

## Article

# Analysis of Social Sustainability Information in a Global Context According to the New Global Reporting Initiative 400 Social Standards

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**Abstract:** Interest is increasing in what information companies disclose regarding the social aspects of their operations. This research therefore develops an index to analyze the social disclosure of companies from various countries and geographical regions including Latin America, Europe, Africa, Asia, and the United States. Using categorical principal component analysis and partial triadic analysis, we build a numerical value for a specific social individual index by firm. Then, we analyze the extent to which this disclosure follows the Global Reporting Initiative 400 social standards, which became effective on 1 July 2018. In addition to considering geographical aspects, we also analyze social disclosure based on industry, which facilitates firms' decision-making and policy formation in social disclosure.

**Keywords:** social disclosure index; social reporting indicators; consolidated GRI standards; international companies; statistical techniques

## 1. Introduction

Over the last decade, interest in companies' social disclosure has increased substantially. The United Nations Environmental Program [1] shows that the number of companies that released social information doubled between 2006 and 2013. Burrit [2] defines social disclosure as the qualitative and quantitative information that measures, calculates or estimates companies' social impact. Similarly, López-Arceiz et al. [3] refer to social disclosure as a way of measuring the social effect an organization has on its stakeholders: that is, social disclosure makes known nonfinancial data related to social issues. The Global Reporting Initiative (GRI) requirements categorize nonfinancial disclosure information as workforce, human rights, community, and product responsibility.

Essentially, the information disclosed in sustainability reports allows firms to confirm their attempts to adapt to the social and economic context in which they operate. As such, social information disclosure legitimizes firms' actions [4]. In fact, prior research suggests that this desire for legitimacy is the primary reason why firms reveal social information [5].

This study analyzes the social information provided by the Thomson Reuters Eikon database, which is one of the most important databases at the international level. We build a social index that reflects the information quality of companies from various countries and regions. Our index allows companies to increase transparency and to improve key social aspects of their operations. The index also boosts attention among researchers and the general public vis-à-vis the distribution of social

quality information, which is particularly relevant given that the Global Reporting Initiative (GRI) 400 became effective on 1 July 2018 [6]. The GRI guidelines were chosen because they represent the most widely recognized international standards that involve external reporting on social issues [7].

To build our social index, we use categorical principal component analysis (CATPCA) and partial triadic analysis (PTA) to analyze different types of social information. In addition, we use between-group analysis to determine whether a relation exists between the GRI 400 standards, industries, and geographical regions.

Our results show that companies in Asia, Africa, the Middle East, and Latin America are more likely to disclose information on public policy, customer health, diversity, and equal opportunities relative to companies. However, companies from the United States and Europe tend more to disclose information on human rights and the local community.

As regards social indicators and industries, and particularly in the pharmaceutical and chemical as well as metal and mining industries, companies in Asia and Latin America primarily focus on disclosure related to customer health as well as product and service safety throughout the different stages of the product life cycle. These results confirm that companies reveal information in order to evidence their ability to adapt to the needs of the social-economic context in which they operate, thus legitimizing their actions [4,5].

The remainder of the paper is structured as follows. Section 2 discusses previous works and limitations. Section 3 provides the research methods, sample description, and analysis technique. Section 4 presents the results of the empirical analysis in detail. Finally, Section 5 offers some conclusions and implications.

## 2. Previous Works and Limitations

Interest has recently grown not only in the academic world but also in the business environment with regard to corporate disclosure reports related to social policy goals [8]. The private sector is becoming increasingly aware of companies' social policies, and, more and more, governments are extending their policies and regulations in relation to social disclosure. As such, private and public goals are converging to motivate firms to increase disclosure of their social activities, which has a desirable effect on society at large.

Current interest from both companies and society in understanding firms' impact on society as a whole makes the topic of corporate social disclosures highly relevant. In recent years, companies have increasingly included social aspects of their operations in annual reports [9]. Firms voluntarily provide social information as an addendum to the compulsory accounting data they are required to report. Their motivation to disclose social information can stem both from a growing awareness of social policies in the business world and from demands by stakeholders and others to provide such information.

Deegan [5] argues that companies disclose social information in order to ensure public trust. Thus, in a desire to satisfy corporate stakeholders, firms are motivated to efficiently allocate resources. Choudhury [10] suggests that disclosing social information reduces information asymmetries that can lead to market failures and that it instills confidence in the market. Similarly, Iris and Chiu [11] find that when firms voluntarily disclose relevant social information about their business operations, they provide investors with important and otherwise inaccessible information. Given that the goal of social disclosure is to improve how others perceive the company, the most relevant theories in social disclosure are related to legitimacy and stakeholder interests, which are most commonly explained using a sociopolitical approach.

Suchman [12] defines legitimacy as "a generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions" (p. 574). Accordingly, companies carry out strategies, including the disclosure of financial reports, that allow them to gain, or maintain, legitimacy [5]. In other words, companies

undertake strategies that they deem necessary to build or preserve their image [7], based on public pressure related to the social and political environment [13].

Stakeholder theory accepts the existence of different interest groups that have differing ideas about what should be considered optimal company performance and that have diverse capacities to influence the organization's activity (Deegan, 5, p. 294). Different stakeholders take into account varying information regarding a company's relation to social aspects in their strategic decision-making [14,15]. Recently, stakeholders have increasingly been focusing on their relationships with firms not only with regard to the economic but also the social aspects of a firm's operations [16,17]. As a result, the social information a firm chooses to disclose (or not disclose) may influence stakeholders' decisions related to the firm.

According to legitimacy and stakeholder theories, firms therefore reveal social disclosures to protect their reputation and identity by engaging with stakeholders. Prior literature refers to this interaction as a form of moral discourse [18,19]. However, the social impact of a firm cuts both ways—whereas social action can have a positive impact on a firm's reputation, it can also have a negative effect if a firm's decisions on social issues are perceived negatively by stakeholders [15].

Using a range of different methodologies, several previous studies analyze the various social aspects which organizations disclose. Hogner [20] looked at US companies' social reports for several years and examined the variations between years. He found that changes in firms' social information disclosure are linked to variations in the social performance expectations of the community. Gray, Kouhy, and Lavers [21] used content analysis to study UK companies over 13 years and found that firms increasingly disclosed information related to employees and the community. Adams and Kuasirikum [22] conducted a comparative and longitudinal study of corporate reports on ethical issues of chemical and pharmaceutical firms in the United Kingdom and Germany from 1985 to 1995. They examined all types of ethical reports, including customer relations, product quality, public welfare activities, safety, and product policies, and found substantial differences in the nature and patterns of the reports over time and between the two countries.

Snider, Hill, and Martin [23] explored the legal, ethical, and moral aspects of Forbes magazine's top 50 US companies (e.g., Coca-Cola, General Motors, Microsoft Hewlett-Packard) and top 50 non-US companies (e.g., Toshiba, Fiat Group, Sony, HSBC Group). They found that both US and non-US firms focus their attention on a similar group of stakeholders and, in general, on similar social problems. The difference between US and non-US companies relates to the specificity of the messages concerning the firms' ultimate goals with variations evident in specific stakeholder categories such as customers, employees, shareholders, competitors, and society.

Gallego-Álvarez [24] focused on analyzing the social information disclosed by Spanish companies belonging to the Ibex-35, which includes the main Spanish companies in the stock market. He defines ethical behavior as a set of actions taken by a company to improve the quality of life of its workers as well as relevant employee social conditions such as employment, health and safety, training and education, nondiscrimination, disciplinary practices, and freedom of association. Archel, Husillos, Larrinaga, and Spence [25] also used a sample of Spanish firms to examine social disclosure in the automotive sector in the context of the relational dynamic between companies, society, and state. They found that companies used social disclosure to legitimize new production processes.

Gonçalves, Medeiros, Niyama, and Weffort [26] examined the social disclosure of 83 companies listed on the Sao Paulo Stock Mercantile (BM) and Futures Exchanges (FBovespa) from 2005 to 2009. They used a composite index of 13 indicators to evaluate companies' level of social disclosure. These indicators include a description of the objectives and goals for social programs, economic/financial value of the material resources allocated to social programs, economic/financial value of the human resources used in volunteer programs, and a description of the future social policies to be implemented by companies.

Chiu and Wang [27] analyzed social disclosure for a sample of 246 Taiwanese companies. They manually compiled social information, including information related to public policy, diversity, human

rights, employee relations, and philanthropy. Among other aspects, this information reported on the number of personnel involved in policy implementation, a stated human rights policy, employee benefits covered by insurance, the composition of the workforce by location, and philanthropy policies.

Sobhani, Amran, and Zainuddin [28] examined companies in Bangladesh. They found that customer health, as well as the health and safety of products and services at the different stages of the product life cycle, are the indicators most widely used by pharmaceutical and chemical as well as real state (banking and insurance) firms. Gallego-Álvarez, Formigoni, and Pompa-Antunez [29] provide similar results for Brazil. Companies located in the southeast region of the country, which accounts for more than half of the national production, including major factories and steel plants, place the greatest emphasis on social indicators related to customer health as well as public policy initiatives related to anti-corruption or anti-bribery practices.

Prior research has also examined social behavior based on the geographical region or country in which firms are located. Welford [30] analyzed the social practices and disclosures of firms for three geographical areas—Europe, North America, and Asia. He found that Asian companies have more policies on ethics, bribery, and corruption as well as health and safety than are found in developing countries in Africa and Latin America. Specifically, Malaysia and Singapore disclose a greater amount of relevant information on codes of conduct on ethics, bribery, and corruption. This is probably because they trade at high levels with other countries that are perceived as extremely corrupt. Using a combination of interviews and content analysis, Islam and Craig [31] examined the social reporting practices of a major export organization within a developing country such as Bangladesh. They found that the amount of information (measured in words) provided by companies on diversity increased from zero to 412 between 1987 and 2005. This increase is considerably high in relation to other social aspects such as child labor or other human resources.

Content analysis is one of the most frequently used methods in research on social disclosure. This analysis technique is based on searching for the presence or absence of information on a set of social topics. Other business aspects and broader contexts, such as region or location, can also be applied. Yong, Wenhao [32] and Natoli, Zuhair [33], among others, use content analysis to examine the social information made available by firms.

Previous literature also highlights that, although widely used, content analysis has certain limitations, particularly related to the finite number of social indicators considered by such studies. Studies have also noted the number of companies analyzed and single-country status as limitations [34]. To alleviate these concerns, researchers can employ other types of methods. For example, categorical and numerical variables can be used to identify positive or negative social aspects of social information in different companies belonging to several countries. These variables require special treatment.

Given this discussion, we construct our analysis in order to more accurately represent the real social situation, so as to include both positive and negative factors of companies around the world. Specifically, we use CATPCA [35] statistical techniques. Both techniques allow us to obtain a numerical value for each of the social factors from each of our sample firms. The final numerical value is the social index score, which is a linear combination of the values of the original numerical variables and the original categorical variables that are transformed into numerical variables. This index thus provides a global measurement of relevant social information worldwide.

We build the proposed index to create a common language for firms and stakeholders that allows for greater transparency and accountability between organizations. This new index allows us to expand the scope for measuring and analyzing social disclosure across both industry sector and country or geographical region. Using CATPCA and PTA allows us to deal with both categorical and numerical variables using publicly available information. The algorithm we develop from these methods can solve the missing values problem as well as problems related to combining the categorical and numerical variables published by firms and gathered in the databases. Because our index more closely reflects the actual situation of the social policies currently being carried out by companies in different countries and geographical areas, we open up a fresh avenue of research on social issues.

### 3. Research Methods

#### 3.1. Sample Description

We chose a sample of companies from various nations and geographical regions of the world, including Latin America, Europe, Africa, Asia, Oceania, Middle East, the Russian Federation, Canada, and the United States. Table 1 lists these geographical regions/countries and how many companies belong to each. Table 1 also classifies the companies by activity sector, such as materials, software, capital goods, healthcare equipment, consumer services, utilities, transportation, telecommunication, and diversified financials. In sum, our sample, obtained from the Thomson Reuters Eikon database, comprises 5412 companies from nine geographical regions and 22 activity sectors. We use the latest available information, which is data from 2016.

**Table 1.** Sample descriptive statistics.

<b>Panel A. Number of Companies by Region</b>	
Region	Number of Companies
Latin America	173
Europe	412
Africa	55
Asia	547
Oceania	77
Middle East	190
Russian Federation	27
Canada	451
United States	3480
<b>Panel B. Number of Companies by Sector</b>	
Sector	Number of Companies
Automobiles and Components	55
Capital Goods	435
Commercial and Professional Services	150
Consumer Durables and Apparel	166
Consumer Services	192
Diversified Financials	42
Energy	792
Food and Staples Retailing	45
Food, Beverage and Tobacco	255
Health Care Equipment and Services	286
Household and Personal Products	82
Materials	799
Media	135
Pharmaceuticals, Biotechnology and Life Sciences	445
Real State	14
Retailing	173

Table 1. Cont.

Semiconductors and Semiconductor Equipment	148
Software and Services	477
Technology Hardware and Equipment	294
Telecommunication Services	100
Transportation	156
Utilities	171

Each of the firms in the Thomson Reuters Eikon database provides social information on 159 variables dealing with different social aspects such as strikes, salary gap, product delays, daycare services, employee accidents, and human rights policy. We thus build an index comprising all 159 social variables. Table 2 provides details on the variables.

Table 2. Social indicators.

Indicator	Code	Indicator	Code
Health and Safety Policy	V001	Policy Community Involvement	V081
Policy Employee Health and Safety	V002	Improvement Tools Business Ethics	V082
Policy Supply Chain Health and Safety	V003	Whistleblower Protection	V083
Training and Development Policy	V004	OECD Guidelines for Multinational Enterprises	V084
Policy Skills Training	V005	Extractive Industries Transparency Initiative	V085
Policy Career Development	V006	Total Donations to Revenues USD	V086
Policy Diversity and Opportunity	V007	Donations Total	V087
Targets Diversity and Opportunity	V008	Community Lending and Investments	V088
Employees Health and Safety Team	V009	Political Contributions	V089
Health and Safety Training	V010	Lobbying Contribution Amount	V090
Supply Chain Health and Safety Training	V011	Employee Engagement Voluntary Work	V091
Supply Chain Health and Safety Improvements	V012	Corporate Responsibility Awards	V092
Employees Health and Safety OHSAS 18001	V013	Product Sales at Discount to Emerging Markets	V093
Employee Satisfaction	V014	Diseases of the Developing World	V094
Salary Gap	V015	Bribery, Corruption and Fraud Controversies	V095
Salaries and Wages from CSR reporting	V016	Intellectual Property Controversies	V096
Net Employment Creation	V017	Crisis Management Systems	V097
Number of Employees from CSR reporting	V018	Anti-competition Controversies	V098
Trade Union Representation	V019	Public Health Controversies	V099
Turnover of Employees	V020	Business Ethics Controversies	V100
Announced Layoffs to Total Employees	V021	Tax Fraud Controversies	V101
Announced Layoffs	V022	Anti-Competition Controversies Count	V102
Management Departures	V023	Critical Countries Controversies	V103
Strikes	V024	Recent Public Health Controversies	V104
Women Employees	V025	Recent Business Ethics Controversies	V105
New Women Employees	V026	Recent Tax Fraud Controversies	V106
Women Managers	V027	Recent Anti-Competition Controversy	V107

Table 2. Cont.

Indicator	Code	Indicator	Code
HRC Corporate Equality Index	V028	Recent Intellectual Property Controversies	V108
Flexible Working Hours	V029	Policy Customer Health and Safety	V109
Day Care Services	V030	Policy Data Privacy	V110
Employees with Disabilities	V031	Policy Responsible Marketing	V111
Employee Health and Safety Training Hours	V032	Policy Fair Trade	V112
Injuries to Million Hours	V033	Product Responsibility Monitoring	V113
Total Injury Rate Total	V034	Quality Mgt Systems	V114
Total Injury Rate Contractors	V035	ISO 9000	V115
Total Injury Rate Employees	V036	Six Sigma and Quality Mgt Systems	V116
Accidents Total	V037	QMS Certified Percent	V117
Contractor Accidents	V038	Customer Satisfaction	V118
Employee Accidents	V039	Product Access Low Price	V119
Occupational Diseases	V040	Healthy Food or Products	V120
Employee Fatalities	V041	Embryonic Stem Cell Research	V121
Contractor Fatalities	V042	Retailing Responsibility	V122
Lost Days to Total Days	V043	Alcohol	V123
Lost Time Injury Rate Total	V044	Alcohol Revenues	V124
Lost Time Injury Rate Contractors	V045	Alcohol 5% Revenues	V125
Lost Time Injury Rate Employees	V046	Gambling	V126
Lost Working Days	V047	Gambling Revenues	V127
Employee Lost Working Days	V048	Gambling 5% Revenues	V128
Contractor Lost Working Days	V049	Tobacco	V129
HIV-AIDS Program	V050	Tobacco Revenues	V130
Average Training Hours	V051	Tobacco 5% Revenues	V131
Training Hours Total	V052	Armaments	V132
Training Costs Total	V053	Armaments Revenues	V133
Training Costs Per Employee	V054	Armaments 5% Revenues	V134
Internal Promotion	V055	Nuclear 5% Revenues	V135
Management Training	V056	Pornography	V136
Supplier ESG training	V057	Contraceptives	V137
Wages Working Condition Controversies	V058	Obesity Risk	V138
Wages Working Condition Controversies Count	V059	Cluster Bombs	V139
Diversity and Opportunity Controversies	V060	Anti-Personal Landmines	V140
Employees Health and Safety Controversies	V061	Abortifacients	V141
Recent Wages Working Condition Controversies	V062	Consumer Complaints Controversies	V142
Recent Diversity Opportunity Controversies	V063	Product Quality Controversies	V143
Recent Employee Health and Safety Controversies	V064	Responsible Marketing Controversies	V144
Human Rights Policy	V065	Drug Delay	V145



Table 2. Cont.

Indicator	Code	Indicator	Code
Policy Freedom of Association	V066	Consumer Complaints Controversies Count	V146
Policy Child Labor	V067	Controversies Customer Health and Safety	V147
Policy Forced Labor	V068	Controversies Responsible R&D	V148
Policy Human Rights	V069	Controversies Privacy	V149
Fundamental Human Rights ILO UN	V070	Controversies Responsible Marketing	V150
Human Rights Contractor	V071	FDA Warning Letters	V151
Ethical Trading Initiative ETI	V072	Product Delays	V152
Human Rights Breaches Contractor	V073	Product Recall	V153
Human Rights Controversies	V074	Recent Consumer Controversies	V154
Freedom of Association Controversies	V075	Recent Customer Health and Safety Controversies	V155
Child Labor Controversies	V076	Recent Privacy Controversies	V156
Recent Human Rights Controversies	V077	Recent Responsible Marketing Controversies	V157
Policy Fair Competition	V078	Recent Product Access Controversies	V158
Policy Bribery and Corruption	V079	Recent FDA Warning Letters	V159
Policy Business Ethics	V080		

Before constructing our index, we must address three principal problems. First, some of the indicators are presented as TRUE/FALSE; that is, these indicators are categorical rather than numerical. Therefore, we must employ a statistical method to transform them into numerical data. Specifically, we use CATPCA, which is discussed in greater detail in Section 3.2.1, to transform the categorical data into numerical form by assigning the numerical value of 1 and  $-1$  to TRUE and FALSE, respectively.

Second, as is a recurrent problem in this kind of research, we suffer from an insufficient amount of data given that most companies do not report information on several indicators. In other words, many reports contain missing values (NULL). However, CATPCA does not treat values as irrelevant but instead assigns a numerical value to all NULL elements. These NULL values, based on the CATPCA, indicate when companies do not reveal certain information. Specifically, we assign all NULL elements a weight of zero in the index, which allows us to sidestep a frequent problem in similar investigations.

Finally, we must address the differences in meanings among the indicators. Some indicators report information in a positive form whereas other indicators are reported in the negative form. For example, an answer high on the scale to the question “Does the company claim to favor promotion from within?” reflects positively on social behavior, whereas an answer high on the scale to the prompt “Number of controversies published in the media linked to workforce diversity and opportunity (e.g., wages, promotion, discrimination and harassment)” reflects negatively on social behavior, given that a greater amount of controversies is not a favorable attribute. To alleviate this problem, we change the signs in all the indicators that have a negative character in order to homogenize all the indicators.

### 3.2. Analysis Technique

#### 3.2.1. Categorical Principal Component Analysis

As previously discussed, some indicators available in our database are categorical (i.e., TRUE, FALSE, NULL), so we cannot perform a direct statistical analysis. We could simply rewrite the TRUE, FALSE, and NULL answers as 0, 1, and  $-1$ , respectively, and then conduct the appropriate statistical analysis. However, the randomness of the 0, 1, and  $-1$  decisions are seemingly quite random. For example, why is the distance between NULL and TRUE the same as the distance between NULL



and FALSE? We solve this dilemma using CATPCA, which allows us to assign objective numerical values to those answers, no matter how they are defined.

CATPCA, proposed by Gifi (1990), applies to a data set with  $I$  rows (the individuals) and  $J$  columns (the categorical variables) codified by integer numbers, called the  $X$  matrix. Every variable has a different number of categories, namely,  $b_j$  for  $j = 1, \dots, J$ . For example, if the first variable has three categories,  $b_1 = 3$ . Thus, CATPCA is suitable for our sample database comprising a sequence of categorical variables placed by columns and different subjects from which we take values for these variables—in our case, 159 social indicators and 5412 companies.

The first step before performing the CATPCA algorithm is to codify the categorical results as numbers. For example, if one variable has three different categories, we codify them as 1, 2, and 3. For our analysis, we use 1~NULL, 2~TRUE, and 3~FALSE, but any other combination (such as 0, 1, and -1, as we tried to define in the previous section) leads to the same result after the finalization of the CATPCA algorithm, although the simplest 1,2,3 combination is preferred on the algorithm. Thus, we use CATPCA to transform the categorical variables into numerical variables. That is, we obtain a sequence of column vectors  $v_j$  for  $j = 1, \dots, J$  with length  $b_j$ , as the scores for the categories of each one of the variables.

We use the class indicator matrices for every variable, namely,  $B_j$  for  $j = 1, \dots, J$ , where  $B_j$  has  $I$  rows and  $b_j$  columns:

$$\begin{cases} (B_j)_{ib} = 1 \text{ if } X_{ij} = b \\ (B_j)_{ib} = 0 \text{ if } X_{ij} \neq b \end{cases} \quad (1)$$

where  $b = 1, \dots, b_j$ , and  $D_j$  is the diagonal matrices with the number of individuals that belong to each one of the categories for each one of the variables. For example, if the first variable has three categories, and 2, 3, and 5 individuals belong to each category, respectively, the diagonal matrix is

$$D_1 = \begin{pmatrix} 2 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 5 \end{pmatrix}. \quad (2)$$

Moreover, we need an additional column vector  $u$  with length  $I$ . This vector is just for the algorithm of the CATPCA method and is useful to obtain some measures of the reliability of the results.

Let us state the problem we want to solve from the mathematical point of view:

We want to minimize the function  $F$ ,

$$F(v_j, u) = \frac{1}{I} \sum_{j=1}^J (u - B_j v_j)^t (u - B_j v_j). \quad (3)$$

We solve the problem by performing the following iterative algorithm, where  $v_j^n$  and  $u^n$  are defined as the vectors in the  $n$ th iteration of the algorithm.

- 1 We choose at random the vector  $u^0$ , with  $u^0$  centered and standardized; that is, its mean and standard deviation have values of zero and 1, respectively;
- 2 Iteration step,  $n = 1, \dots$ 
  - (a) For  $j = 1, \dots, J$ , we recalculate (or calculate, if  $n = 1$ )  $v_j^n = D_j^{-1} B_j^t u^{n-1}$ ;
  - (b) We define  $u^*$  as  $u^* = \sum_{j=1}^J B_j v_j^n$ ;
  - (c)  $u^n$  is calculated as  $u^*$  after centering and standardizing;
  - (d) If the absolute difference between  $F(v_j^{n-1}, u^{n-1})$  and  $F(v_j^n, u^n)$  is lower than an initial established value, this iteration step is stopped; we define  $F(v_j^0, u^0) = 0$  by convention.
- 3 The vectors  $v_j$  and  $u$  are defined as ones obtained after the  $n$ th iteration,  $v_j = v_j^n$ ,  $u = u^n$ ;

- 4  $v_j$  and  $u$  are rotated so they achieve the principal axes orientation. This step is necessary because a wide range of different solutions can be obtained depending on the choice of the initial  $u^0$ , but all of them will be the same up to rotations.

Now, we can calculate the percentage of the explained variance, a measure of the reliability of the results, as

$$VAR = \frac{\|u^*\|}{J \sqrt{I}} \cdot 100, \quad (4)$$

where  $u^*$  is the vector obtained in Step 2.b in the last iteration. We can also use Cronbach's Alpha as another measure of the reliability of the results, computed as

$$\alpha = \frac{J}{J-1} \left( 1 - \frac{\sqrt{I}}{\|u^*\|} \right). \quad (5)$$

So, we obtain a sequence of vectors  $v_j$  with the numerical transformations of the original categories for each one of the variables. We can then calculate the new data matrix with as many rows and columns as  $X$  with the only difference that now the data are numerical instead of categorical. We can name this matrix as  $X$ .

$$X_{ij} = (B_j v_j)_i \quad (6)$$

for  $I = 1, \dots, I$  and  $j = 1, \dots, J$ .

### 3.2.2. Partial Triadic Analysis

Because our data consist of a collection of variables, some categorical and other numerical, we have already performed the CATPCA analysis to the categorical ones in order to transform them into numerical, and only then do we join all the numerical variables (the original numerical ones and the categorical ones transformed into numerical values) before reducing the dimensionality. Consequently, we include all numerical variables in one matrix, which we again name  $X$ , with the same  $I$  rows but as many columns as the  $J$  categorical variables transformed into numerical form (the ones that have been obtained after the CATPCA) plus the original numerical variables (the ones not used on the CATPCA). Thus, our input is matrix  $X$  with  $I$  rows and  $J$  numerical variables (all of them numerical now).

Now, we can reduce the dimensionality of matrix  $X$  to only one column (i.e., a one-dimensional vector) to create our final index. We then use PTA to evaluate the vectors using a linear combination of all the columns of  $X$  and the scores of a vector  $\omega = (\omega_1, \dots, \omega_J)$  as the "weights" (i.e., coefficients) in each column. The algorithm to find this vector uses the following steps:

- 1 We center and standardize  $X$  by columns;
- 2 We compute the variances–covariances matrix,  $Covv$ , for each pair of columns as

$$Covv_{j_1 j_2} = \frac{1}{I} \sum_{i=1}^I X_{ij_1} X_{ij_2}, \quad (7)$$

where  $j_1$  and  $j_2$  go from 1 to  $J$ .

We perform the eigendecomposition for,  $\frac{1}{J} Covv$  after which we obtain  $V$  as the eigenvectors. Then, we recalculate the first one as its absolute value (to avoid a result in different symmetrical solutions) and obtain  $\omega$  as

$$\omega_j = \frac{V_{j1}}{\sum_{j=1}^J V_{j1}}. \quad (8)$$

Finally, we can obtain the “compromise” (average column)  $X_c$ , as the linear combination with weights  $\omega$ .

$$X_c = \sum_{j=1}^J X_{ij}\omega_j \quad (9)$$

We can plot a graphic, called an interstructure, to examine the similarity between the compromise vector and all columns of  $X_e$ . Specifically, we consider the obtained weights by means of the vectors, their angles, and their lengths: the higher a variable’s weight is, the nearer to the positive horizontal axis it is placed and the longer its vector is. So, on the one hand, long vectors close to the positive horizontal axis belong to variables that are more similar to the compromise: They have contributed more to build the compromise, and their weights are the highest. On the other hand, short vectors, or vectors close to the vertical axis, are less important and less associated with the compromise. Long vectors close to the negative horizontal axis are conversely important. These variables are inversely proportional to the compromise: Values over the average in these variables related to value under the average in the compromise.

By conducting CATPCA and PTA calculations, as previously discussed, we obtain an index that allots a numerical value for each row of the original matrix—5412 companies. This index is built as a linear combination of the values for each organization of all the first numeric indicators and of the first categorical indicators changed into numeric quantities.

We can suppose that this index follows a normal distribution with  $-1.1181 \times 10^{-11}$  and standard deviation 0.4491. Therefore, we can assume that our index obeys a normal distribution with a mean of zero and the deviation  $\sigma = 0.4491$ . Using this index, we can clarify what the obtained values for each company can tell us. If the index for one company is close to zero (i.e., the mean), the company’s social behavior falls, overall, in the average. If the index is nearer to  $\sigma$  or  $-\sigma$ , the company’s social behavior diverges from the average, above or below, respectively, not more than  $\sigma$ . This result is always accomplished for 68% of the sample companies. If the value is  $2\sigma$  above or  $-2\sigma$  below the average, the company’s social rating differs from the average more than 2 standard deviations, which means that these companies are distinguished for their substantially higher or lower rating.

Let us examine the normal distribution of the index by mean of an example: if the index value for a company is 0.69, and if in a standard normal distribution  $Z = 0.69/\sigma = 1.5364$ , the value is 0.9378, where this value denotes the area to the left of the Z score; that is, 93.78% of the companies in our sample engage in less socially positive behavior than this company. In other words, only 6.22% of the companies have a higher social rating, and thus this company differentiates itself by its exceptional actions regarding the social indicators.

In this manner, we construct an index that quantifies the performance of corporate social behavior for a global representative sampling of companies from the Thomson Reuters Eikon database. The worldwide nature of our sampling is essential because companies cannot be evaluated in isolation; rather, their social behavior is viewed in relation to their peers in similar industries and similar regions, based on the expectations of the society in which they operate. Our index allows us to compare companies’ social behavior relative to their industry and location, giving managers additional tools to assess and, if necessary, alter about their social activities.

### 3.2.3. Between-Group Analysis

The companies, represented by rows, belong to different geographic regions or sectors. The social indicators, represented by columns, assess different aspects of the GRI standard (e.g., employment, occupational health and safety, diversity and equal opportunities, human rights, public policy, marketing or customer privacy, etc.). To establish relations between these regions or sectors and the GRI standards, we perform a between-group analysis. This method allows us to represent graphically the average values of the companies from each group against the GRI standards.

To run the between-group analysis, let us suppose our numeric data are collected in matrix  $X$  with  $I$  rows and  $J$  columns where the rows belong to  $M$  different groups  $G_1, \dots, G_M$  with sizes  $M_1, \dots, M_M$  and the columns belong to different  $N$  groups  $H_1, \dots, H_N$  with sizes  $N_1, \dots, N_N$ , with  $M$  and  $N$  lower than  $I$  and  $J$ , respectively. From these groups we build another matrix,  $X_B$ , with the group averages

$$(X_B)_{mn} = \frac{1}{M_m N_n} \sum_{i \in G_m} \sum_{j \in H_n} x_{ij}. \quad (10)$$

As such, the between-group analysis for  $X$  is the principal component analysis (Gabriel, 1971) for  $X_B$ .

#### 4. Results

Table 3 provides the results by companies based on five subgroups: categorical positive variables, numerical positive variables, categorical negative variables, numerical negative variables, and low contribution variables. The second and third columns, respectively, indicate whether the variable was originally a categorical indicator and/or stated in the negative form. As previously discussed, a higher value or an affirmative answer to a negative indicator suggests a negative response that does not support social conduct. For instance, variable V023—management departures—is assessed negatively with the question “Has an important executive management team member or a key team member announced a voluntary departure (other than for retirement) or has been ousted?” In this case, a negative answer supports positive social behavior. This variable is also a categorical indicator because only two answers, yes or no, are possible.

**Table 3.** Variables and weights for the proposed index.

	Variables	c	n	Weight
<b>Group 1: Categorical Positive Variables</b>				
V109	Policy Customer Health and Safety	x		0.0134
V071	Human Rights Contractor	x		0.0134
V057	Supplier ESG training	x		0.0134
V003	Policy Supply Chain Health and Safety	x		0.0134
V073	Human Rights Breaches Contractor	x		0.0134
V067	Policy Child Labor	x		0.0134
V068	Policy Forced Labor	x		0.0134
V111	Policy Responsible Marketing	x		0.0134
V113	Product Responsibility Monitoring	x		0.0134
V120	Healthy Food or Products	x		0.0134
V011	Supply Chain Health and Safety Training	x		0.0134
V082	Improvement Tools Business Ethics	x		0.0134
V030	Day Care Services	x		0.0134
V029	Flexible Working Hours	x		0.0134
V091	Employee Engagement Voluntary Work	x		0.0134
V080	Policy Business Ethics	x		0.0134
V093	Product Sales at Discount to Emerging Markets	x		0.0134
V078	Policy Fair Competition	x		0.0134
V110	Policy Data Privacy	x		0.0134
V121	Embryonic Stem Cell Research	x		0.0134

Table 3. Cont.

	Variables	c	n	Weight
V138	Obesity Risk	x		0.0134
V119	Product Access Low Price	x		0.0134
V050	HIV-AIDS Program	x		0.0134
V079	Policy Bribery and Corruption	x		0.0134
V056	Management Training	x		0.0134
V065	Human Rights Policy	x		0.0134
V116	Six Sigma and Quality Mgt Systems	x		0.0134
V070	Fundamental Human Rights ILO UN	x		0.0134
V122	Retailing Responsibility	x		0.0134
V069	Policy Human Rights	x		0.0134
V066	Policy Freedom of Association	x		0.0134
V007	Policy Diversity and Opportunity	x		0.0134
V081	Policy Community Involvement	x		0.0134
V055	Internal Promotion	x		0.0134
V004	Training and Development Policy	x		0.0134
V112	Policy Fair Trade	x		0.0134
V084	OECD Guidelines for Multinational Enterprises	x		0.0134
V072	Ethical Trading Initiative ETI	x		0.0134
V006	Policy Career Development	x		0.0134
V097	Crisis Management Systems	x		0.0134
V114	Quality Mgt Systems	x		0.0134
V115	ISO 9000	x		0.0134
V085	Extractive Industries Transparency Initiative	x		0.0134
V005	Policy Skills Training	x		0.0134
V009	Employees Health and Safety Team	x		0.0134
V002	Policy Employee Health and Safety	x		0.0134
V001	Health and Safety Policy	x		0.0134
V013	Employees Health and Safety OHSAS 18001	x		0.0134
V010	Health and Safety Training	x		0.0134
V092	Corporate Responsibility Awards	x		0.0134
V083	Whistleblower Protection	x		0.0128
Total				0.6806
<b>Group 2: Other Positive Variables</b>				
V028	HRC Corporate Equality Index			0.0045
V018	Number of Employees from CSR reporting			0.0020
V090	Lobbying Contribution Amount			0.0020
Total				0.0085

Table 3. Cont.

	Variables	c	n	Weight
<b>Group 3: Categorical Negative Variables</b>				
V143	Product Quality Controversies	x	x	0.0134
V153	Product Recall	x	x	0.0134
V098	Anti-competition Controversies	x	x	0.0134
V095	Bribery, Corruption and Fraud Controversies	x	x	0.0134
V142	Consumer Complaints Controversies	x	x	0.0134
V094	Diseases of the Developing World	x	x	0.0134
V137	Contraceptives	x	x	0.0134
V058	Wages Working Condition Controversies	x	x	0.0134
V123	Alcohol	x	x	0.0134
V126	Gambling	x	x	0.0134
V024	Strikes	x	x	0.0134
V136	Pornography	x	x	0.0134
V129	Tobacco	x	x	0.0134
V023	Management Departures	x	x	0.0134
V139	Cluster Bombs	x	x	0.0134
V132	Armaments	x	x	0.0134
V140	Anti-Personal Landmines	x	x	0.0134
V144	Responsible Marketing Controversies	x	x	0.0075
Total				0.2346
<b>Group 4: Other Negative Variables</b>				
V107	Recent Anti-Competition Controversy		x	0.0019
V102	Anti-Competition Controversies Count		x	0.0019
V100	Business Ethics Controversies		x	0.0019
V059	Wages Working Condition Controversies Count		x	0.0017
V155	Recent Customer Health and Safety Controversies		x	0.0015
V154	Recent Consumer Controversies		x	0.0012
V146	Consumer Complaints Controversies Count		x	0.0012
V062	Recent Wages Working Condition Controversies		x	0.0011
V104	Recent Public Health Controversies		x	0.0010
V096	Intellectual Property Controversies		x	0.0010
V101	Tax Fraud Controversies		x	0.0008
Total				0.0152
<b>Group 5: Low Contribution Variables</b>				
V019	Trade Union Representation			0.0024
V008	Targets Diversity and Opportunity	x		0.0021
V014	Employee Satisfaction			0.0019
V134	Armaments 5% Revenues	x	x	0.0018
V051	Average Training Hours			0.0016
V025	Women Employees			0.0016



Table 3. Cont.

	Variables	c	n	Weight
V026	New Women Employees			0.0014
V022	Announced Layoffs		x	0.0014
V016	Salaries and Wages from CSR reporting			0.0013
V020	Turnover of Employees		x	0.0013
V147	Controversies Customer Health and Safety		x	0.0013
V012	Supply Chain Health and Safety Improvements	x		0.0013
V089	Political Contributions			0.0013
V042	Contractor Fatalities		x	0.0013
V103	Critical Countries		x	0.0012
V108	Recent Intellectual Property Controversies		x	0.0012
V156	Recent Privacy Controversies		x	0.0012
V135	Nuclear 5% Revenues	x	x	0.0012
V041	Employee Fatalities		x	0.0012
V061	Employees Health and Safety Controversies		x	0.0011
V044	Lost Time Injury Rate Total		x	0.0011
V149	Controversies Privacy		x	0.0011
V063	Recent Diversity Opportunity Controversies		x	0.0011
V027	Women Managers			0.0011
V043	Lost Days to Total Days		x	0.0011
V117	QMS Certified Percent			0.0010
V060	Diversity and Opportunity Controversies		x	0.0010
V128	Gambling 5% Revenues	x	x	0.0010
V099	Public Health Controversies		x	0.0009
V038	Contractor Accidents		x	0.0009
V157	Recent Responsible Marketing Controversies		x	0.0009
V106	Recent Tax Fraud Controversies		x	0.0008
V150	Controversies Responsible Marketing		x	0.0008
V133	Armaments Revenues		x	0.0008
V046	Lost Time Injury Rate Employees		x	0.0008
V125	Alcohol 5% Revenues	x	x	0.0007
V033	Injuries to Million Hours		x	0.0007
V037	Accidents Total		x	0.0007
V039	Employee Accidents		x	0.0007
V127	Gambling Revenues		x	0.0007
V034	Total Injury Rate Total		x	0.0007
V131	Tobacco 5% Revenues	x	x	0.0006
V064	Recent Employee Health and Safety Controversies		x	0.0006

Table 3. Cont.

	Variables	c	n	Weight
V053	Training Costs Total			0.0006
V151	FDA Warning Letters		x	0.0006
V048	Employee Lost Working Days		x	0.0006
V015	Salary Gap			0.0006
V047	Lost Working Days		x	0.0005
V130	Tobacco Revenues		x	0.0005
V074	Human Rights Controversies		x	0.0005
V036	Total Injury Rate Employees		x	0.0005
V040	Occupational Diseases		x	0.0005
V152	Product Delays		x	0.0004
V035	Total Injury Rate Contractors		x	0.0004
V031	Employees with Disabilities			0.0004
V124	Alcohol Revenues		x	0.0004
V075	Freedom of Association Controversies		x	0.0004
V159	Recent FDA Warning Letters		x	0.0004
V141	Abortifacients	x	x	0.0004
V021	Announced Layoffs to Total Employees		x	0.0004
V052	Training Hours Total			0.0003
V086	Total Donations to Revenues USD			0.0003
V105	Recent Business Ethics Controversies		x	0.0003
V087	Donations Total			0.0003
V148	Controversies Responsible R&D		x	0.0003
V158	Recent Product Access Controversies		x	0.0003
V032	Employee Health and Safety Training Hours			0.0003
V077	Recent Human Rights Controversies		x	0.0003
V145	Drug Delay		x	0.0003
V088	Community Lending and Investments			0.0003
V118	Customer Satisfaction			0.0003
V054	Training Costs Per Employee			0.0003
V045	Lost Time Injury Rate Contractors		x	0.0002
V049	Contractor Lost Working Days		x	0.0002
V076	Child Labor Controversies		x	0.0002
V017	Net Employment Creation			0.0001
Total				0.0611

The fourth column of Table 3 provides the weight of each indicator. Given the large number of indicators, we use these weights as the coefficients to construct an average of all the indicators. Thus, the greater a variable's weight in the index the more the variable contributes to it. For example, V023—in subgroup 4, categorical negative variables—has a weight of 1.34%. In other words, this indicator provides 1.34% of the total information for the entire index, or 1.34% of the average of all the indicators.

According to Table 3, subgroup 1, categorical positive variables, has the greatest weight in the index. This finding shows that these indicators, which account for 68.06% of the total index weight, are the most relevant because they provide the most information. Subgroup 2, numerical positive indicators, accounts for 0.85% of the index's weight. Subgroups 3 and 4 provide the weights of categorical negative and numerical negative variables, respectively. Categorical negative variables account for 23.46% of the index's weight, and numerical negative variables account for 1.52% of the index's weight. These findings once again suggest that the categorical variables are more relevant to the index than the numerical indicators. Finally, subgroup 6, low contribution variables, includes all other variables—both categorical and numerical and/or positive and negative—that do provide non-significant information to the index. This subgroup adds 6.11% to the weight of the index.

To confirm our results of the CATPCA and PTA calculations, we create an interstructure that demonstrates the relations between the indicators and the proposed index. Figure 1 plots our findings, and Figures 2 and 3 provide more detailed graphing of Figure 1 for clarity. In this plot, the positive horizontal semi-axis represents our index. Consequently, the closer an indicator is located to that semi-axis, the more weight it gives to the index.

As previously mentioned, we interpret the construction of the index with this interstructure plot based on the length and angle of the vectors that symbolize the different indicators. Because the index is a weighted average of all the indicators, some indicators provide more information than others in the construction of the index, depending on the similarity and diversity between them. In the plot, both axes are used to portray that amount of information; they do not have a unit of measurement. However, the positive horizontal semi-axis is a representation of the index, so the closer an indicator's vector is to that semi-axis and the longer it is, the more weight it provides to the average when the index is constructed.

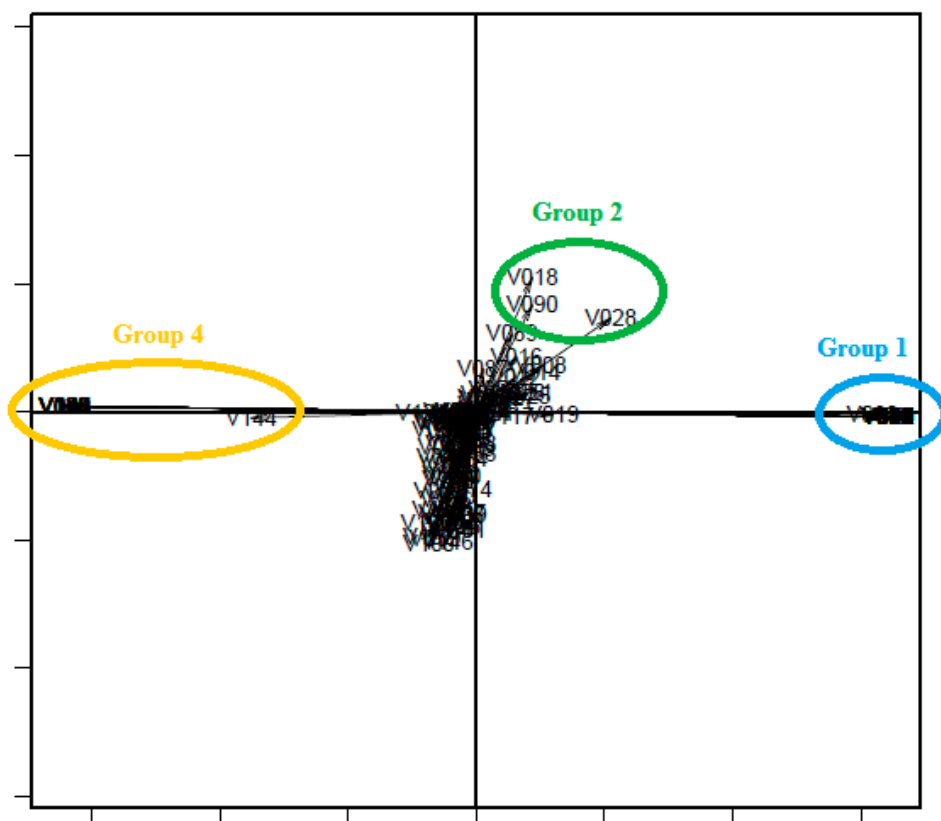


Figure 1. Plot with the interstructure for the variables.

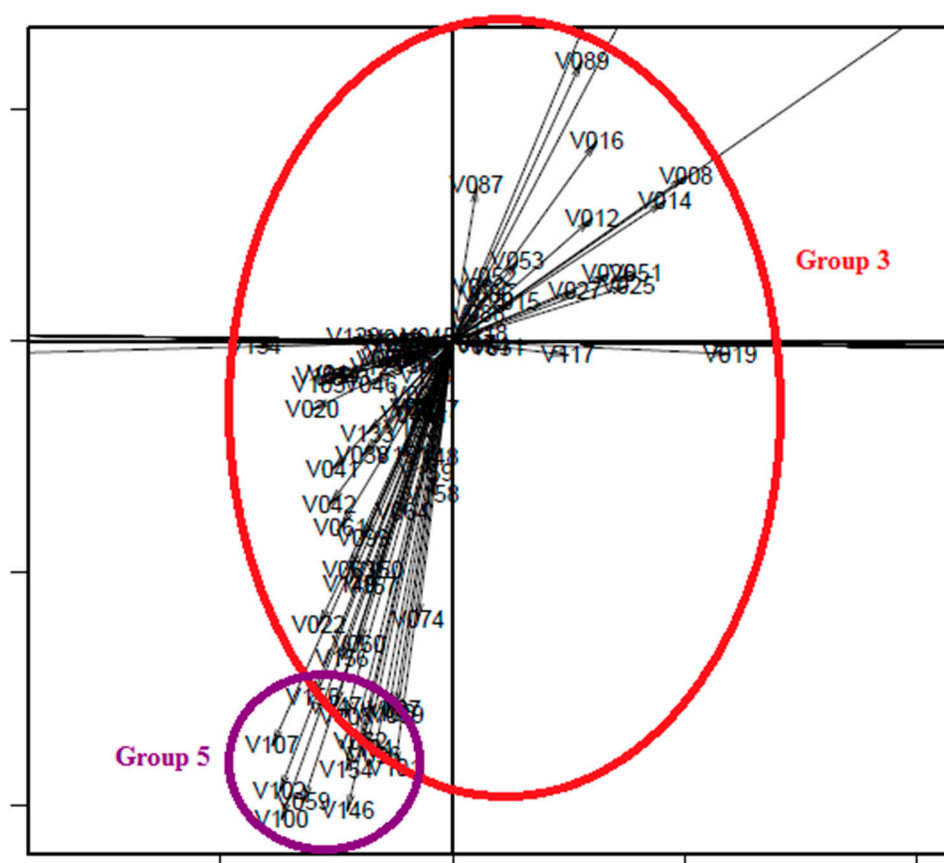


Figure 2. Detailed central part of Figure 1.

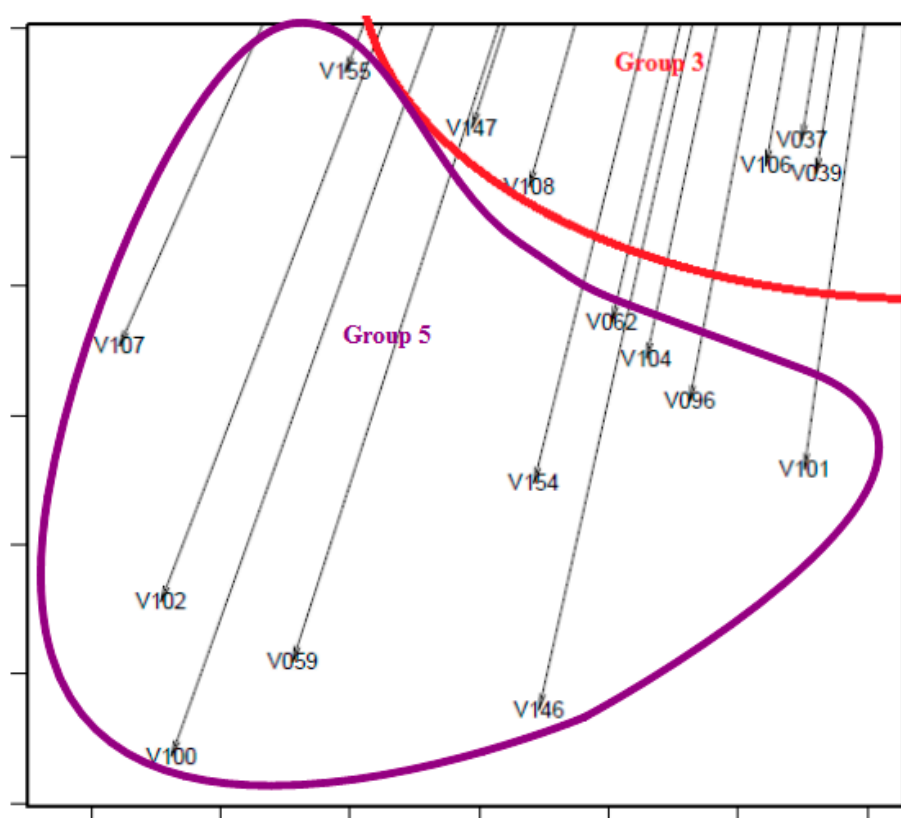


Figure 3. Detail of Figure 1, differentiating subgroups 3 and 5.

In line with Table 3, the weight of each subgroup matches its placements on the interstructure plot. Accordingly, the vectors of subgroup 1, categorical positive indicators, which contribute the greatest weight to the index's construction (68.06%), are located very close to the positive horizontal semi-axis and have the longest vectors. Similarly, vectors subgroup 3, categorical negative indicators, which contribute the second-highest weight to the index (23.46%), are very long and located close to the horizontal semi-axis, but on the negative side of the semi-axis. Because subgroups 2, 4, and 5 do not contribute as much weight (0.85%, 6.11%, and 1.52%, respectively) to the index as subgroups 1 and 3, their vectors are shorter vectors and/or are not very close to the horizontal semi-axis. Subgroup 4 appears on the left side of the plot because its indicators are in the negative form. Subgroup 5 vectors appear furthest from the horizontal semi-axis that represents the index because the information provided by these indicators is very poor and thus not significant to the construction of the index.

To confirm the strength of the cluster classification, we perform a discriminant analysis to determine whether we effectively characterize the clusters. Table 4 shows that 153 out of the 159 indicators retain the initial classification. All the variables in subgroups 1, 2, and 5 stay in their respective groups as per the discriminant analysis. One of the 11 variables in subgroup 3 together with five of the 76 variables in subgroup 4 do not align with the findings of the initial analysis. Consequently, 96.2264% of the initially grouped indicators are accurately arranged. This finding thus provides strong support for our results from the CATPCA and PTA.

Moreover, we also performed discriminant analysis in order to check the classification for the countries into regions. Table 5 shows that 64.7% of all the companies are accurately arranged.

**Table 4.** Results of the classification.

Original Group	Predicted Membership Group					Total
	1	2	3	4	5	
1	51	0	0	0	0	51
2	0	3	0	0	0	3
3	0	0	71	0	5	76
4	0	0	0	18	0	18
5	0	0	1	0	10	11

**Table 5.** Results of the classification for the countries.

Original Group	Predicted Membership Group									Total
	1	2	3	4	5	6	7	8	9	
1	6	3	0	0	6	0	2	0	127	144
2	1	22	0	0	8	0	11	5	269	316
3	0	0	0	0	0	0	0	0	44	44
4	0	2	0	2	4	0	4	3	412	427
5	0	2	0	0	13	0	1	0	45	61
6	1	2	0	0	2	0	2	0	140	147
7	0	0	0	0	0	0	9	0	17	26
8	1	3	0	0	4	0	0	19	273	300
9	3	22	0	0	26	0	15	8	2618	2692

We then conducted a between-group analysis to analyze the relation of geographical areas and activity sectors with the GRI indicators. This data matrix includes rows or columns (or both) that belong to different groups. Therefore, we run the between-group analysis on the 5412 sample companies (in rows) and the 159 social indicators (in columns); that is, we use our original matrix with all the variables transformed into numerical form.

The first step of the between-group analysis is to evaluate the averages of the rows and columns according to the group to which they belong. We examine nine geographical regions, 22 sectors, and

15 GRI indicators. Accordingly, we run two between-group analyses using two matrices: one matrix with nine rows (regions) and 15 columns (GRI indicators) and one matrix with 22 rows (sectors) and 15 columns (GRI indicators). Table 1 provides the classifications for geographical regions and industry sectors. Table 6 shows the indicators that belong to each of the 15 GRI standards.

**Table 6.** Social indicators for each series Global Reporting Initiative (GRI) standard.

GRI Indicators	Code	Social Indicators
Employment	X401	V001, V002, V003, V014, V017, V018, V025, V026, V027, V031, V032, V058, V059, V062
Labor	X402	V015, V016, V019, V020, V021, V022, V023, V024, V028, V029, V030
Occupational health and safety	X403	V009, V010, V011, V012, V013, V033, V034, V035, V036, V037, V038, V039, V040, V041, V042, V043, V044, V045, V046, V047, V048, V049, V050, V061
Training and education	X404	V004, V005, V006, V051, V052, V053, V054, V055, V056, V057
Diversity and equal opportunities	X405	V007, V008, V060, V063, V064
Freed of association	X407	V066, V075
Child labor	X408	V067, V076
Forced and compulsory	X409	V068
Human rights	X412	V065, V069, V070, V071, V072, V073, V074, V077
Local community	X413	V086, V087, V088, V089, V096, V097, V098, V099, V100, V101, V102, V103
Public policy	X415	V078, V079, V080, V081, V082, V083, V084, V085, V090, V091, V092, V093, V094, V095, V104, V105, V106, V107, V108
Customer health	X416	V109, V120, V121, V122, V123, V124, V125, V126, V127, V128, V129, V130, V131, V132, V133, V134, V135, V136, V137, V138, V139, V140, V141, V147, V148
Marketing	X417	V111, V150, V155, V157
Customer privacy	X418	V110, V112, V113, V114, V115, V116, V117, V118, V142, V143, V144, V145, V146, V149, V151, V152, V153, V154, V156, V158, V159
Socioeconomic compliance	X419	V119

Figures 4 and 5 depict the relation between regions and industry sectors, respectively, and GRI indicators per the between-group analysis. Similar to Figure 1, the axes do not have units because they graphically demonstrate the relations between geographical zones (Figure 4) or industries (Figure 5) and the GRI indicators. We interpret the findings based on the quadrants or semi-planes in which the regions or industries are located and, in the case of the GRI indicators, on the length and angle of the vectors. The percentages refer to the explained variance of each axis. Because we plot a matrix with several rows and columns on just two axes (i.e., a two-dimensional graph), some information is wasted during that dimension reduction.



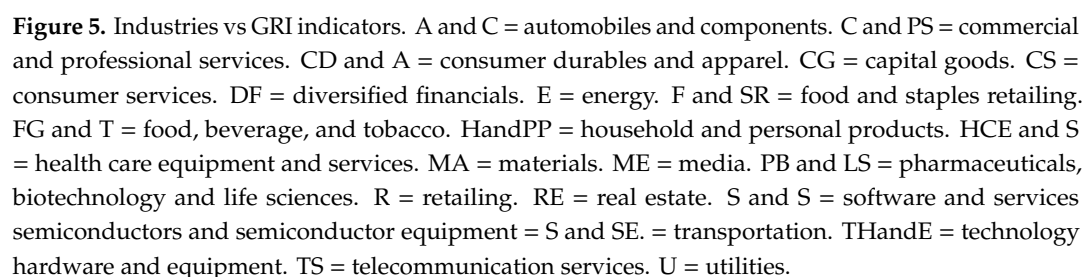
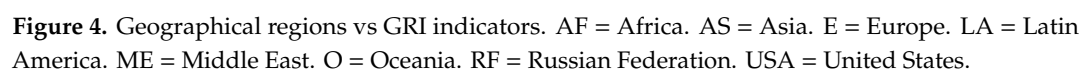


Figure 4 shows that Asia, Africa, the Middle East, and Latin America are located on the right semi-plane. Therefore, they are more closely related to the indicators on the right side: public policy (X415), customer health (X416), and, although its vector is quite short, diversity and equal opportunities (X405). The other indicators, appearing in the left semi-plane, are of little importance. Conversely, the

Russian Federation, Oceania, the United States, and Europe appear on the left semi-plane, indicating the increased importance of the other 12 GRI indicators also appearing in the left semi-plane.

The importance of public policy, a GRI indicator associated with Asia, Africa, the Middle East, and Latin America, may highlight some risks associated with corruption, bribery, and undue influence. Public policy refers to the firm's collaboration in the development of public policies that benefit society at large. Such activities may include, for example, use of pressure groups and financial or in-kind contributions to political parties, politicians, or their interests. Hence, in line with the findings of Welford [30], our results suggest that aspects such as ethics, bribery, or corruption are of more interest in these countries.

Prior research shows that customer health is a priority in countries in less developed regions such as Africa and Latin America [16,17,36]. Firms wish to garner customer loyalty by emphasizing the safety of the products they sell. Companies may increase their efforts along this line by revealing health and safety aspects of the products and services at the different stages of the product's life cycle, such as development of product concept, research and development, certification, manufacturing and production, marketing and promotion, storage, distribution, and supply, use and service and disposal, reuse, or recycling.

Although widely relevant worldwide, diversity and equal opportunities are particularly important for developing countries, which may need to increase social behavior in these areas. When companies actively promote diversity and equal opportunities, they generate benefits, for both company and worker alike, by gaining access to a larger and more diverse set of potential workers. Society at large also benefits from this situation because greater equality promotes social stability and supports greater economic development. These policies also positively affect women by increasing their participation, responsibilities, and pay within [6]. Consequently, our results on the GRI indicators of diversity and equality of opportunities support the findings of Islam and Craig [31].

Figure 5 shows that the GRI indicators public policy (X415) and customer health (X416) appear together on a semi-plane—the left semi-plane in this case. The corresponding sectors, which also appear in the left semi-plane are real estate; energy; diversified financials; household and personal products; food, beverage, and tobacco; materials; telecommunication services; technology hardware and equipment; transportation; media; and pharmaceuticals, biotechnology, and life sciences. We obtain the same indicators because these industries are related to the countries in the right semi-plane of Figure 4. These results support the findings of both Sobhani et al. [28] and Gallego-Álvarez et al. [29].

The remaining 13 GRI indicators are related to utilities, retailing, health care equipment and services, capital goods, consumer services, automobiles and components, commercial and professional services, semiconductors and semiconductor equipment, consumer durables and apparel, food and staples retailing, as well as software and services.

## 5. Conclusions and Implications

The rise in the number of companies disclosing information to stakeholders on their social behavior derives from an increased focus on social policies in the business world and, relatedly, to companies' desire to legitimize their social actions by disclosing this information to stakeholders as well as society as a whole [9].

Thus, the objective of social disclosure is to improve stakeholders' and society's image of the company. As such, prior research primarily relies on sociopolitical approaches, which confirm that companies disclose social information to protect their reputation and identity by engaging with stakeholders.

However, the methods by which social data are obtained, the use of a limited number of social indicators, and even the number of companies analyzed, which, in some cases, belong to a single country, might limit the applicability of previous studies [34]. To mitigate these concerns, we use both categorical and numerical variables that identify positive or negative social aspects of social information for a large sample of companies belonging to several countries or regions. We build

a social index using a linear combination of the values of all the original numerical variables and categorical variables, which are transformed into numerical variables. To construct our social index, we use the statistical techniques of CATPCA and PTA to analyze the different types of social information. In addition, we use between-group analysis to determine the relation of industries and geographical regions, respectively, with the new GRI 400 standards, which became effective on 1 July 2018 [6].

Our results show that companies belonging to different geographical areas of Asia, Africa, the Middle East, and Latin America tend to disclose more information about public policy, customer health, as well as diversity and equal opportunities. However, companies from other geographical areas including the United States and Europe disclose more information on other social aspects such as human rights and the local community. We also verify the relation between social indicators and industries. Customer health, product and service health, and safety throughout the different stages of the product life cycle are the indicators most widely used by firms belonging to the pharmaceutical and chemical industries as well as metal and mining industries. These findings are in line with prior findings reported by [28,29] for companies in Bangladesh and Brazil, respectively. Consequently, our results add evidence to the notion that companies' disclosure of their social behavior is relative and adaptable to the needs and norms of the social and economic context in which they operate. By responding appropriately (i.e., disclosing relevant social information), companies earn, or retain, their legitimacy [4,5].

Our index provides a measure of relevant social sustainability information in a global context and across industries. Therefore, companies can use the index as a measuring stick to determine their weak and strong areas in social aspects and disclosure in relation to their peers, based both on region and sector. In addition, other public and private enterprises (e.g., government bodies, stakeholders, society) can use the index to assess strengths and weaknesses when reporting in order to reward good practices and encourage increased disclosure (e.g., by demanding more information in a given country or a given industry). Furthermore, future studies that require social disclosure information and which need to examine the policy implications of disclosure, such as strengthening social legislation and related controls, can use our index and build on our results. The results also provide a relevant policy criterion to decide whether to distribute more or less awards or where to prioritize abatement and enforcement efforts among existing sources to positively affect social disclosure practices. In this sense, policymakers could use this index in their countries' companies in order to improve the effectiveness of their policies based on greater transparency and in the context of the relational dynamic between companies, society, and state. Moreover, firms might use this index to consider the relevance of disclosure not only for themselves but also as a way of knowing in which environments social disclosure proves more effective.

Our main limitations stem from the non-availability of a longitudinal database, which could help to better understand the social evolution of our results, including the effect of institutional frameworks. Future research should examine more time periods to determine how the social indicator index evolves over time, both in the context of geographical areas and industries. Another interesting line of inquiry would be to investigate how institutional factors such as culture or legal systems influence the social aspects that companies disclose.

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