı sonuçlar doğurabilmektedir. Aynı şekilde, güçlü bir fikri mülkiyet rejimi, ESG'nin itibar yaratma ve kurumsal şeffaflık gibi yönlerini daha anlamlı hale getirebilirken, zayıf bir IP ortamı bu çabaları sınırlandırabilir.

Araştırmada, 201 telekomünikasyon firmasına ait 2013–2023 yılları arasındaki 2211 gözlemden oluşan panel veri seti kullanılmıştır. Telekomünikasyon sektörünün analizde seçilme nedeni, bilgi çağının temel yapı taşlarından biri olması ve fikri mülkiyetin, yenilikçiliğin en yoğun olduğu sektörlerden biri olmasıdır. Sektörde faaliyet gösteren firmalar için marka değeri, müşteri sadakati, yazılım çözümleri ve teknolojik patentler firma değerinin önemli bir bölümünü oluşturur. Dolayısıyla bu sektör, ESG stratejilerinin somut olmayan varlıklar üzerindeki etkisinin analiz edilmesi için doğal bir laboratuvar işlevi görmektedir. Ayrıca sektördeki düzenleyici çerçeve, ESG uygulamalarının kurumsal uyum düzeyine doğrudan yansımaktadır.

Çalışmanın ekonometrik analizinde, heteroskedastisite, otokorelasyon ve yatay kesit bağımlılığına karşı dayanıklı olması nedeniyle Driscoll-Kraay standart hataları ile tahmin edilen random-effects panel

regresyon modeli tercih edilmiştir. Modelde bağımlı değişken, firmanın somut olmayan varlıklarının toplam varlıklara oranıdır. Bağımsız değişken olarak ESG skorları, IP düzeyi ve bu ikisinin etkileşim terimi kullanılmıştır. Modelde firma düzeyinde kullanılan kontrol değişkenleri (ROA, ROE, cari oran, borç/özsermaye oranı) ise firma performansı, likidite ve finansal yapı gibi ESG ve IA ilişkisini etkileyebilecek faktörleri dengelemek amacıyla eklenmiştir.

Bulgular

Tüm firmalar düzeyinde, ESG'nin IA üzerindeki doğrudan etkisi negatif ve anlamlı bulunmuştur. Ancak ESG ile IP rejiminin etkileşim terimi pozitif ve anlamlıdır. Bu bulgu, ESG stratejilerinin tek başına IA birikimini teşvik etmediğini; ancak güçlü bir fikri mülkiyet ortamında bu etkinin olumluya döndüğünü göstermektedir.

Genç firmalarda, ESG'nin IA üzerindeki etkisi istatistiksel olarak anlamsızdır. Ancak ESG * IP etkileşim terimi pozitif ve anlamlıdır. Bu, genç firmaların ESG stratejilerinden doğrudan fayda sağlayamasa da, IP ortamı güçlü olduğunda bu stratejileri IA oluşturmak için daha etkin kullanabildiklerini göstermektedir.

Orta yaşlı firmalarda, ESG'nin etkisi negatif ve anlamlı, ESG * IP etkileşimi ise pozitif ve yüksek düzeyde anlamlıdır. Yani ESG stratejileri IA'ya zarar verirken, IP rejimi bu olumsuzluğu telafi edebilmektedir.

Yaşlı firmalarda, ESG'nin doğrudan etkisi pozitif, ESG * IP etkileşimi ise zayıf bir negatif eğilim göstermektedir. Bu, bu firmaların ESG stratejilerini oturmuş yapılarla sürdürdüğünü; ancak IP ortamındaki gelişmelerin marjinal katkısının azaldığını düşündürülebilir.

Kontrol değişkenlerinden ROA ve ROE çoğu zaman negatif yönde etkilidir, ancak bu etkiler bazı modellerde istatistiksel olarak anlamlı değildir. Cari oran, genellikle negatif ve bazı yaş gruplarında anlamlı etkilere sahiptir. Borç/özsermaye oranı ise çoğu modelde anlamlı değildir.

Bu bulgular, iki temel teori ile ilişkilendirilebilir:

1. Kurumsal Kuram (Institutional Theory): Firmalar, içinde bulundukları kurumsal çevreden (yasa, norm, teşvik, IP koruması gibi) etkilenir. Bu çalışmada IP rejimi, ESG'nin IA üzerindeki etkisini önemli ölçüde dönüştürmektedir. Genç firmalar, daha esnek ve adapte olabilir yapılar olarak IP rejiminden daha fazla fayda sağlamaktadır.
2. Örgütsel Öğrenme Kuramı (Organizational Learning Theory): Firmanın yaşı arttıkça, bilgi birikimi artar ancak yeni bilgiye adaptasyon yavaşlar. Genç firmalar yeni politikaları daha kolay entegre edebilirken, yaşlı firmalar mevcut yapılarını koruma eğilimindedir. Bu, IP'nin ESG üzerindeki marjinal etkisinin yaşlı firmalarda neden azaldığını açıklamaktadır.

Sonuç ve Öneriler

Sonuç olarak, ESG stratejilerinin IA oluşumuna katkısı firma yaşı ve IP ortamına bağlı olarak büyük farklılıklar göstermektedir. IP düzeyi, genç ve orta yaşlı firmalar için ESG'nin olumsuz ya da anlamsız etkilerini pozitif çevirebilmektedir. Ancak yaşlı firmalar bu tür dışsal iyileştirmelerden daha az etkilenmektedir. Bu bulgular, ESG stratejilerinin etkisinin sadece firma içi değil, aynı zamanda ülke düzeyindeki kurumsal çevreye ve firmanın yaşam döngüsündeki konumuna da bağlı olduğunu göstermektedir.

Elde edilen sonuçlar, politika yapıcılar için önemli çıkarımlar içermektedir. Özellikle genç ve orta yaşlı firmalarda ESG yatırımlarının etkisinin artabilmesi için, fikri mülkiyet haklarını koruyan ve destekleyen yasal düzenlemelere ihtiyaç duyulmaktadır. Ayrıca yatırımcılar, ESG performansını değerlendirirken firmaların faaliyet gösterdiği IP rejimlerini ve kurumsal olgunluk düzeylerini de dikkate almalıdır. Bu çalışmanın bulguları, ESG'nin firmaya olan katkısının bağlamsal olarak değerlendirilmesi gerektiğini göstermekte, bu da ESG puanlarının tek başına karar verme süreçlerinde yetersiz kalabileceğine işaret etmektedir.

Kısıtlar ve Gelecekteki Çalışmalar

Bu çalışma sadece telekomünikasyon sektörüne odaklanmıştır. Diğer bilgi yoğun veya geleneksel sektörlerde yapılacak benzer çalışmalar, bulguların genellenebilirliğini değerlendirmek açısından önemlidir. Ayrıca gelecekte, fikri mülkiyet rejimi dışında ülkelerin yüksek teknoloji ihracatı, Ar-Ge harcamaları ya da inovasyon kapasitesi gibi değişkenlerin de IP ortamının göstergesi olarak değerlendirilmesi faydalı olacaktır.