# A Confirmatory Factor Analysis of Measurement Models of Risk Management Tools in UAE Public sector Performance

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**ABSTRACT**

Risk management should be embraced by organisational governance in ensuring the performance of the organisation is achieved. However using obsolescence risk management tools employed by many organizations in UAE affect negatively the public sector performance of UAE. This paper presents the development and assessment of four risk management related tools for the performance of UAE public organizations. The measurement models are Delphi Technique; SWOT Analysis; Document Review and the mediator that is Risk Management Culture. These models were developed and assessed using AMOS-SEM software. All the four measurement were re-specified until achieved the model goodness of fit criteria values. These models are ready to be used in the structural model that relate the risk management tools with the organisational performance of UAE public organisation. The findings of this paper show the assessment procedure in determining the fitness of the measurement model.

**Keywords**

Risk Management Tools, Public Sector, Performance, UAE.

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## Introduction

In risk analysis it requires necessary, relevant and reliable information of possible threats to be analysed on the probability to the organisation [1]. The risk analysis is directly on mapping the areas and processes which bear the highest risk. It needs to identify and assess risks to the organisations which should be audited [2, 3]. The United Arab Emirates (UAE) public sector have been established many decades ago, however the public sector need to be equipped in term of latest risk management skills and operational systems. This is to withstand the challenges poses by the current financial system environment. By identifying the inherent risk of UAE government services, it could be managed in ensuring a sustainable growth and survival of the entire sector. For organisations in the public domain, risk management is a modern organisational governance tool that seeks to optimize the result of business decisions [4, 5]. In public sector institutions, risk management conscious awareness and risk control activities the best option for UAE organisations. However, according to [6] there is no academic and practical paper that has been conducted in UAE, which is a real gap in terms of public organizations in the United Arab Emirates (UAE).

As compared with private organisation, any risk in public organisations is minimal. Thus, the top management of public entity seeks to mitigate risks easily even though it resulted to excessive resource leakage. Most of the senior official in public organisation made decisions which seems help risk management motivations like loyalty, enjoyment in acting for the public, growing power, income, prestige, security or comfort. These factors are used as a role in risk perception and risk management attitude for bureaucratic leader [7]. Unfortunately, very little researches have been conducted on this in terms of United Arab Emirates (UAE) perspective. This appears as a gap in the literature.

Analysis and assessment of risks in public sector organisation plays a vital role in the selection of the appropriate activities. Suitable control system can respond properly to the risks from such activities. Thus, the risks control systems should be tailored to the conditions of changes [8, 9]. The probability of effect can be reduced with the control system that aligned to the nature of the organisational [10]. Risk management process is described by the international and government organisations standards and guidelines. These standard defines six steps in the risk management process, regardless of the domain in which the organisations functions, from legislation through administration, environmental protection, healthcare, education and defence also to local governments [11, 12]. The entire risk management

process is subjected to organisational goals [13]. However, these issues are not being addressed properly in UAE public sector. Thus, the gap of knowledge relating to risk management in the UAE is a great problem faced by the business executives to design the work to win the challenges ahead. Since the solution has not been made, thus this is another practitioners' gap in UAE.

As discussed above, this paper addresses the risk management tools practiced in public sector in United Arab Emirates (UAE). Hence, worth to examine in what level risk management strategies helps the risk management tools practiced in public sector in United Arab Emirates (UAE).

## Methodology

Risk management plays a vital role on the performance of many organizations including UAE organization. The main issue that affects the performance of public sector in UAE is the used of outdated risk management tools, this tremendously affects the performance of public sector in UAE. This study adopted a methodological framework based on positivist paradigm which is quantitative research approach. Respondents of this study were stakeholders of public service in UAE. Data collected from the questionnaire survey was used for the model development. The data was collected through questionnaire survey and analysed statistically to deduce the research hypotheses. The model was developed and assessed based on the causal effect of risk management tools with Public Service Performance and Risk Management Culture as a mediator. The modelling process was conducted using AMOS-SEM software [14]. However for this paper it presented the analysis of measurement models of the risk management tools which are Delphi Technique; SWOT Analysis; Document Review and the mediator that is Risk Management Culture

## Confirmatory Factor Analysis (CFA)

Confirmatory Factor Analysis (CFA) is to evaluate measurement model. In CFA, any item that does not fit the measurement model due to low factor loading should be removed from the model. Fitness of a measurement model is indicated through certain Fitness Indexes. If the items deletion exceed 20% of total items in a model then the particular construct is deemed to be invalid [failed confirmatory]. CFA could be run for every measurement model separately or run the pooled measurement models at once.

Having established the model fit for the individual constructs, it is required to assess the validity of the entire measurement model of this study before developing and evaluating the structural model. This is to establish the validity of the entire constructs in harmony. The validity of the entire measurement model was assessed by examining the convergent validity, discriminant validity and multicollinearity of the models constructs [15]. However for this paper it presents the results of individual fitness assessment only.

CFA analysis began with specification of the model; model identification; estimation of parameters; assessment of goodness-of-fit and finally model re-specification. These processes are repeatedly followed in the assessment of individual measurement model, entire measurement model and also structural model until the model validity is achieved. The validity of the models was evaluated based on the established criteria for CB-SEM evaluation presented in Table 1. The model should satisfy at least one index from each of the index category that are absolute fit, incremental fit and parsimonious fit indices.

Table 1 - Goodness-of-fit acceptance levels [15,16, 17]

| **Index Category** | **Indices Used** | **Acceptable level** |
|---|---|---|
| Absolute fit | Chisq. | $P < 0.05$ |
| | RMSEA | Value $\leq 0.08$ |
| | GFI | Value $\geq 0.90$ |
| Incremental fit | AGFI | Value $\geq 0.90$ |
| | CFI | Value $\geq 0.90$ |
| Parsimonious fit | Chisq./df | Value $\leq 5.0$ |

The analysis was conducted using AMOS graphic software in evaluating the measurement models of the risk management tools and culture in accordance with the goodness-of-fit indices recommended values as presented in Table 1. If the models are not fit, then it will repeatedly re-specified until it reach goodness fits condition as stipulated in table 1.

### 3.1 Assessment of Delphi Technique (DT) Measurement Model

In Delphi technique measurement model there are seven items or indicators. The graphical display and results of the CFA of the DT initial measurement model is presented as Fig.1

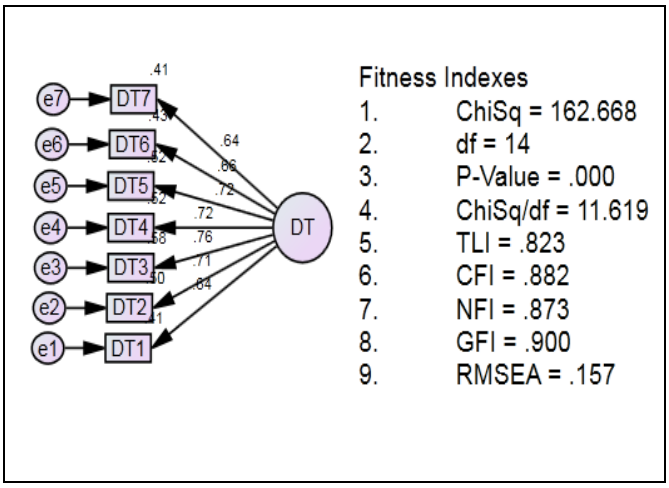


Fig.1 – DT Initial measurement model

Fig.1 shows the relationship of DT construct with its items or indictors. The results generated from the initial modelling are presented in table 2.

Table 2 – results of DT initial measurement model

| Factor Loading | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Indicators | | Construct | Estimate | S.E. | C.R. | P | SMC | Recommended level |
| DT1 | ← | DT | .637 | - | - | *** | .406 | achieved |
| DT2 | ← | DT | .706 | .098 | 12.039 | *** | .498 | achieved |
| DT3 | ← | DT | .764 | .103 | 12.759 | *** | .583 | achieved |
| DT4 | ← | DT | .724 | .102 | 12.268 | *** | .524 | achieved |
| DT5 | ← | DT | .720 | .094 | 12.222 | *** | .519 | achieved |
| DT6 | ← | DT | .651 | .104 | 12.562 | *** | .430 | achieved |
| DT7 | ← | DT | .641 | .096 | 11.157 | *** | .411 | achieved |
| Goodness-of-fit measures | | | | | | | | |
| Model identification | | | | | | Model fit statistics | | |
| Observed variables | = | 7 | $X^2$ | = | 162.668 | CFI | = | .882 |
| Estimated parameter | = | 14 | $X^2$/df | = | 11.619 | RMSEA | = | .157 |
| Degree of freedom | = | 14 | P-value | = | .000 | NFI | = | .873 |
| Decision | Model unaccepted | | | | | | | |

Table 2 shows that all the factor loadings values within the acceptance level. However in respect of model fit statistics, the analysis results indicated that some of the goodness-of-fit criteria are not satisfied. For instance, both CFI and NFI reported values less than the recommended threshold of 0.90. Reported RMSEA value far greater than the recommended value of 0.08. Hence the model re-specification was conducted until then model achieve the goodness of fit as Fig.2.

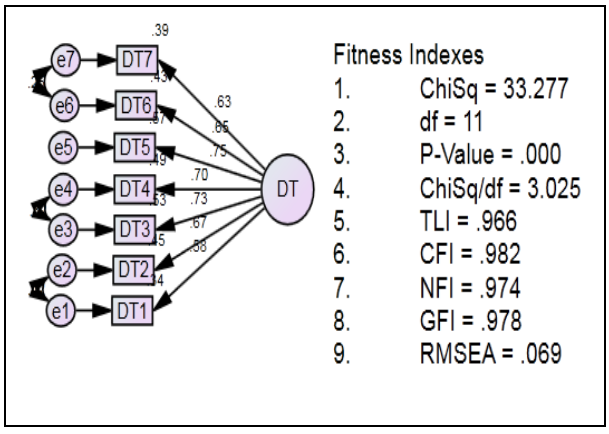


**Fig.2** - Final measurement model of DT

Fig 2 shows the final re-specified measurement model of Delphi Technique together with the

generated fitness values. These generated fitness values are tabulated in table 3.

Table 3 – results of DT Final measurement model

| Factor Loading | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Indicators | | Construct | Estimate | S.E. | C.R. | P | SMC | Recommended level |
| DT1 | ← | DT | 0.583 | - | - | *** | 0.340 | achieved |
| DT2 | ← | DT | 0.667 | 0.090 | 13.506 | *** | 0.445 | achieved |
| DT3 | ← | DT | 0.728 | 0.129 | 10.621 | *** | 0.530 | achieved |
| DT4 | ← | DT | 0.700 | 0.128 | 10.353 | *** | 0.490 | achieved |
| DT5 | ← | DT | 0.754 | 0.120 | 10.939 | *** | 0.569 | achieved |
| DT6 | ← | DT | 0.655 | 0.129 | 10.011 | *** | 0.428 | achieved |
| DT7 | ← | DT | 0.626 | 0.118 | 9.700 | *** | 0.391 | achieved |
| Goodness-of-fit measures | | | | | | | | |
| Model identification | | | | | | Model fit statistics | | |
| Observed variables | = | 7 | $X^2$ | = | 33.277 | CFI | = | 0.982 |
| Estimated parameter | = | 14 | $X^2$/df | = | 3.025 | RMSEA | = | 0.069 |
| Degree of freedom | = | 11 | P-value | = | 0.000 | NFI | = | 0.974 |
| Decision | Model accepted | | | | | | | |

Table 3 shows the graphical final measurement model of DT construct. The results from the table indicate that the whole model fit statistics and validity requirements are achieved after freeing some of the parameters. Both the factor loadings and the $R^2$ values for the seven (7) indicators of the final DT measurement model satisfied the recommended criteria for acceptance. Also the model goodness-of-fit indices generated values are within the acceptable range of the model fit measures. Specifically, RMSEA=.069, CFI=.982, NFI=.974, X2/df = 3.025 and p< .05 which is an indication of good-fit model. Therefore, the all the seven indicators are retained for inclusion in further analysis.

**3.2 Assessment of** SWOT Analysis (**SA) Measurement Model**

This measurement model is between SA and its five related indicators. Fig 3 show the initial measurement model of SA after the fitness and validity of the model are tested by running CFA without imposing any co-variation on the parameters.

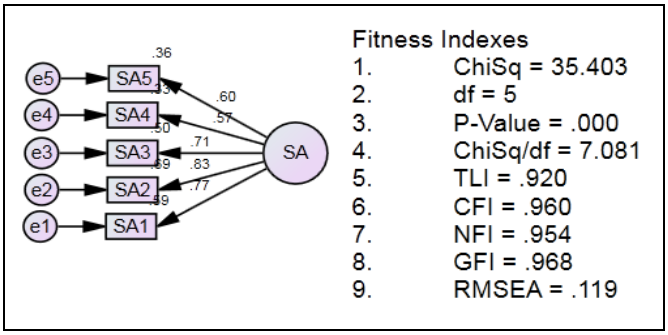


Fig.3 - SA Initial measurement model

Fig 3 of the graphical analysis on the initial model indicate that it failed to meet the recommended criteria for model fitness. The results from CFA on the model are as in table 4.

Table 4: results of SA Initial measurement model

| Factor Loading | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Indicators | | Construct | Estimate | S.E. | C.R. | P | SMC | Recommended level |
| SA1 | ← | SA | .771 | - | - | *** | .594 | achieved |
| SA2 | ← | SA | .833 | .065 | 16.039 | *** | .693 | achieved |
| SA3 | ← | SA | .707 | .060 | 14.008 | *** | .500 | achieved |
| SA4 | ← | SA | .573 | .061 | 11.241 | *** | .328 | achieved |
| SA5 | ← | SA | .599 | .062 | 11.785 | *** | .359 | achieved |

| Goodness-of-fit measures | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Model identification | | | | | | Model fit statistics | | |
| Observed variables | = | 10 | $X^2$ | = | 35.403 | CFI | = | .960 |
| Estimated parameter | = | 10 | $X^2$/df | = | 7.081 | RMSEA | = | .119 |
| Degree of freedom | = | 5 | P-value | = | .000 | NFI | = | .954 |
| Decision | Model not accepted | | | | | | | |

From Table 4, while the factor loadings and the SA of the indicators meet the acceptable threshold but the RMSEA and the X2/df failed to satisfy the recommended thresholds. This implies that some of the model fitness indicators were also outside the acceptance threshold which suggests the need for model re-specification to ensure the attainment of goodness-of-fit and model acceptance. The graphical results of the SA model re-specification is as Fig 4.

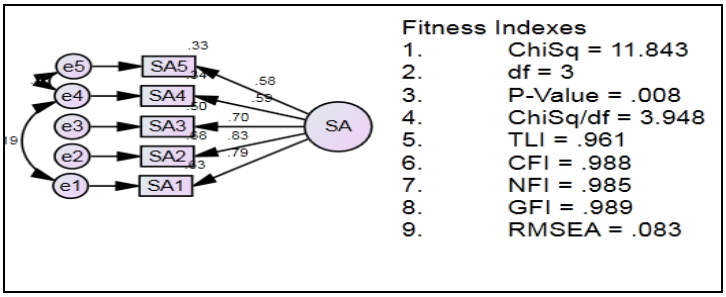


**Figure 4: Final SA measurement model**

Fig.4 presents the graphical display of the re-specified measurement model. Upon examining the modification index of the initial measurement model, a final measurement model was created by deleting the three problematic items. This led to the achievement of the model goodness of fit. Results from this final SA measurement model are presented in table 5.

Table 5: Final measurement model for SA

| Factor Loading | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Indicators | | Construct | Estimate | S.E. | C.R. | P | SMC | Recommended level |
| SA1 | ← | SA | .771 | - | - | *** | .594 | achieved |
| SA2 | ← | SA | .833 | .065 | 16.039 | *** | .693 | achieved |
| SA3 | ← | SA | .707 | .060 | 14.008 | *** | .500 | achieved |
| SA4 | ← | SA | .573 | .061 | 11.241 | *** | .328 | achieved |
| SA5 | ← | SA | .599 | .062 | 11.785 | *** | .359 | achieved |

| Goodness-of-fit measures | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Model identification | | | | | | Model fit statistics | | |
| Observ | = | 1 | $X^2$ | = | 11. | CFI | = | .98 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| ed variables | | 0 | | | 843 | | | 8 |
| Estimated parameter | = | 12 | $X^2$/df | = | 3.948 | RMSEA | = | .080 |
| Degree of freedom | = | 3 | P-value | = | .008 | NFI | = | .989 |
| Decision | Model accepted | | | | | | | |

Table 5 presented the final measurement model for the SA. All the five (5) indicators are retained to be used in further analyses. Both the measures of construct validity and model fit statistics meet the recommended thresholds for model acceptance. The entire factor loadings and the SMCs for the seven indicators meet the acceptable limits. In addition, all the generated model fitness indexes values are within the acceptance levels. RMSEA reported a value of 0.08, CFI = 0.988, NFI = 0.985, X2/df = 3.948 and p=0.008.

### 3.3 Assessment of Document Review (DR) Measurement Model

There are five items/indicators in document review measurement model as presented in Fig.5. The fitness and the validity of the model are tested by running the initial CFA without imposing any co-variation on the parameters.

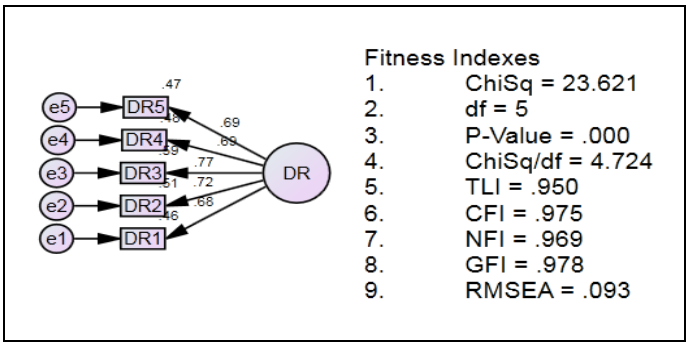


**Fig.5 - Initial DR measurement model**

The results generated from CFA process are as show in Fig 5. Some of the values are not at the acceptable level. The overall results from this process are as in table 6.

Table 6 - Initial DR measurement model results

| Factor Loading | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Indicators | | Construct | Estimate | S.E. | C.R. | P | SMC | Recommended level |
| DR1 | ← | DR | .677 | - | - | *** | .459 | achieved |
| DR2 | ← | DR | .717 | .090 | 12.451 | *** | .515 | achieved |
| DR3 | ← | DR | .770 | .096 | 13.106 | *** | .593 | achieved |
| DR4 | ← | DR | .695 | .095 | 12.135 | *** | .482 | achieved |
| DR5 | ← | DR | .689 | .087 | 12.050 | *** | .474 | achieved |

| Goodness-of-fit measures | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Model identification | | | | | | Model fit statistics | | |
| Observed variables | = | 10 | $X^2$ | = | 23.621 | CFI | = | .975 |
| Estimated parameter | = | 10 | $X^2$/df | = | 4.724 | RMSEA | = | .093 |
| Degree of freedom | = | 5 | P-value | = | .000 | NFI | = | .969 |
| Decision | Model not accepted | | | | | | | |

As shown in Table 6, the results from the initial model failed to meet the suggested model fitness criteria. The factor loading and the DR of the five (5) indicators shows that the required minimum thresholds are achieved, however, examination of the goodness-of-fit measures revealed that the model was not acceptable. Particularly, RMSEA generated value is greater than the recommended

value of 0.08. Thus the model was re-specified to rectify the problem. The final re-specification of the model is as Fig. 6.

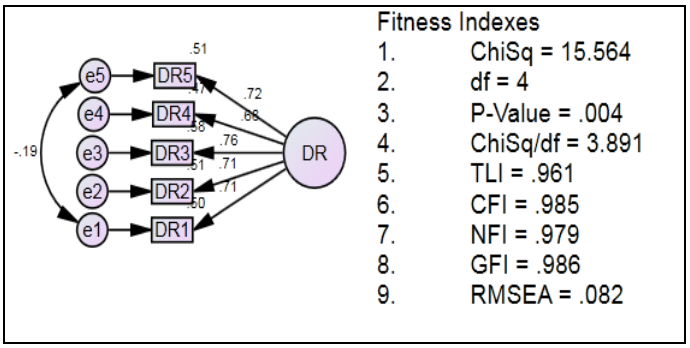


**Fig.5 - Final measurement model for DR**

Fig.6 shows the re-specified model for the DR measurement model. Upon freeing up of one parameter through co-varying the error terms e1 and e5, the required model fitness is achieved. The results from this re-specification model are as in table 7.

Table 7: Final DR measurement model results

| Factor Loading | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Indicators | | Construct | Estimate | S.E. | C.R. | P | SMC | Recommended level |
| DR1 | ← | DR | .677 | - | - | *** | .459 | achieved |
| DR2 | ← | DR | .717 | .090 | 12.451 | *** | .515 | achieved |
| DR3 | ← | DR | .770 | .096 | 13.106 | *** | .593 | achieved |
| DR4 | ← | DR | .695 | .095 | 12.135 | *** | .482 | achieved |
| DR5 | ← | DR | .689 | .087 | 12.050 | *** | .474 | achieved |
| Goodness-of-fit measures | | | | | | | | |
| Model identification | | | | | Model fit statistics | | | |
| Observed variables | = | 10 | $X^2$ | = | 15.564 | CFI | = | .985 |
| Estimated parameter | = | 9 | $X^2$/df | = | 3.891 | RMSEA | = | .082 |
| Degree of freedom | = | 4 | P-value | = | .004 | NFI | = | .979 |
| Decision | Model accepted | | | | | | | |

Table 7 shows the results of the final DR measurement model from CFA analysis. The results indicate that both factor loading and the generated values within are at the acceptable level. It also indicates that the respective fitness indices values in agreement with good-fit values. Hence the model is accepted.

### 3.4 Assessment of Risk Management Culture (RCA) Measurement Model

The relationship between the RCA construct and its respective indicators is presented in Fig.7. The factor loadings and the corresponding SMCs for the five (5) indicators all meet the 0.50 and 0.30 thresholds respectively. However, RMSEA failed to meet the desired level of acceptance which necessitates model re-specification.

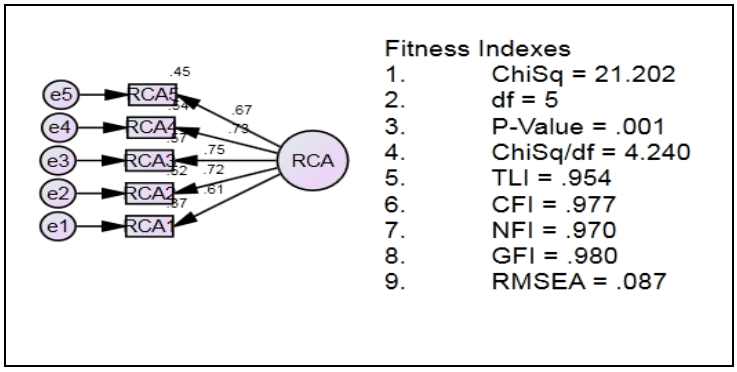


**Fig.7 - Initial measurement model for RCA**

Table 8 shows the detailed information about the factor loading, SMC and the fitness statistics for the initial model. Both measures of validity meet the desired level. Similarly, the NFI, CFI and the, X2/df satisfied the level of acceptance. However RMSEA generated value is greater than the acceptable limit. This requires the model to be re-

specified in order to obtain its goodness of fit criteria.

Table 8 - Initial measurement model for RCA

| Factor Loading | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Indicators | | Construct | Estimate | S.E. | C.R. | P | SMC | Recommended level |
| RCA1 | ← | RCA | .605 | - | - | *** | .366 | achieved |
| RCA2 | ← | RCA | .719 | .1111 | 11.146 | *** | .517 | achieved |
| RCA3 | ← | RCA | .753 | .1113 | 11.456 | *** | .567 | achieved |
| RCA4 | ← | RCA | .734 | .1113 | 11.287 | *** | .539 | achieved |
| RCA5 | ← | RCA | .668 | .1003 | 10.623 | *** | .446 | achieved |
| Goodness-of-fit measures | | | | | | | | |
| Model identification | | | | | | Model fit statistics | | |
| Observed variables | = | 10 | $X^2$ | = | 21.202 | CFI | = | .977 |
| Estimated parameter | = | 10 | $X^2$/df | = | 4.240 | RMSEA | = | .087 |
| Degree of freedom | = | 5 | P-value | = | .001 | NFI | = | .970 |
| Decision | Model not accepted | | | | | | | |

Fig.8 depicts the re-specified of RCA measurement model. Based on the figure, the desired criteria for model acceptance are met. Hence, the model is considered as final and retained for inclusion in further analysis of the structural model.

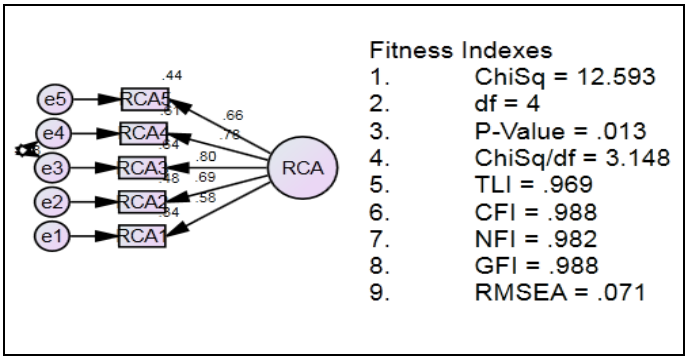


**Fig.8 - Final measurement model for RCA**

Table 9 further clarifies the attainment of model fitness for the RCA construct. After examination of the M.I. a parameter was freed up by creating co-variation between the error terms e3 and e4. This resulted in scaling down the RMSEA to acceptable value of .071. Therefore, the five indicators are all retained for inclusion in the subsequent analyses.

Table 9: Final measurement model for RCA

| **Factor Loading** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Indicators** | | **Construct** | **Estimate** | **S.E.** | **C.R.** | **P** | **SMC** | **Recommended level** |
| RCA1 | ← | RCA | .584 | - | - | *** | .341 | achieved |
| RCA2 | ← | RCA | .695 | .1113 | 10.986 | *** | .483 | achieved |
| RCA3 | ← | RCA | .797 | .1130 | 10.917 | *** | .636 | achieved |
| RCA4 | ← | RCA | .782 | .1130 | 10.786 | *** | .612 | achieved |
| RCA5 | ← | RCA | .660 | .1005 | 10.613 | *** | .435 | achieved |
| **Goodness-of-fit measures** | | | | | | | | |
| Model identification | | | | | | Model fit statistics | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Observed variables | = | 10 | $X^2$ | = | 12.593 | CFI | = | .988 |
| Estimated parameter | = | 9 | $X^2$/df | = | 3.148 | RMSEA | = | .071 |
| Degree of freedom | = | 4 | P-value | = | .013 | NFI | = | .982 |
| Decision | Model accepted | | | | | | | |

## Conclusion

This paper has presented the development and assessment of four risk management related tools for the performance of UAE public organizations. The measurement models are Delphi Technique; SWOT Analysis; Document Review and the mediator that is Risk Management Culture. These models were developed and assessed using AMOS-SEM software. All the four measurement were re-specified until achieved the model goodness of fit criteria values. These models are ready to be used in the structural model that relate the risk management tools with the organisational performance of UAE public organisation.

## Acknowledgement

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