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Environmental, Social, and Governance Information Disclosure and Intellectual Capital Efficiency in Jordanian Listed Firms

Juan C. Reboredo * and Samih M. A. Sowaity

Department of Economics, Faculty of Economics and Business, University of Santiago de Compostela, 15782 Santiago, Spain; s0599721030@gmail.com
* Correspondence: juancarlos.reboredo@usc.es

Abstract: In this study, we explore the association between the intellectual capital (IC) efficiency of firms and their voluntary disclosure of environmental, social, and governance (ESG) information, using data on Jordanian listed firms and the value-added intellectual coefficient (VAIC) model with its three components of human, structural, and relational capital efficiency (HCE, SCE, and RCE, respectively). We find that disclosing environmental information is unrelated to IC efficiency, that disclosing governance information is associated with raised IC efficiency through the HCE and RCE components, and that disclosing social information is negatively associated with IC efficiency through the SCE and RCE components. We also find that releasing information on one or two of the three ESG dimensions has a positive effect on IC efficiency. This evidence has implications for the management of intangible assets.

Keywords: ESG information disclosure; corporate sustainability; intellectual capital efficiency; Amman Stock Exchange; VAIC

1. Introduction

In this study, we examine how voluntary information disclosure on the environmental, social, and governance (ESG) dimensions of firms is associated with intellectual capital (IC) efficiency. Reported information on ESG issues is useful for corporate stakeholders concerned with social firms' features that go beyond their financial performance. Specifically, ESG signals information regarding a firm's pledges towards welfare, social, and environmental issues that contribute to creating a close connection between stakeholder and societal interests. Therefore, ESG information disclosure may enhance a firm's reputation and increase the value of intangible assets as reflected in IC efficiency, embracing employee expertise, organizational processes, and the sum of knowledge contained within the organization.

Previous studies have documented that ESG information disclosure has a positive impact on a firm's financial performance [1–3], improves risk-adjusted returns [4,5], and enhances a firm's value by augmenting cash flows and reducing the cost of equity [6]. ESG information disclosure can also lessen corporate bond credit spread [7] and decrease default risk [8]. Whether disclosure on each ESG dimension, individually or aggregately, affects the value of intangible assets remains an open question.

In this paper, we address how ESG information disclosure is associated with the value of intangible assets as accounted for by the IC efficiency of firms, especially in emerging economies, where intangible assets may play a crucial role in boosting productivity, and where ESG information is crucial to characterizing a firm's sustainability focus [9] and to signaling its social pledge. We fill this gap by analyzing ESG information disclosure by Jordanian companies.

We study a panel of non-financial Jordanian listed firms (2009–2018) that voluntarily report information on ESG practices when that reporting is not compulsory and external information on ESG ratings is missing. This is an interesting setup, as the association between

ESG information and IC efficiency is not mediated by the intervention of third parties that assess the quality of ESG practices, and consequently, the impact of ESG information on IC is only driven by whether ESG practices are/are not implemented, mitigating difficulties regarding asymmetric information between rating agencies, investors, and corporate managers. Hence, we can clearly identify whether voluntary ESG information disclosure has any impact on IC efficiency, independently of assessments regarding the quality of ESG practices. This is particularly relevant to promoting ESG practices in emerging economies where such practices are not as widespread as in developed countries.

By applying the value-added intellectual coefficient (VAIC) model and its three components of human, structural, and relational capital efficiency (HCE, SCE, and RCE, respectively), we find that disclosing information on the environmental dimension is not associated with IC efficiency (even though corporate engagement in environmental activities improves SCE and RCE), that disclosing information on the governance dimension raises IC efficiency through the HCE and RCE components, and that disclosing social information is negatively associated with IC efficiency through the SCE and RCE components. In assessing whether ESG information disclosure intensity is associated with IC efficiency, we find that releasing information on one or two of the three ESG dimensions is positively associated with IC efficiency.

By reporting evidence on the relationship between ESG disclosure and IC efficiency, our study not only extends the above-mentioned literature on the role of ESG disclosure, but also adds to the IC literature. Previous research has considered, among other variables, the impact of profitability, risk efficiency, barriers to entry, and firm size and age on IC efficiency (see, e.g., [10–14]), disregarding social and sustainability features that could boost the value of a firm's intangible assets through knowledge innovation and the corporate culture. Our evidence provides information on the relevance of each of the three ESG dimensions for the value of intangible assets as given by IC efficiency.

Our findings have management implications in that ESG information disclosure has positive effects on the value of IC, ultimately affecting the performance of firms. Interestingly, voluntary reporting on ESG practices reflects greater transparency and social involvement, which could attract the interest of socially responsible investors from both Jordan and abroad, thus increasing the capital strength of companies. Our evidence also has implications for policymakers, as they could support through legislation the release of non-financial corporate information to stimulate capital flows towards Jordan, a capital-scarce country.

The rest of the paper is organized as follows: the literature is reviewed and hypotheses are developed in Section 2, the data are described in Section 3, descriptive statistics and empirical results are reported and discussed in Section 4, and finally, Section 5 summarizes our findings and our main conclusions.

2. Literature Review and Hypotheses

With growing global concerns regarding the scarcity of natural resources, social inequity, rapid environmental degradation, sustainability issues are attracting growing attention and are becoming key concerns for companies and investors in terms of realizing long-term value [15–17] and accountability legally and ethically for internal and external actions aimed at ensuring long-term survival [18,19]. Therefore, ESG pillars are a potential source of competitiveness [20,21].

According to the Global Reporting Initiative [22], the motives underpinning ESG practices and reporting are: (a) to gain a comprehensive understanding of risks and opportunities; (b) to build trust with customers and partners, leading to a positive financial impact; (c) to signal company management quality, as ESG practices proxy better financial risk management [8,23]; and (d) to develop customized investment portfolios, improve returns on capital, increase profits, enhance corporate image, and retain talent. ESG information disclosure also reduces information asymmetry between principals and agents [24]. Table 1 summarizes the main features of the three pillars of sustainability as described by

ESG information, while Ting-Tinget al. [25] summarize research and development data on ESG principles.

Most empirical studies on ESG information disclosure have been conducted for developed economies, but their conclusions cannot be easily generalized to developing countries [26]. For European firms included in the S&P Europe 350 index, Arif et al. [27] show that ESG disclosure is related to a firm's energy risk. Likewise, Constantinescu et al. [28] find that an energy firm's value is associated with ESG disclosure. Laskar and Maji [21] argue that firms engage in corporate sustainability reporting in response to certain external pressures and not necessarily because of a feeling of responsibility towards the environment, the economy, or society. For Jordanian firms, Al Amosh and Khatib [29] show that ESG information disclosure is influenced by corporate mechanisms, such as board meetings, board size, and shareholder pressures.

Table 1. Environmental, social, and governance dimensions.

Environmental performance disclosure	Activities in favor of maintaining the eco-system [30] and that reflect corporate eco-literacy. Addressed are the impact of business environmental activities on society and the planet. It covers disclosure policies on CO_2 emissions, energy consumption, total waste, energy efficiency emissions reduction, number of environmental safety accidents, total investment in environmental protection as a share of revenues, smoke emissions, etc. [9,18].
Social performance disclosure	Addressed are policies such as the number of employees, employee turnover, number of unionized employees, percentage of women in management, percentage of women employees, proportion of employees with disabilities, average annual paid holidays, annual health checks, major equipment accidents, charity donations, sponsorships, etc. [9,18].
Governance performance disclosure	A safeguard against mismanagement. Addressed are corporate organizational characteristics such as ownership structure, board size, independent directors, and outsiders [31]. Other determinants include the frequency of audit committee meetings, CEO duality (role separation), board gender diversity, existence of a sustainability committee, and age of the youngest director [32].

For the European banking industry for the period 2009–2015, Gangi et al. [33] document a positive effect of corporate social responsibility (CSR) engagement on financial performance; banks that undertake more CSR initiatives outperform those less engaged in CSR, attract better employees and garner a higher market share. CSR can enhance value creation as evidenced by Husted and Allen [34] for the Spanish context. In the same vein, a positive association with ESG information disclosure is reported between government ownership, firm size, and financial leverage in a study of 33 partially state-owned rail companies in 9 countries [31]. In their study of 53 organizations through structured interviews, Balugani et al. [35] find a significant association for the sustainability maturity index with corporate profitability, but an insignificant association with country of origin, firm size, and market focus. For their survey of 92 multinational firms over the period 2009–2013, Giannarakis et al. [32] report evidence that environmental performance positively affects the environmental disclosure level, but the impact on a firm's value is insignificant, and the environmental score is negatively related to financial performance. For institutional investors, Park and Jang [36] show that environmental and governance factors are more relevant than social factors.

The growing interest in IC is supported by the fact that IC is a relevant competitive factor, as evidenced by firms achieving different results when employing similar resources [37,38]. In addition, the importance of IC in today's knowledge economy is

leading companies to favor IC disclosure [39] as a good tool to manage corporate talents and competencies, increase transparency, and enhance corporate reputation, which in turn, helps recruit and retain high-level candidates.

As for the relationship between CSR and IC, Pedrini [40] shows that investment in CSR (The term CSR reflects only environmental and social activities, so governance is not reflected in the cited studies.) activities generates benefits for IC efficiency. Branco and Lucia [41] also evidence a positive correlation between CSR practices and IC efficiency in improving a firm's reputation. Battacharya and Sanker [42] and Mont and Leire [43] find a strong and positive relationship between CSR activities and a company's brand, pointing to the importance of the structural capital element. In their study of Luxembourg listed firms, Bocquet et al. [44] find that firms with proactive CSR profiles are more likely to innovate in brands and processes, while firms with reactive CSR profiles experience barriers to innovation. For Malaysian firms, Arshad et al. [45] document a positive relationship between SCE and sustainability performance, but find a weaker positive, though still significant, relationship with HCE and RCE. Likewise, Albakri [46] and Sharaf [47] report a connection between IC efficiency and sustainability.

Previous literature has also explored the connection between IC and environmental issues. Omar et al. [48] document how IC efficiency can be used to resolve environmental problems since it incorporates both tangible and intangible assets in attaining sustainability. Rae et al. [49] report a significant association between HCE and environmental performance, while Abu Bakar et al. [50] explore how sustainability is measured specifically towards HCE development through the resolution of social problems. For a survey of Nigerian manufacturing firms, Sunday [30] finds a positive and significant relationship between IC efficiency and corporate sustainability, and a significant impact of HCE on economic, social, and environmental sustainability. For Islamic banks, Aslam and Razali [51] show that corporate governance measures have a bearing on IC efficiency. In a study of the effects of green IC efficiency on competitive advantage, Chen [52]—who splits IC into green HCE, green SCE, and green RCE components, and business sustainability into economic, social, and environmental dimensions—documents that green IC is a key element in sustainable operations.

Our study contributes to the literature by accounting for the hitherto unexplored impact of sustainability disclosure, proxied by ESG information disclosure, on IC efficiency. ESG information disclosure may have a signaling effect for intangible asset values and managerial commitment to different sustainability actions that may increase stakeholder involvement, ultimately affecting firm performance. Specifically, on the basis of the above empirical evidence, we test the following hypotheses for Jordanian listed companies:

Hypothesis 1a: *Information disclosure on ESG dimensions is associated with IC efficiency.*

Hypothesis 1b: *Information disclosure on ESG dimensions is associated with the different components of IC efficiency.*

Hypothesis 2a: *ESG information disclosure intensity is associated with IC efficiency.*

Hypothesis 2b: *ESG information disclosure intensity is associated with the different components of IC efficiency.*

The first hypothesis draws on previous empirical evidence suggesting that the three ESG dimensions are not homogeneous across economic sectors, i.e., once ESG is disaggregated into its parts, different significant impacts may be documented for corporate performance [53].

3. Research Design

3.1. Data

The data sample includes observations for all non-financial (manufacturing, services, and real estate) companies listed on the Jordanian Amman Stock Exchange (ASE) over the decade 2009–2018.

Although Jordan has high human capital potential, it has a low level of structural capital [54], low per capita GDP, high public debt and unemployment levels. It is struggling to find solutions for its ailing economy, where economic growth has slowed down dramatically since 2009, and the 24% drop in the value of real estate and 40% free-fall in the construction sector associated with shrinking foreign investment. A large proportion of Jordanian young people cannot find decent employment and so are forced to consider emigration [29]. These realities are the main driver for research that can enrich the corporate literature for emerging economies.

Disclosure practices in Jordan are still emerging and are voluntary. While the level of ESG information disclosure is weak, some progress is being made in response to shareholder pressures [29]. Like many developing countries that have received less attention in the literature, Jordan suffers from ESG practices [55]. In 2015, the Jordanian government launched a comprehensive development plan, called Jordan 2025, setting economic, social, and environmental goals aimed at achieving sustainable development [29]. They added, among its measures to incentivize listed and unlisted firms to contribute to sustainability development issues. The Jordanian government passed new income tax legislation in 2009 that tax-exempt any charitable, humanitarian, scientific, environmental, social or cultural payments within Jordan by firms participating in sustainability activities.

The study period was selected to commence in 2009—to avoid the direct effect of the global financial crisis [10] and to be consistent with the launch of the new Jordanian tax law of 2009—and extends to the end of 2018 (as data collection commenced in the first quarter of 2019). Companies were included if audited and disclosed statements were reported and published in the ASE official website [56]). Table 2 shows details of the companies and sectors and describes the selection process. Companies were selected according to predefined criteria as follows:

1. Financial data with a clear reporting structure of the company are available over the period of the study.
2. The company has continuous activity during the study period and trades publicly on the ASE over the sample period.
3. To ensure comparability, fiscal years should end on 31 December and fiscal year definition should not be changed during the sample period.

Table 2. Included/excluded listed Jordanian firms.

Industry	Total Listed	Excluded Firms	Included Firms	% of Full Sample	% Inclusion	# Obs.
Included sectors						
Manufacturing	47	5	42	40%	89%	420
Services	77	26	51	49%	66%	510
Real estate	33	22	11	11%	33%	110
Excluded sectors						
Banking	15	15	0			0
Insurance	21	21	0			0
Total	**193**	**89**	**104**	**100%**		**1040**
Margin of error calculation for sample selection at 95% level of confidence						
	Manufacturing	Margin of error	Services	Margin of error	Real estate	Margin of error
Full sample	42 of 104	11.73%	51 of 104	9.84%	11 of 104	28.08%
Sub-sample	42 of 47	4.99%	51 of 77	8.03%	11 of 33	24.50%

Valid for statistical analysis were 42 of 47 manufacturing sector companies (pharmaceutical, medical, chemical, paper, food, beverage, tobacco, mining, extraction, engineering, construction, electrical, and textiles), 51 of 77 services companies (healthcare, education, hotels, tourism, transportation, technology, communication, media, utilities, energy, commercial, and diversified financial services), and 11 of 33 real estate companies (land management and housing projects).

Excluded were companies with missing data and an unclear disclosed data structure. ASE listed public companies in 2019 numbered 193 when data collection started. Meeting the above criteria were 104 companies, reflecting a total of 1040 annual observations.

3.2. Variables

From the audited accounting information for Jordanian companies, we extracted ESG information disclosure data by means of content analysis of published annual financial statements, and then computed IC efficiency and its three components (HCE, SCE, and RCE), and control variables.

We measured ESG information disclosure in two different ways. First, we used ESG information (Sustainability disclosure for the ASE, which joined the United Nations Sustainable Stock Exchanges (SSE) initiative in March 2016, is close to voluntary except for corporate governance) disclosure in annual financial statements as reflected in an independent variable based on dichotomous scores: 1 for each individual ESG dimension—i.e., environmental, social, and governance—if disclosed, regardless of any criteria the company may follow, and 0 otherwise. Environmental disclosure is based on the firm's performance in relation to climate change, hazardous waste, nuclear energy, and sustainability indicators; social disclosure is based on the firm's performance in relation to consumer protection, diversity, human rights, animal welfare, child labor, and employee health and safety indicators; and governance disclosure is based on the firm's performance in terms of management structure, executive compensation, and conflict of interest indicators [8]. We thus attained three dummy variables that reflect the firm's performance in each ESG dimension. Second, we accounted for the relative aggregate disclosure of ESG information using the approach described by Oliveira et al. [57] and Hasan et al. [58]. Thus, from information on the dummies for each ESG dimension, we reflected disclosure intensity as maximum disclosure, moderate disclosure, and minimum disclosure, using proxies scored as 1 when information on three, two, and one dimensions is disclosed, respectively, and 0 otherwise.

We computed IC efficiency using Pulic's [59] widely used VAIC model, as it is easily computed from audited financial statements. Its three IC efficiency components are described as follows:

1. HCE indicates the innovation potential of a firm, reflecting the genetic inheritance, know-how, and experience of employees in terms of professional skills, experience, innovativeness, competencies, and mental agility [60]. Regarded as a critical strategic resource for organizational growth and survival [30,61,62], HCE indicates the contribution to corporate added value of each unit of spending on employee costs: the higher this value, the greater the HCE [63]. This component includes employee salaries, bonuses, other compensations, and training costs [64].

2. SCE reflects the share of organizational capital in the value creation process by capturing all nonhuman capital in an organization, including databases, corporate charts and culture, patents and trademarks, systems, processes, policies, procedures, and overall infrastructures that empower human resources to perform [60]. Sarea and Alansari [64] described the major distinction between HCE and SCE: human capital is attached to the employee and disappears if they leave the firm, whereas SCE is owned by the firm and remains even after the employee leaves.

3. RCE reflects the physical and financial capital in the value creation process that drives HCE and SCE [11,65]. It includes all company's formal and informal relationships with stakeholders [60].

In addition, as in the CSR literature, we take into account control variables for firm size and risks so as to avoid confounding effects. Firm size is measured as the natural logarithm of the firm total assets, whereas risk is reflected in leverage, defined as the debt-to-asset ratio and where a higher ratio reflects greater exposure to default and bankruptcy. (See the Appendix A, Table A3 for specific details on computations for all variables).

3.3. Regression Model

We used a panel regression model where the dependent variable is IC efficiency or any of its components, the independent variables are the dummy ESG information disclosure variables, and the control variables are firm size and leverage:

$$VAIC_{i,t} = \alpha_i + \beta_1 E_{i,t} + \beta_2 S_{i,t} + \beta_3 G_{i,t} + \beta_4 Size_{i,t} + \beta_5 Leverage_{i,t} + \varepsilon_{i,t} \tag{1}$$

where $E_{i,t}$, $S_{i,t}$, and $G_{i,t}$ denote the dummy variables that indicate whether firm i releases environmental, social, and/or governance information at time t, respectively, and where β_1, β_2, and β_3 account for the marginal effects of that disclosure on IC efficiency as given by the dependent variable *VAIC*. Exchanging $E_{i,t}$, $S_{i,t}$, and $G_{i,t}$ in Equation (1) for *ESGMax*, *ESGMod* and *ESGMin*, we obtain maximum, moderate, and minimum ESG information disclosure intensity, respectively. Likewise, exchanging *VAIC* for each of its components (*HCE*, *SCE*, and *RCE*), we can check for the effects of ESG information disclosure on the individual IC efficiency components. To control for unobserved heterogeneity by cross-section and over time, we include firm fixed-effects dummies, as given by α_i, and year fixed-effect dummies.

4. Empirical Results

4.1. Descriptive Statistics

Tables 3 and 4 present descriptive statistics for all the variables used in our analysis. Control variables (except size), and the dependent variables were winsorized at the 5% level to control for the effect of outliers, and the normality of all variables was checked by running the Shapiro–Wilk's test (see the Appendix A for specific details of computations).

Table 3. Descriptive statistics for environmental, social, and governance information disclosure.

	E		S		G		ESGMin		ESGMod		ESGMax	
	n	%	n	%	n	%	n	%	n	%	n	%
Nondisclosure	410	39	315	30	71	7	813	78	872	84	453	44
Disclosure	630	61	725	70	969	93	227	22	168	16	587	56
Total	1040	100	1040	100	1040	100	1040	100	1040	100	1040	100

Notes. E, S, and G: environmental, social, and governance (ESG) information disclosure; ESGMin, ESGMod, and ESGMax: disclosure of one, two, and three ESG dimensions.

The mean VAIC value is 3.6757, indicating that added value is positively generated from integration of all the IC components during the study period, i.e., the contribution of IC in generating added value exceeds the costs incurred. The VAIC standard deviation is 3.0898, indicating that IC dispersion over the listed firms is relatively low. As for individual VAIC components, HCE and RCE exhibit the highest and lowest mean values, at 2.8594 and 0.1327, respectively. The relatively high mean value for HCE is explained by the key role played by human resources in adding value, and, since HCE is the dominant VAIC component, it may determine and enhance the competitive edge of a firm. The descriptive statistics also indicate that the added value generated by the VAIC components exceeds the costs incurred.

Table 4. Descriptive statistics for the full sample.

Variable	Mean	Min	Max	SD	Skewness	Kurtosis	Observations
VAIC	3.6757	−0.3064	12.6096	3.0898	1.5451	5.1041	1040
HCE	2.8594	−0.7995	11.3493	2.7857	1.7168	5.7891	1040
SCE	0.5644	−0.3224	1.5159	0.4025	0.0649	3.7169	1040
RCE	0.1327	−0.0181	0.3926	0.1075	0.8605	3.1457	1040
E	0.6058	0	1	0.4889	−0.4329	1.1874	1040
S	0.6971	0	1	0.4597	−0.8579	1.7361	1040
G	0.9317	0	1	0.2523	−3.4236	12.721	1040
ESGMax	0.5644	0	1	0.4961	−0.2599	1.0675	1040
ESGMod	0.1615	0	1	0.3682	1.8393	4.3831	1040
ESGMin	0.2183	0	1	0.4132	1.3641	2.8607	1040
Size	7.5046	5.3013	9.9848	0.5571	0.7369	4.2019	1040
Leverage	0.2740	0.0072	0.7881	0.2215	0.7459	2.7323	1040

Notes. The full sample includes annual data for firms listed on the ASE for the period 2009–2018. E, S, and G: environmental, social, and governance (ESG) information disclosure; ESGMin, ESGMod, and ESGMax: disclosure of one, two, and three ESG dimensions; VAIC, value-added intellectual coefficient, composed of human, structural, and relational capital efficiency (HCE, SCE, and RCE).

As for the independent variables, these are all dummy variables (except for the control variables), implying that the mean values represent disclosing firm frequencies in the sample over the studied period. For the environmental, social, and governance dimensions, mean values are 0.61, 0.70, and 0.93, respectively. Disclosure is greatest for the governance dimension (93%), and lowest for the environmental dimension (61%). Mean values for minimum, moderate, and maximum ESG information disclosure intensity are 0.22, 0.16, and 0.56, respectively; around 56% of the companies disclose their full ESG profile, 16% disclose information on two ESG dimensions, 22% disclose information on a single ESG dimension, while the remaining 6% do not disclose any type of ESG information.

Regarding control variables, firm mean size is 7.5046, and the fact that size ranges from a minimum of 5.3013 to a maximum of 9.9848 reflects great variation. The mean leverage value of 0.27 (under one third of total assets is financed by creditors) indicates that indebtedness is within an acceptable range and is not a threat to the firms' existence.

4.2. Regression Results

Panel fixed-effects and random-effects estimators are presented below, along with the Hausman test to select the appropriate model. The Breusch–Pagan Lagrangian multiplier (LM) test was also run to determine whether ordinary least squares (OLS) or generalized least squares (GLS) was more appropriate for model estimation.

Table 5 presents evidence for two regression models where the dependent variable is the VAIC, and the explanatory variables are information disclosure for each ESG dimension and disclosure intensity.

At the 10% significance level, the evidence in Table 5 points to social information disclosure having a negative significant effect on IC efficiency, indicating that disclosing information on corporate engagement in social issues negatively affects IC efficiency. In contrast, at the 1% significance level, the results evidence a positive effect of governance disclosure on IC efficiency, but no significant impact for environmental disclosure; this nonsignificant result for the environmental dimension is inconsistent with the evidence reported by Omar et al. [48] and Chen [52]. Corporate size and leverage have no effect on VAIC, suggesting that all firms disclose information on corporate governance, irrespective of size or indebtedness, to improve IC efficiency. Accordingly, Hypothesis 1a is accepted, except in relation to the environmental dimension.

Table 5. Regression results for the impact of environmental, social, and governance information disclosure on the value-added intellectual coefficient.

ESG Dimensions		ESG Disclosure Intensity	
Intercept	−0.086 (0.983)	Intercept	−0.871 (0.986)
E	0.032 (0.221)	ESGMax	0.430 (0.264)
S	−0.382 * (0.214)	ESGMod	0.491 * (0.286)
G	0.747 *** (0.233)	ESGMin	0.797 *** (0.266)
Size	0.554 (0.659)	SIZE	0.546 (0.529)
Leverage	−1.142 (1.021)	Leverage	−1.151 (0.976)
R-squared	0.1750	R-squared	0.1758
F-stat	29.75 ***	F-stat	30.21 ***
Group	104	Group	104
Observations	1040	Observations	1040
Hausman	$x^2(14)$ 19.55 Random effect	Hausman	$x^2(14)$ 20.07 Random effect
Breusch-Pagan LM	$x^2(1)$ 1194.24 *** GLS applied	Breusch-Pagan LM	$x^2(1)$ 1196.03 *** GLS applied
Year effect	Yes		Yes

Notes. * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$. F-stat results for regression model significance: ***, **, and * at the 1%, 5%, and 10% levels. Bootstrap standard errors are reported in parenthesis. E, S, and G: environmental, social, and governance (ESG) information disclosure; ESGMin, ESGMod, and ESGMax: disclosure of one, two, and three ESG dimensions; GLS: generalized least squares.

As for disclosure intensity, the evidence in Table 5 indicates that there is a positive significant impact of minimum ESG disclosure and moderate ESG disclosure on IC efficiency at the 1% and 10% significance levels, respectively, but no significant effect for full disclosure. That evidence indicates that one or two ESG information disclosure dimensions may improve IC efficiency. Accordingly, Hypothesis 2a is accepted, except in relation to maximum ESG disclosure.

Tables 6–8 below summarize results on the relationship between ESG disclosure and the three individual components of IC efficiency.

Table 6, showing evidence on the relationship between ESG information disclosure and HCE, points to a positive and significant relationship between corporate governance information disclosure and HCE at the 5% significance level, underlining a relevant role in recruiting and retaining quality human resources. In contrast, we find no evidence of an association between either social or environmental information disclosure and HCE, contradicting the results of Ab Samad et al. [66] and Sunday [30], and [49]. We accordingly reject our Hypothesis 1b regarding HCE, except for governance disclosure. As for firm size and leverage, and consistent with Gallego-Alvarez et al. [67], size has a positive and significant impact on HCE, and leverage has a negative and significant effect on HCE.

Considering ESG disclosure intensity, estimates reveal a significant impact of minimum and moderate ESG disclosure on HCE at the 5% significance level. Whereas leverage has a significant and negative impact on HCE, the relationship between firm size and HCE, consistent with the results reported by Ozcan [31], is significant and positive; a possible explanation is that large firms have a greater incentive to disclose ESG practices in order to attract talent that will impact positively on their competitive edge. This finding is in line with Astuti et al. [68], Eleftheriadis and Evgenia [69], Albakri [46], and Arshad et al. [45], but inconsistent with Mukherhee and Som [37]. As for leverage, when high, it negatively affects HCE, since corporate engagement in costly ESG practices is influenced by external control by creditors, impeding improvements in HCE. Accordingly, we accept Hypothesis 2b regarding HCE, except for maximum ESG disclosure.

Table 6. Regression results for the impact of environmental, social, and governance information disclosure on human capital efficiency.

ESG Dimensions		ESG Disclosure Intensity	
Intercept	−5.095 (2.696)	Intercept	−5.066 (2.282)
E	−0.046 (0.239)	ESGMax	0.331 (0.243)
S	−0.203 (0.194)	ESGMod	0.593 ** (0.252)
G	0.582 ** (0.270)	ESGMin	0.567 ** (0.235)
Size	1.003 *** (0.384)	Size	0.996 *** (0.332)
Leverage	−1.693 *** (0.741)	Leverage	−1.719 *** (0.633)
R-squared	0.1939	R-squared	0.1922
F-stat	37.40 ***	F-stat	37.92 ***
Group	104	Group	104
Observations	1040	Observations	1040
Hausman	$x^2(14)$ 7.16 Random effect	Hausman	$x^2(14)$ 7.13 Random effect
Breusch-Pagan LM	$x^2(1)$ 1403.11 *** GLS applied	Breusch-Pagan LM	$x^2(1)$ 1405.12 *** GLS applied
Year effect	Yes		Yes

Notes. * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$. F-stat results for regression model significance: ***, **, and * at the 1%, 5%, and 10% levels. Bootstrap standard errors are reported in parenthesis. E, S, and G: environmental, social, and governance (ESG) information disclosure; ESGMin, ESGMod, and ESGMax: disclosure of one, two, and three ESG dimensions; GLS: generalized least squares.

Table 7 presents evidence on the relationship between ESG disclosure and the SCE component, showing a significant and negative relationship between corporate social information disclosure and SCE at the 5% significance level, and a positive and significant association between environmental information disclosure and SCE at the 10% significance level. Thus, disclosures on social activities negatively affect SCE, disclosures on environmental activities increase SCE, while, in contrast, governance disclosures have no effect on SCE. We therefore accept Hypothesis 1b regarding SCE, except for the governance dimension.

Table 7. Regression results for the impact of environmental, social, and governance information disclosure on structural capital efficiency.

ESG Dimensions		ESG Disclosure Intensity	
Intercept	−0.052 (0.333)	Intercept	−0.051 (0.286)
E	0.070 * (0.042)	ESGMax	−0.025 (0.059)
S	−0.075 ** (0.041)	ESGMod	−0.067 (0.068)
G	−0.037 (0.061)	ESGMin	0.002 (0.061)
Size	0.091 ** (0.043)	Size	0.088 ** (0.037)
Leverage	−0.192 * (0.098)	Leverage	−0.194 * (0.106)
R-squared	0.0930	R-squared	0.0884
F-stat	46.04 ***	F-stat	48.11 ***
Group	104	Group	104
Observations	1040	Observations	1040
Hausman	$x^2(14)$ 9.72 Random effect	Hausman	$x^2(14)$ 11.05 Random effect
Breusch–Pagan LM	$x^2(1)$ 399.66 *** GLS applied	Breusch–Pagan LM	$x^2(1)$ 398.60 *** GLS applied
Year effect	Yes		Yes

Notes. * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$. F-stat results for regression model significance: ***, **, and * at the 1%, 5%, and 10% levels. Bootstrap standard errors are reported in parenthesis. E, S, and G: environmental, social, and governance (ESG) information disclosure; ESGMin, ESGMod, and ESGMax: disclosure of one, two, and three ESG dimensions; GLS: generalized least squares.

As for the effects of ESG disclosure intensity on SCE, the evidence points to no effects on SCE. Hence, we reject Hypothesis 2b. Our evidence is consistent with the results reported by Arshad et al. [45] and Mukherjee and Som [37].

In Table 8, evidence for each of the ESG dimensions reveals that disclosing information on the environmental and governance dimensions has a positive and significant impact on RCE; in contrast, social dimension information disclosure has a significant and negative effect on RCE. Note that the positive relationship we find between environmental performance and RCE is consistent with Hami et al. [15]. Thus, Hypothesis 1b is accepted for all three IC efficiency components. Our finding that firm size has a negative impact on RCE is not consistent with evidence reported by Ozcan [31].

Table 8. Regression results for the impact of environmental, social, and governance information disclosure on relational capital efficiency.

ESG Dimensions		ESG Disclosure Intensity	
Intercept	0.648 *** (0.189)	Intercept	0.650 *** (0.190)
E	0.012 * (0.007)	ESGMax	0.017 ** (0.008)
S	−0.014 ** (0.006)	ESGMod	0.011 (0.008)
G	0.017 ** (0.008)	ESGMin	0.019 ** (0.009)
Size	−0.069 *** (0.026)	Size	−0.070 *** (0.026)
Leverage	−0.047 (0.048)	Leverage	−0.048 (0.044)
R-squared	0.0829	R-squared	0.0801
F-stat	3.87 ***	F-stat	3.52 ***
Group	104	Group	104
Observations	1040	Observations	1040
Hausman	$x^2(14)$ 32.63 *** Fixed effect	Hausman	$x^2(14)$ 40.05 *** Fixed effect
Breusch–Pagan LM	$x^2(1)$ 2281.72 *** GLS applied	Breusch–Pagan LM	$x^2(1)$ 2200.73 *** GLS applied
Year effect	Yes		Yes

Notes. * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$. F-stat results for regression model significance: ***, **, and * at the 1%, 5%, and 10% levels. Bootstrap standard errors are reported in parenthesis. E, S, and G: environmental, social, and governance (ESG) information disclosure; ESGMin, ESGMod, and ESGMax: disclosure of one, two, and three ESG dimensions; GLS: generalized least squares.

As for the effects of ESG disclosure intensity on RCE, the empirical estimates show that minimum and maximum disclosure is positively associated with RCE at the 5% significance level, suggesting that ESG disclosures improve corporate RCE performance. This finding is consistent with results for sustainability and IC reported by Mukherjee and Som [37], Branco and Lucia [41], and Arshad et al. [45]. Finally, we find that firm size has a significantly negative effect on RCE.

4.3. Robustness

The main purpose underpinning ESG information disclosure and IC efficiency management are to produce added value and ensure corporate survival [68,70]. Accordingly, we argue that profitability is an important mechanism through which ESG information disclosure intensity influences IC efficiency, and, therefore, investigate that relationship via profitability indicators, namely, net profit margin (NPM), earnings per share (EPS), and revenue growth (REVGRW) (See the Appendix A for specific details of computations).

Table 9 summarizes the interaction effect of ESG disclosure and profitability indicators on the VAIC, finding, without exception, that all interaction coefficients are statistically significant and positive. Those results suggest that firms with better ESG disclosure are more profitable and have greater IC efficiency.

The findings confirm the important role of ESG information disclosure in attracting quality human resources that would improve the financial performance of firms, and so attract investors, especially socially responsible investors who are likely to incorporate ESG information in developing and evaluating their portfolios. Consequently, financial markets may need to ensure greater efficiency to develop a system to reveal information on firms' socially responsible activities in a timely manner.

Table 9. Regression results for the impact on the value-added intellectual coefficient of environmental, social, and governance information disclosure interaction with profitability.

ESG Disclosure Intensity			
Intercept	4.683 (3.569)		
ESGMax*EPS	2.287 *** (0.813)	ESGMax * NPM	3.697 *** (0.623)
ESGMod*EPS	3.454 *** (1.064)	ESGMod * NPM	4.931 *** (0.696)
ESGMin*EPS	2.884 *** (1.197)	ESGMin * NPM	1.805 * (0.969)
Size	−0.195 (0.498)	ESGMax * REVGRW	0.003 *** (0.001)
Leverage	0.262 (0.793)	ESGMod * REVGRW	0.002 *** (0.000)
R-squared	0.0750	ESGMin * REVGRW	0.243 * 1 (0.145)
F-stat	1463.33 ***		
Group	104		
Observations	1040		
Hausman	x^2(20) 24.30 Random effect		
Breusch–Pagan LM	x^2(1) 1531.48 *** GLS applied		
Year effect	Yes		Yes

Notes. * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$. F-stat results for regression model significance: ***, **, and * at the 1%, 5%, and 10% levels. Bootstrap standard errors are reported in parenthesis. ESGMin, ESGMod, and ESGMax: disclosure of one, two, and three environmental, social, and governance (ESG) dimensions; NPM: net profit margin; EPS: earnings per share; REVGRW: revenue growth; GLS: generalized least squares.

Finally, in running our analysis at the sectoral level, we could confirm that ESG information disclosure is relevant to shaping IC efficiency. (For the sake of brevity, these results are not included but are available on request).

4.4. Result Implications

Our evidence highlights the importance of disclosing ESG information in increasing the value of intangible assets as measured by the IC, thereby enhancing the company's reputation and competitive edge, and increasing investor and stakeholder interest. We summarize the practical implications of our study as follows:

1. The study draws attention to the potential offered by corporate involvement in sustainability practices in improving IC efficiency, which, in turn, can improve added value and competitive edge, with the proviso that firms should adhere to low indebtedness in their capital structure.
2. ESG disclosure, especially for small companies, improves corporate RCE and therefore represents a better chance of survival, as it presents issues positively, by forward-forecasting, to current and potential investors and to other corporate stakeholders.
3. Given the negative impact of social information disclosure on SCE and RCE, to generate added value, management should align social practices with the firm's vision and strategic objectives, which requires reengineering engagement in social practices with an approach that reflects an added-value perspective.
4. Owing to ASE adoption in 2016 of the United Nations Sustainable Stock Exchanges (SSE) initiative, regulatory bodies in Jordan should legislate professional codes as a way to enforce sustainability (ESG) reporting for listed firms and include harsh sanctions for noncompliance, e.g., delisting. It is also recommended to extend board governance committees' authority and control over sustainability issues, since adherence is unlikely without the oversight of sustainability committees [17].
5. The Jordan Securities Commission could create corporate ratings to reflect adherence to ESG information reporting rules, with rankings available online for public scrutiny.
6. Empirical results suggest that firms that disclose ESG information are more profitable, and thus, have greater IC efficiency imply that disclosing information on ESG dimensions is advisable for firms to be able to attract investors and other stakeholders.
7. It is recommended that the Jordan Securities Commission authorizes third-party sustainability audits, to ensure credibility, secure the investment environment, and

attract international capital, since such audits would improve transparency for capital market stakeholders.

5. Conclusions

We have explored how voluntary information disclosure on the ESG dimensions of firms is associated with IC efficiency and with each of its components. For Jordanian listed firms, we have documented that governance information disclosure is associated with increased IC efficiency, and especially with the RCE and HCE components, that social information disclosure is negatively associated with decreased IC efficiency, mainly through the SCE and RCE components, and that information disclosure for the environmental dimension is not associated with IC efficiency, although it positively affects the SCE and RCE components. We also find that disclosing information on one or two dimensions of ESG has a positive effect on IC efficiency, mainly transmitted through the RCE and HCE components.

In relation to the limitations of this study, as with other empirical studies, the results may be affected by endogeneity problems. While this research used year and firm fixed-effects to control for unobservable confounding variables possibly differing over time and across industrial sectors, it was not possible to fully control for all other unobservable bias or omitted variables that could potentially influence the explanatory power and results of the regression model. Another limitation arises from the absence of clear standards for Jordanian firms disclosing ESG practices, as the information we use in our study was obtained from reports that mostly reflect each company's own narrative of ESG practices. A further possible limitation is in relation to the validity of the VAIC model to account for IC efficiency [63]; hence, future research could consider other models for measuring IC and IC efficiency.

As for future research, our study could be extended by considering other models of IC and ESG measurement, by including financial firms, by including additional control variables, and by drawing comparisons with different economies and settings through the use of a scoring method that tests the quality of ESG information disclosure and its relationship with intellectual capital, among others.

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Appendix A

This section describes diagnostic checks for the full study sample coupled with the related tables. In panel data with time series of more than 10 years, there is always the possibility of non-stationarity shocks that will affect the long-term equilibrium of the series [71]. Therefore, a Levin–Lin-Chu panel unit root test checks for data stationarity. Evidence from this test, reported in Table A1, indicates that all variables are stationary except for the dummy variables, which by their nature are not subject to diagnostic tests. This study is based on only 10 years, while there are only effects in panel series when the period is more than 10 years.

Table A1. Panel unit root test results for the whole sample.

Variables	Adjusted t-Stat	*p*-Value
ESGMax	16.356	1.000
ESGMod	13.250	1.000
ESGMin	17.654	1.000
E	12.051	1.000
S	10.864	1.000
G	11.756	1.000
VAIC	−11.596	0.000 ***
RCE	−9.739	0.000 ***
SCE	−11.690	0.000 ***
HCE	−13.355	0.000 ***
Leverage	−11.728	0.000 ***
SIZE	−28.197	0.000 ***

Notes. The Levin–Lin-Chu panel unit root test includes the adjusted t-statistic and *p*-value, and a significant *p*-value indicates that variables are stationary. Significance: *** at the 1%, 5%, and 10% levels. E, S, and G: environmental, social, and governance (ESG) information disclosure; ESGMin, ESGMod, and ESGMax: disclosure of one, two, and three ESG dimensions.

The results for the Wooldridge test for autocorrelation are reported in Table A2. Some models have autocorrelation and heteroskedasticity problem. However, to ensure valid statistical inference regarding problems of heteroskedasticity and autocorrelation in the models, cluster-robust standard errors are estimated, as this has the advantage that it produces heteroskedasticity-consistent standard errors that are robust and thus appropriate for balanced panel data.

Table A2. Autocorrelation and heteroskedasticity test.

		VAIC			SCE	
E S G	Wooldridge test autocorrelation	F (1103) = 6.801	0.011	E S G	F (1103) = 6.801	0.011
	Breusch–Pagan test heteroskedasticity	$x^2(1) = 24.97$	0.000		$x^2(1) = 50.78$	0.000
ESGMax ESGMod ESGMin	Wooldridge test autocorrelation	F (1103) = 1.031	0.312	ESGMax ESGMod ESGMin	F (1.103) = 1.031	0.312
	Breusch–Pagan test heteroskedasticity	$x^2(1) = 45.65$	0.000		$x^2(1) = 48.99$	0.000
		RCE			HCE	
E S G	Wooldridge test autocorrelation	F(1103) = 6.801	0.011	E S G	F (1103) = 6.801	0.011
	Breusch–Pagan test heteroskedasticity	$x^2(1) = 24.97$	0.000		$x^2(1) = 117.28$	0.000
ESGMax ESGMod ESGMin	Wooldridge test autocorrelation	F (1103) = 1.031	0.312	ESGMax ESGMod ESGMin	F (1103) = 1.031	0.312
	Breusch–Pagan test heteroskedasticity	$x^2(1) = 28.89$	0.000		$x^2(1) = 120.76$	0.000

Notes. Significant x^2 values in both the Wooldridge and Breusch Pagan tests indicate autocorrelation and heteroskedasticity problems treated by robust standard errors. E, S, and G: environmental, social, and governance (ESG) information disclosure; ESGMin, ESGMod, and ESGMax: disclosure of one, two, and three ESG dimensions; VAIC, value-added intellectual coefficient, composed of human, structural, and relational capital efficiency (HCE, SCE, and RCE).

Table A3. Definition and measurement of study variables.

Variable	Label and Measurement	Definition
Value added (VA)	VA = output-input VA = IN + HC + D + A + T + I IN = net income after tax HC = employee costs D = depreciation A = amortization T = taxes I = interests	Output refers to net revenues generated. Input refers to expenses incurred excluding employee benefits.
Relational capital (RC)	Total net tangible assets	Capital that enables HC and SC in creating added value [65]. It is capital employed equal to the book value of net total assets.
Human capital (HC)	All costs invested in employees	Knowledge owned by the staff. Refers to wages, salaries, bonuses, compensations, social security expenses, insurance, end of service benefits, and any other renumeration.
Structural capital (SC)	SC = VA − HC	Knowledge owned by the company. Excludes employees' costs from VA to determine the value added by structural elements
Relational capital efficiency (RCE)	RCE = VA/CE	RCE † coefficient describing the value-added created by each monetary unit spent on capital employed
Human capital efficiency (HCE)	HCE = VA/HC	HCE coefficient describing the value added generated by each monetary unit spent on HC
Structural capital efficiency (SCE) Intellectual capital efficiency (ICE) Value-added intellectual coefficient	SCE = SC/VA ICE = SCE + HCE	SCE coefficient describing the value added generated by structural capital efficiency ICE coefficient describing the value created by intangible asset efficiency
(VAIC) ††	VAIC = RCE + HCE + SCE	Overall value-added efficiency generated by intellectual coefficient proxied by IC. Higher VAIC represents greater efficiency in IC employed, and thus greater value generated to the firm [72].
Firm size (SIZE)	SIZE = (Log TA)	Firm size, to control for the effect of large and small firms on the regression model Calculated by taking the logarithm for total net assets (TA).
Financial leverage (LEV) Net profit margin (NPM) Earnings per share (EPS) Revenue growth (REVGRW)	LEV = (TD/TA) $NPM = \frac{Net\ Income}{Total\ Revenues}$ $EPS = \frac{Net\ income - preferred\ dividends}{Total\ outstanding\ common\ shares}$ REVGRW = current year sales − last year sales/last year sales × 100%	Company indebtedness, to control for the effect of firm debt on the regression model, considered a risk factor in our study Calculated by dividing total debt (TD) by total net assets. The net profit margin illustrates how much of each unit of revenue translates into profit. This ratio illustrates outstanding share profitability This ratio illustrates growth rates of sales

Notes. † RCE includes the efficiency that HCE and SCE fail to capture. Pulic [59] argues that IC cannot create value on its own, but must be combined with physical and financial capital [72]. †† VAIC includes the three individual efficiency components and their aggregation.

Finally, the Shapiro–Wilk's test provides evidence that some of the data are not normally distributed. As a result, evidence on Spearman's correlation is presented to show dependence among variables. Table A4 presents the Shapiro–Wilk's test and Spearman's correlation results. No evidence was found of high correlation between the explanatory variables except for VAIC with HCE and E with ESGMax. This not a problem, however, as the variables are not included in the same regression model. Results for multicollinearity analysis using the variance inflation factor (VIF) show no multicollinearity among variables except for ESGMax, ESGMod and ESGMin, but this is not problem because they are dummy variables and not subject to diagnostic tests. A VIF value of less than 2.5 reflects the robustness of the study model in explaining the effect on the dependent variable.

Table A4. Spearman correlation matrix/normality and multicollinearity test for the whole sample.

Variables	VAIC	RCE	SCE	HCE	E	S	G	ESGMax	ESGMod	ESGMin	SIZE	Leverage	VIF
VAIC	1.000												
RCE	0.215 *** 0.000	1.000											
SCE	0.693 *** 0.000	0.172 *** 0.000	1.000										
HCE	0.920 *** 0.000	0.273 *** 0.000	0.5464 *** 0.000	1.000									
E	0.022 0.477	0.104 *** 0.000	0.023 0.468	0.018 0.569	1.000								1.88
S	−0.001 0.972	0.053 * 0.089	−0.013 0.666	−0.001 0.977	0.676 *** 0.000	1.000							1.93
G	0.059 * 0.056	−0.056 * 0.073	0.018 0.571	0.050 0.106	0.250 *** 0.000	0.311 *** 0.000	1.000						1.11
ESGMax 100%	0.025 0.417	0.123 *** 0.000	−0.003 0.917	0.016 0.599	0.918 *** 0.000	0.750 *** 0.000	0.308 *** 0.000	1.000					4.86
ESGMod 67%	−0.030 0.329	−0.122 *** 0.000	0.021 0.509	−0.014 0.664	−0.320 *** 0.000	0.107 *** 0.001	0.015 0.624	−499 *** 0.000	1.000				3.85
ESGMin 33%	0.025 0.431	−0.081 *** 0.009	−0.003 0.936	0.016 0.608	−0.650 *** 0.000	−0.792 *** 0.000	0.115 *** 0.000	−602 *** 0.000	−0.232 *** 0.000	1.000			3.29
Size	0.262 *** 0.000	0.033 0.286	0.163 *** 0.000	0.273 *** 0.000	−0.079 *** 0.011	0.014 0.650	0.049 0.112	−0.053 0.081	0.063 ** 0.040	0.033 0.295	1.000		1.09
Leverage	−0.135 *** 0.000	0.169 *** 0.000	−0.188 *** 0.000	−0.136 *** 0.000	−0.038 0.223	−0.031 0.322	−0.042 0.181	−0.024 0.437	−0.28 0.364	0.033 0.291	0.144 *** 0.000	1.000	108
Shapiro–Wilk	0.000	0.000	0.000	0.000	0.999	0.535	0.000	1.000	0.000	0.001	0.000	0.000	

Notes. Spearman correlation is used due to the non-normal distribution of data for some variables. Variance inflation factor (VIF) values are within the acceptable statistical range. Significance: ***, **, and * at the 1%, 5%, and 10% levels. E, S, and G: environmental, social, and governance (ESG) information disclosure; ESGMin, ESGMod, and ESGMax: disclosure of one, two, and three ESG dimensions; VAIC, value-added intellectual coefficient, composed of human, structural, and relational capital efficiency (HCE, SCE, and RCE).

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