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Designing a New Curriculum System to Train Comprehensive Audit Talents in the Big Data Era

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Abstract

The big data era is bringing profound changes to the audit environment and the audit evidence collection model, increasing the requirements placed on auditors. Most colleges and universities, however, still use the traditional audit talent training system, which has long been unable to adapt to the knowledge structure/ability requirements placed on auditors in the "Internet plus" and big data era. Changes must be made. This article analyses the impact of the big data era on auditing and explores the design of a comprehensive audit talent training curriculum system from an interdisciplinary integration perspective. The article also discusses issues that must be considered in the implementation of the new curriculum system.

Keywords

Big data; Comprehensive audit talent; Interdisciplinary; Curriculum system.

1. Introduction

In recent years, auditing has become increasingly prominent as a means of national governance. In November 2015, China released target requirements for full audit coverage; as part of this, the country strengthened the auditing of public funds, state-owned assets, and state-owned resources and implemented economic accountability audits of leading cadres. In March 2018, the Central Audit Committee was established, with General Secretary Xi Jinping serving personally as the director. Due to these developments, the recognition and status of national auditing have improved significantly. In addition, demand for audit talent has greatly increased due to changes in the audit environment such as government streamlining and delegation of power, supply-side structural reforms, and the implementation of various audit projects (e.g., follow-up oversight concerning the implementation of policies and measures, natural resources departure audits on leading cadres, etc.).

Meanwhile, the big data era (including transformative technologies such as artificial intelligence, mobile Internet, cloud computing, and blockchain) is bringing profound changes to the audit environment and the audit evidence collection model. As one of the most important developments in management practice, big data is expected to fundamentally change not just business but the world [1]. For auditors, the scope of evidence collection has greatly expanded due to big data and other information technologies, which have become indispensable in carrying out audit work [2]. As such, auditing in the era of big data involves higher requirements for auditors.

Universities shoulder the important task of cultivating audit talent that can meet the needs of society. Faced with the significant changes and challenges brought on by the era of big data, colleges and universities should take the initiative by adjusting the audit talent training curriculum system to cultivate comprehensive audit talent and enhance professional competence.

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In this article, we discuss the impact of the big data era on auditing and explore the design of a comprehensive audit talent training curriculum system from an interdisciplinary integration perspective. We also discuss issues that must be considered in the implementation of the new curriculum system.

This article represents an important supplement to the literature because it is the first to propose and systematically construct an interdisciplinary integrated audit talent training curriculum system.

The remainder of this paper is organised as follows. In section 2, we discuss the characteristics of big data and of auditing in the context of big data. Section 3 describes the new demands placed on auditors (in terms of required competencies) in the big data era. Section 4 outlines the problems with the current audit talent training curriculum system. The comprehensive audit talent training curriculum system is presented in section 5. Section 6 discusses issues that must be considered in the implementation of the proposed curriculum system. Finally, we conclude our work and discuss future research directions in section 7.

2. Big Data and Auditing

2.1. Characteristics of Big Data

Big data is often defined in terms of the "four V's," i.e., volume, variety, velocity, and value [3].

2.1.1. Huge scale and volume

Big data combines different types of granular data generated from multiple sources, such as the Internet of Things (IoT) and social media [4]. As mobile Internet and other information technologies increasingly penetrate various fields, data on all aspects of society have increased exponentially [5].

2.1.2. Diverse data types

In big data, there are diverse data types, including structured data, semi-structured data, quasi-structured data, and unstructured data. In recent years, there has been a surge in data with no fixed structure, usually stored as different types of unstructured data. As a result, both the amount and the complexity of data have increased.

2.1.3. Fast processing speed requirement

In the big data context, the term velocity refers to the fast processing speeds required to meet the real-time needs of users. Big data processing follows the "one second rule," referring to the extremely short time range within which analysis results need to be given.

2.1.4. Low density and high value

The ultimate purpose of big data is to obtain valuable insights [3]. With the widespread application of the Internet and IoT, there is vast and ubiquitous information, but it is characterised by low value density. Obtaining insights from massive amounts of information provides value to society.

2.2. Characteristics of Auditing in The Context of Big Data

2.2.1. Commonly used technical methods involving big data [6]

a) Association analysis of spatial data and structured data: While big data can be collected with relative ease, processing and extracting useful information from such data are harder tasks [7]. In association analysis, finding the correspondence between spatial data and structured data is often the key.

b) Machine learning algorithms: Computers simulate human learning behaviors to acquire new knowledge or skills and continuously improve their own performance by reorganizing the existing knowledge structure.

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c)Unstructured data analysis technology: Unstructured data contain a wealth of information, which can be analysed and exploited through various technical means; this is the meaning of big data analysis. In auditing work, it is necessary to use relevant algorithms to extract certain needed information from unstructured documents and convert it into structured data.

d)Python technology: Python is a cross-platform computer programming language characterised by concise language, ease of reading, and extensibility. Auditors can quickly carry out the extraction, cleaning, and processing of audit data through the existing Python extension library or software call interfaces.

e) Visual analysis technology: This technology helps users to analyse and make sense of large-scale complex data sets through an interactive visual interface. It has excellent human-computer interaction capabilities and can easily be used by auditors without a professional computer background.

2.2.2. Characteristics of big data audits

Audit work in the context of big data involves not only the use of advanced technology to gather large amounts of data but also the in-depth integration of data, business, and technology. Modern audit engagements often involve the examination of clients that are using big data and analytics to remain competitive [8]. These types of audits have several specific features [9]:

a) Multiple data sources: Audit data sources are more extensive when big data is involved. Audit data involve more objects, broader fields, and broader coverage, usually including structured, semi-structured, and unstructured data across the financial, business, and management spheres.

b) Multiple technical means: Big data auditing uses a range of technologies and methods, such as data collection, storage management, and mining analysis. In data collection, traditional ETL (extract, transform, load) technologies, such as geographic remote sensing, are continuously integrated. Meanwhile, storage management technology is evolving from a centralized architecture to a distributed architecture, and mining analysis is changing from an approach based on simple summary statistics to one that is more complex, visualized, and focused on intelligent development.

c)More complex data relationships: With the help of big data technology, auditors can carry out more in-depth and extensive comparisons of the relationships among audit data; this aids cross-department communication, enabling more integrated and holistic data analysis from multiple levels. Such an integrated approach helps to address prior shortcomings and improve the objectivity of audit work.

d)Diversified audit modes: The in-depth analysis enabled by big data technology can help auditors to gather audit trails to support on-site project inspections. In this way, off-site big data audits can be combined with on-site audits, resulting in a more robust and diversified audit process.

3. Competence of Auditors in the Context of Big Data [10]

3.1. Big Data Audit Thinking

Against the backdrop of big data, the focus of audit work has shifted from micro-operations to macro-management and from after-the-fact investigations to the prevention of issues through continuous supervision. In short, audit work is moving toward a scientific standard of high efficiency and accuracy. Therefore, auditors also must transform their thinking from traditional financial audits to big data audits.

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3.2. Information Technology Operation Ability

To achieve efficient audit work in the big data era, it is necessary to have computer capabilities, including big data mining and analysis capabilities, model software application capabilities, and computer audit operations capabilities. These analytics tools enable auditors to import nearly limitless amounts of data for analysis [7]. Such big data-assisted evidence collection can help auditors not only verify traditional financial statements but also enhance their knowledge for client assessment. [11]

3.3. Comprehensive Processing Capability of Audit Business

Auditing in the big data era has moved beyond single audit reports to comprehensive results. Techniques such as pattern recognition, data mining, and natural-language processing have improved the predictive power of data analysis [12]. Therefore, auditors now need to have much higher business processing capabilities. Aside from their professional knowledge of auditing, accounting, and management, auditors also need to become multi-disciplinary talent with an understanding of professional areas like sociology, law, environmental science, political science, and other disciplines.

4. Problems in the Current Audit Talent Training Curriculum System

4.1. Exam-Oriented Education

Accounting education in China has long resisted any change to the exam-oriented approach, and there is a general tendency to “emphasize examinations and ignore ability” [13]. This phenomenon is especially obvious in audit education. Although the auditing majors of most colleges and universities are currently divided into CPA auditing, internal auditing, and government auditing, curriculums are still dominated by CPA auditing and financial auditing courses [14]. There are few courses related to government and internal auditing. In addition, students generally make CPA certification their learning goal and believe that the CPA exam courses represent the main courses on auditing; most still do not appreciate the importance of information technology such as big data and blockchain.

4.2. Outdated Curriculum

Over the years, auditing has become more interdisciplinary in nature. For auditors, a solid foundation in traditional auditing practices is no longer sufficient; they also need to have a good grasp of other professional disciplines to adapt to the ever-changing requirements of the field. At most universities in China, there is significant overlap between audit talent training programs and accounting majors, as auditing is widely seen as a second major for accounting students [15]. In addition, auditing curriculums generally focus on accounting and financial management under the “accounting informatization” framework. In terms of information technology courses, most schools only offer computer basics and computer (assisted) audit courses, while big data, artificial intelligence, database, and other related information technology courses are rarely offered. Such a curriculum framework has been in use for many years, and has long been unable to adapt to the knowledge structure/ability requirements placed on auditors in the “Internet plus” and big data era. Therefore, changes must be made.

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5. Design of the Curriculum System for Comprehensive Audit Talent Training

5.1. The Knowledge Structure Requirements for Audit Talent in the Big Data Era

In the era of big data, audit talent with wide-ranging knowledge and comprehensive audit capabilities is needed. Cultivating such talent necessitates the construction of practical, intersecting, and comprehensive audit courses. The auditing discipline thus needs to embrace an interdisciplinary curriculum design approach [16].

5.1.1. The intersection between auditing and sociology, political science, and logic

The key to the intersection of auditing, sociology, political science, and logic lies in the supervising role that auditing plays in social, economic, and political life. Government auditing is a manifestation of the full integration of auditing and political science. As a national governance mechanism and an important part of the state machinery, government auditing has the core function of checking political power. Therefore, students who study and understand auditing from the perspectives of political science, sociology, and logic can better interpret audit laws, discuss audit theory and practice, and clarify the strategic direction of auditing development [16].

5.1.2. The intersection between auditing and economics, management, and law

The intersection of auditing and economics lies in the question of how to rationally allocate limited or scarce resources. Economics studies this question from the perspective of human behavior. In-depth economic analysis of social and economic phenomena and systems can aid the understanding of how auditing standards evolve and lay a solid foundation for the auditing discipline.

Regarding the intersection of auditing and management, the key point is the role that auditing plays in improving national governance and corporate management. As the management discipline studies the structure, process, and method of organization of resource allocation, it forms the basis and starting point of auditing. Auditing arises from the needs of management practice, and its functions expand as management practices develop. Students who understand the importance of auditing from the perspective of modern management can better grasp the role of auditing and its general trend and direction.

The intersection of auditing and law lies in the inherent legal attributes of auditing [17], and both audit work and judicial work aim to maintain a certain order [18]. The rationales and methods of law provide a good reference for auditing.

5.1.3. The intersection between auditing and environmental science and engineering management

Auditing and the environmental sciences intersect because of the specific issues that have arisen from the emergence of environmental auditing and natural resource auditing in recent years.

5.1.4. The intersection of auditing and IT

The intersection of auditing and IT mainly lies in the growing role of big data and related technology in driving innovation in auditing methods. New research areas include auditing issues particular to big data, auditing issues particular to cloud computing and cloud service platforms, audit reforms under the e-commerce/network economy model, network security audits, continuous audit issues, and data mining.

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5.2. Design of the Curriculum System for Comprehensive Audit Talent Training

5.2.1. Basic theoretical modules

Basic modules include auditing foundations, auditing standards, auditing theory, internal control theory and practice, management foundations, economic foundations, political science foundations, sociology foundations, legal science foundations, logic foundations and environmental science foundations.

5.2.2. Technical modules

Technical modules include audit technology and methods, the basics of data science, statistics and R language, Python data processing programming, machine learning and pattern recognition, data mining, big data collection and processing, applied regression analysis and deep learning algorithms.

5.2.3. Special auditing modules

Special modules include financial statement audits, financial audits, resource audits, environmental audits and information system audits.

The curriculum system is shown in Figure 1.

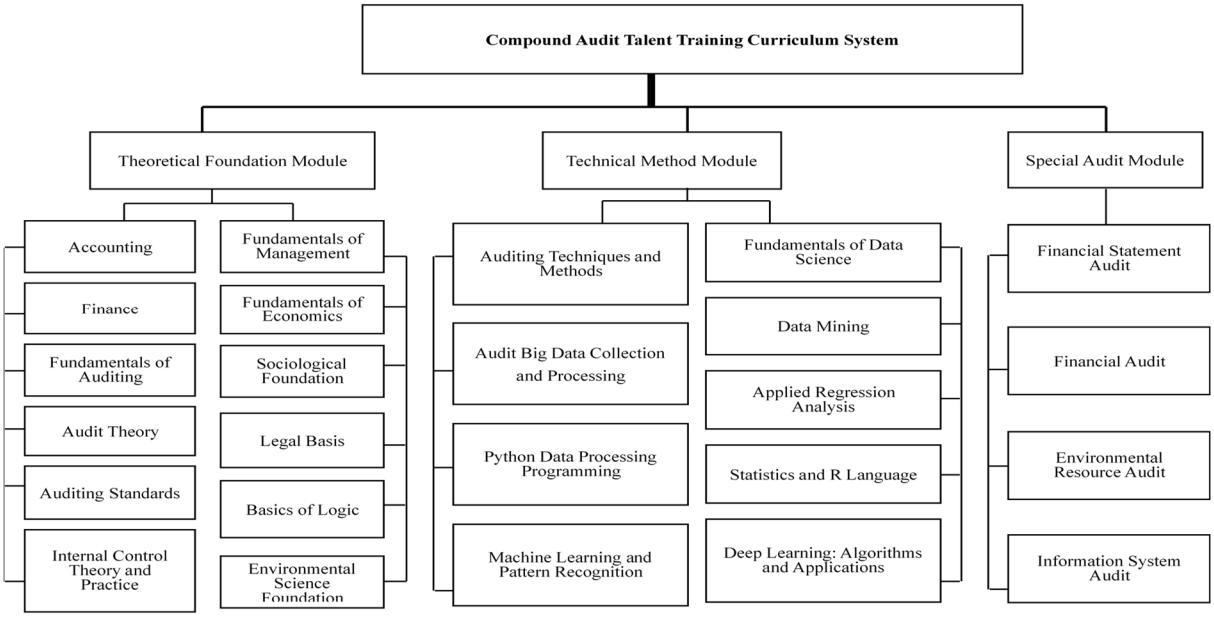

Figure 1. The curriculum system for comprehensive audit talent training

6. Issues to be Considered in the Implementation of the Comprehensive Audit Talent Training Curriculum System

6.1. Strengthen Learning and Update Ideas

Ways to improve teachers' awareness and understanding of the new curriculum system and inspire their participation in education reform include inviting expert lectures, strengthening internal and external teacher education and teaching seminars, visiting advanced schools for education reform and organizing outings.

6.2. Advance Preparation and Reserving of New Teachers

The new curriculum system includes many information technology courses, including the basics of data science and data mining. Teaching tasks for such courses are generally undertaken by teachers in the information science discipline. However, when these courses are given to audit students, the teaching content needs to be tailored to the actual needs of auditing.

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In addition, as current teachers may be unable to offer brand-new courses, advance preparation is required to contact and reserve new teachers.

6.3. Gradual Implementation, Starting with a Pilot Run

It is suggested that the new training program be evaluated through a pilot test; this could involve a 30-person "Big Data Audit Innovation Class" in the audit department. Based on experience and insights gathered in this way, the program can then be comprehensively promoted.

7. Conclusions

The proliferation of information technologies such as big data and mobile Internet has profoundly changed the methods and content of audit work, posing new challenges to the functional competence of auditors. As an important training base for auditing talent, universities must actively respond to social changes. This article analyses how the requirements placed on auditing talent have changed in the big data era, and proposes a cross-disciplinary integrated audit talent training curriculum system. It also discusses issues that must be considered in the implementation of this curriculum system.

It is important to note that this article discusses the design of an audit talent training curriculum system suited to the big data era from a theoretical standpoint only; the effectiveness of the system has yet to be tested. The rapid changes that are unfolding in artificial intelligence, IoT, blockchain, and other information technologies will undoubtedly have a deep impression on auditing [19, 20]. Future research can follow up on the ideas presented in this article, continue to explore the effects of new technology on auditing and further build a new audit talent training system.

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