

# The coordinated development between the internal audit guidance by the government audit departments and internal audit units: applying the principal component analysis and Monte-Carlo simulation

Hong Yu Guo<sup>1,4</sup>, Yi Cen Ding<sup>2</sup>, Qian Chang<sup>3</sup>, Chang Ping Zhu<sup>4</sup>, Ying Zhao<sup>5</sup>, Qing Zhang<sup>6</sup>

<sup>1</sup>Tianjin University of Finance and Economics, 300222 Tianjin, China

<sup>2</sup>Audit Bureau of Tianjin Hexi District, 300060 Tianjin, China

<sup>3</sup>Tianjin Municipal Water Affairs Bureau, Tianjin, China

<sup>4</sup>Tianjin Audit Bureau, 300200 Tianjin, China

<sup>5</sup>Tianjin Foreign Studies University, 300204 Tianjin, China

<sup>6</sup>Tianjin University of Science and Technology, 300222 Tianjin, China

E-mail: guohongyu@foxmail.com, yicending@163.com

**Abstract.** In the new era, reform of the audit management of Official Audit Organs need systems thinking. This paper focus on the guidance and supervision of internal audit, which is the important content of the audit management system. Through the analysis of the present situation from various perspectives, aiming at the outstanding problems that still need to be paid attention to under the new situation. It explores a feasible way to coordinate the development of internal audit guidance and internal audit institutions, and tries to exemplify the application section on the basis of empirical analysis. To quantify the relevance between internal audit guidance and internal audit institutions through scientific method, introducing Principal Component Analysis and Monte Carlo Method, also provides some reference ideas for practical application.

## 1. Introduction

The 19th National Congress of Communist Party of China has proposed the deployment of reforming the audit management system. Guiding and supervising the internal audit unit according to the law is the important responsibilities of our government audit departments and paying high attention to the guidance on the internal audit is the practical measures to implement the spirit of the 19th National Congress of Communist Party of China. After “The Regulation on the Internal Audit Practice Issued by the National Audit Office of the People’s Republic of China” in 2018, the National Audit Office has released “the Opinions On Strengthening the Professional Guidance and Supervision on the Internal Auditing Work” recently, which highlights the importance of the guidance on the internal audit and indicates at the same time that there are still some underlying problems between the internal audit guidance and internal audit unit.

## 2. The coordination and linkage between the government audit and internal audit



Content from this work may be used under the terms of the [Creative Commons Attribution 3.0 licence](https://creativecommons.org/licenses/by/3.0/). Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI.

The coordination and linkage between the government audit and internal audit are the basis to achieve a full coverage of audit supervision. The Third Session of the 19th CPC Central Committee in 2018 made comprehensive deployment of deepening the reform in party and government institutions. Seizing the opportunity of deepening the reform and making good use of bonus from reforms to find a solution for the coordinated development of internal audit unit and internal audit guidance on it; preventing the systematic risks with the help of internal audit guidance and supervision and leveraging the transformation of the internal audit in to the endogenous power to safeguard the high-quality development are the innovative development directions in the new era and under the situation.

### **3. The concept and method are to be updated**

It's worth noting that some internal audit units in the internal audit guidance range of government audit departments such as grassroots administrative organs and public institutions still follow the tradition to focus on the internally auditing the compliance of financial affairs because of their own special attributes like small scale and single layer. Their business is single and comparatively limited comparing with the rapidly developing market economy and they are lack of communication channels to the new methods and motivation to face the new situation. All the above mentioned are becoming gradually the short slabs of the innovative development of the internal audit in our country.

#### *3.1. Law and regulations construction*

Legislative guarantee is the priority among priorities, which means to formulate the legal and regulatory framework with complete levels and in accordance with the Socialism with Chinese Characteristics for the internal audit guidance and to build a legal environment to promote the development of internal audit. The matters which need adjusting through legal means include: organizational structure, rights and duties of internal audit guidance, application of the internal audit achievements, the use of social auditing efficacy, purchase of social auditing service to implement the internal audit and so on.

#### *3.2. The establishment of a dynamic data base system*

Setting up the dedicated data base for internal audit and paying high attention to the completeness and integrity of basic data could provide data support for the application of internal audit achievements and macro policy making. The dynamic data base platform could be used to promote the internal audit guidance and the auditing method update of the internal audit unit through the adaptation to the development tendency of big data and cloud technology. Additionally, the disclosure measures of the dynamic information about the internal audit need to be formulated to improve the information transparency, eliminate in steps the restriction on the internal audit caused by the asymmetric information and promote the result and efficacy of internal audit.

#### *3.3. The construction of a relevance measure mechanism*

The problems about relevance have not yet gained enough attention. However, the quantization of relevance is an avoidable step not only for the internal audit guidance but also for the scientific transformation of public governance. The relevance and interaction between the audit measuring departments' guidance and internal audit unit's work need to be clarified. The quantized indexes could be used to define clearly the fields that the internal audit of the auditing bodies should regulate and could regulate. The guiding policy should be formulated prudently. The influenced range should be predicted in advance and the policy should be adjusted according to the feedback information. What's more, the process of measuring the factors consisting of the relevance and discriminating and selection results of influencing factors could be further used in the construction of assessment system for the quality of internal audit units' work, which will form the assessment index spontaneously.

### **4. Explore the systematic development planning under the scientific methodology**

Taking the scientific method as the guidance and strengthening the supporting system to ensure the sustainable and long-term coordinated development of internal audit guidance and internal audit unit.

To expound the path for a scientific and coordinated development of the relevance between internal audit guidance and internal audit unit, the following ideas are proposed based on the living examples:

- Clarify the internal audit guidance boundary of the government audit departments and influence factors of internal audit unit with the application of the statistical and experimental simulation methods.
- Along with advancement of the internal audit guidance in the new mode and in the new era, more and more data will be added, so we must be able to use the factor analysis to discriminate the influence factors and explore further the internal relationships and structure of each part.
- The interactional model of the internal audit guidance could be set up through regression analysis and it could be verified and modified via real-time data. Finally it could be used for prediction.
- Once the model is matured, analytic hierarchy process could be used to generate an index and weight system which could be used for assessing the internal audit units. In addition, from the perspective of state level, the data will be more, so the data mining technology could be considered to generate more detailed indexes and reference information for making macro policy.

### 5. The empirical exploration on the relevance between internal audit guidance and internal audit unit

At present, there are in fact lots of matured statistical approaches to scientize the internal audit guiding methods of government audit departments. What we need to prepare is the construction of the scientific public governance idea and the collection of the essential data.

#### 5.1. Using the Principal Component Analysis (PCA)

Principal component analysis is used because it seeks to suitable rotation strategy. Data were analysed with the aid of the SPSS version 12 statistical software application.

**Table 1.** Total Variance Explained.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.39	34.136	34.136	2.39	34.136	34.136
2	1.98	28.289	62.425	1.98	28.289	62.425
3	1.033	14.762	77.186	1.033	14.762	77.186
4	0.897	12.813	89.999	0.897	12.813	89.999
5	0.37	5.281	95.281			
6	0.193	2.752	98.033			
7	0.138	1.967	100			

Extraction Method:Principal Component Analysis

**Table 2.** Component Matrix.

	Component			
	1	2	3	4
Type of internal audit unit	.297	.872	.222	.152
Nature of internal audit unit	-.154	-.394	.230	.875
Full-time internal audit staff	.868	-.286	.131	-.068
Part-time internal audit staff	.073	.916	.271	.116
Independent accounting subordinate units	.876	-.232	.223	-.057
Non-Independent accounting subordinate units	.224	.302	-.867	.246
Internal audit system	.838	-.003	-.197	.161

Extraction Method:Principal Component Analysis.

Table 1&2 provides a summary of the correlations between the component of internal audit unit questionnaire topics which serve as the basis of the factor analysis using principal component procedure. Principal component analyses suggest four factor solutions where the factor represents independent character of internal audit unit, subordinate character of internal audit unit, character of internal audit guidance and scale of the internal audit unit.

### 5.2. Introducing the Monte-Carlo simulation

The above is only an example of the guidance of internal audit and the research methods of internal audit institutions under the scientific concept. In reality, if historical data is scarce, mature experimental techniques such as simulation can also be selected.

Linking fiscal budget revenue and expenditure, using Monte Carlo simulation method, combining with macro-control data, measuring the expected Value at Risk (VAR) scientifically, focusing on key funds and units, comprehensively determined the national audit annual plan and the internal audit guidance or supervision plan, forming a dynamic closed-loop of full audit coverage under the macro-prudential thinking.

Monte Carlo method is selected to avoid the lack of empirical data and the lack of simulation data in scenario analysis. Due to the research object, internal audit risk and risk loss occurrence events are typical skew thick-tailed problems, non-normal problems. Monte Carlo method can deal with such problems well. A few domestic researchers have applied Monte Carlo method in the field of approximation in practice (Dongxia Liu, 2016).

The main steps of applying Monte Carlo method can be summarized as follows:

- determining variables
- determining the probability distribution of variables
- randomization and bootstrap
- conducting simulation
- finding approximate solutions and making corrections

## 6. Conclusion

The coordinated development and mutual promotion between the internal audit guidance by the government audit departments and internal audit units are good for the realization of the simultaneous improvement in public governance of national government audit departments, government sectors and state-owned enterprises and institutions and also beneficial to the public sectors' and its officials' abilities in financial and audit to satisfy the social development needs and play the leading roles in the field at home and abroad. A clear target, the selection of proper mode and a complete supporting system which could form collaboratively a systematic and scientific organic and a closed loop, should be able to serve as reference path for the coordinated development of internal audit guidance by the government audit departments and internal audit units.

## References

- [1] Badara M S, Saidin S Z. Internal audit effectiveness: Data screening and preliminary analysis[J]. *Asian Social Science*, 2014, 10(10): 76-85.
- [2] Sovinová H, Csémy L. The Czech audit: internal consistency, latent structure and identification of risky alcohol consumption[J]. *Central European journal of public health*, 2010, 18(3).
- [3] Thomas Schillemans, Mark van Twist, Martijn van der Steen, Ilsa de Jong. New development: Breaking out or hanging on? Internal audit in government[J]. *Public Money & Management*, 2018, 38(7).
- [4] Laurence Ferry, Zamzulaila Zakaria, Zarina Zakaria, Richard Slack. Watchdogs, helpers or protectors? - Internal auditing in Malaysian Local Government[J]. *Accounting Forum*, 2017, 41(4).
- [5] Robyn Pilcher. Role of Internal Audit in Australian Local Government Governance: A Step in the Right Direction[J]. *Financial Accountability & Management*, 2014, 30(2).
- [6] Dean Neu, Jeff Everett, Abu Shiraz Rahaman. Internal Auditing and Corruption within Government: The Case of the Canadian Sponsorship Program[J]. *Contemporary Accounting Research*, 2013, 30(3).
- [7] Jeremy Raemaekers. Corporate environmental management in local government: A review of action programmes, internal audits, and state of the environment reports[J]. *Planning Practice and Research*, 1993, 8(3).
- [8] Zvi Haimon. Internal auditing in local government in Israel: status vs effectiveness?[J]. *Israel Affairs*, 2003, 9(4).
- [9] Stephen Kwamena Aikins. Government Internal Audits: The Determinants of Quality Supervisory Review of Audit Documentation[J]. *International Journal of Public Administration*, 2013, 36(10).
- [10] Mary Bowerman, Shirley Hawksworth. Local government internal auditors' perceptions of the Audit Commission[J]. *Managerial Auditing Journal*, 1999, 14(8).
- [11] Pulina T e tiana V.. The Analysis of Internal Audit Methods to Assess the System of Quality Management in the Government Authorities[J]. *Biznes Inform*, 2017, 8(475).
- [12] Novita Puspasari, Meutia Karunia Dewi. The effect of government internal auditors moral reasoning and situational pressure on the tendency to commit fraud when auditing: An experimental study[J]. *Journal of Economics, Business & Accountancy*, 2015, 18(3).
- [13] Greg Jones, Claire Beattie. Local Government Internal Audit Compliance[J]. *Australasian Accounting, Business and Finance Journal*, 2015, 9(3).
- [14] Erny Prasetyaningsih, Gufratul Yuhalfiyah, Heri Susanto. Internal Control System Weakness and Non-Compliance to the Provision of Legislation in Practicing Audit of Local Government in Indonesia[J]. *Open Journal of Political Science*, 2014, 04(04).
- [15] Soratana K, Marriott J. Increasing innovation in home energy efficiency: Monte Carlo simulation of potential improvements[J]. *Energy and Buildings*, 2010, 42(6): 828-833.

## Acknowledgments

This project is supported by the Tianjin Finance Bureau & Accounting Society of Tianjin, Key Accounting Scientific Research Project of 2019-2020 (Y190202).