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Structural Equation Modelling to Measure Efficiency of Namibian Pension Funds

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Abstract

The purpose of the study is to analyse the association of various determinants of operational efficiency of Namibian pension funds. The analysis was conducted using questionnaire based survey measuring each variable on a 5-point Likert-scale with choices ranging from (1) Not very important, (2) Less Important, (3) Moderately important, (4) Important and (5) Very Important. The data analysis was conducted with the aid of Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA) and Structural Equation Modelling (SEM) using SPSS and AMOS software. The overall findings reveal satisfactory goodness of fit of the structural models and assert governance, ethics, compliance and operational efficiency as reliable predictors of organisational efficiency.

Keywords

Operational Efficiency, Governance, Parallel Analysis, Ethics, Investment Strategy, Structural Equation Modelling, Confirmatory Factor Analysis

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1. Introduction

Pension Funds are important for macro-economic development (Bui, 2013) re-distribution (Stewart & Yermo, 2008) and fiscal augmentation (Stensnes and Stolen, 2007). Because of the strategic importance of pension funds for countries and the recent global economic crisis, it has become imperative to analyse the efficiency of these institutions.

Efficiency is defined in production economics as the ability of an organisation to maximise resources to deliver products and services on a cost-effective basis without compromising on its objectives (Hackman, 2008). The criterion for efficiency can include both financial and non-financial considerations as will be seen in the literature review. Therefore, the present study only looks at the association between the defined non-financial variables on the organisational efficiency of pension funds in Namibia.

Many scholarly studies on organisational performance have approached the subject of efficiency from a strict financial point of view and have largely ignored the non-financial factors driving efficiency (Alzoubi, 2014). Therefore, recent studies are now shifting the analytical focus to non-financial variables into the mix of factors driving efficiency (Chenhall, 2003).

The theory of non-financial factorization as a measure of pension fund efficiency was applied in previous studies like Kenya (Njuguna, 2010), Norway (Clark & Monk, 2010) and South Africa (South African National Treasury, 2014). In Kenya, various factors like governance, regulations and fund sizes were held to be determinants of operational efficiency. In South Africa, governance, regulation, fund size, fund structure and compliance were also cited as antecedents of efficiency of pension funds (South African National Treasury, 2014). The Norwegian experience however espoused a theory that supports fund ethics over financial efficiency

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(Clark & Monk, 2010). Therefore, the hypothesized measurement model in the study is grounded on the above literature and aims to evaluate and measure the relative efficiency of Namibian pension funds using non-financial factors like governance, compliance, regulations, fund design, ethics, investment strategy and fund size. Therefore, the research looks at the dimensions of the issues that (based on the literature) have been assumed to be the drivers of organisational efficiency.

2. Literature Review

The literature defines efficiency as the ability of an organisation to optimise on scarce resources in order to achieve its objectives (Hager & Flack, 2004). Borrowing from the resource-based view of the firm in strategic management, pension fund possess tangible and intangible resources and are required to optimize on this to achieve efficiency (Quarter, Carmichael, & Ryan, 2008). Therefore, it is imperative to understand the antecedents of pension fund efficiency. The literature revealed 7 drivers of efficiency and these form the theoretical basis for the hypothesised measurement model in the study. The 7 measuring variables are operationalized in summary as follows:

2.1. Governance and Operational Efficiency

Governance has gained prominence in global literature over the last two decades and especially as a result of the global financial crisis (Antolin & Stewart, 2009). The OECD and World Bank define governance in terms of segregation of duties, risk management and operational efficiency. (Carmichael & Palacious, 2003). Therefore, although the literature seems to create a positive association between governance and operational efficiency, the concepts are similar, but not the same (OECD, 2009). Whilst both concepts relate to optimization, the former broadly creates the framework for organizational synthesis and the latter focus on process and systems to ensure effectiveness and efficiency (Harris, 2006). Despite the critics of good governance who argues its sinister political motive and flawed methodological approach (Kwame & Chowdhury, 2012), modern scholars support the above definition and argue that strong governance leads to resource optimization and hence improved efficiencies for pension funds (Volpato & Scheerlinck, 2014) (Bikker & De Dreu, 2009). Therefore, despite the common denominators, governance and organisational efficiency are seen as a distinct and reliable measure of pension fund efficiency (Faryadras, 2004).

2.2. Regulations and Compliance

The literature consulted posits both regulations and compliance as important factors impacting on pension fund efficiency (Stewart, F, 2009). In short regulatory compliance guarantees the financial soundness of pension funds and protects the interest of members (Vittas, 1998). At the same time, compliance improves the level of efficiency and overall image of an organization and creates confidence amongst stakeholders (Bikker & De Dreu, 2009). Regulations create the legislative and supervisory framework for pension fund whilst compliance ensures adherence to rules of market conduct (Stewart, 2010). Both concepts are interrelated and mutually inclusive to avoid financial catastrophe for pension funds (Shah, 1997). The contrarian view is that compliance with the myriad of legislation creates additional layers of costs and hampers efficiency (Srinivas & Yermo, 1999). However, the empirical evidence suggests that funds that adhere to regulations reduce compliance costs due to fewer penalties (Steele, 2006). Therefore, regulations and compliance are separate instruments and each is positively associated with pension fund efficiency (James, 2000).

2.3. Investment Strategy, Ethics and Risk

Investment strategy is defined as the plan used by pension funds to place assets in a mix of portfolios with an expectation of growth (Russel, 2006). Therefore, investment strategy is mainly a function of risk management (OECD, 2006). Whist his approach perceives investment strategy in terms of market risk, the concept of risk is much broader and includes employer default and systematic risks (Srinivas & Yermo, 1999). Conceptually, risk is defined as the occurrence of some adverse event (Randle & Rudolph, 2014) whilst ethics is seen in terms morality (Bunge, 1989), fiduciary (Richardson, 2013) and transparency (Stewart & Yermo, 2008). Therefore, modern investment theorists caution that efficiency is more than risk/return trade-offs and avers that non-financial criteria like ethics must be applied to investment strategy and risk (Quarter, Carmichael, & Ryan, 2008). The logical interpretation is that ethics sets the behavioural benchmark for investment strategy whilst risk management reduces adverse events. In Norway, issues of ethics were chosen over pure investment returns (Clark & Monk, 2010) and in the United States, investments in environmentally friendly stocks were upheld as prudent (Baltimore, 1989). However, empirical findings in Kenya shunned fund ethics as a reliable predictor of pension fund efficiency (Njuguna, 2010). Despite divergent views, the balance of literature creates a significant link between investment strategy, risk and ethics (Mitchel, Piggot, & Kumru, 2008).

2.4. Design and Size of Pension Funds

Based on the World Bank 3-pillar constellation of pension

design structures, many pension systems in the world are made up of defined benefits or defined contribution schemes (Stiglitz, 1999). However, the Namibian situation poses a challenge given the relatively smaller size of the pension fund industry and the fact that over 99% of private pension funds are funded on a defined contribution basis. Nevertheless, comparative literature suggests that defined benefit schemes are more efficient than defined contribution funds. (Dyck & Pomorski, 2011). However, in the United States, an opposite view is offered in that defined contribution funds yield better efficiencies than defined benefit funds (Tang, 2008). In Africa and more specifically Kenya, it was found that pension fund design had no impact on efficiency (Njuguna, 2010). The Canadian experience on the other hand found that larger funds were relatively more efficient than smaller schemes. (Dyck & Pomorski, 2011).

The comparative literature review does not seem to offer consensus on whether the size of a pension fund affects efficiency and the results seem to embrace the divergent nuances and peculiarities of geographical dimensions. However, the results of a Namibian study using Data Envelopment Analysis have found that smaller pension funds were more financially efficient than larger schemes (Zamuee, 2015). Therefore, unlike in other jurisdictions like Kenya, Canada and the United States, the homogeneous pension design structure in Namibia does not support any sensible study hypotheses premised on size and design structures of pension funds as predictors of organisational efficiency.

3. Methodology of the Study

The methodology covers sampling, measurement methodology, data collection and analysis.

3.1. Sample Selection

Study population refers to a group of potential participants to whom you want to generalise the study results and sample is a subset of the population (Salkind, 2012). Since the unit of analysis is pension funds, the study population and sample covers all the registered and active pension funds with the Namibian Financial Institutions Supervisory Authority (NAMFISA).

Therefore, a total of 158 questionnaires were mailed to the Principal Officer and the Trustees of each registered pension fund. The collected responses were 105 fully completed questionnaires covering a rate of response of 66%.

Although generally SEM requires large data, a sample of 100 items or more carries adequate statistical power to use this analytical tool (Hair, Black, Babin, & Anderson, 2010). SEM is the most long standing and widely used program for this type of analysis involving multi-dimensional data sets (Byrne, 1998).

3.2. Theoretical Measurement Model

A total of seven variables were hypothesized to measure the drivers of operational efficiency and each one was anchored on a 5-point Likert-scale questionaire as follows: governance was adopted from Bikker and De Dreu (2009), Njuguna (2010) and Volpato and Scheelinck (2014)-[12 items], compliance was adopted from Steele (2006), Njuguna (2010) and Tricker (2015)-[13 items], investment strategy was adopted from Mitchel *et al* (2008), Bikker and De Dreu (2009) and Njuguna (2010)-[13 items], ethics and risk management was adopted from Stewart and Yermo (2008), Rossouw (2005) and Richardson (2013)-[13 items], regulations was adopted from Vittas (1998), Srinivas *et al* (2000) and Richardson (2013)-[11issues].

3.3. Data Collection

The study used a questionnaire survey approach as an effective method to collect data for quantitative studies (Saunders *et al*, 2007). Questionnaires can be used for both descriptive and analytical research that seeks to test relationships between variables (Robson, 2002). The questionnaires had a 5-point Likert scale with choices ranging from (1) Not very important, (2) Less Important, (3) Moderately important, (4) Important and (5) Very Important. Each question was aligned to the hypothesized measuring instruments covering governance, investment strategy, compliance, risk management, ethics and regulations as suggested in the comparative literature review.

3.4. Data Analysis

The data analysis for the study was informed by various statistical methods using SPSS and AMOS software. First, the survey ordinal data was treated to numeric to aid parametric analysis using a statistical method of scaling as will be discussed below. The test for internal consistency and reliability of data was carried out using the Cronbach alpha. Second, EFA was conducted to analyse the patterns of the extracted factors using parallel analysis. Third, CFA and SEM were used to validate and test the measurement model using AMOS. Since the study was testing theory, the SEM analysis was conducted using covariance as the input matrix (Hair, Black, Babin, & Anderson, 2010).

4. Results of the Study

As indicated before, various statistical techniques were used to analyse the data and the findings are as follows:

4.1. Data Preparation

Since ordinal data was obtained from the Likert-styled survey, it was necessary to convert the data into numeric to aid parametric analysis. Therefore, an algorithmic optimisation method of scaling was applied which uses algorithmic discretisation transformation techniques to analyse ordinal data. This means that ordinal data is transformed into numeric values based on Gaussian distribution to aid analysis without an assumption of it being numeric (Stacey, 2015). Although there seem to be no global consensus on the most effective method to treat analysis of ordinal data from a Likert-scale, the scaling method is novel in approach and robust enough to deliver reliable and valid analysis without the need to apply the traditional non-parametric tests to the data. Scaling has been implemented using SPSS. The result of scaling shows the values of the standard deviation below or above the average and the variance in the results making it more convenient to conduct the parametric analysis.

4.2. Internal Consistency Reliability Tests

Internal consistency reliability tests were implemented using Cronbach's alpha coefficient with a minimum benchmark of 0.7 (Hair, Black, Babin, & Anderson, 2010). The Cronbach alpha coefficients of all the variables showed an adequate score above 0.70, meaning that the data meaningfully measured organisational efficiency (Gliem & Gliem, 2003). Equally the Cronbach alpha coefficients for the revised model post EFA and CFA also shows strong internal reliability.

4.3. Exploratory Factor Analysis

EFA seeks to analyse general relationships between variables through observation of patterns on the extracted factors (Young & Pearce, 2013). This step is a prelude to multi-variate estimation (Hair, Black, Babin, & Anderson, 2010). Various tests are carried out to decide on the number of factors to retain from the data. This includes the commonly used methods like Bartlett's chi-square or the Kaiser test which retain factors with eigenvalues greater than 1 (Field, 2000). Many of these tests tend to over or under factor and reduce the accuracy of the measured factor structure. Therefore, parallel analysis (PA) has been developed as a more accurate and reliable factor retention strategy in factor analysis (Hayton, Allen, & Scarpello, 2004). This study has adopted PA as the preferred method using SPSS. PA has been implemented in four steps by generating random data, extracting eigenvalues using principal component analysis, calculating the average eigenvalues and comparing the above two eigenvalues. Factors with eigenvalues greater than the 95th percentile between actual and random data were retained as shown in table 1 below (Hayton, Allen, & Scarpello, 2004).

Table 1. Eigenvalues/Parallel Analysis.

Eigenvalue Number	Eigenvalue	Parallel Analysis	
1	22,057888	3,495667	11,764
2	5,7292232	3,176667	9,574
3	5,025756	3,062	8,796
4	3,3904532	2,988	6,07

The results in table 1 above were graphically illustrated in figure 1 below as follows:

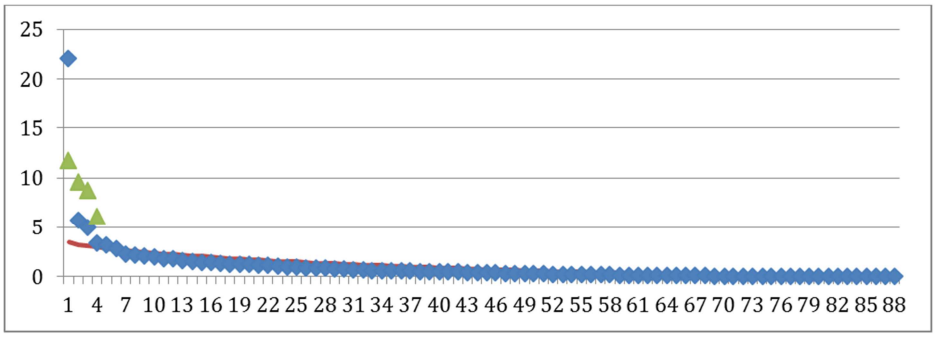

Figure 1. Results of Parallel Analysis.

Using PA, the data has been summarised into four distinct factors as discussed below. These results infer some deviation from the primary literature, which had originally suggested seven separate and distinct variables in the hypothesized measurement model of organisational efficiency. As per the EFA factor structure in Table 1 below, Factor 1 shows that investment strategy and ethics are significantly related and together form a new construct namely investment fiduciary based on common characteristics as per the secondary literature review (Njuguna, 2010). Factor 2 summarises risk management

into operational efficiency, which laments the initial literature findings positing the same as separate measurement instruments (Thompson, 2008). Given its overall dominant score loadings, operational efficiency retains its standing as a separate and distinct measurement instrument of organisational efficiency as per the EFA results. On the other hand, Factor 3 converts regulations and compliance into a new variable namely regulatory compliance, which is supported by the secondary literature. Factors 4 retain governance as a separate category and retain its significance as a predictor of organisational efficiency in congruence with the primary literature review. For purposes of analysis cross-loadings were ignored and a minimum factor loading of 0.40 was considered significant (Field, 2000). Therefore the four new EFA factor structure represented investment fiduciary, operational efficiency, regulatory compliance and governance.

4.4. Confirmatory Factor Analysis (CFA) and SEM

Whilst EFA illustrated the underlying factor structure of the scale items, CFA is used to further summarise the data and show the results of the latent variables, measurement models and structural models (Albright & Park, 2009). The analysis was carried out using AMOS 21.0. The results of CFA show that all factor loadings were statistically significant at values greater than the benchmark of 0.4 (Nunnally & Bernstein, 1994).

The path model in figure 2 below depicts the link between the scale items (manifest variables) measuring the latent variables they represent as per the CFA analysis. Therefore, the path model diagram tests the hypothesized association between governance and organisational efficiency, regulatory compliance and organisational efficiency, investment fiduciary and organisational efficiency and operational efficiency and organisational efficiency. The rectangular shapes points to manifest variables; the ecliptic shapes represent the latent variables whilst small circles show measurement error. Single-headed arrows show a dependence relationship whilst a double-herded arrow shows covariance. The numeric value of 1.0 shows the fixed parameter on the path.

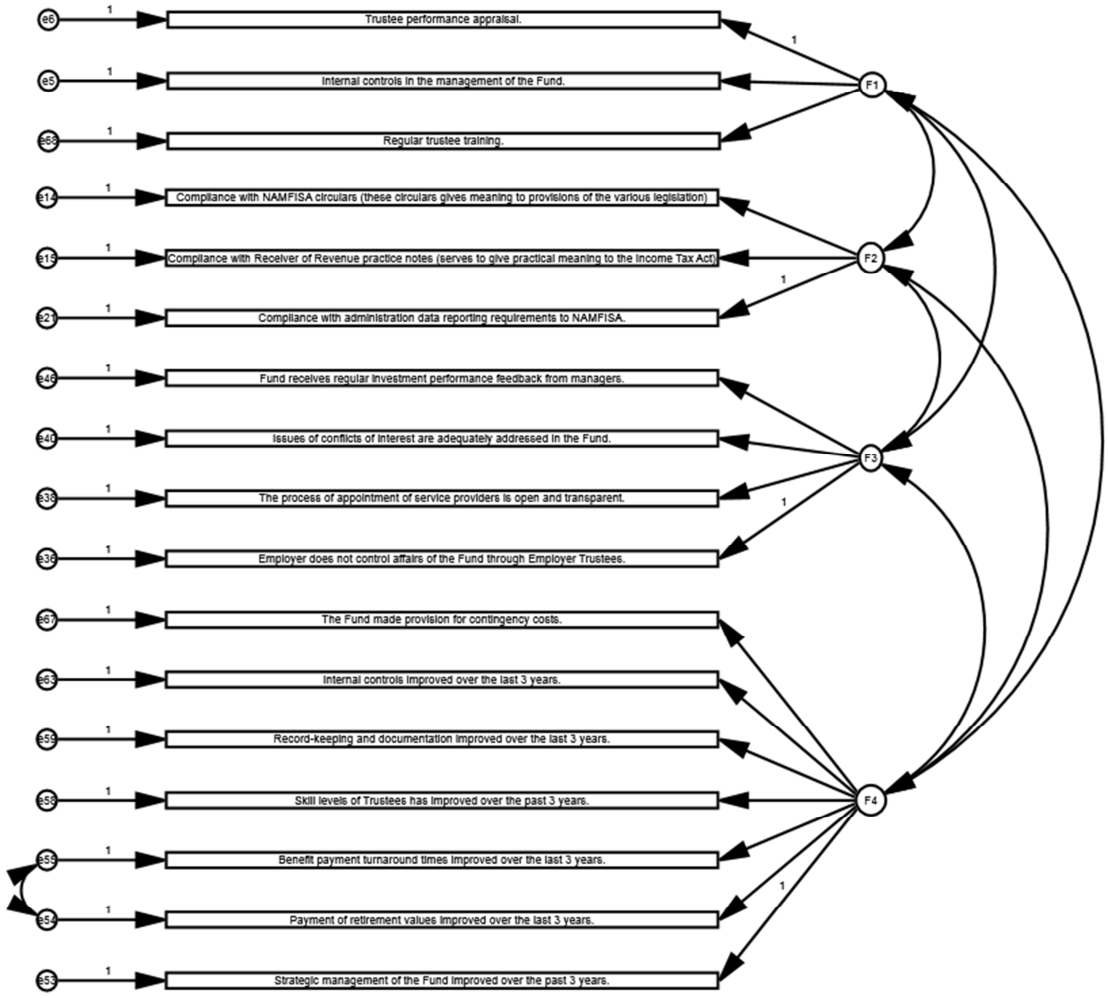

Figure 2. Path Analysis Diagram.

The results of the CFA has converged the data into four factors. As can be seen from figure 1 above, factor 1 represents governance as separate and distinct predictor of organisational efficiency in tandem with literature. Factor 2 interestingly covers only scale items of compliance and has no empirical association with regulations. This can be explained by the collegial logic that compliance refers to adherence with regulations (OECD, 2009) (IOPS, 2011). Factor 3 mainly represents scale items of ethics and only includes only one item of investments, which in the final literature analysis also relates to ethics. Factor 4 virtually covers 50% of all the scale items of operational efficiency and is only closely associated with one scale item of risk which in itself points to an operational aspect of risk management. The latent variables as represented by the factors are correlated as shown by the double-edged arrows. This represents the revised measurement model for organisational efficiency.

For model specification under SEM, a free parameter method was used. The measurement model parameters were estimated using maximum likelihood estimation method and bootstrapping (Hair, Black, Babin, & Anderson, 2010). The ratio of CMIN values relative to degrees of freedom (DF) is 1.481<2 and a P-value of.001<.05 indicating statistically significant relationships represented by the model. Therefore, the path model was tested for goodness of fit using Root Mean Square Error of Approximation (RMSEA) to determine accuracy of matching between observed input covariance matrix and predicted matrix of theoretical model (Kline, 2005). The RMSEA benchmark value between zero (0) and 0.05 shows a close fit; between 0.05 and 0.08 a reasonable fit and greater than 0.08 a poor fit (Hair, Black, Babin, & Anderson, 2010). The study results revealed a RMSEA value of 0.068 and root means squared residual (RMR) of 0.045<0.1, which suggest a reasonable fit and good model. The goodness of fit index (GFI) at 0.853 was greater than the benchmark level of 0.85 whilst AGFI as an adjusted indicator of GFI scored a value of 0.8. Furthermore, the comparative fit index (CFI) was at.943, normed fit index (NFI) at 0.846 and the Tucker Lewis Index (TLI) value at 0.930. This result indicates a very good and replicable model (Hair *et al.* 2006). The parsimony adjusted NFI (PNFI) and the parsimony adjusted CFI (PCFI) were largely above the benchmark of 0.70 which provides further evidence that the model reasonably explains the observed covariance between the constructs.

Therefore, the empirical results not only show that the model is relevant to the applied sector, but is an accurate representation of the event to be measured.

The underlying linearity assumption of SEM was confirmed by the empirical results in that the dependence associations between the measuring constructs were found to be linear. In other words, governance, ethics, compliance and operational efficiency were held to be linearly associated with organisational efficiency as hypothesized in the theoretical model. At the same time, the constructs are highly correlated as per the path coefficients in figure 1.

5. Limitations, Suggestions for Future Research and Conclusion

Although the results of this study will contribute significantly to the Namibian pension fund industry and contribute to the heterogeneous body of knowledge on pension fund management, the findings are limited by mainly two factors. First, the study used cross-sectional data and hence the results only show associations between constructs and do not cover causal relationships. Second, the sample data was relatively smaller given the size of the Namibian pension fund market and hence an elaborate CFA/SEM analysis was not possible. However, this did not compromise validity given the high values on virtually all indices applied to the data. These limitations also offer opportunities for future research using a larger regional database covering few countries within the Southern African Development Community (SADC) and extending the variables to cover other efficiency indicators not used in the present study.

In conclusion, the objective of the study was achieved in that the findings confirmed four major antecedents of organisational efficiency. Governance, ethics, compliance and operational efficiency were found to be the most significantly related to organisational efficiency. At a practical level, the study will further enhance the understanding of industry practitioners on pension fund efficiency and especially the Government who are currently busy with legislative review of the pension fund and social security sectors.

Appendix 1. Summary of Factor Structure

Rotated Component Matrix[a]

	Component			
	1	2	3	4
Delegating some functions to sub- committees.				,430
Regular trustee training.				,570
Transparency in outsourcing of services.				,461
Separating services to the Fund between different service providers.				,526
Internal controls in the management of the Fund.				,635
Trustee performance appraisal.				,607
Code of conduct for Trustees.				,549
Solvency requirements for pension funds (Funds are required to have enough assets to n				,559
Consistent adherence to the Rules of the Fund by the Trustees.				,563
Regular trustee meetings (twice per year) as required by NAMFISA				,421
Investment decisions are delegated to a Sub-Committee.				,411
Payment of levies to the Namibian Financial Institutions Supervisory Authority (NAMFISA)			,677	
Compliance with local investment requirements (minimum of 35% of total pension fund as			,523	
Compliance with NAMFISA circulars (these circulars gives meaning to provisions of the va			,781	
Compliance with Receiver of Revenue practice notes (serves to give practical meaning to			,747	
Compliance with reporting requirements to NAMFISA (this refers to reporting of non-comp			,690	
Compliance with insured benefits underwriting policy for death and disability benefits offer			,503	
Payment of premiums to the insured benefit underwriters on time (insurance companies)			,492	,484
Submission of medicals for members over the free cover limits.			,430	
Financial reporting requirements to NAMFISA.			,647	
Compliance with administration data reporting requirements to NAMFISA.			,757	
Regulation of administration fees by NAMFISA (currently fees are not regulated and perce			,548	
Regulation of compliance costs by NAMFISA (no industry standards exits for these costs)			,538	
Limitation of pension fund investments by Regulation 28 (Pension Funds Act specified exp			,465	
Regulation of commission payments to brokers by NAMFISA.			,493	
Regulation to invest pension fund assets in local unlisted investments (between 1.75% an			,549	
Member complaints procedure in the Rules of the Fund.			,600	
Membership of voluntary industry associations.			,487	
The nature of supervision of pension funds by NAMFISA (whether risk-based requiring risk			,402	
Investment decisions are based on a formal investment policy.	,509			
Fund investment returns are measured by agreed benchmark.	,628			
Fund investments are adequately diversified across asset classes.	,668			
Fund assets are invested through multiple managers.	,448			
The Trustees have appointing qualified experts to advise on investments.	,560			
The Trustees are adequately covered under Professional Indemnity.	,411			
Fund receives regular investment performance feedback from managers.	,693			
Fund is adequately invested in socially desirable investments (SDIs)	,569			
Investment fees are competitive and market related.	,673			
Funds are invested on a full discretionary basis.	,565			
Fund has adopted a formal policy on ethical standards.	,645			
Fund communicates honestly and timeously with members on all Fund issues.	,667			
Issues of conflicts of interest are adequately addressed in the Fund.	,692			
Fund matters are dealt with utmost confidentiality by Trustees.	,669			
The process of appointment of service providers is open and transparent.	,724			
Criteria of honesty and integrity is consistently used to qualify as Trustees.	,634			
Employer does not control affairs of the Fund through Employer Trustees.	,723			
Trade unions do not control affairs of the Fund through Member Trustees.	,413			
Generally, Trustees upholds high ethical standards in line with fiduciary duties.	,681			
Trustee discretion is always used fairly and equitably in the Fund's interest.	,657			
Trustees are accessible to Members at all relevant times.	,565			
Procedure is in place for removal of Trustees found to be unethical.	,458			
The Fund has been operating independently from the Employer's business.	,547			
Strategic management of the Fund improved over the past 3 years.		,736		
Payment of retirement values improved over the last 3 years.		,721		
Benefit payment turnaround times improved over the last 3 years.		,732		
Payment of contributions has been on time and accurate over the last 3 years.		,549		
Insurers admitted all death and disability claims over the past 3 years.		,457		
Skill levels of Trustees has improved over the past 3 years.		,708		
Record-keeping and documentation improved over the last 3 years.		,727		
Retirement funding contributions improved over the last 3 years.		,656		
Investment strategies yielded relatively good returns over the last 3 years.		,543		
Members been engaged in the management of the Fund over the last 3 years.		,625		
Internal controls improved over the last 3 years.		,730		
The Fund been exposed to Employer contribution default risk.		,407		
The Fund has implemented measures to mitigate stock market risk.		,563		
The Fund implemented a formal risk management strategy.		,584		
The Fund made provision for contingency costs.		,538		
The Fund is prepared for imminent radical changes to the Pension Funds Act.		,462		
The Fund encouraged members to retain benefits in the Fund on exit.		,426		
Trustees regularly updated the risk register of the Fund.		,583		
The Fund mitigated insolvency risk or underfunding.	,424	,486		

Appendix 2. Validity and Measurement Model Fit Summary

Cronbach alphas of empirical factor structure

Factor 1	.947
Factor 2	.910
Factor 3	.916
Factor 4	.843

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
	41	165.879	112	0.001	1.481

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
	0.045	0.853	0.799	0.624

Baseline Comparisons

Model	NFI	RFI	IFI	TLI	CFI
	0.846	0.813	0.944	0.93	0.943

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
	0.824	0.697	0.776

RMSEA

Model	RMSEA
	.068

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