Developing a Sustainability Reporting Index using the Sustainable Development Goals (SDGs) for Sri Lankan Business Firms

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Abstract

While many listed firms in Sri Lanka adapt sustainability reporting into their annual reports, a few firms use a combination of both Global Reporting Initiative (GRI) guidelines and SDGs when preparing sustainability reports. The current study attempts to develop an index to monitor firms' sustainability reporting practices based on both GRI guidelines and SDGs. A sample of 100 firms listed in the Colombo Stock Exchange (CSE) was chosen to evaluate the extent of firms' sustainability reporting. The principal component analysis was employed in the study to examine the reliability of the formulated scoring methodology by evaluating the 17 Sustainable Development Goals. Results indicate that the developed scoring index is efficient for evaluating the sustainability reported content in Sri Lankan firms. The study findings may be useful for organisations and statutory bodies to find a replicable method to measure the sustainable performance of business firms.

Keywords: Sustainable development, Sri Lanka, Principal component analysis, SDGs, Sustainability reporting index

1. Introduction

The term sustainability was introduced in the report "Our common future" by the Brutland Commission in 1987. Sustainable development was then defined as the development that meets the needs of the present generation without compromising the ability of the future generation to meet their own needs (Brundtland, et al., 1987; Brundtland, et al., 1987). The concepts of sustainability have evolved over the past few decades with the introduction of new theories and principles. Sustainability has now become a notion that matters to the entire world, facilitating a better future. The introduction of the SDGs by the United Nations member states in 2015 have elevated the urge of business firms to act responsibly towards the environment and people. Even though SDGs were introduced as an inter-governmental initiative, business organisations have a unique role in achieving the SDGs. Business firms are significant in encouraging and investing in innovative opportunities and reporting to the relevant stakeholder on the firms' contribution towards the global sustainability agenda (Business and Sustainable Development Commission, 2017).

Corporate Sustainability Reporting (CSR) is an emerging discipline. However, the term CSR does not own a universally-agreed definition to date (Dissanayake , et al., 2016). Several organisations have defined the word sustainability reporting as a non-financial reporting mechanism that would

address the needs of the probable stakeholders of the firm. CSR was demarcated to create data and measure the firm's progress and role in achieving global sustainable objectives (UNEP, 2021). Further, engaging in sustainability reporting practices would facilitate the firms in numerous ways. For example, it would support the firms in building, maintaining and enhancing the corporate reputation, marketing firms' products and services, gaining employee commitment, reducing firms' risk and costs and enjoying tax benefits (Ali & Rizwan, 2013).

Moreover, the sustainability reporting practices of firms would offer the stakeholders a mechanism to monitor and evaluate the sustainable performance of the firm and its business operations. The investors and other stakeholders need to assess the content of the sustainability reports to decide on their future investments through risk minimisation. However, the monitoring mechanism of CSR is ineffective, without a standardised framework to assess the individual firm's non-financial reporting practices enabling the comparability of the data. It is identified that a global challenge has been created by the lack of a consistent reporting framework (World Economic Forum, 2020). Therefore, firms need to have a standard set of reporting guidelines or frameworks to promote the comparability of sustainability reports. Even though the 6th target of the 12th SDG emphasises the significance of corporate sustainability reporting practices in the global arena, mere SDG definitions may not be adequate for SDG reporting (Pizzi, et al., 2020). Therefore, firms should be encouraged to adapt reporting frameworks to promote the adaption of SDGs into their reporting cycles.

Several sustainability reporting frameworks are introduced to guide organisations on sustainability reporting practices. A number of organisations have introduced methodologies on how to approach sustainability reporting and what content to be covered in the disclosures. For example, the guidelines by the Accountability Institute (AA1000APS), Global Reporting Initiative (GRI), International Integrated Reporting Council (IIRC) and Sustainability Accounting Standards Board (SASB) are some of the well-known and leading guidelines to aid sustainability reporting practices (Gill, 2019). Firms operating in different industry sectors may adopt these guidelines for their corporate reporting cycle upon the top management preference, necessities and legitimacy requirements. The GRI guidelines are the dominant global standard practice and the most widely acknowledged framework for corporate sustainability reporting (KPMG, 2020). Even though there is a vast range of guidelines to facilitate sustainability reporting, the diffusion of these exact guidelines to the corporate reporting cycle remains a problem. The content of sustainability reports may vary from region to region based on external and internal environmental characteristics. Some researchers have examined how firms select sustainability KPIs for sustainability reporting. It is revealed that the adaption of the KPIs to corporate reporting varies on the relevance of the guidelines to business operations and the knowledge of the firm employees on sustainability concepts (Dissanayake, 2020).

Extensive work has been conducted by the United Nations Global Compact (UNGC) and the Global Reporting Initiative (GRI) to identify the key actions and disclosure themes for firms' sustainable performance on the globally acknowledged SDGs (Price Waterhouse & Coopers, 2018). Firms tend to select the performance indicators they disclose upon the employee knowledge of the GRI guidelines in Sri Lanka (Dissanayake, 2020). Therefore, a simplified set of indicators

based on the well-known SDGs would facilitate the firms reporting their sustainable performance. Furthermore, governmental organisations would have the opportunity to assess the firm's contribution to the global sustainability agenda easily. Ample research has been conducted on the extent of the firms engaging in sustainability reporting using the GRI guidelines as the base. However, there is a dearth of research on examining the sustainability reported content using a combination of GRI and SDGs, which would directly facilitate the achievement of SDGs in the business context. The current study attempts to fill the knowledge gap by developing an index to monitor the sustainability reporting practices of firms by using SDGs and by developing the matrices for sustainability reporting on the content of SDGs disclosed. Prior literature has developed indices and sustainability reporting scores based on whether firms report on the particular SDG or otherwise. The present study attempts to develop a sustainability reporting index based on the extent a firm has engaged in achieving a particular SDG. A sample of 100 firms listed at least 5 years in the Colombo Stock Exchange as of June 2020 was selected for the study, and the index for sustainability reporting was constructed and applied to the sample.

The rest of the paper comprises five sections. The second section reviews the existing literature regarding the sustainability reporting practices of Sri Lanka and developed sustainability reporting indices. The third section illustrates the sample and the methodologies used to analyse the data by the development of sustainability reporting scores, and the fourth section includes the results of the study. The fifth section presents the discussion and section six summarises the paper's key conclusions.

2. Literature Review

2.1 Sustainability and Corporate Sustainability reporting

Sustainability is widely recognised as a driver of the corporate reputation and financial performance of a firm (Jain & Winner , 2016). Christofi et al. (2012) state that sustainability is often viewed as a cost for the business and yet should be considered an opportunity for the firm to sustain itself in the long run through risk management of the three elements; economic, social and environmental. Nevertheless, it is acknowledged to gain employee satisfaction, stakeholder interest and trust, enhancing a firm's financial performance. Rising concerns over corporate sustainable performance from firms' stakeholders have pushed the firms to communicate the performance through disclosures on sustainability (Dissanayake, et al., 2021)

Corporate sustainability reporting is widely acknowledged as an act of transparency for corporates on their sustainable performance. Corporate sustainability reporting is associated with different theories and these theories explain sustainability reporting behaviour of firms. The legitimacy theory is a widely acknowledged concept of explaining sustainability reporting practices of firms (Deegan, 2002; Patten, 1991; Momin & Parker, 2013). The theory advocates that, companies are compelled to adhere with the societal norms and ethics to operate legitimately in the environment they operate in (Aggarwal & Singh, 2019). Legitimacy is defined as a generalized perception that the firms' actions are appropriate within a socially constructed system (Suchman, 1995) . Thus, the firms' managers operating in accordance with the legitimacy theory propagate over ethical dimensions and enhance the public perception related to the firm operations (Momin & Parker, 2013; Aggarwal & Singh, 2019). Since, the firm legitimacy is offered by the people outside of the

organization, firms tend to encourage appropriate information be disclosed on their environmental and social performance so that they are legitimate and acceptable to the community (Da Costa Tavares & Dias, 2018).

In parallel, the stakeholder theory holds that the firms should conduct their operations adhering the interests of the stakeholder groups associated with the firm in an equitable manner (Clarkson , 1995). The stakeholder theory addresses over a set of interest group that influence a firms' legitimacy, while the legitimacy theory refers more broadly on the society in total (Ching & Gereb, 2017). As for the sustainability in the long run depends on the support of the stakeholders of interest, the firms are obliged to identify the stakeholder interests and demands to manage their legitimacy (Ching & Gereb, 2017; Clarkson , 1995). Stakeholders are able to influence the corporate behaviour by stating that different actions and processes doesn't comply with the societal expectations (Dawkins & Ngunjiri, 2008).

Furthermore, the impression management theory states that firms should provide information in order to manage the perception of the key stakeholders while the signalling theory expresses the deliverance of a superior information transparency would signal the firm with better corporate governance (Dawkins & Ngunjiri, 2008). According to the signalling theory, the signals that an organization direct to their stakeholders could be signals of intent (future action related), camouflage (divert attention from potential negative impacts) or signals of necessity (Lopez-Santamaria, et al., 2021). These theoretical perspectives supporting the corporate sustainability disclosure mechanism, provides explanation of the reasons why a firm should engage in sustainability reporting and need continuous monitoring on the reporting practises.

Sustainability reporting tools are important in monitoring the corporate sustainability disclosure mechanisms. The tools are reported to support measuring progress and aid in the decision-making process. According to prior literature, corporate sustainability reporting tools are classified into 3 major categories; frameworks, standards ratings and indices (Siew, 2015). The respective tools were identified to guide the firms on disclosing about their sustainable performance to their probable stakeholders and help the management and stakeholders related to the firm in monitoring and evaluating about firms' sustainability in the long run. The lack of standardization of the frameworks, standards and indices were identified to have led to difficulties of comparing and benchmarking firms' sustainability performance (Siew, 2015). In particular, indices constructed by different institutions were shown to conceal information about the criteria and methodology used to rate the firms. Examples of the commonly identified ratings and indices include KLD, EIRIS, SAM, Asian Sustainability Rating, Dow Jones Sustainability Index (DJSI), MSCI ESG Indices, FTSE4Good Index, Bloomberg ESG Disclosure Scores (Siew, 2015).

2.2 SDG Reporting

Sustainable Development Goals reporting has become a coveted research topic in sustainability research in the recent years. SDGs formulated by the United Nations in 2015 have offered a significant challenge to business organizations on how the firms are prepared to address the sustainability issues with the existing limitations of their business models and strategies. SDG

reporting is proven to provide a better platform for firms to incorporate sustainability issues in the corporate reporting cycle (Erin, et al., 2021).

The firms are found to gain a competitive advantage by synchronizing the corporate sustainability reporting practices and SDGs by means of spelling out the SDGs in the sustainability reports. Firms' contribution to the National Development agenda could be expressed more systematically with the SDG reporting practices, and firms could uplift their corporate image by being more environmentally and socially conscious (Erin, et al., 2022). SDGs are also viewed as a framework for strategic corporate sustainability reporting (Elalfy, et al., 2021). Firms could differentiate themselves from their competitors concerning sustainability reporting by adapting sustainability concepts and frameworks such as the SDGs (Rosati & Faria, 2019). As businesses are identified to play a critical role in achieving SDGs (Bose & Khan, 2022) they have the opportunity to gain a competitive advantage through their sustainable performance by including their performance in the corporate reporting practises.

Larger organisations and publicly listed firms are found to integrate SDGs more likely than small organisations (Elalfy, et al., 2021). The reason for this disintegration could be viewed as the SDG reporting not being a mandatory requirement. Wealth maximisation prioritisation by the stakeholders has identified a significant barrier to corporate sustainability reporting practises in Sri Lanka (Dissanayake, et al., 2020). The inability to identify the relevant key performance indicators in measuring the particular SDG activities is a challenge for the firms (Erin & Bamigboye, 2021) Therefore, proper regulatory enforcement, a strong institutional setting and a government structure are essential in systematically promoting SDGs reporting.

2.3 Development of non-financial reporting scores and indices

A sustainability index is alleged to stimulate firms' reporting practices, which would drive profits and growth (Beekaroo et al.,2019). Nevertheless, independent assurance of sustainability reports to enhance the credibility of the firm hardly captures the volume and quality of sustainable information provided. This phenomenon has led to the necessity of a scoring system for firms sustainability reporting practises (Ching & Gereb, 2017). Different authors have developed sustainability Indices in diverse country and industrial settings to measure the sustainability performance of firms and non-profit organisations. Beekaroo et al. (2019) work on developing a sustainability index to quantify the impacts of Mauritian manufacturing activities. In the study, the evaluation of the sustainability efforts is done using a set of performance indicators. This combination of indicators is identified to enable a multi-item measuring tool called the "sustainability index" by Beekaroo et al. (2019)..

A similar approach has been undertaken by Boggia et al. (2018) in developing an assessment procedure to measure environmental sustainability with an index. A multi-criteria index is built by combining several indicators, including nine categories. A score of 0-5 is assigned for each category while evaluating the content. The multi-criteria analysis procedure known as "METER (Measuring events through Environmental research)" is developed to measure the environmental sustainability of events.

For the cruise industry, a corporate sustainability reporting index has been built by Bonilla-Priego et al. (2014). The authors have used the content reported in the sustainability reports of 80 firms in the cruise industry and developed an index to measure the sustainability reporting practices concerning 14 categories. These 14 categories are created based on the GRI guidelines and preceding literature. These categories include 14 aspects (7 environmental, 6 social and 1 economic), including labour and huma n rights, health and safety matters, and environmental and economic features. A coding sheet is developed, and coding rules are identified. A binary score of 1 or 0 is assigned for firms if the item in the coding scheme is reported (Bonilla-Priego, et al., 2014). An index is identified to aid the firms' stakeholders by providing them with comparable information to analyse the firms in making their investment decisions.

A sustainability reporting index has been developed by Garg (2017) with specific reference to the Indian context. It is identified that a framework is necessary for the Indian firms to report in a standard and comparable manner grounded on the lack of a general framework for sustainability reporting in all three aspects; economic, social and environmental. The index has been developed by referring to the available indices such as GRI, (DJSI) Dow Jones Sustainability Index, and SIGMA (Sustainability Integrated Guidelines for Management) (Garg, 2017). The prominent existing global indices are analysed, and the operational disclosures related to sustainability reporting in India are identified to aggregate them into the sustainability index.

Twelve major rating agencies' perspectives are combined to build a sustainability reporting framework for the Indonesian market. A company's best performance is recognised through developing a sustainability reporting index withering risks and business opportunities (Firmialy & Nainggolan, 2019). The sustainability reporting index is constructed to simultaneously focus on all three dimensions of sustainability by combining the perspectives of social rating agencies, academic theorists and Indonesian companies (Firmialy & Nainggolan, 2019). Firmly & Nainggolan (2019) use a 1–3-point scale to assign a score for the study's content analysis results.

A similar sustainability reporting index is developed by Aggarwal & Singh (2019) to analyse the corporate social responsibility reporting and sustainability reporting practices in the Indian context using content analysis techniques. The reporting index is built based on the existing standard guidelines. Each item identified is recorded with a binary score (1 or 0), and the reports' quality is assessed with a six-point scale (0-5).

In addition to the sustainability reporting scores constructed, several authors have evaluated the extent of reporting of SDGs by firms in different contexts. For example, Pizzi, Rosati, & Venturelli (2020) construct a score to assess the achievement of SDGs by firms in the Italian context using the methodology of whether SDG indicators are reported or otherwise. Further, Bose & Khan (2022) have used the method of assigning binary variables for the indicators reported on SDGs. However, the scores developed have not captured the extent of the goals or indicators the firms have reported on their sustainability efforts in the SDG-related studies. Bose & Khan (2022) have used the SDGs indicators in constructing a reporting index using a binary score and discovered the extent of SDG reporting among the regions worldwide across time (Bose & Khan, 2022).

2.4 Measuring the Corporate sustainability reporting Content in Sri Lanka

Research in the Sri Lankan context has primarily measured the sustainability performance of firms using the content analysis of published sustainability information or semi-structured interviews with managers (Dissanayake, et al., 2021). The work by Wijesinghe (2012) is built upon developing a disclosure index for Corporate Social Responsibility Disclosures. Content analysis is used in the study to develop the disclosure index, where 57 disclosure items are identified based on the GRI index. The score is built upon the percentage of the disclosure items adapted by each disclosure compared to the total disclosure items.

Shamil et al. (2014) have produced the sustainability reporting score basically by using a binary variable representing the publication and non-publication of sustainability reports. A more complex sustainability reporting scoring model is developed by Dissanayake et al. (2016), using 10 criteria and giving a score from 0-4 based on their performance. Sustainability reports are subjected to content analysis, and the scores are assigned on a scale of 0-4 for the 10 criteria. The work by the same authors in 2019, has used the word count of specifically identified items on environmental, social and economic sustainability, where the score identifies the exact number of words for each item without assigning scores.

Referring to the prior literatures, to the best of our knowledge no study has evaluated the corporate sustainability reporting content using SDGs as a framework that would facilitate business organisations in monitoring their path towards the 2030 Sustainability Agenda in the Sri Lankan context. Therefore, this study intends to fill that gap by evaluating the corporate sustainability reporting content using SDGs as a framework. Furthermore, our study would make key contribution to the limited SDG research in sustainability literatures as the study develops a reporting index based on the extent to which the SDGs have been disclosed.

3. Methodology

3.1 Data

This study employed a sample of 100 firms in Sri Lanka listed in the Colombo Stock Exchange (CSE) as of June 2020 for the financial reporting period from 2015-2019. The sustainability reports of the firms with the highest and lowest market capitalisation were examined in the study, which included the top 50 firms and the bottom 50 firms according to the market capitalisation. These firms were selected based on having a sustainability report or containing sustainability content in their annual reports, whereas the firms with no sustainability report were disregarded. Thus 500 yearly reports were evaluated to develop an index for sustainability reporting. Further, the firms were categorised under the Global Industry Classification Standards-GICS (MSCI, 2022; Whittingham, et al., 2022). The industry categories defined for each firm by the CSE were classified into 10 industry sectors under the GICS standards to simplify data classification.

An index was developed in the study to evaluate the sustainability information in the sustainability reports of Sri Lanka. A methodology similar to Joseph et al. (2014) was applied; a simplified disclosure index was developed using content analysis results. The study by Joseph, Pilcher, & Taplin (2014) defined the level of sustainability reporting in the study using the frequency

percentage of the predefined indicators recognised to measure the level of sustainability reporting. Content analysis was employed in the research to measure the level of sustainability reporting.

3.2 Content Analysis

Content Analysis is considered a primary tool for analysing published information (Jose & Lee, 2007). The technique was selected for the study to obtain a more eminent output by systematically and objectively identifying specified characteristics of text within the sustainability reports. Content analysis has been considered a technique widely used in corporate social responsibility research (Gray , et al., 1995). Hence the content analysis methodology was used in the study to evaluate the content reported in the annual reports and sustainability disclosures of the Sri Lankan firms.

Initially, a set of codes was developed based on existing literature (Lopez, 2020; Erin & Bamigboye, 2021; Buhmann, et al., 2019). Quantitative content analysis was performed where the set of codes or the coding scheme according to the SDGs was decided before the coding process. Appendix I presents the SDGs and the relevant business reporting indicators used as the coding scheme in the content analysis. The text was then coded while reading the sustainability reports thoroughly. NVivo Qualitative Analysis software was used to reduce the complexity of the data. Coding the data refers to encoding them after reading and classifying crucial moments and putting them into containers named by the identified specific name of the goal. Since codes assign a symbolic meaning to the information compiled during the study (Miles, et al., 2014), the words and phrases denoting important sustainability aspects in the sustainability reports referred to the SDGs were identified concerning the prior defined coding schemes as in Appendix 1. The phrases where the specified indicators were identified were used as references which was the primary output in the content analysis conducted and was subsequently used in developing the score.

3.3 Developing a score for sustainability reporting

Score system can be defined as a methodology to provide alleged credibility to the interested stakeholders or readers concerning the expanse of disclosure in sustainability reports (Ching & Gereb, 2017). The Sustainability Reporting Score was assigned correspondingly to the methodology followed by Boggia et al. (2018) and Firmialy & Nainggolan (2019) allocating scores for the content disclosed. It was identified that most of the studies used a binary scale to evaluate the sustainability reporting content by identifying whether sustainability reporting or performance indicators are included are conducted or otherwise (Rosati & Faria, 2019; Shamil, et al., 2014; Bonilla-Priego, et al., 2014). Only a few studies used multiple scoring (Aggarwal & Singh, 2019; Firmialy & Nainggolan, 2019; Garg, 2017). This study assigned a 1-5 score for each firm's performance in a particular year, with indicators created concerning the SDG. The score was initiated from score 1 to avoid the index getting a null sustainability reporting score since all the firms were selected based on the fact that there was a sustainability disclosure mechanism for that firm for all five years. Therefore, the minimum score for sustainability reporting by a firm was accounted for a score of 17(17*1), while the maximum score was allegedly accounted for 65 (17*5).

D_{it} represents the number of references (coded through content analysis of the reports) for a particular firm *i* in the reporting year *t.* The goal number is represented by j= {1,2,3….,17}. D_j represents the number of references of a particular firm referring to the goal *j*. The score for that firm i for goal j, $S_{i,j}$was determined by dividing the range of the series of references under the particular goal by 5 and assigning a value from 1-5 as per equation 1 and equation 2.

$$S_{i,j} = \begin{cases} 5, & if\ D_{ij} > \min(D_j) + 4W \\ 4, & if\ D_{ij} > \min(D_j) + 3W \\ 3, & if\ D_{ij} > \min(D_j) + 2W \\ 2, & if\ D_{ij} > \min(D_j) + W \\ 1, & Otherwise \end{cases} \quad (1)$$

$$W = \frac{(\max(D_j) - \min(D_j))}{5} \quad (2)$$

The sustainability reporting score for a firm i in the particular reporting year t was calculated as in equation [3]. The sustainability reporting score $SR_{i,t}$ for the firm, i in the year t would be the summation of the scores obtained for all 17 goals.

$$SR_{i,t} = \sum_{j=1}^{17} S_{i,j} \quad (3)$$

A score was developed using the PCA methodology and compared with the developed index in the study to ensure the validity of the Sustainability Reporting Index constructed. Principle Component Analysis (PCA) was used to identify the optimum variables while reducing the dimensionality of the data set and retaining as much variation as possible in the data set. Further, descriptive statistics examined the scores developed according to different industry sectors.

4. Results

4.1 Content analysis of the annual reports

The study employed content analysis to explore the information reported on the sustainability disclosures of 100 firms in Sri Lanka. NVivo qualitative analysis software was used, and the predefined criteria were evaluated (Appendix I) and coded. Each phrase or information related to the criteria coded was identified as a reference. A total of 11,802 references were identified while coding the data according to the SDG-related indicators.

4.2 Sustainability Reporting Index

The Sustainability Reporting Score (SRS) was created using the references identified for each report coded. General descriptive statistics of the sustainability reporting score obtained are summarised in Figure 1 and Table 1. The sustainability reporting score created with the developed index shows that the maximum score is 45, while the minimum score is 17. The mean sustainability reporting score is 22.482. Figure I show the boxplot diagram on the concentration of data of the sustainability reporting scores developed in the study. It is observed that 50% of the data sample companies have sustainability reporting scores in the 17-21 range.

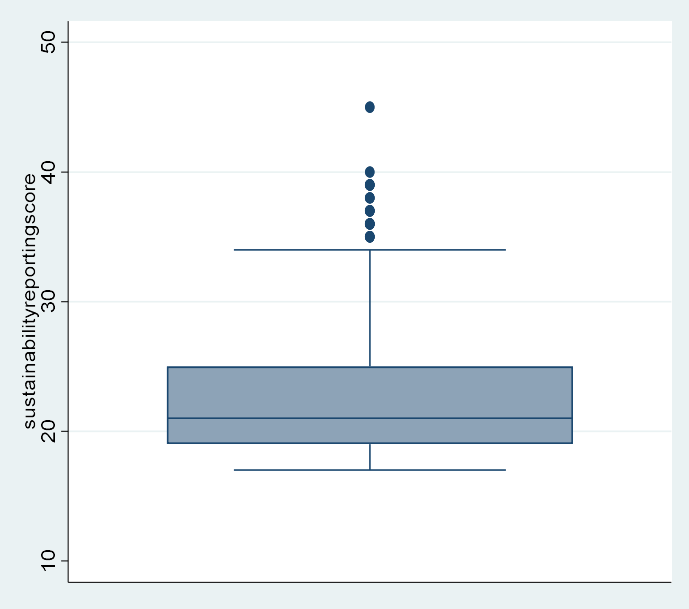

Figure 1: Boxplot diagram for developed SR score

Table 1: Descriptive statistics of the Sustainability reporting score developed

Variable	mean	Overall Standard deviation
Goal 1	1.348	0.6226326
Goal 2	1.188	0.5703566
Goal 3	1.3	0.6409537
Goal 4	1.412	0.6123773
Goal 5	1.292	0.6779788
Goal 6	1.206	0.5478725
Goal 7	1.318	0.676603
Goal 8	1.422	0.6361804
Goal 9	1.32	0.6248046
Goal 10	1.316	0.6819635
Goal 11	1.41	0.7286713
Goal 12	1.638	0.8720533
Goal 13	1.226	0.4974121

Goal 14	1.29	0.6773608
Goal 15	1.462	0.6910217
Goal 16	1.166	0.467848
Goal 17	1.168	0.4244246
Sustainability reporting score	22.482	4.871667

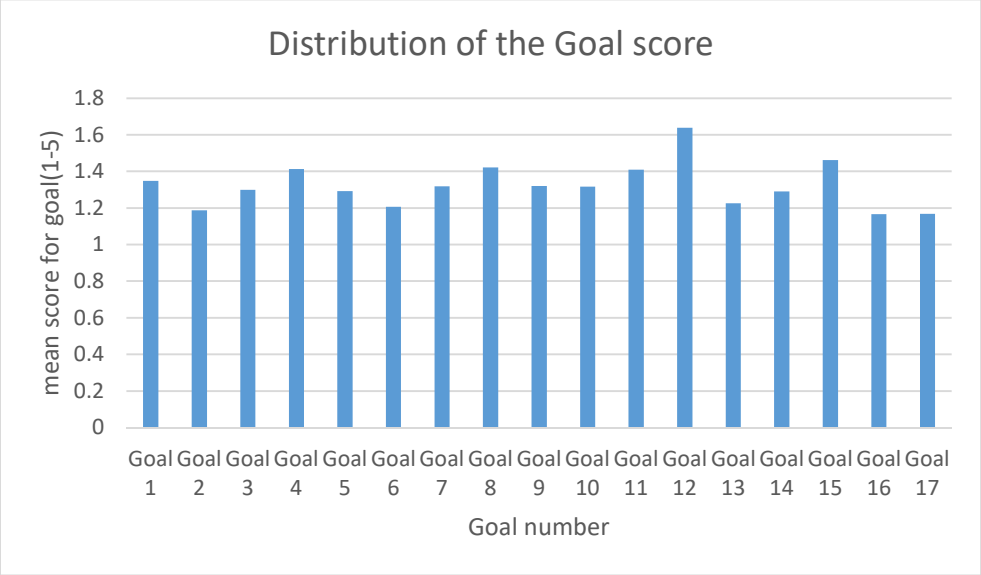

Figure 2:Variation of the mean scores according to each SDG

The descriptive statistics obtained for individual SDGs in Table 1 show that SDGs 12 and 15 were most commonly reported by firms, while the least reported goals were 16 and 17. Figure 2 gives a graphical illustration of the variation of written content according to the specific SDGs.

Principal Component Analysis (PCA) was performed to identify the best linear combination of variables, demonstrating the data set variation more precisely. Further, the PCA-predicted results were compared with the developed sustainability reporting score to assess the reliability of the data.

Before performing the PCA, some pre-estimation tests, such as the Kaizer-Meyer-Olkin (KMO) test for measuring sample adequacy and the Bartlett test of sphericity were conducted. The results are shown in Table 2. The KMO test, which tests the sample adequacy of the data, was performed, and each variable resulted in a value greater than 0.5. This denotes the variables are acceptable for the PCA. The overall value of 0.0797 means that sampling is adequate for all variables. Bartlett's test for sphericity compares the identified matrix with an observed correlation matrix., where redundancy is checked between the variables. The null hypothesis expresses the variables are not inter-correlated. The p-value of 0.00 for the Bartlett test confirmed that the null hypothesis variables were not correlated and could be rejected. Accordingly, the KMO and Bartlett test results led to performing PCA on the data set.

Table 2: Results of KMO and Bartlett Test

Kaiser–Meyer–Olkin measure of sampling adequacy	0.797
Bartlett's test of sphericity	
Chi-Squared	1320.704
Degree of Freedom	136
P- value	0.0000

Table 3 shows the principal component analysis (PCA) results. The principal components show the orthogonal linear combinations of the defined variables, which depicts the highest variability in the data. The first principal component accounted for the most significant possible variance in the data set. The components with the Eigenvalue above 1 were selected, and the Eigenvalue score of the corresponding Eigenvector signified the expanse of variation in each principal component. The first principal component, which demonstrates 21% variability in the data set, was chosen as the linear combination of the variables, illustrating the highest variability in the data set. The sustainability reporting score SR_{pca} was obtained by predicting the values for the first principal component using the STATA 16 statistical software.

Table 1: Principal Component Analysis results

Indicator	**Principal components**				
	1	2	3	4	5
Goal 1	0.247479	-0.17585	-0.18012	0.094561	0.056039
Goal 2	0.085762	0.036465	-0.35626	0.641317	-0.06541
Goal 3	0.272437	0.198823	-0.2753	-0.03689	0.150521
Goal 4	0.346506	-0.11382	-0.04245	-0.02965	0.067519
Goal 5	0.207611	-0.33337	0.041037	0.331304	0.315947
Goal 6	0.210229	0.519212	-0.07485	-0.08752	0.312295
Goal 7	0.260327	0.359846	-0.20961	-0.2097	0.122026
Goal 8	0.273563	-0.22724	-0.11137	-0.35865	-0.2188
Goal 9	0.26777	-0.18216	0.225962	-0.15666	-0.17697
Goal 10	0.165712	-0.42612	0.120549	0.041236	0.31074
Goal 11	0.25934	-0.09847	-0.13193	0.090889	0.08602
Goal 12	0.294025	-0.03397	0.213234	-0.0759	-0.18822
Goal 13	0.253472	0.226246	0.322355	0.08714	-0.03619
Goal 14	0.094873	0.201224	0.423376	0.314393	-0.40772
Goal 15	0.300351	0.16699	0.140532	0.303106	-0.11482
Goal 16	0.263018	-0.08472	-0.29785	-0.16252	-0.458
Goal 17	0.147303	0.032678	0.423477	-0.15006	0.379548
Eigenvalues	3.706101	1.602696	1.346524	1.108664	1.055284
Variance explained	21.8	9.43	7.92	6.52	6.21

The developed SRS was compared with the predicted SRS through the principal component analysis to check the validity of the developed model *(Firmialy & Nainggolan, 2019)*. The pairwise comparability test was performed, and SR_{it} and SR_{pca} results were observed to be highly correlated with each other with a value (0.9899) with statistical significance (p-value<0.05). This

indicates that the results from these two approaches are comparatively similar, and the developed SR index is effective.

4.3 Sustainability reporting score according to industry sectors

The firms in the sample in the study were identified into 10 industry categories following the GICS as in Table 4. Most of the firms in the sample belonged to the financial sector, while a few belonged to the communication and utility sectors.

Table 4: Description of data- Industry sector

Industry sector	**Number of firms**	**% total**
Energy	2	2
Material	7	7
Communication services	1	1
Consumer discretionary	18	18
Consumer staples	21	21
Financials	31	31
Health care	3	3
Industrial	14	14
Real estate	2	2
Utilities	1	1
Total	**100**	**100**

Figure 3 represents the boxplot diagram of the developed sustainability reporting scores according to the industry categories. A maximum reporting score was observed in the firms in the real estate sector and consumer discretionary (non-essential consumer goods) sector. In contrast, the least sustainability reporting scores were reported from the utilities and communication services sectors. The real estate and healthcare sector have reported the highest mean SRS. The boxplots of the communication and energy sectors have shown that the developed SRS of the firms in those sectors has less variability across the score developed. The healthcare sector firms' SRS exhibits more variation, according to Figure 2.

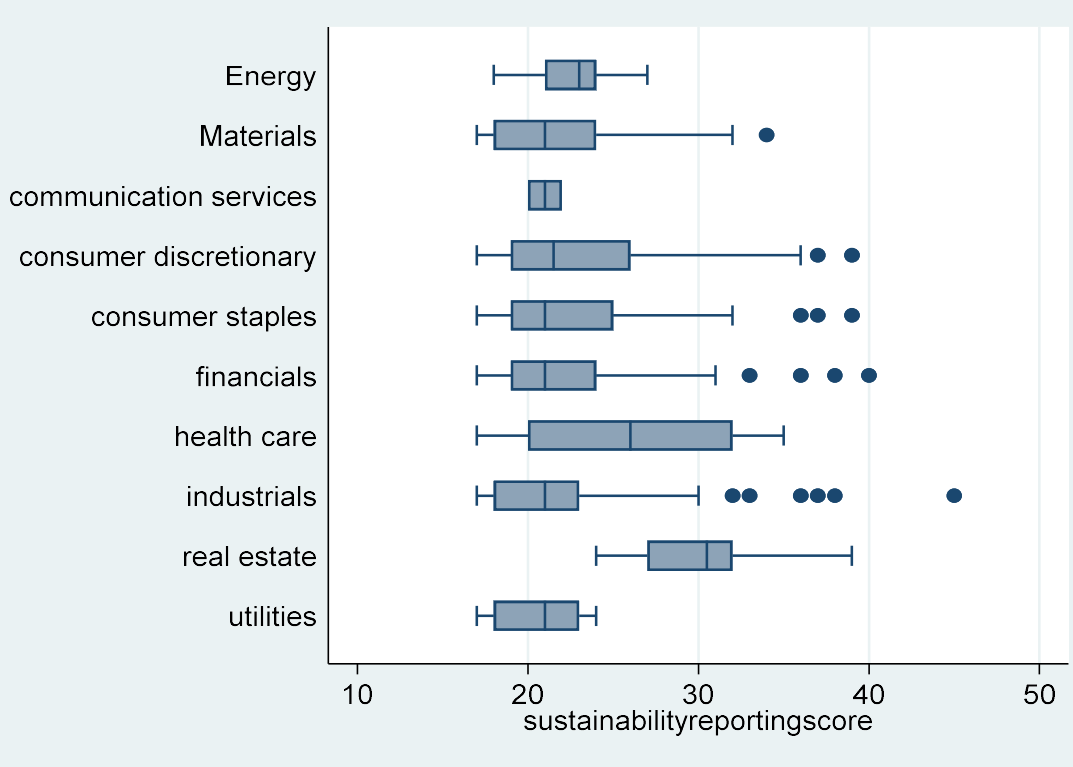

Figure 3: Boxplot diagram for SR score according to industry sector

Figure 4 shows the variability of the average sustainability reporting scores from 2015-2019 according to industry categories. It was observed that all industry sectors represent a downward trend in sustainability reporting practises concerning the SDGs from 2015 until 2017 and an upward trend from 2017- 2019.

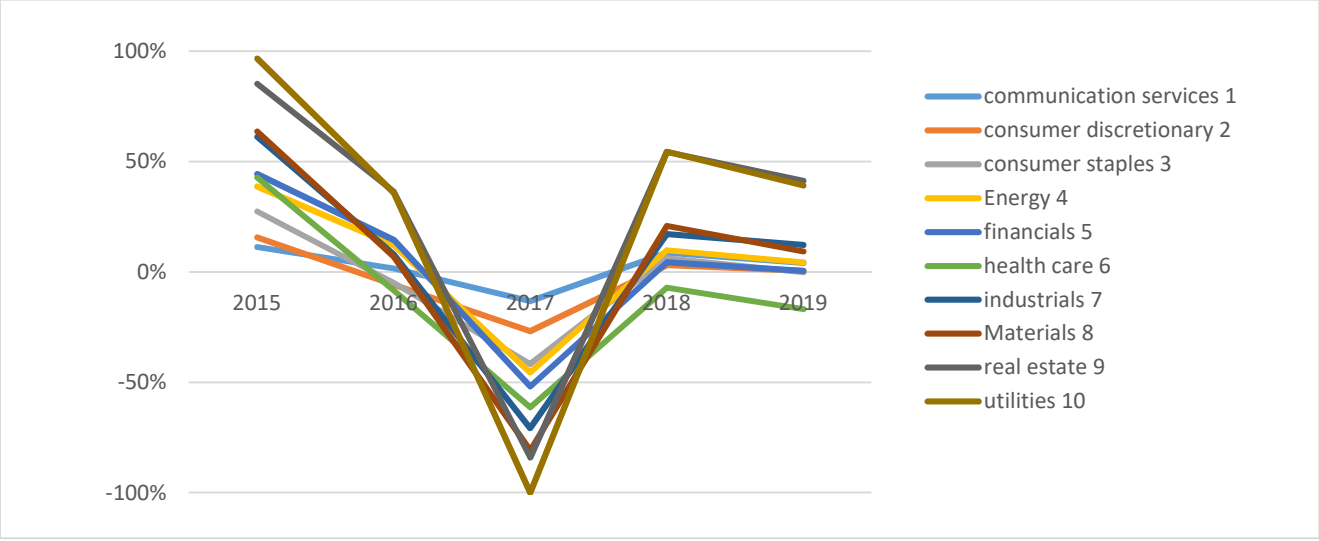

Figure 4: Variation of the mean SRS from years 2015-2019 according to the industry sector

5. Discussion

Sri Lankan organizations consider sustainability reporting practices essential; however, the lack of a more straightforward and understandable framework could reduce the possibility of the firms reporting on sustainability measures in their sustainability disclosures or annual reports. Dissanayake (2020) states that the lack of knowledge of employees and the top management's decision could limit reporting content in the sustainability reports in Sri Lanka. Thus, a sustainability reporting framework developed based on more straightforward terms, or the well-acknowledged SDGs, would facilitate Sri Lankan firms in sustainability reporting and encourage non-reporting firms to engage in sustainability reporting. Therefore, the framework suggested in the study could be used to promote the firms to report and gain a competitive advantage in the global market while adhering to the SDGs.

The sustainability reporting framework developed could be employed as guidelines to report and measure the firm's sustainability levels. The present study used the sustainable development goals (SDGs) to establish the matrices or criteria to evaluate the sustainability content in the reports. Previous researchers have constructed reporting indices focused on environmental sustainability efforts for specific industries and indicators based on GRI guidelines (Boggia, et al., 2018; Beekaroo, et al., 2019; Bonilla-Priego, et al., 2014; Garg, 2017).

It is observed that the average SRS of 22.5 is about 35% of the maximum reporting score that could be achieved. The SDG reporting score developed by Pizzi, Rosati, & Venturelli (2020) showed that the average score equals 33.6% of the total indicators to be covered in the case of Italian companies. This indicates that the average sustainability reporting practices incorporating SDGs are at a lower level in Sri Lanka, in line with the findings of Pizzi, Rosati, & Venturelli (2020) and Bose & Khan (2022). The necessity of establishing guidelines in favour of SDGs is exhibited through the findings.

The results of the study revealed that publicly listed Sri Lankan firms tend to report more information regarding SDGs 12 and 15, which are on responsible consumption and production and life on land. More firms have referred to mitigating the environmental impact of their operations as the current sustainability reporting regulations are more inclined towards environmental aspects (Ministry of Environment Sri Lanka, 2011). Further, the results were in line with the work of Fonseka & Carvalho (2019) and Whittingham et al. (2022), where it was revealed that the highest average score accounted for SDG 12. The inclination of the firms towards reporting on environmental aspects and resource efficiency signifies the firms are paying attention on gaining credibility and legitimacy in the societal context in the case of Sri Lanka, conforming with the legitimacy theory. (Suchman, 1995)

The results shown in figure 4 for different industry sectors reveal that the overall sustainability reporting concerning SDGs decreased over the years from 2015-2017 and increased until 2019. This variation of SDG incorporate reporting in Sri Lankan firms is justifiable to the findings of Bose & Khan (2022). Bose & Khan (2022) demonstrate that the level of SDGs reporting by most firms across the world had shown less adaption in the years from 2016-2018. Additionally, in the case of the global scenario on SDG-incorporated reporting, the firms incorporating SDGs were limited only to European and Latin American firms from 2015- 2017. A rapid growth in SDG-

incorporated reporting was observed after that, including Asian and North American firms on the list (KPMG, 2020; KPMG, 2017). This shows that the newly established concepts in European nations on sustainability, such as the global SDGs, have taken some time to be adopted by the non -European countries such as Sri Lanka.

The study by Bose & Khan (2022) further points out that countries with national sustainability regulations and better SDGs performance scores have better reporting levels than countries without national sustainability regulations and better SDGs performance scores. The slow increase of the level of sustainability reporting score concerning SDGs from 2017- 2019 could thus be explained as new sustainability regulations on sustainability performance established in 2017 in Sri Lanka with the establishment of the Sustainable Development Council of Sri Lanka. The recent governmental approaches for sustainability reporting are significantly fewer in number (Dissanayake, et al., 2020). The Sustainable Development Council of Sri Lanka was established after the establishment of the Sustainable Development Act No. 19 of 2017 to coordinate, facilitate, monitor and evaluate the reporting practises on the implementation of the global agenda for sustainable Development in Sri Lanka (Sustainable Development Council of Sri Lanka, 2022). This establishment of national regulations could trigger SDG-incorporated reporting practices in Sri Lanka after 2017. Even though the rules are established, the guidelines are essential for the Sri Lankan firms for SDGs. Presently, the sustainability reported content is evaluated based on the National Green Reporting System of Sri Lanka, a set of guidelines which were developed together with the Ministry of Environment in 2011 after the introduction of the National Action Plan of the Haritha (green) Lanka Program in 2009 (Ministry of Environment Sri Lanka, 2011). Furthermore, the reporting NGRS is formulated based on the GRI – G3 guidelines, which were launched in 2006 (Global Reporting Initiative, 2022) together with ISO 26000 standards. It would be beneficial to update these guidelines based on the novel standards and formulate a framework to encourage all the firms in Sri Lanka on sustainability reporting. Editing and revising the evaluation criteria and indicators to best suit the current reporting practice of Sri Lanka, combined with the SDGs, would be an added advantage. Reporting on SDGs achievement is a better impression and risk management tool for firms and a tool to gain a competitive advantage in the global market. The firms will likely be confused by adapting DGs (Bose & Khan, 2022). Thus, SDGs need to be promoted while conveying the importance to different industry categories and explaining how SDGs could be used to exploit benefits through adoption. Therefore, the research findings could encourage governmental organisations and regulators to set and update national guidelines to measure the private sector's progress towards achieving the global agenda. On the other hand, it would facilitate the firms in gaining a competitive advantage in whatever industry they operate in.

6. Conclusion

The study has developed a sustainability reporting index using the global SDGs. A scoring methodology for evaluating the sustainability content in the reports or a sustainability reporting index was created for the firms in Sri Lanka using existing literature on sustainability reporting and sustainable development goals. The Principal Component Analysis was employed in the study to check the reliability of the formulated scoring methodology by evaluating the 17 Sustainable Development Goals. It was identified that the developed scoring mechanism efficiently assesses the sustainability of reported content in Sri Lankan firms. A sample of 100 firms listed in the CSE

was chosen, and the methodology was implemented to determine the extent of firms' sustainability reporting. The methodology developed contributed to the literature by introducing a novel framework for evaluating the sustainability reporting content with specific reference to SDGs, which will facilitate the firms and governmental organisations to assess the path of Sri Lanka towards a sustainable future.

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Appendix 1: SDGs and the relevant business reporting indicators

SDG	Description	Criteria evaluated
Goal 1	No Poverty	Content related to the firm's programs to support the low-income groups around its environment
Goal 2	Zero Hunger	Content related to efforts of the firm to support communities through food distribution programs
Goal 3	Good Health and Wellbeing	Content related to the firm's commitment to improving the healthy lives of both internal and external stakeholders
Goal 4	Quality Education	Content related to firms' activities to improve educational programs and support the less educated
Goal 5	Gender equality	Content related to the involvement of women in management and executive positions and equal payment standards for both men and women.
Goal 6	Clean water and sanitation	Content related to the proportion of recycling, safety waste water treatment etc.
Goal 7	Affordable and clean energy	Content related to energy-saving trends, renewable energy investments etc.
Goal 8	Decent work and economic growth	Content related to employees getting permanent positions with fair labour practices, incentives to enhance the firms' economic growth etc
Goal 9	Industry, Innovation and Infrastructure	Content related to the inclusion of innovation and technology in firms' activities to promote the growth of the firm's operations
Goal 10	Reducing inequalities	Content related to firms' emphasis on creating equal opportunities for all employees and stakeholders disregarding backgrounds and disabilities
Goal 11	Sustainable cities and communities	Content related to firm investment in safe and sustainable means of transportation, sanitisation and energy to the stakeholders of the firms
Goal 12	Responsible consumption and production	Content related to firms' contribution to waste recycling practices and promoting resource efficiency
Goal 13	Climate action	Content-related firms' target setting on reducing the climatic risks and related performance measurement against those targets
Goal 14	Life below water	Content related to firms' contribution in addressing future aquatic eco-system depletion
Goal 15	Life on land	Content related to firms' contribution to addressing terrestrial eco-system depletion
Goal 16	Peace, Justice and strong institutions	Content related to firms' commitment to promoting fair business practices
Goal 17	Partnerships for the goals	Content related to firm investment and involvement in multi-stakeholder partnerships to engage in sustainable production practices.