Towards better governance: creating a corporate governance index for South African firms

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Abstract

Purpose – *The purpose of this study is to construct a robust index and subindices to measure the quality of corporate governance for 266 firms listed in South Africa from 2004 to 2021.*

Design/methodology/approach – *Public information on the compliance of King Code of Good Corporate Governance is used to construct a main index predicated on provisions relating to board characteristics, accounting and auditing and risk management. These categories are transformed into three subindices. All constructs are scored with binary coding and equally weighted.*

Findings – *Cronbach's alpha test reveals that the index and subindices are highly reliable measures of corporate governance. The principal component analysis supports the construct validity of all measures.*

Research limitations/implications – *The index is limited to only three corporate governance subcategories and only focuses on South Africa.*

Practical implications – *These corporate governance indices provide governing authorities, policymakers, investors and other market participants direct information on the quality of corporate governance in South African firms.*

Originality/value – *As South Africa lacks a formal corporate governance indicator, the development of an appropriate corporate governance index and subindices contributes towards understanding the quality of corporate governance in South African firms. To the best of the authors' knowledge, this is the first paper to conduct robustness tests on corporate governance indices designed for South African companies.*

Keywords *Corporate governance index, Compliance, Reliability, Construct validity*

Paper type *Research paper*

1. Introduction

Corporate governance codes provide a guiding framework of recommended practices crucial for achieving optimal governance (Mallin, 2006). Several studies assert that robust governance frameworks are critical for ensuring that firms operate in a responsible, transparent and accountable manner (Mallin, 2006), potentially bolstering financial performance. As such, shareholders actively advocate for compliance with recommended governance codes to maximize returns and avoid corporate failures (Aguilera and Cuervo-Cazurra, 2009).

Widespread interest in a firm's compliance with corporate governance codes has sparked debate on "how to measure the quality of firm corporate governance" (Da Silva and Leal, 2005: p.4). Most studies quantified corporate governance through individual measures, such as board size, auditing, disclosures, shareholder rights and risk management; however, this approach fails to capture corporate governance compliance and has been criticized for representing "only certain aspects of governance" (Ananchotikul, 2007: p.3).

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To address this criticism, researchers began adopting compliance index models, in which they constructed indices that combined a set of corporate governance provisions (Gompers *et al.*, 2003; Ananchotikul, 2007; Black *et al.*, 2017; Kobuthi, 2018). These indices measure a firm's level of compliance with recommended corporate governance codes, providing a holistic view of their governance compliance status. The use of compliance index models increased following the worldwide proliferation of corporate governance codes, which prompted firms to collectively adopt recommended practices (Kobuthi, 2018). This collective approach establishes a country-specific indicator, as indices are primarily predicated on governance standards relevant to a particular country (Ntim, 2009).

Despite advancements in measuring corporate governance compliance, significant research gaps persist. Many studies that developed corporate governance indices overlooked the construct's validity and reliability, casting doubt on what these indices "actually measure" (Black *et al.*, 2017: p.397). Moreover, existing studies have focused on developed countries, neglecting emerging markets such as South Africa (Ntim *et al.*, 2012). The Institute of International Finance Report Institute of International Finance (IIF) (2007: p.1) highlighted this gap, noting that, despite South Africa's pioneering status as the first emerging market to establish a corporate governance code, there remains a lack of studies evaluating South African firm's compliance levels. Previous attempts to fill this gap, such as Ntim (2009) and Waweru (2014), were constrained by small sample sizes, short sample periods and a lack of robustness tests, raising concerns about the validity of their findings.

Our study aims to construct a robust corporate governance index (CGI) and subindices for South African firms listed on the Johannesburg Stock Exchange (JSE) from 2004 to 2021. We formulate an appropriate construction methodology for developing the index and subindices and examine the reliability and validity of the constructs. As South African firms are governed by the King Code of Good Corporate Governance, our index is predicated on 20 provisions from King II, King III and King IV Reports, focusing on the key areas of board characteristics, accounting and auditing and risk management. We assess reliability using Cronbach's alpha, which gauges the internal consistency of the elements within the index (Ibrahimpašić, 2012), and validity using principal component analysis (PCA), which evaluates how well the elements capture the fundamental concept of the index (Dacakis *et al.*, 2017). Cronbach's alpha test and the PCA results confirm that these index and subindices are reliable and valid constructs of corporate governance compliance in JSE-listed firms.

This study makes several contributions. First, we expand the limited knowledge on constructing corporate governance indices in emerging markets, particularly South Africa. Our approach may be used as a blueprint for creating similar indices in other countries. Second, by implementing both Cronbach's alpha and PCA, we provide a robustness examination of the constructs. Third, the incorporation of provisions from the King Reports ensures that our index is tailored to South Africa's governance framework. This is particularly valuable given the absence of a formal corporate governance indicator in South Africa. The development of the index and its subindices contribute greatly towards understanding the quality of corporate governance in JSE-listed firms. With this index, governing authorities, policymakers and practitioners receive direct evidence on the level of corporate governance compliance exhibited by South African firms.

2. Literature review

2.1 Corporate governance in South Africa

As the first emerging market to establish corporate governance codes, South Africa commenced with the release of the King Report (King I) in 1994 (Maroun and Cerbone, 2024). The adoption of the King Codes is voluntary (Natesan, 2020). King I primarily addressed the roles of the board of directors, auditing committee and internal controls

(Van der Nest *et al.*, 2008; Ntim, 2009). King I was replaced by King II in 2002 to reflect economic, social and political changes between 1994 and 2002 (Maroun and Cerbone, 2024). In 2009, King III introduced provisions to enhance sustainability and transparency (Natesan, 2020). To address "emerging issues and corporate governance developments since the release of King III", King IV was launched in 2016 (Esser and Delport, 2018: p.4), integrating areas surrounding ethical culture, performance, control and legitimacy (Natesan, 2020). Throughout these reports the focus remains on boards of directors, audit committees and risk management.

The board of directors monitor managerial actions, oversee the appointment of senior executives, establish corporate missions, design and execute company strategies, allocate capital and set performance targets (Goel, 2018; Munisi, 2020; Alabdullah *et al.*, 2022). Consequently, the King Reports place increased focus on board characteristics (Waweru, 2014). Accounting and auditing are also critical, with audit committees verifying financial information and preventing manipulative practices (Nasrallah and El Khoury, 2022). Many notable corporate failures were attributed to fraudulent financial reporting (Smith and Marx, 2021). Therefore, the King Reports make several recommendations regarding accounting and auditing practices for South African firms. Corporate failures also result from the inability to manage firm risk (Alabdullah *et al.*, 2022). Thus, risk management guidelines are integral within the King Reports for firms to improve their risk management functions.

2.2 Index construction

Constructing corporate governance indices considers four aspects: compliance information, scoring system, weightage techniques and robustness. First, corporate governance compliance data can be sourced from firm reports or questionnaires. While firm reports are regarded as reliable sources of corporate information (Ntim, 2009), surveys are associated with potential misreporting and low response rates (Ananchotikul, 2007). Second, indices can be scored using binary coding or ordinal methods. Binary coding awards one point for compliance and zero otherwise, while ordinal scales account for partial levels of compliance.

Third, indices can be either unweighted or weighted. The unweighted scheme applies an equal weighting to all corporate governance variables within the index (Silveira *et al.*, 2009). The weighted scheme assigns different weights to variables based on their information value. Most studies prefer the unweighted approach, as the weighted approach may introduce subjectivity risk because of the lack of a theoretical basis for assigning weights (Ntim, 2009).

Finally, the robustness of an index can be determined by its reliability and validity (Sullivan, 2011). Reliability signifies internal consistency among items in the index, ensuring they reflect the same underlying aspect, while validity ensures the index accurately captures the aspect it intends to assess (Hajjar, 2018). Conducting reliability and validity tests is crucial to ensure that the construct is a robust measure of corporate governance.

2.3 Research on corporate governance indices

Gompers *et al.* (2003), the pioneers of constructing corporate governance indices for US firms, established an index and four subindices based on compliance with 24 provisions from the Investor Responsibility Research Centre. They applied a binary scoring method and an unweighted scheme. In Brazil, Silveira *et al.* (2009) constructed an unweighted index and four subindices (disclosure, board structure and operation, ethics and conflicts of interest and shareholder rights) using 24 governance provisions, binary coding and public company information. To validate their findings, Silveira *et al.* (2009) tested a weighted version of the index and found no significant changes, affirming the robustness of their constructs. Ananchotikul (2007) used company data and binary coding but used a weighted scheme when constructing a CGI for firms on the Thai Stock Exchange. As a robustness check, Ananchotikul (2007) applied an unweighted system and reported consistent results irrespective of the weightage system used.

While Ananchotikul (2007) and Silveira *et al.* (2009) conducted robustness checks by adjusting index weights, later studies adopted statistical tests, notably Cronbach's alpha, to evaluate index reliability. Kobuthi (2018) constructed an index for Kenyan firms based on Capital Markets Authority recommendations regarding board operations and control, rights of shareholders, stakeholder relations, ethics and social responsibilities, accountability, risk management and internal audit, transparency and disclosure, supervision and enforcement. To address concerns about using survey-based data, Kobuthi (2018) used Cronbach's alpha and content validity tests to verify the internal consistency of the index.

Goel (2018) used firm-level data to create a CGI for Indian firms under the Company Act, 2013. The index used an ordinal scale from 0 to 3, and its reliability was assessed using Cronbach's alpha, where a value above 0.70 indicates strong internal consistency and reliability (Black *et al.*, 2017). Goel's (2018) index attained an alpha value of 0.84. Cronbach's alpha was also used to confirm the reliability of corporate governance indices developed by Shahwan and Fathalla (2020) for Egyptian firms and Nasrallah and El Khoury (2022) for Lebanese firms, with coefficients of 0.78 and 0.87, respectively.

Black *et al.* (2017) used both Cronbach's alpha and PCA to investigate the robustness of corporate governance indices developed for Brazil, India, Korea and Turkey. All indices held four equally weighted subindices: board structure, disclosure, board procedure and ownership and shareholder rights. While most elements were scored using binary variables, ownership components were scored with continuous variables. Cronbach's alpha suggested that most indices were reliable, but the PCA revealed that some were not valid constructs, diminishing their overall robustness. This study is unique, as it explored robustness from the lens of both reliability and validity.

In the South African context, Ntim (2009) constructed an index and subindices for 100 JSE-listed firms based on 50 provisions across six areas of King II: board and directors, risk management, internal audit and control, accounting and auditing, integrated sustainability reporting and compliance and enforcement. Ntim (2009) used annual reports, binary coding and an unweighted scheme. Waweru (2014) developed a CGI for firms in South Africa and Kenya, drawing on provisions from the Institute of Shareholder Services and King III. Waweru's (2014) index aggregated 51 provisions across 6 subindices with binary coding. Both studies are constrained by small sample sizes, short timeframes and the absence of robustness tests, which hindered their generalizability and raised concerns about the validity of their results. Similarly, when constructing an index for sub-Saharan African countries (excluding South Africa, Zimbabwe, Côte d'Ivoire and Mozambique), Munisi (2020) also applied binary coding and equal weighting and failed to conduct robustness tests.

3. Data and methodology

3.1 Sample

The sample consists of all non-financial firms listed on the JSE from 2004 to 2021. In the South African context, the sample period provides coverage of provisions from three King reports, which were released in response to the financial crisis, domestic corporate failures and fraud (Maroun and Cerbone, 2024). The study includes both listed and delisted companies but excludes financial firms because their regulatory frameworks differ from firms in other industries (Munisi, 2020). The final data set contains 266 firms, in an unbalanced panel of 3,169 annual observations. Corporate governance data was sourced from annual firm reports through the IRESS database.

3.2 Construction methodology of index and subindices

Our CGI is predicated on 20 provisions from King II, King III and King IV relating to three categories: board characteristics, accounting and auditing and risk management. These categories form the three subindices within the main index, namely, board characteristics subindex (BCS), accounting and auditing subindex (AAS) and risk management subindex (RMS).

We use binary coding to score CGI and the subindices, where firms earn one point for compliance with a provision, and zero otherwise. As the index is predicated on 20 variables, the highest possible score a firm can attain is 20 points. The index and subindices are structured using an unweighted scheme, where all variables are assigned equal weights. These scores are transformed into a percentage so that firm's total score can vary between 0% and 100%.

Table 1 describes the composition of CGI and the subindices, displaying the variables, provisions and binary scoring rules in each subindex. Panel A reflects the attributes of BCS, while panels B and C pertain to AAS and RMS, respectively.

BCS measures the compliance of 12 provisions concerning the board, nomination committee and remuneration committee. AAS measures the compliance of four audit provisions, and RMS focuses on four risk management provisions. Although an unweighted scheme is used, there are variations in weights among the subindices, as the number of variables within the subindices differ, as shown in Table 1. BCS constitutes 60% of the main index as 12 out of the 20 variables pertain to board characteristics. This aligns with the emphasis placed on the board in the King reports (Waweru, 2014). The remaining weight of 40% is equally distributed between AAS (20%) and RMS (20%). The composition of the subindices is expressed in equations (1)–(3), equation (4) specifies the CGI. In all cases, $i = 1 \ldots N$ and $t = 1 \ldots 18$:

Table 1 Variable definitions and scoring rules

Variables	*Provisions*	*Scoring rule*
Panel A: Board characteristics subindex (BCS)		
BC1	Board majority are independent non-executive directors (NEDs)	1 if yes; 0 otherwise
BC2	Minimum four board members	1 if yes; 0 otherwise
BC3	Chairman and chief executive officer (CEO) split	1 if yes; 0 otherwise
BC4	Chairman of an independent NED	1 if yes; 0 otherwise
BC5	Company secretary present	1 if yes; 0 otherwise
BC6	Board meets at least four times a year	1 if yes; 0 otherwise
BC7	Nomination committee exists	1 if yes; 0 otherwise
BC8	Nomination committee has mostly independent NEDs	1 if yes; 0 otherwise
BC9	Remuneration committee exists	1 if yes; 0 otherwise
BC10	Remuneration committee only has independent NEDs	1 if yes; 0 otherwise
BC11	Chairman of remuneration committee an independent NED	1 if yes; 0 otherwise
BC12	Record of meeting attendance is disclosed	1 if yes; 0 otherwise
Panel B: Accounting and auditing subindex (AAS)		
AA1	Audit committee exists	1 if yes; 0 otherwise
AA2	Audit committee has at least two independent NEDs	1 if yes; 0 otherwise
AA3	Chairman of committee is an independent NED, who is also not the main board chairman	1 if yes; 0 otherwise
AA4	Record of meeting attendance is disclosed	1 if yes; 0 otherwise
Panel C: Risk management subindex (RMS)		
RM1	Risk management committee exists	1 if yes; 0 otherwise
RM2	Company discloses actual and potential future non-systematic risks	1 if yes; 0 otherwise
RM3	Company discloses how current and future assessed risks will be managed	1 if yes; 0 otherwise
RM4	Company provides a narrative of existing internal control	1 if yes; 0 otherwise

Source: Authors' own creation

$$BCS_{it} = \frac{\sum_{i}^{n} \eta p_{it}}{\sum_{i}^{n} MSA_{it}} \tag{1}$$

where p_{it} is the set of scores obtained by firms for all 12 variables presented in Panel A of Table 1; and MSA_{it} is the maximum possible score that can be awarded to firms (12 points):

$$AAS_{it} = \frac{\sum_{i}^{n} \eta q_{it}}{\sum_{i}^{n} MSB_{it}} \tag{2}$$

where q_{it} constitutes the scores that firms obtained for the four variables presented in Panel B of Table 1, and MSB_{it} is the maximum possible score that can be awarded (four points):

$$RMS_{it} = \frac{\sum_{i}^{n} \eta z_{it}}{\sum_{i}^{n} MSC_{it}} \tag{3}$$

where z_{it} constitutes the scores that firms obtained for the variables in Panel C of Table 1, and MSC_{it} is the highest possible score (four points):

Based on the aggregation of the three subindices, the CGI is specified as:

$$CGI_{it} = \frac{\sum_{i}^{n} \eta p_{it}}{\sum_{i}^{n} MS_{it}} + \frac{\sum_{i}^{n} \eta q_{it}}{\sum_{i}^{n} MS_{it}} + \frac{\sum_{i}^{n} \eta z_{it}}{\sum_{i}^{n} MS_{it}} \tag{4}$$

where p_{it}, q_{it}, z_{it} are defined as above; and MS_{it} is the maximum possible score (20 points).

3.3 Methodology to assess reliability and validity

Two methods are used to assess the reliability and validity of CGI and the subindices: Cronbach's alpha and PCA.

3.3.1 Cronbach's alpha. Cronbach's alpha assesses how well a set of individual elements measures an underlying broad aspect (Ibrahimpašić, 2012). This is a suitable estimate for the internal consistency of the variables enclosed in the main index and subindices (Black *et al.*, 2017). Internal consistency is a form of reliability that "ascertains the degree to which instrument items are homogenous and reflect the same underlying constructs" (Kobuthi, 2018: p.49). Cronbach's alpha is determined by the average intercorrelation between the elements and the number of elements within the construct (Black *et al.*, 2017):

$$\alpha = \frac{nr_i}{1 + (n-1)\ r_i} \tag{5}$$

where $i = 1 \ldots n$; α is Cronbach's alpha of either CGI, BCS, AAS or RMS; n is the number of corporate governance variables; and r_i is the average intercorrelation between the variables.

The value of Cronbach's alpha ranges from 0 to 1, alpha coefficients exceeding 0.70 indicate high reliability, those above 0.60 are moderately reliable and values below 0.50 suggest low reliability (Kobuthi, 2018). Piedmont (2014) recommends an average intercorrelation between 0.20 and 0.40 for a set of variables, as this signifies that, although the variables are standardized, they have unique variance and are not too similar to one another.

3.3.2 Principal component analysis. We use PCA to examine the construct validity of CGI and the subindices. This approach involves the extraction of principal components from eigenvectors and eigenvalues of a sample correlation matrix (Kim and Kim, 2012). The eigenvectors are the linear combinations of the corporate governance variables, whereas eigenvalues reflect the scaling factor and the explanatory strength of the eigenvectors (Black *et al.*, 2017). Following Kaiser's (1970) criteria, principal components are retained only from eigenvectors that have eigenvalues above one as eigenvalues less than one exhibit weak explanatory power (Todorov *et al.*, 2018).

The eigenvector with the largest eigenvalue is the first principal component (PC1), the eigenvector with the second largest eigenvalue is the second principal component (PC2) and so forth (Black *et al.*, 2017). PCA assumes that PC1 accounts for the largest portion of variance, explaining most of the information in the construct, after which PC2 subsumes the second largest variance and so on (Todorov *et al.*, 2018). Streiner (1994) suggested that principal components should cover at least 50% of the total variance.

Principal components are interpreted based on the original variables which they "load" on (Todorov *et al.*, 2018: p.4). These component loadings represent the correlation between original variables and principal components and are important, as these determine whether the components carry a unique effect in the underlying constructs of the CGI, BCS, AAS and RMS (Kim and Kim, 2012). PCA recommends that the cluster of variable loadings be unique for each principal component to ensure that the indices measure distinct, but consistent constructs of the underlying concept, i.e. corporate governance compliance (Black *et al.*, 2017). The distinctiveness among the principal components indicates that each component provides unique information and is not redundant (Kim and Kim, 2012).

Principal components often load and cross-load across more than one variable, where the magnitude of each loading represents the relative contribution of the individual variable to the principal component. According to Black *et al.* (2017), variables with component loadings greater than 0.40 are reliable, as they are positively intercorrelated as a group, suggesting that they fit well with other elements across the principal component (Kim and Kim, 2012). Accordingly, we apply a cut-off of 0.40 (i.e. $w_i \geq 0.40$), where variables are only significant if their loading exceeds 0.40.

4. Results

4.1 Cronbach's alpha

Cronbach's alpha results are presented in Table 2.

The Cronbach's alpha values reflect a strong degree of reliability and internal consistency among the variables in CGI and the subindices, with coefficients ranging from 0.700 to 0.832. CGI has the highest Cronbach's alpha, indicating that 83.2% of the 20 variables are reliable and reflect similar underlying constructs of corporate governance. The alpha value of 0.832 is consistent with Goel's (2018) coefficient of 0.84.

Unlike prior studies (Kobuthi, 2018; Goel, 2018; Shahwan and Fathalla, 2020; Nasrallah and El Khoury, 2022), our analysis considers inter-element correlation to provide a deeper insight into the construct's reliability. The inter-element correlation for CGI is narrowly below the preferred range of 0.20–0.40, implying that its high alpha is driven by the number of elements within the index (i.e. 20), rather than inter-element correlation (Black *et al.*, 2017).

Table 2 Cronbach's alpha results

	r	n	*Cronbach's alpha*
CGI	0.198	20	0.832
BCS	0.190	12	0.738
AAS	0.368	4	0.700
RMS	0.380	4	0.710

Notes: Table reports average correlation among elements (*r*); number of corporate governance variables (*n*); and Cronbach's alpha (α) across the elements in the corporate governance index (CGI), board characteristics subindex (BCS), accounting and auditing subindex (AAS) and the risk management subindex (RMS)
Source: Authors' own creation

CGI's low inter-element correlations, combined with its strong alpha infers that the variables capture distinct consistent aspects of corporate governance, whilst collectively measuring similar governance aspects (Cooper and Schindler, 2006; Black *et al.*, 2017). Thus, CGI is considered a reliable measure of corporate governance compliance for JSE-listed firms.

Table 2 shows that the subindices, BCS, AAS and RMS, are reliable measures of the underlying aspects of corporate governance, as their Cronbach's alpha coefficients all exceed 0.70. The alpha values of AAS and RMS appear to be induced through the inter-item correlation estimates, as these indices only contain four variables and exhibit desired inter-item correlations.

The alpha coefficient of BCS exceeds that of AAS and RMS. BCS encloses 12 elements and has a low inter-element correlation, suggesting that, even though there is a higher degree of uniqueness among the 12 variables, they still measure the same underlying board characteristics. Despite differences in the strength of average correlation, BCS, AAS and RMS are all considered reliable measures of corporate governance compliance pertaining to the board, audit committees and risk management committees, respectively. Overall, the reliability of our constructs aligns well with previous research.

4.2 Principle component analysis

Table 3 presents the results for the PCA with the eigenvalues, explained variance and component loadings of each construct, where only principal components with eigenvectors above one are reported. Appendix Table A1 presents all 20 CGI components.

Panel A shows seven principal components from the 20 CGI variables (eigenvalues greater than one). These seven principal components explain 62.55% of the total variance in CGI, which is sufficient as it exceeds 50% (Streiner, 1994). Consistent with Black *et al.* (2017), the explained variance of PC1 is larger than other principal components. Based on the acceptable threshold of component loading ($w_i \geq 0.40$), PC1 is significantly loaded on 13 of the 20 CGI variables.

Since PC1 loads on 65% of the corporate governance variables across the three subindices (seven in BCS, three in AAS and three in RMS), it singlehandedly represents most aspects of corporate governance. Although PC1 is not loaded on BC9 and AA1 (the formation of remuneration and audit committees), PC1 is still significantly loaded on provisions relating to these committees (BC10, BC11, BC12, AA2, AA3 and AA4), suggesting that the compliance of BC9 and AA1 are indirectly captured through other loaded variables.

PC2 loads on AA4 only, capturing the disclosure of attendance registers of audit meetings. As PC2 accounts for the second largest portion of variance (8%) in CGI, it is expected to

Table 3 Component loadings for principal components

	PC1	*PC2*	*PC3*	*PC4*	*PC5*	*PC6*	*PC7*
Panel A: CGI							
λ_i	4.971	1.588	1.503	1.162	1.146	1.097	1.033
Explained σ^2	0.249	0.080	0.075	0.058	0.057	0.055	0.052
BC1	*0.466*	−0.250	−0.201	0.020	0.283	0.325	0.252
BC2	0.105	0.175	0.312	−0.253	0.078	*0.555*	0.030
BC3	0.130	−0.042	0.060	0.727	−0.039	0.174	−0.081
BC4	*0.431*	−0.347	−0.142	0.178	0.374	0.272	0.211
BC5	0.086	0.054	0.053	0.001	0.082	−0.295	*0.829*
BC6	0.376	0.307	0.358	−0.272	−0.041	0.058	0.172
BC7	*0.661*	−0.245	0.004	−0.156	−0.266	−0.097	−0.195
BC8	*0.664*	−0.369	−0.025	−0.265	−0.196	−0.112	−0.138
BC9	0.296	−0.126	*0.567*	*0.444*	−0.136	0.117	0.010
BC10	*0.465*	−0.511	0.185	−0.184	0.084	−0.105	0.063
BC11	*0.615*	−0.400	0.209	−0.098	0.088	−0.129	−0.048
BC12	*0.568*	0.032	*0.447*	0.173	−0.149	−0.249	0.011
AA1	0.235	0.355	*0.441*	−0.235	−0.005	0.358	−0.008
AA2	*0.682*	0.267	−0.192	0.010	*0.423*	−0.083	−0.195
AA3	*0.661*	0.263	−0.172	−0.012	*0.437*	−0.069	−0.208
AA4	*0.511*	*0.419*	0.096	0.091	0.117	−0.289	−0.068
RM1	*0.599*	0.210	0.013	0.182	−0.013	−0.053	−0.012
RM2	*0.658*	0.120	−0.406	0.042	−0.408	0.225	0.090
RM3	*0.645*	0.127	−0.406	0.018	−0.421	0.211	0.127
RM4	0.287	0.355	−0.116	0.019	−0.136	−0.206	0.166
Panel B: BCS							
λ_i	3.184	1.255	1.140	1.055	1.003		
Explained σ^2	0.265	0.105	0.095	0.088	0.084		
BC1	*0.493*	−0.359	0.239	0.396	0.164		
BC2	0.104	0.328	−0.152	0.380	*0.701*		
BC3	0.138	0.214	*0.700*	−0.160	0.042		
BC4	*0.485*	−0.365	*0.415*	0.344	0.108		
BC5	0.090	0.094	−0.104	*0.602*	−0.638		
BC6	0.350	*0.407*	−0.358	0.287	0.088		
BC7	*0.718*	−0.078	−0.212	−0.295	0.066		
BC8	*0.755*	−0.222	−0.254	−0.246	0.038		
BC9	*0.402*	*0.583*	0.381	−0.086	−0.080		
BC10	*0.632*	−0.184	−0.054	−0.005	−0.092		
BC11	*0.734*	−0.061	−0.032	−0.083	−0.099		
BC12	*0.600*	*0.483*	−0.028	−0.062	−0.164		
Panel C: AAS							
λ_i	2.105						
Explained σ^2	0.526						
AA1	0.317						
AA2	*0.885*						
AA3	*0.879*						
AA4	*0.700*						
Panel D: RMS							
λ_i	2.153						
Explained σ^2	0.538						
RM1	*0.615*						
RM2	*0.899*						
RM3	*0.896*						
RM4	0.405						

Notes: Table reports component loadings of seven principal components in the CGI (PC1–PC7); five principal components in the BCS (PC1–PC5); one principal component in the AAS (PC1); and one principal component in the RMS (PC1). Items in italic face exceed 0.40. Eigenvalues (λ_i) and explained variance (σ^2) are stated for each principal component.
Source: Authors' own creation

encompass more than one variable. As PC1 already assimilates the general role of AA4, the cross-loading by PC2 may be redundant in the CGI (Reise *et al.*, 2010).

PC3 encapsulates the significance of forming remuneration and audit committees with loadings greater than 0.40 on BC9 and AA1. PC3 strongly loads on BC12, implying that remuneration committees will disclose meeting attendance records. Nevertheless, in accounting for 7.5% of total variation in CGI, PC3 is primarily regarded as a rendition of the presence of an audit and remuneration committee. The formation of remuneration committees is also prevalent in PC4, which loads on RM1, as well as BC3, covering a 5.8% of explained variance. As per Table 1, BC3 considers if the roles of the CEO and chairman are separate. According to Broye *et al.* (2017: p.336), separate roles require “payment of incentive compensation for the chairman in addition to that defined for the CEO”. This implies that independent positions increase the prevalence of remuneration committees, as separate compensation packages need to be strategically designed to incentivize both the CEO and chairman (Broye *et al.*, 2017). BC9 may be viewed as a complement to BC3, explaining the combined loading by PC4. Despite the cross-loading on BC9 by PC3 and PC4, both are distinct as their loading combinations depict different aspects of corporate governance.

PC5 annotates 5.7% of the total variation in CGI, loading strongly on AA2 (independence of the NEDs) and AA3 (chairman of the audit committee is a NED). Hence, PC5 is regarded as a constituent of the independence of the audit committee. The combined loadings for AA2 and AA3 suggest that both provisions need to be satisfied for the committee to be independent (Deloitte and Touche, 2014). Although AA2 and AA3 are cross-loaded on PC1 and PC2; the components are distinct as PC2 captures the independence factor of the audit committee, whereas PC1 assimilates the broad roles of AA2 and AA3 in corporate governance.

PC6, which contributes to 5.5% of the total variance, loads only on BC2 (four or more board members). It is distinct as no other component loads on this variable. Similarly, PC7 is unique as it is the only component to load on BC5 (the presence of company secretary). No components load on BC6 (frequency of board meetings) and RM4 (disclosure of internal controls), implying that these factors are not imperative in explaining variation in corporate governance compliance. Overall, the principal components in Panel A confirms that CGI captures distinct areas of governance and is regarded as a valid construct of corporate governance compliance for JSE-listed firms.

Panel B shows five principal components retained for the BCS with eigenvalues greater than one. PC1 contributes to the largest portion of variance (26.5%) and loads on all variables relating to nomination and remuneration committees and two variables pertaining to board independence (BC1 and BC4). As the board of directors participate in the appointment of subcommittees (Wijethilake *et al.*, 2015), the combined PC1 loadings suggest independent boards are more likely to establish nomination and remuneration committees that comply with the King reports. PC1 of the BCS captures the same board variables as PC1 of the CGI. This reinforces the notion that the subindices capture an important underlying aspect of corporate governance (Black *et al.*, 2017).

PC2 explains 10.5% of the variation in BCS (loads on BC6, BC9 and BC12). The combined loading for BC9 and BC12 implies that remuneration committees consistently disclose their meetings attendance register. The additional loading on BC6 by PC2 may suggest that boards that meet more frequently will encourage a higher meeting frequency for their subcommittees (Raghunandan and Rama, 2007). Thus, PC2 is regarded as a representation of board and remuneration meetings.

PC3 explains 9.5% of the total variance, loading strongly on BC3 and BC4, where BC3 notes whether the chairman and CEO are separate, and BC4 considers if the chairman is an independent NED. The combined loadings of BC3 and BC4 suggest that an independent chairman is indicative of a separate CEO and chairperson. Hence, PC3 is considered as a reflection of the qualities of the chairman.

Regarding the last two principal components, Panel B shows that PC4 strongly loads on BC5, whereas PC5 is loaded on BC2. As there are no combined loadings on either principal component, PC4 and PC5 capture the general aspect of these variables. Overall, the BCS yields sufficient construct validity to be considered valid, as each principal component retains distinctive governance information that is aligned with various board structure provisions.

The PCA for the AAS in Panel C presents PC1 only, as it is the only component with an eigenvalue above one. Apart from AA1, PC1 loads on all variables in the AAS, implying that the component captures provisions specific to audit committees. This was also observed for PC1 in CGI, where the loading on AA1 was insignificant. Despite the insignificant loading, PC1 still subsumes information on AA1, as loadings on the remaining variables (AA2, AA3 and AA4) convey that an audit committee is appointed. Panel C indicates a coherence of the AAS variables as they converge on PC1 to encapsulate the overall governance of audit committees. The combination of AAS loadings matches the variable loadings by PC1 of CGI, verifying that the AA subindex captures a section of corporate governance compliance.

The results from Panel D for the RMS are similar to Panel C, in that PC1 loads on three of the four variables. In accounting for 53.8% of the total variation of the RMS, PC1 reflects the underlying governance of the risk management committee, as it strongly loads on RM1, RM2 and RM3. The insignificant loading on RM4 implies it does not explain variation in risk committees across firms. Nevertheless, the RMS is regarded as a valid construct of the underlying compliance of risk committees.

The results confirm the robustness of the constructed CGI, BCS, AAS and RMS, all of which are established as reliable and valid measures of corporate governance compliance in JSE-listed firms. This stands in contrast to Black *et al.* (2017), whose indices were deemed reliable but not universally valid.

5. Conclusion

The aim of this study was to construct an index and subindices that are reliable and valid measures of corporate governance compliance for JSE-listed firms. The CGI is predicated on 20 provisions of the King II, King III and King IV reports, resulting in three subindices: BCS, AAS and RMS. The CGI and the subindices are scored using binary coding and structured with an unweighted scheme.

Cronbach's alpha test reveals that the CGI and its subindices are highly reliable measures of corporate governance, as each instrument satisfies the reliability benchmark ($\alpha \geq 0.70$). Similarly, the results of the PCA support the validity of the constructs, as the principal components demonstrate uniqueness, indicating that they capture distinct consistent aspects of corporate governance. Thus, the CGI, BCS, AAS and RMS are reliable and valid constructs of corporate governance compliance in JSE-listed firms.

This study contributes to our understanding of corporate governance among JSE-listed firms, offering a practical tool for ranking companies based on their compliance with King Code provisions, enabling regulatory bodies, policymakers and investors to identify firms with varying levels of compliance. In addition, the proposed index construction methodology can be adopted in future research and may be adapted for use with different corporate governance standards in other countries.

The index is limited to board characteristics, accounting and audit and risk management. While these are core components of the King Reports, they alone may not fully capture the corporate governance of JSE-listed firms. Further research should consider expanding the indices to include additional categories (such as ethics, sustainability, diversity) to achieve a broader outlook of corporate governance across firms. This study focused on South Africa, recognizing its financial system as the most advanced among African nations (Van Wyk *et al.*, 2015). Future research should include a range of African countries to provide more widely applicable insights.

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Appendix

Table A1. Eigenvalues of components in indices and subindices

Components	*CGI*	*BCS*	*AAS*	*RMS*
1	*4.971*	*3.184*	*2.105*	*2.153*
2	*1.588*	*1.255*	0.962	0.918
3	*1.503*	*1.140*	0.696	0.750
4	*1.162*	*1.055*	0.237	0.178
5	*1.146*	*1.003*		
6	*1.097*	0.939		
7	*1.033*	0.857		
8	0.927	0.722		
9	0.857	0.592		
10	0.835	0.526		
11	0.742	0.472		
12	0.712	0.254		
13	0.685			
14	0.640			
15	0.573			
16	0.469			
17	0.400			
18	0.253			
19	0.236			
20	0.172			

Notes: This table reports the eigenvalues of 20 components in the corporate governance index (CGI), 12 components in board characteristics subindex (BCS), 4 components in accounting and auditing subindex (AAS) and 4 components in risk management subindex (RMS). Components in italic face are eigenvalues values that exceed 1
Source: Authors' own creation

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