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Advances in Climate Change Research 12 (2021) 263−269

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Determinants of financial-risk preparedness for climate change: Case of Fiji

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Received 11 April 2020; revised 25 December 2020; accepted 22 March 2021
Available online 29 March 2021

Abstract

There is a growing concern among central bankers that climate change poses not only serious environmental problems but also a potential economic and financial crisis. This study first confirms a hypothesized theoretical framework with different dimensions of the overall preparedness for climate related financial risk in the Fijian context, and then utilizes this framework to assess the present risk preparedness in Fiji. We tested two Confirmatory Factor Analysis (CFA) models in Structural Equation Modeling (SEM) Framework to analyse the survey data. We evaluated these models using several fit indices. The first CFA model included four correlated latent factors defined by multiple indicators (items) reflecting four hypothesized dimensions. The four latent factors were correlated significantly. The second CFA model included a second-order multi-level constructs reflecting overall preparedness along with four constituent dimensions. The four dimensional factors showed significant and substantial loadings towards overall risk preparedness suggesting that there also exists an overall higher order construct. The model fit indices showed that this second-order CFA model has an acceptable model fit. These results confirm that the four hypothesised dimensions − political leadership (*Political*), administrative direction (*Administration*), international standards (*Standards*) and supervisory mechanisms (*Supervision*) − are identifiable and distinct aspects. In addition to the four dimensions, the results suggest that overall preparedness should also be tackled in a multi-level integrated manner. The results also reveal that political initiatives would be futile without proper administrative direction and strong supervisory mechanisms. This theoretical framework can also be used to assess financial systems in other developing countries with similar socioeconomic contexts.

Keywords: Climate change; Fiji; Financial regulations; Financial risk; Pacific countries; Political leadership

1. Introduction

The financial systems in most developing nations have been shown to be highly vulnerable to climate change − highlighting the urgent need for strengthening their financial systems (Alexander, 2019; Alexander and Baden, 2013; Saliya and Pandey, 2021; Tooze, 2019). It is noticeable that financial sectors have been late to respond to issues related to environmental sustainability and climate change (CDP, 2013). The Environment and Sustainable Development Statement (ESDS) from the United Nations Environment Programme (UNEP, 2011) declared that banks have a critical role in sustainable development in emerging economies.

Banks too, similar to any other businesses, produce greenhouse gases (GHG) directly from their normal operations but banks' indirect contribution to the problem, by way of financing projects causing environmental pollution (Kılıç and Kuzey, 2019), is mammoth. Banks can adjust the conditions of loans that they provide to GHG incentive industries which can help to reduce the impact of climate change in their business practices (Furrer et al., 2012).

The three main climate-related financial risks (CRFRs) have been identified as physical risks, where insurers may charge higher premiums and bankers have concerns of types of collateral; transition risks associated with a society's

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Peer review under responsibility of National Climate Center (China Meteorological Administration).

https://doi.org/10.1016/j.accre.2021.03.012

adjustment to a low-carbon economy, where values of certain assets are affected, especially investment valuations; so banks, investors and insurers will have to ensure that their portfolios are resilient to climate change; liability risks arise from parties who have suffered loss or damage from the physical and transition risk factors (Roberts, 2019; Scott et al., 2017).

Campiglio (2015) argues that, as the main source of external finance for firms, banks are capable of performing a more effective role in the process of creating and allocating of credit considering climate-related financial risks. The possibility for banks to facilitate climate change mitigation and transition to a low-carbon economy is seen through their unique business practices as well as off-putting (or restraining) GHG emissions of other corporate actors (Bowman, 2010). Although there are various international agreements on climate change initiated by United Nations Climate Change Conferences in the framework of the United Nations Framework Convention on Climate Change (UNFCCC), consideration has to be given to a focus on national and regional regulations.

The Supervisory Statement PRA SS 3/2019 of the Prudential Regulatory Authority (PRA) of the Bank of England outlines the financial risks from climate change (physical and transitional) where the regulators require firms to adopt a strategic approach to risk management on four key expectations (BoE, 2019): governance, risk management, scenario analysis, and disclosure. According to Australian Accounting Standards Board/Auditing and Assurance Standards Board (AABS, 2018), information (omitted or misstated) becomes material, if it could influence decisions that users make on the basis of financial information about a specific reporting entity.

Krasodomska (2015) highlighted the Equator Principles, which were published in 2003, and based on World Bank and International Finance Corporation standards as a set of general guidelines for financial institutions to assess the environmental and social risk in project finance. Similarly, in 2008, the Climate Principle was initiated by many financial institutions to tackle the challenges of the banking sector in response to climate change. In addition to this, numerous non-government organisations (NGOs) like Bank Track, Rain Forest Network, among others, examined financial institutions with a view to ensuring that their operations would preserve the ecosystem and natural well-being of the planet (Buranatrakul and Swierczek, 2017).

The Fiji's government has stressed that Fijians should determine “to build an inclusive, prosperous, resilient and low-carbon future for ourselves, and so remain steadfast in the battle against climate change, the single greatest threat to our future” (RBF, 2018). The governors of the nine central banks in the Pacific region agreed to involve the Network for Greening the Financial System (NGFS) to assess the impact of climate change on the Pacific's financial systems and foster investment in green technology (RBA, 2019). However, it requires a generous investment in low-carbon-intensive infrastructure, including go-green initiatives, energy efficiency, renewable energy, transportation etc., relevant to climate change mitigation (Sørensen and Pfeifer, 2011). One of the goals of the NGFS is to promote markets for green bonds. The first green bonds were issued by the World Bank in 2008 (World Bank, 2019). By 2018, that market had expanded to an annual volume of 170 billion USD (Tooze, 2019).

The World Wildlife Fund (WWF, 2019a; 2019b) has developed a framework called The Sustainable Banking Assessment (SUSBA) to assess banks' performance on the integration of ESG. Using this method, after a study of 35 banks in the Southeast region, WWF revealed that banks are not adequately addressing the climate change issue. Investor Responsibility Research Center (IRRC) studied 40 of the world's largest banks introducing another framework, named Climate Change Governance Index (CCGI) covering four main aspects using 14 criteria (Cogan, 2006).

Climate related financial risks (CRFR) have been studied in the academic research through climate stress-testing methods or macroeconomic modelling. However, the analysing methodologies are still in the developmental stage and the challenges for researchers are significant due to various factors such as the availability of, and access to, credible data, poor integration between regulatory supervision, the financial system, climate change and environmental policies (Campiglio et al., 2018).

We posit that financial risk-assessment methods should take the country-specific socioeconomic and geographical contexts into account. This provides a deeper understanding about, not only the overall risk preparedness, but also different dimensions of risk preparedness within the country. Particularly, identifying the severity of present overall financial risk preparedness as well as the varying severity of constituent dimensions of financial risk preparedness is vital to prepare for Fiji's task in dealing with climate-related financial risks.

All these frameworks, methods and tools are designed to assess financial institutions in advanced economies; it appears that they lack appropriateness and practical applicability to assess less developed financial systems in small emerging economies such as Fiji's. Discussions with the individuals working in financial institutions, and meetings with senior bank executives revealed that there is no specific circulars/directives issued in Fuji by the regulatory authorities in relation to climate related financial risk management such as stress-testing and scenario analysis. Thus, the primary objective of the present study is to gain an insight into an appropriate financial risk management policies and programmes in Fujian context. We posit that there are four possible, distinct aspects, which underpin the overall readiness in handling the impact of climate change on financial stability. These discrete dimensions are identified as: political leadership, administrative direction, compliance with international standards, and institutional supervision. Although these dimensions are generally interdependent and correlated, we consider they can be considered as distinct constructs which, together, constitute overall risk preparedness. Therefore, we articulate our research problems as;

Are these four dimensions significant in assessing the financial-risk preparedness for climate change in Fiji?

If so, to what extent?

Thus, the present study aims to identify the different dimensions (the factor structure) of preparedness in Fiji's battle against climate-related financial risk using Confirmatory Factor Analysis, then to examine the differences in the levels or severity of these different dimensions. Second, based on the results, we attempt to assess the robustness of the perceived preparedness of Fiji's financial system in dealing adequately with the potential financial risks caused by climate change.

2. Methodology

We designed four dimensions based on extant literature and the two frameworks; SUSBA and CCGI (Cogan, 2006; RBA, 2019; RBF, 2018; WWF, 2019a; 2019b). To assess the impact of climate change on financial stability, SUSBA proposed six pillars (purpose, policies, processes, people, products and portfolio) using 11 indicators, and CCGI used 14 indicators to construct five governance areas, board oversight, management execution, public disclosure, emission accounting, and strategic planning. After reviewing all these pillars, governance areas and indicators etc., we initially formulated 30 questions and ran Principal Components Analysis (PCA) which is a variable-reduction technique in SPSS. PCA results produced nine 'principal components' covering 69.4% of cumulative variance of the variance in the original variables. Based on the SUSBA and CCGI theories, knowledge on the Fiji context, together with the level of contributions of each factor (e.g., Eigenvalues of higher than two) and correlations and component matrices among all items, we identified a substantively important and empirically powerful four components/factors and constituent items which explained 50% of variance. As shown in Fig. 1, this was a process combining theories, local knowledge and empirical findings (data). We considered questions having more than 0.45 of loadings under the four most prominent components with the total Eigenvalues of higher than two. We really blended our experience and background knowledge of Fijian context in this exercise. For further analysis, based on CFA results, we computed composite measures for each factor by adding constituent items. For example, the composite measure for Political leadership was created by adding Q1, Q2, Q3 and Q4. As shown in Fig. 1, this was a process combining theories, local knowledge and, empirical findings (data).

There were 212 participants including 23 accountants/auditors, 107 related academics/students and 82 bankers/financiers/stock brokers. Six research assistants were involved in collecting data, and 108 questionnaires were received via emails and Google forms. The survey was carried out with the employees of the six commercial banks and other financial institutions. In order to confirm that respondents' responses define the previously hypothesized factors (political, administration, standards, and supervision) and whether these dimensional factors would ultimately define the overall factor of preparedness, we tested a) first-order Confirmatory Factor Analysis and b) a second-order Confirmatory Factor Analysis (CFA) in the Structural Equation Modeling (SEM) framework (Bollen, 1989). Table A1 provides the 16 questions/indicators with the frequency distributions of the responses; Yes, No and Neutral which were attached weights of 100, 0 and 50 respectively for statistical analysis.

2.1. Hypothesis and the model

The overall preparedness will be assessed by the four previously hypothesized dimensions: political leadership, administrative directions, standards followed, and supervisory control mechanisms. We will test two Confirmatory Factor Analyses (CFA) in Structural Equation Modeling (SEM) framework. First, we will test a CFA with correlated four latent factors representing four dimensions. Each latent factor will be captured by valid items or indicators. The four dimensions will be defined by 16 items/responses, four items for each dimension. Statistically, latent factors reflect the common variance of indicators, and the squared loading of indicators

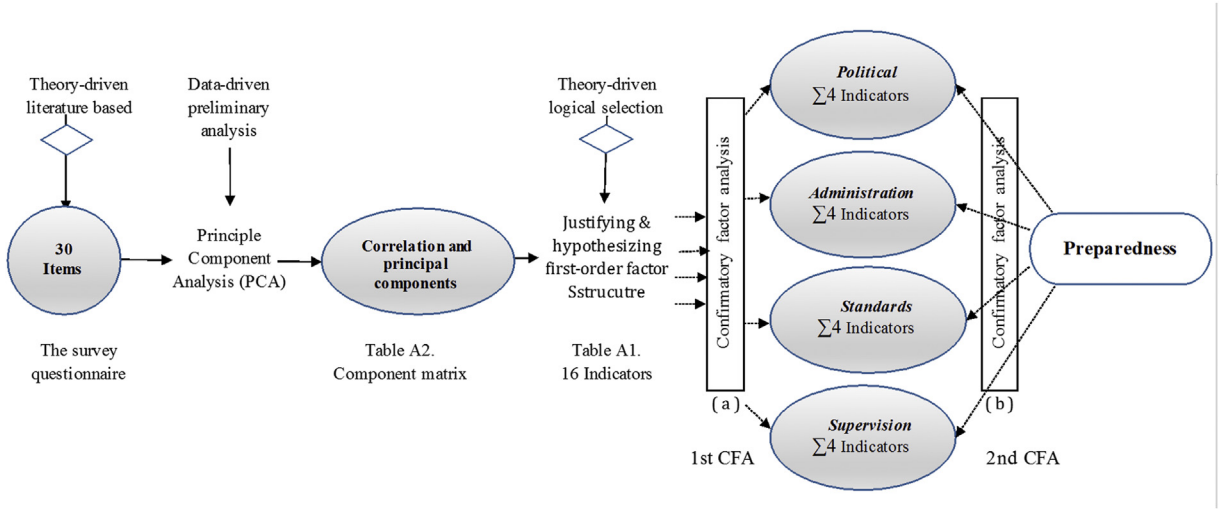

Fig. 1. Methodology flow-chart.

reflects the amounts of variance of the indicators explained by the latent factor. We will assess the distinctiveness or discriminant validity of four hypothesized factors and the inter-factor association. Second, we will test four second-order factor structure with second-level overall factor of preparedness. The second-level latent factor of overall preparedness will be defined by first-level four latent factors reflecting four dimensions of preparedness (Fig. 2).

This analysis was performed with Mplus version 7.0 (Muthén and Muthén, 2017) with Maximum Likelihood Estimation. A range of fit indices were used to evaluate the model fit of the models including the chi-square statistic, Cumulative Fit Indices (CFI), and Root Mean Square Error of Approximation (RMSEA). For the chi-square fit statistic, the model is thought to fit the data well when the chi-square divided by the degrees of freedom is below 3.0 (Carmines and McIver, 1981). The CFI and RMSEA are used to evaluate the models' fit due to the fact that they are not directly related to the sample size. We used the chi-square statistic, the CFI, and the RMSEA to evaluate the model fit. Hu and Bentler (1999) report that a CFI value greater than 0.90 ensures that the model is not mis-specified. MacCallum et al. (1996) reported that a RMSEA nearing 0.08 indicates a reasonably good model fit.

In sum, we expect to confirm the distinctiveness of the identified four distinct dimensions and their contributions to the overall preparedness based on their correlation matrix.

3. Results

The first-order CFA model with four latent factors representing political, administrative, standards and supervision dimensions is presented in Fig. 2. The responses to Q1, Q2, Q3 & Q4 were used as indicators of political leadership. The responses to Q5, Q6, Q7 & Q8 were used as indicators of administration while the responses to Q9, Q10, Q11 & Q12, and Q13, Q14, Q15 & Q16 were used as indicators of standards and supervision dimensions respectively. The second-order factor structure with the overall preparedness factor is presented in Fig. 3.

This CFA model reflected an acceptable model fit (chi-square/df = 2.12, CFI = 0.92, RMSEA −0.07, CI: 0.052, 0.083). Overall, the CFA model provided evidence for a hypothesized first-order factor structure. Accordingly, political, administrative, standards, and supervision are four distinct dimensions of risk preparedness. The highest correlation between administration and standard suggests a close relationship or the least distinctiveness between these two dimensions. The lowest correlation between political and standard suggests a weak relationship or the greatest distinctiveness between the two dimensions. However, significant correlations among four factors suggest that there is a common variance across these factors, which may represent a higher order factor. Thus, we will test the second CFA after incorporating the higher-order factor of preparedness.

All 16 items showed significant substantial factor loadings to respective dimensional factors ranging from 0.42 to 0.95 ($p < 0.05$) showing the reliability and validity of these items in relation to the respective factor (Bollen, 1989). There were no significant cross-factor loadings. Four dimensional factors showed significant and substantial loadings (0.49, 0.55, 0.51 and 0.89 to political, standard, supervision and administration, respectively) to the second-order overall latent factor of preparedness. Measurement errors of observed responses are shown in Fig. 3 (significant error correlations were freed to be correlated, not shown in the figure). This CFA model reflected an acceptable model fit (chi-square/df = 0.91, CFI = 0.91, RMSEA = 0.07). Overall, the CFA model provided evidence for a hypothesized factor structure. Accordingly, political, administrative, standards, and supervision are four distinct dimensions of risk preparedness. Also, there exists an overall higher-order factor of preparedness along with four first-order factors reflecting four dimensions.

For further analysis, based on CFA results, we computed composite measures for each factor by adding constituent items. For example the composite measure for political leadership was created by adding Q1, Q2, Q3 and Q4. These composite measures of four factors were used to produce statistics in Table A2. The descriptive statistics and paired *t*-test results for composite measures for four factors are also

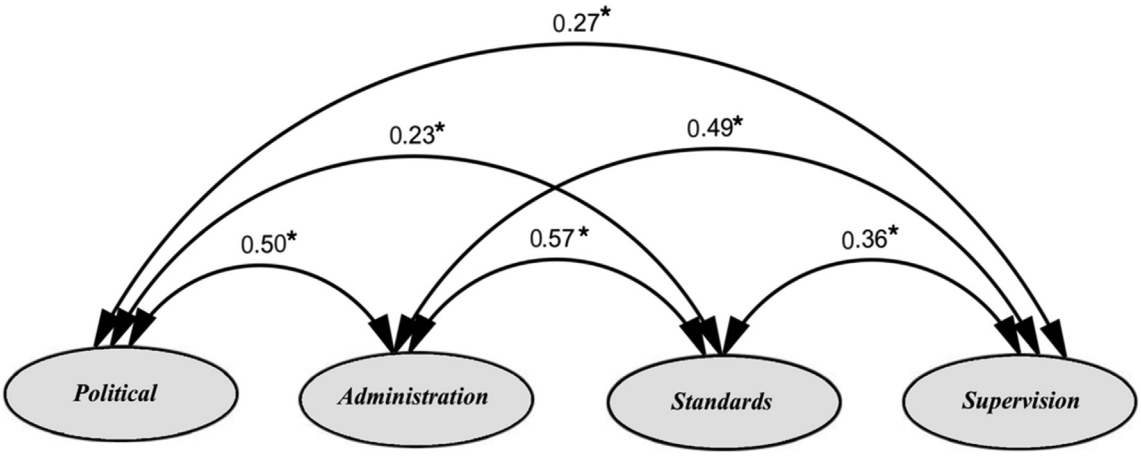

Fig. 2. First-order factor structure reflecting four dimensions of preparedness (*$p < 0.05$; measurement error correlations are not shown).

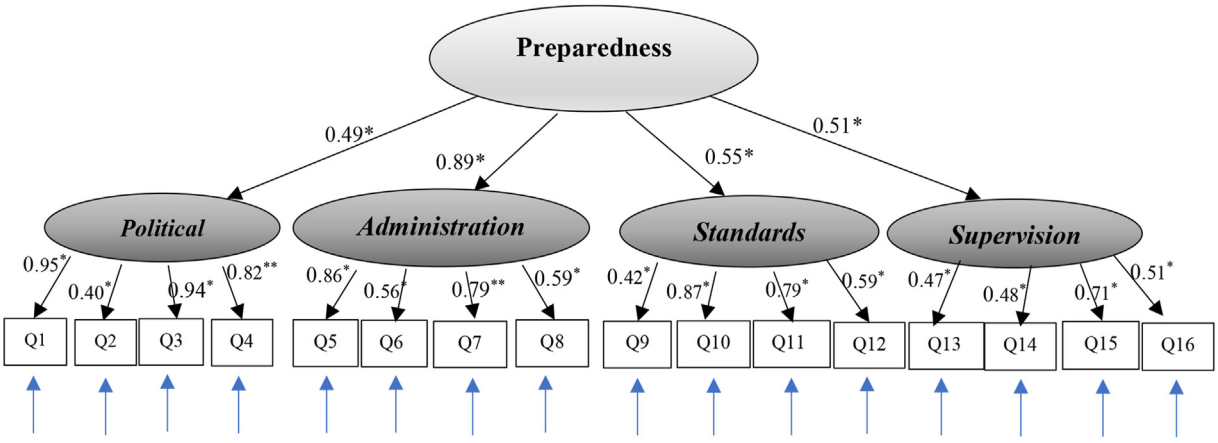

Fig. 3. Latent second-order factor structure reflecting different dimensions of vigilance (*$p < 0.05$, **$p < 0.01$; measurement error correlations are not shown).

presented in Table A3. The paired *t*-test compared the average levels of factor scores.

4. Discussion

The political dimension consists of the perceived importance and awareness of four factors; government initiative, public awareness of such initiatives, mobilizing funds for the cause within, and internationally, and shows a loading of 0.49 towards financial-risk preparedness to climate change (FRPCC). Encouragingly, more than 75% of the respondents acknowledged that the government is actively engaged in its battle against climate change, and contributing towards FRPCC is commendable. However, a majority of respondents (> 60%) were not satisfied with the efforts and results of mobilizing funds for the cause. Generous investment relevant to climate change mitigation is required (Sørensen and Pfeifer, 2011), and this market has expanded to an annual volume of 170 billion USD (Tooze, 2019).

The administrative dimension consists of the perceived awareness of the respondents on the part played by regulators, financial institutions (including the members of the management team), and their clients (borrowers). The administrative dimension carries the highest loading of 0.89 and the factors underpinning this dimension show that the efforts towards the FRPCC are poor — many regulators are in agreement that financial sectors have been late to respond to environmental sustainability and climate change (CDP, 2013). The respondents perceived that government agents such as the Reserve Bank of Fiji and responsible ministries are not developing adequate policy procedures to transform the political initiatives into action. On the other hand, they perceived that there is no system to motivate responsible employees both at the regulatory bodies and financial institutions towards FRPCC. In this study, it is also widely perceived that dealing with non-compliance and disclosure in the same way is not satisfactory with less than 30% of the respondents saying 'Yes'.

The standards dimension concerns the perceived awareness of following the international standards by the financial institutions and how far the regulators impose directives towards compliance. The perceived knowledge is tested on standards such as 'low carbon incentives', 'high carbon penalties', utilizing of Greenbonds funds for the relevant projects, among other things. The loading indicates 0.55 and the perceived assessment is the lowest amongst the four dimensions with below 14% confirmation that FRPCC is satisfactory despite the concerns expressed by CSR Asia (2011) that high rates of failure of many banks are due to ignorant financing practices endangering sustainable development in South East Asian Nations.

The supervision dimension shows a loading of 0.51 and consists of factors such as internal and external audit, disclosure requirements and adherence. The perceived knowledge on these issues is very poor with less than 10% of the respondents believing that the contribution from this dimension towards FRPCC is not satisfactory. This dimension needs more attention because regulators and associations will issue sustainable banking regulations or guidelines (SBRG) by 2020 (WWF, 2019a; 2019b).

According to this framework, the administrative direction plays the most important role by formulating strategies and policies and communicating them effectively to the respective parties for implementation. Then, in implementation of those policies, the administrative direction prompts these parties to comply with international standards, as appropriate. This framework attaches more importance to the supervision dimension than to the political dimension, and suggests strict control measures to make ensure compliance with the set benchmarks and standards. Finally, it suggests that political patronage is also a critical factor, in particular, in financing this battle against climate change.

Practically, the research participants' results suggest that administrations should set the rules and goals in line with appropriate standards and advise the regulators to develop guidelines and directives for financial institutions to follow. The study also revealed that the control mechanism has to be equipped with modern technical skills such as how to carry out scenario analysis and stress-testing in relation to CRFR. The regulatory returns (the forms to be filed with the authorities by

the financial institutions) have to be updated by incorporating appropriate benchmarks, which are suitable for underdeveloped systems in emerging economies such as Fiji's.

5. Conclusions

In general, the results of the study supported the hypothesized framework for financial system risk preparedness for climate change in this context. Overall, the study provided useful findings about the varied severity of different dimensions, which may constitute important input for financial policy and programme planners.

This study revealed that four observed factors (political leadership, administrative direction, international standards, and supervisory mechanisms) as distinct dimensions of risk preparedness. In addition, there exists a higher-level risk preparedness factor. These findings inform financial planners and policymakers and aid preparing for the financial risk caused by climate change. These four dimensions of risk preparedness and the overall risk preparedness can be tackled independently and also in an integrated manner in a multi-pronged integrated manner. We believe that this theoretical framework can also be used to assess financial systems in other developing countries with similar socioeconomic contexts.

The administrative direction and supervision mechanism play critical roles in designing, implementing and monitoring effective systems to ensure compliance with the standards. The regulatory returns have to be updated by incorporating appropriate benchmarks, which are suitable for underdeveloped systems in emerging economies such as Fiji's. The results also reveal that political initiatives would be futile without proper administrative direction and strong supervisory mechanisms.

Therefore, it is evident that the political leadership cannot be just confined to acknowledging the importance of preparing for preventing and/or mitigating the impact of climate change on the financial system. To complete the preparation process, all four dimensions have to be integrated and implemented smoothly especially because stricter standards and compliance can cause harm to small developing economies such as that of Fiji. On the other hand, if not prepared with appropriate standards and compliance procedures in a timely manner, the possible consequences could cause more painful shocks and damage to the financial system. These results confirmed that the existing political initiatives need to be effectively communicated and/or implemented in the financial system by the regulatory agencies.

The present study has used Confirmatory Factor Analysis (CFA) in Structural Equation Modeling (SEM) Framework to analyse the data. SEM allowed us to account for the measurement errors of the responses. Also, we have used several fit indices to evaluate the hypothesised model. This has enhanced the quality of estimated parameters and provided statistically more convincing results (Bollen, 1989). Further, second-order CFA confirm multi-level constructs (reflecting overall preparedness and five constituent dimensions) are provided that can be considered for policy and programme formulation.

The present study has several limitations. First, the sample size is relatively small; it would need to be larger to yield more statistical power. Second, respondents with more diverse backgrounds and from diverse geographical areas would have increased the generalisability of the study findings. Third, greater numbers of questionnaire items would have produced higher reliability of factors reflecting different dimensions. Future studies should test this theoretical framework with a larger and more diverse sample, and with a more comprehensive instrument.

Despite these limitations, the current study enhanced our knowledge about the assessment of financial system preparedness for climate change in Fijian context as well as its application for strengthening of the current financial system.

Declaration of competing interest

The authors declare no conflict of interest.

Acknowledgment

We sincerely thank the editors and two anonymous reviewers for their careful reading of the manuscript and insightful comments and suggestions. We also thank the survey respondents for their valuable time.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.accre.2021.03.012.

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