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Adopting continuous auditing

A cross-sectional comparison between China and the United States

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Abstract

Purpose – The purpose of this paper is to analyze the hurdles, compared with that in the United States, for the implementation of Continuous Auditing in China. As a timely, cost-saving and efficient auditing method, continuous auditing is being increasingly adopted throughout the world. However, while it is increasingly applied in the USA, continuous auditing is still in its infancy in China.

Design/methodology/approach – This paper compares and contrasts China and the USA in three important dimensions that determine the "economic architecture" of assurance: the business environment, the audit profession and technology.

Findings – The authors find that excessive government intervention in business, the lack of competition, independence of auditors, the support from management and the continuous auditing-specific regulations, as well as the technology gap between these two countries, are the main barriers for the implementation of continuous auditing in China.

Research limitations/implications – The findings of this paper provide better understanding of the drivers of continuous auditing adoption in the USA and the barriers toward doing so in China.

Practical implications – The term "continuous auditing" has never been formally introduced until the release of the draft of the Internal Control Audit Guide in 2011.

Originality/value – The paper highlights how technology by itself is not deterministic, but given the extraordinary rise in the Chinese economy in both its size and its sophistication, it has be to assumed that its "leapfrog" into parity if not outright leadership in continuous assurance is still a matter of "when" and not of "if".

Keywords China, Adoption, Continuous auditing, The USA

Paper type Conceptual paper

1. Introduction

In today's economy, organizations tend to rely on information technology (IT) to record and process business transactions. More and more businesses are running on a continuous basis (Vasarhelyi and Greenstein, 2003; Arens *et al.*, 2012) and accounting systems are changing to reflect the increasing pace of transactions: "Accounting processes were progressively formalized and currently encompass the corporate digital infrastructure and super-corporate interconnectivity" (Krahel *et al.*, 2012). The

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increasing volume of transactions and the digitization of accounting processes reduces human oversight and increases business risks. There have been numerous examples of companies such as AIG and Citibank that have faced considerable losses due to the failure of control systems and the lack of oversight of niche sectors. In response, organizations have worked to strengthen their ability to monitor, identify, assess and control risks. Risk management is now considered a crucial function of internal control systems, as the development of the COSO enterprise risk management framework indicates. Effective risk management aims to help enterprises seize opportunities related to the achievement of their objectives by ensuring that risks are detected automatically and dealt with in a real time basis.

Although not directly tasked with risk management decisions for the enterprise, auditors play an essential role in monitoring and evaluating the entities' risk management systems. Traditional auditing, however, lacks the ability to respond to risks in the same time frame in which they appear since they only perform risk assessments on a periodic basis (e.g. review risk assessments performed by the enterprise such as strategic plans, competitive benchmarking, Sarbanes–Oxley Act (SOX) top-down risk assessment, etc.). To achieve the purpose of coordinating with digitalized accounting processes and satisfying demands from shareholders and regulators for risk-based, automatic, effective, continuous or nearly real-time audit procedures, the way in which auditing is performed needs to be updated.

As "a type of auditing that produces audit results simultaneously with, or a short period of time after, the occurrence of relevant events" (Kogan and Vasarhelyi, 1999), continuous auditing (CA) emerged in the USA in the late 1980's. After decades of development, the theory and methodology of CA have relatively matured. In 2009, ACL and the Institute of Internal Auditors (IIA) jointly conduct a survey (Askelson *et al.*, 2009; IIA, 2009), showing that 36 per cent of US companies have implemented CA approaches either across all of their business processes or within certain areas, with 39 per cent of the responders planning to use CA in the near future.

Compared with the optimistic picture in the USA, the adoption of CA in China is still in an early stage. The term "continuous auditing" had not been formally introduced in official regulations or guidelines until the China Institution of Certified Public of Accountant (CICPA, 2011) released the Enterprise Internal Control Audit Guidelines (Draft for Comments) in 2011. Lacking formal guidance from professional organizations and academic institutions, few Chinese executives have adequate knowledge of what is CA. As we discuss in this paper, a large majority of local companies and accounting firms prefer the traditional periodic auditing method. Even the "big 4" perform CA to a limited extent. As the Beijing partner of PwC China, Philip Yang points out:

> Considering the frequency of application, it would be more appropriate to call continuous auditing IT auditing or Information system auditing in China. In practice, PwC only uses it quarterly, and almost all of the CPA firms consider that it is unnecessary to use continuous auditing more frequently.

Does this mean that China does not need CA at all? Our argument is that in fact China is at the point when CA is most needed because the increase in size and importance of Chinese companies has seen them lag in their development of internal controls and practices.

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Over the past 30 years, as China has pursued policies of economic reform and re-balancing, China's economy has maintained a high speed of average annual growth from 8 to 9 per cent. Chinese corporations "have quickly risen up the global league tables" and even ranked among the top 500 most profitable corporate players in the world (KPMG, 2013). Nevertheless, ranking on the Fortune Global 500 list does not indicate that a company is internationally competitive (Shambaugh, 2012). Chinese enterprises are actually experiencing a crisis: losing competitiveness. There are 95 Chinese enterprises in the list of 2013 Fortune Global 500. Among them, a great majority are state-owned enterprises (SOEs), mainly distributed in regulated industries such as steel, automobile, energy, chemistry, finance, etc. Only seven (enterprises of mainland China) are private enterprises whose operation are totally market oriented. Nine commercial banks (only one of them is a private bank, China Minsheng Bank) make 55.2 per cent of the total profits of these 95 companies. In contrast, eight listed US commercial banks contribute 11.9 per cent of the total profits made by all listed US companies. It implies that Chinese companies, especially non-SOEs that are not in the regulated markets, are much less efficient in operation than companies headquartered in the developed nations.

Why are Chinese enterprises less efficient? The key is the weak internal control, especially the lack of a powerful tool to monitor risk management systems. In recent years, the occurrence of business failures in China, especially food safety scandals such as Sanlu, Shuanghui, and so on, has reflected the deficiency in Chinese companies' risk management procedures. The "poison milk" scandal in 2009 shocked the world. Hundreds of thousands of babies were sickened by melamine-tainted milk produced by Sanlu, a well-known Chinese enterprise. The scandal discloses serious deficiency in the internal control of its raw material purchasing, producing and selling processes. More importantly, it raises fierce public discussions on the effectiveness of enterprises' risk management. In response, many Chinese consumers have shifted to purchasing foreign products even though they cost significantly more than the local products.

Facing the increasingly complicated and uncertain business circumstance, the key to the survival of an enterprise lies in its ability to make timely adjustments to changes. In response, Chinese regulators have recognized the importance of internal control and have endeavored to improve the internal control of Chinese enterprises by promulgating standards and guidance such as the "China SOX". But Chinese entities have not been aware of the benefits a revolution in audit method could bring to them. As CA performs frequent or real-time monitoring on the entity's existing control system and compares certain controls with the auditor's expectations, a problematic event (i.e. a critical business risk that is not identified by the entity's risk management process) may be immediately observed and evaluated, and, if necessary, trigger a system alarm which automatically informs the management for further investigation. Thus, CA could offer Chinese enterprises a route to improve their operation efficiency and boost their competitiveness.

A recently initiated anti-corruption campaign further makes the case for wider adoption of CA. In 2013, the central government launched a fierce anti-corruption campaign and put the greatest efforts of the past 30 years into it. A large number of crimes were uncovered, but almost all of them were discovered by reactive method such as tips or accidents. The statistics from China Central Commission for Discipline Inspection show that, in 2013, the discipline inspection organs at all levels received the

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1,950,374 tips. While a reactive detective approach aims at discovering corruption or other crimes (such as assets theft, embezzlement and fraud) after it has been committed, a proactive approach such as CA prevents it from taking place in the first place.

As the "unsound corporate risk management and the anti-corruption wave" indicates the demand for better audit practices, why does China lag behind the USA in the implementation of CA? Why do most enterprises and accounting firms still prefer the traditional auditing method? To understand these questions, it is of great importance to highlight the factors that have driven businesses in the USA to adopt technology-driven auditing. If the possibility to "leapfrog" to new audit technologies is ever to be realized in China, as Alles *et al.* (2003) had hoped, it is necessary to better understand the drivers of CA adoption in the USA and the barriers toward doing so in China.

In our analysis, we follow the framework outlined by Alles *et al.* (2002), who state that more attention has to be paid to the "economic infrastructure necessary to produce and pay for CA". Therefore, in this paper, we compare and contrast China and the USA in three important dimensions that determine the "economic architecture": the business environment that creates the demand and supply of CA, the audit profession that provides academic and regulatory support and the technology that facilitates the application of CA.

We begin the paper with a brief overview of the characteristics and components of CA. We then turn to a detailed discussion of the three determinants of the economic architecture within which decisions about CA implementation are made. We first discuss the overall economic environment that shapes the macro-demand for auditing and then the auditing circumstance within the USA and China. We round out our discussion by considering the specific role of technology itself. In the final section, we discuss the hurdles, compared with the USA, for the implementation of CA in China and provide suggestions for China to hasten the implementation of CA.

2. Continuous auditing

Groomer and Murthy (1989) and Vasarhelyi and Halper (1991) originally a proposed computer-based, close to the event assurance technology, motivated by the progressive impossibility of manual audits and the availability of less costly computer systems. Their conception of CA, although initially ignored by the standard setting entities, has been increasingly considered, adapted, advanced and adopted as a way to deal with progressively large sets of data, the challenge of auditing enterprise resource planning (ERP) systems and the need of access to electronic records. The original AT&T application (Vasarhelyi and Halper, 1991) focused on monitoring data on a large customer relationship management system (billing), comparing these data to normative models (standards) for the data and detecting exceptions (called alarms) upon significant discrepancies. This process of comparing actual data to models (standards) has been labeled continuous data audit (CDA).

The advent of the SOX in the USA and the consequent emphasis on assurance of an organizations' control system brought increased focus on the evolving problem of non-visually observable configurable controls and their effect on data quality. Alles *et al.* (2008) worked with Siemens in the development of a methodology that extracted the parameters of existing controls in SAP systems and compared it with a baseline. This methodology transformed an annual or biannual review of controls into a daily

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monitoring activity where control changes could be observed and evaluated. This methodology was called continuous control monitoring (CCM).

Finally, after the SOX, the USA's PCAOB (2004) has strongly suggested the performance of risk-based audits, where risk evaluation further guides the performance of audit procedures. Vasarhelyi *et al.* (2010) propose a methodology called continuous risk monitoring and assessment (CRMA), where risk monitoring leads to dynamic change in audit procedure aiming to mitigate risk effects.

CDA, CCM and CRMA are the three components consisting continuous assurance. Figure 1 brings together these three components in the vision of the audit of the future that is closer to the event, substantively automated, rich in analytic procedures, activated by exception and highly integrated with corporate control systems acting as meta-controls. This environment will require substantive changes in the conceptualization of issues such as auditor independence, materiality and report targeting, all aimed at improving data reliability and quality.

Compared with traditional auditing methods which periodically examine a sample of transactions, CA performs control and assesses risk for entities on a more frequent basis, and could automatically review 100 per cent of transactions (Coderre, 2005). Therefore, it could provide faster, cheaper, more efficient and more effective assurances. Realizing its value in risk management, internal control, audit and assurance service, accounting professional organizations encouraged the adoption of CA. As early as 1999, the Canadian Institute of Chartered Accountants (CICA) and the American Institute of Certified Public Accountants (AICPA) advocated the viability of CA and described a conceptual framework for its adoption in their report (CICA/AICPA, 1999). It was the 1999 CICA/AICPA committee that first defined "continuous auditing":

> A continuous audit is a methodology that enables independent auditors to provide written assurance on a subject matter, for which an entity's management is responsible, using a series of auditors' reports issued virtually simultaneously with, or a short period of time after, the occurrence of events underlying the subject matter.

After interviewing internal audit management and staff members from nine leading internal audit organizations, Vasarhelyi *et al.* (2012) found most of interviewed

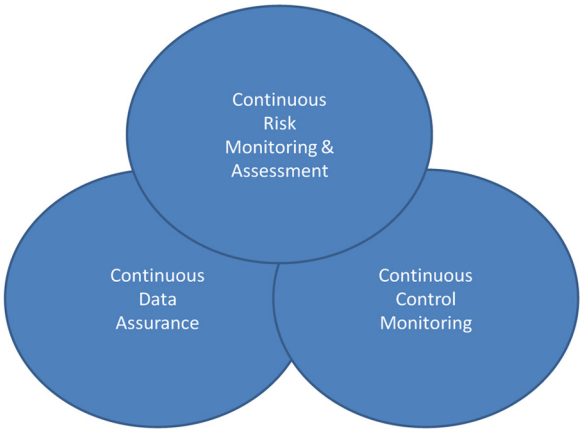

Figure 1.
Continuous assurance

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companies to have automated to a certain extent some of their existing audit practices.

In China, however, because of the lack of the guidance provided by professional and official organizations, few executives have recognized the concept of CA and the benefits that CA could bring for them. Some of them consider that CA is simply the use of CAAT software without any change in reporting frequency, and others have never heard of it. CA is performed only by the "big 4", and even then only to a limited extent, as the quote above indicates. In summary, current usage of CA remains slight relative to its potential. Chinese chief executives have not been aware of the changes of the current market and the appropriately adapted organizational strategies.

To understand the reasons behind the lagging performance of China in regard to CA at a time when it is racing ahead in many other aspects of modernization, it is necessary to understand the different business environment which determines the demand for assurance.

3. The business environment for CA adoption

Over the past few decades, global business is going through a series of substantial and interrelated changes such as increasing globalization(Friedman, 2005), intensified competition, growing business scandals(Coderre, 2005) and the wide use of supply chain management, raising the demand of CA. However, compared with China, US enterprises face significantly high risk and have to withstand increasing and stiff competition (Schwab and Sala-i-Martín, 2012).

3.1 The impact of SOX

As a reaction to a series of high-profile business and accounting scandals, involving cases of Enron, Tyco International, WorldCom, etc., SOX was enacted on July 30, 2002. The promulgation of SOX shows that the US federal government, through the Securities and Exchange Commission (SEC), makes great efforts to improve the accuracy and integrity of financial reporting process, and the effectiveness of companies internal control system. For instance, SOX Section 302 mandates assurance of internal control procedures. Chief officers are required to be responsible for establishing and maintaining effective internal controls, and certify that relevant material information is known by them. Furthermore, SOX Section 404(a) mandates management to create an "internal control report" as a part of annual financial report, concluding "the responsibility of management for establishing and maintaining an adequate internal control structure and procedures for financial reporting" and the assessment of the effectiveness of such internal control structure and procedures. Particularly, SOX Section 404(b) asks auditors to issue audit reports for attesting the assessment made by management (SEC, 2002).

While SOX promotes the efficiency and improves the quality of business operations, it also brings challenges to listed companies. As compliance with the SOX has become a "must", to meet the compliance demand, auditors are finding that they are becoming more and more involved with the examination of the transparency in business processes and the efficiency of the internal control system. The substantial and costly compliance burden fuels the need for auditors to leverage CA to optimize internal audit processes. El-Masry and Reck (2008) found that, as a response to SOX, continuous online auditing increased after the US Congress-issued SOX in 2002.

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Similar to USA, China has its own standards for enterprise internal control. As shown in Table I, in 2008, for the purpose of strengthening and standardizing internal control and risk management for public companies, the Ministry of Finance (MOF), China Securities Regulatory Commission (CSRC), China National Audit Office (CNAO), China Banking Regulatory Commission and China Insurance Regulatory Commission jointly issued Basic Standards for Enterprise Internal Control. Like SOX in the USA, it requires listed firms to conduct self-assessment on the effectiveness of the company's internal control, which must be disclosed in their annual reports and audited by qualified certified public accountants (CPA) firms (Chapter 6 Article 46). In 2010, Enterprise Internal Control Supporting Guidelines was released to provide a necessary guide for the application of Basic Standards for Enterprise Internal Control, The Basic Standards for Enterprise Internal Control and its guidelines are called "China SOX", which marks the initial establishment of Chinese enterprise internal control standards system. More importantly, both of the standards and guidelines have taken IT into consideration. It requires that companies should establish an appropriate IT system with embedded controls (Chapter 1 Article 7) to improve the integration and information sharing, and emphasizes that management should strengthen the control over the development and maintenance of information systems, data access and change, document storage and custody, network security, etc., to ensure the safe and stable operation of information systems. The emphasis on the establishment of IT system suggests that internal auditors use advanced tools to assist them to further improve the effectiveness and efficiency of internal audit processes.

3.2 The effect of financial crisis

It has often been remarked that crises, such as wars, often prompt rapid innovation precisely because the intensity of the times enable barriers to change to seem less compelling and demands imaginative solutions to urgent problems. That is no doubt the basis of the well-known Chinese proverb about crises ("危机") that was alluded to earlier. With regard to the drivers of demand for CA, Alles *et al.* (2002) pointed out that CA is not an inevitable outcome of modern IT, but being propelled by business necessity. The Enron and WorldCom scandals that prompted the passage of the SOX in 2002 and kick started CA adoption in the USA was only prelude to the far greater crisis that erupted in 2009 in the banking sectors throughout the Western world. This late-2000s world financial crisis was triggered by the collapse of financial institutions, due mainly to the mishandling of the USA's subprime loan market. The US business landscape has been altered. Stock market fell. Many enterprises either became insolvent or laid-off employees as a consequence of the reduced demand. It could

Business factors	USA	China
SOX	SOX, Sections 302 and 404 (2002)	"China SOX": "Basic Standard for Enterprise Internal Control"(2008), "Enterprise Internal Control Guidelines" (2010)
The effect of financial crisis	Direct	Indirect
Other characteristic	Outsourcing	SOEs issueMNCs' need for information transparency

Table I.
Business environment for CA adoption comparison: USA versus China

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be exemplified by the largest failure made by an investment bank, the bankruptcy of Lehman Brothers Holdings Inc. Since the beginning of 2008, over 65 US banks have gone bankrupt and have been taken over by the Federal Deposit Insurance Corporation. "These banks held over $55 billion in deposits, and the takeovers cost the USA federal government an estimated $17 billion"[1].

The world financial crisis directly intensified corporate attention to risk management, as it, to an important extent, can be attributed to failures and weaknesses in internal control, especially risk management, which did not serve their purpose to safeguard against excessive risk (OECD, 2009). As an OECD report (2009) states, it is primarily the board of directors (BOD') responsibility to guarantee that the entity's risk management systems are conform to its operation objectives and risk appetite. Internal audit should have the capacity of assisting the board to do so. Thus, it is necessary to employ a new audit method to effectively enforce monitor over the company's financial reporting process and incorporate information from all business procedures into evaluating the internal control system. Furthermore, Senior Supervisors Group (2008) surveys 11 major banking and securities firms and discovers that some firms did not anticipate fully the risk of having too many exposures to US subprime mortgage-related credit and put appropriate controls in place to oversee or mitigate those risks. The result suggests some potential deficiencies in the traditional auditing approach. They conclude that "Companies need more adaptive risk measurement processes and systems that could rapidly alter underlying assumptions (such as valuations) to reflect current circumstances".

In addition, the financial turmoil caused great loss of confidence that hits all financial institutions. In fact, the loss of confidence in one major financial institution could snowball into a loss of confidence in the entire financial system because the inability of one bank to meet its obligations could drive other banks, which are otherwise healthy, and even non-financial companies into insolvency. That is why US companies are under intense pressure to earn and retain customers through using better auditing method. Learning lessons from the past, existing companies realize the role of CA and start to employ various types of CA technologies (Vasarhelyi *et al.*, 2012).

However, unlike US companies that are severely affected by the financial crisis, Chinese enterprises are less affected (Table I). For example, although the global financial crisis on the job market caused heavy losses, most Chinese companies do not need to control costs through layoffs; on the contrary, in the premise of steady economic growth, some enterprises have a corresponding increase in staff. As shown by International Business Report 2010 (Grant Thornton Jingdu Tianhua, 2010) of Grant Thornton, 50 per cent of surveyed US enterprises suffered great decrease in employee number. Although 41 per cent of surveyed mainland China enterprises increased the number of employees in 2009, 44 per cent of them claimed no change. Only 15 per cent of respondents reduced their employee numbers. The survey result indicates that most of mainland China companies are optimistic about the future of the economy. Thus, they are less motivated to change their existing auditing methods than the US counterparts.

3.3 The characteristics of business

The current economic downturn in the USA has accelerated the maturation of the outsourcing industry. To acquire potential growth opportunities and long-term benefits, companies become more and more interested in promoting the integration of product

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and service. Thus, numerous companies expand their range of outsourcing. Today's outsourcing is not merely about call centers anymore. Companies are ramping up outsourcing of back office functions, knowledge and analytical services, engineering services, R&D, product design, finance and accounting, etc. as well. The Conference Board[2] (2009) investigates approximately 70 senior executives attended 2009 Strategic Outsourcing Conference. According to the conference keynotes, among all participants, 57 per cent of them claim that their companies had increased the use of outsourcing during the past year.

The prevalence of business processes outsourcing prompts companies to put more emphasis on integrity not only within their own departments in US headquarters but also over sub-branch offices located in other countries. In a company that has parts or all of its products or services outsourced in locations outside the country where it is headquartered, there exist a number of different business processes. As the data originated from these business processes will not naturally flow through the companies' common value chains (Vasarhelyi *et al.*, 2004), the integrity throughout the electronic data exchange procedure is critical, driving a demand for technology like CA. For enterprises where all processes are encompassed in an ERP system where allows seamless real-time data exchange, by providing logic links among different processes of business, CA that embedded in the monitoring and control layer of the ERP system is able to define the logical functioning of any process along and across the value chain of the company, so that the intrinsic associations among data came from different business processes can be analytically examined, relationally modeled, reasonably predicted and closely tracked (Vasarhelyi *et al.*, 2004). As a result, the data integrity can be consequently improved. Although most supply chains needed the assistance of CA originated in China, China, ironically, has not adopted CA to the same extent as has USA. It is partially due to the lack of stimulation of crisis of the same magnitude over a decade characterized by rapid growth rather than recession. What is more, less competitive business environment makes Chinese enterprises have little or no incentive to adopt CA.

Table I also indicates that the existence of an SOE is one of the most important characteristics of the business environment in China. Most of China's critical industries, especially natural monopoly industries that are considered to be strategically important, such as telecommunication, tobacco, transportation, energy, etc., are in the form of an SOE. The monopoly position of SOEs protects them from business threats from competitors. For example, the Chinese nation-wide railway market is monopolized by the China Railway Group limited (CRGL), a central SOE encompassing infrastructure construction. It blocks the possibility for other companies being involved in the railway market, leaving CRGL with no competitor. Facing less business risk and competition, the main goal of SOEs tends to lie in keeping stability and consistence with government policies rather than improving the effectiveness and efficiency of internal control. Therefore, there exists serious internal control weakness (e.g. unreasonable allocation of limited resources, severe loss of state-owned assets, rampant official corruption, etc.). For a long time, China's enterprises, especially the large SOEs, are enjoying great existing benefits. According to the People's Daily (*People's Daily Online*, 2011), SOEs generated a total profit of 1.987 trillion Yuan (US$301 billion) in 2010, which is 5 per cent of China's gross domestic product in the same year. The assets controlled by SOEs are even larger. Only the 102 central SOEs *per se* have hold 24 trillion Yuan (US$3808.6

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billion)[3]. Holding such a large number of state-owned assets, many SOE officials use the assets for their own benefits. PetroChina, for instance, is the largest oil and gas producer and distributor, playing a monopolistic role in the oil and gas industry in China. As a result of a long-term monopoly operation, PetroChina has no competitors and has become less and less energetic. While Chinese consumers are paying high price in gasoline, officials of PetroChina attain abundant special benefits. Critics lambasted PetroChina for squandering profits from a state-approved monopoly. Recently, PetroChina's Xinjiang branch was embroiled in a "Luxury Car Gate" scandal over their fleet of imported luxury vehicles like Audis, Range Rovers and VW Touregs for the use of officials. Citing numbers from the 2011 Chinese entrepreneur crime report conducted by legal magazine Faren, *Shanghai Daily* (2012) reveals that 202 cases were identified involving corruption by senior officials or top executives in both SOEs and private companies in 2011, growing from 95 in 2009 to 155 in 2010. Among those 202 cases, 88 in SOEs involved corruption that averaged 33.84 million Yuan (US$5.37 million) per person, whereas the 2010 figure was 9.57 million Yuan (US$1.51 million). Some senior executives take advantage of their powerful position to accept bribes. For instance, enterprises can easily obtain loans from banks through bribery. In the end, they even do not need to pay it back, as long as the enterprise declares bankruptcy. In other cases, loans from banks are given to dummy companies' accounts and immediately transferred to the conspirators. In early 2005, a manager at the Bank of China Harbin branch conspired with a dozen employees from another bank to misappropriate nearly US$1 billion of fund of bank of China by transferring money to offshore accounts.

As most of their shares are owned by government administrators and bureaucrats, many SOEs are directly or indirectly controlled by them. To illustrate, in many SOEs, members of the board of directors and senior managers are appointed by government authorities such as Organization Department. Among the 113 central enterprises listed on the Web site of State-owned Assets Supervision and Administration Commission of the State Council, most of the leaders (refer to chairman, party secretary and general manager) of the first 54 enterprises are appointed and dismissed by Organization Department. Because government acts as policymaker, supervisor of regulatory policies, as well as real operator of business, enterprises do not have market principal status and sufficient power for making managerial decisions. As a result, the dilemma faced by China SOEs is that, because of the deficiencies of current internal control system and the drawbacks of the administrative appointment and removal system, SOEs are the entities that need CA the most; on the other hand, owing to the limit of authority, SOEs cannot make their own managerial decisions such as changing the existing audit method.

The trend of globalization is observed at corporate level since China implement the "go out" policy in1990s. To expand the market reach beyond China and enlarge international influence of their brands, Chinese multinational corporations (MNCs), both state-owned and private, are emerging. This trend started to gain momentum as Lenovo, the leading personal computer brand in China and across Asia, acquired IBM's Personal Computing Division, and TCL, China's largest television maker, acquired Thomson' TV and DVD player division and Alcatel's mobile phone arm in 2004. Other famous Chinese MNCs include Haier, Huawei, Alibaba, Wanda, ZTE, etc.

Although many firms set up branches in foreign countries, acquire or merge with local companies or establish joint ventures or a partnership with foreign companies,

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entering the foreign capital markets through initial public offering (IPO) or reverse mergers has become the preferred modality for Chinese corporations to go global because it is considered a shortcut to raise fund, access international market, improve reputation, standardize corporate governance and attract public attention. The list of Chinese MNCs choosing the go-public route is long: China National Petroleum, Sinopec, China Mobile Communications, Baidu and so on. Despite international success stories, a great number of Chinese MNCs have run into an integrity crisis because of the lack of information transparency. Chinese enterprises listed on foreign stock exchanges have difficulty in adapting to foreign regulatory environment. They have to deal with unfamiliar compliance landscapes from that of China (Shambaugh, 2012). Compared with that in China, the security rules, restrictions and transparency arrangements in many foreign markets, especially those mature markets, are stricter.

To protect stakeholders and the public interest, overseas legislations typically aim at institutionalizing management, financial and accounting controls at publicly traded companies. Thus, information disclosure is their common focus, exacerbating monitoring costs and compliance burdens for MNCs accessing foreign capital (Leuz and Oberholzer-Gee, 2006). They must completely and truthfully disclose detailed, timely and reliable information (including historical, current and future information) to all interested parties in foreign markets.

For instance, in the USA, foreign listed companies face same timely disclosure rules as do domestic listed companies. They must file their annual reports on form 20-F within four months after the end of the fiscal year (ending on or after December 15, 2011). In addition to selected financial data, market segment information, new product plans and subsidiary activities, etc., public companies, to meet the requirement of the US SEC, must disclose any information resulting in significant changes to the corporation's financial or operational situation, information regarding major customers and their trading volume, major shareholders, related party transactions, compensation and pension paid to the directors and members of administrative, supervisory or management bodies, interests of experts and counsel, audit fees and audit commission pre-approval practices and certain off-balance sheet arrangements etc. (SEC, F-20, item 6; SOX section 403).

To promote full and fair disclosure, US legal provision of the securities mandates timely disclosure of material nonpublic information[4]. Compared with the SEC and some provisions, stock exchanges have more detailed rules for timely disclosure. For example, the New York Stock Exchange (NYSE) Listed Company Manual asks companies to "release quickly to the public any news or information which might reasonably be expected to materially affect the market for its securities" (NYSE Listed Company Manual 202.05: "Timely Disclosure of Material News Developments"). The NYSE also mandates the disclosure of financially sensitive information that might affect investor decisions, including "Control Relationship With Issuers" (NYSE Rule 2,262), "Securities Arbitrator" (NYSE Rule 608,610) and "Contributions to Tax-Exempt Organizations" [NYSE Rule 303A.02(v)].

If issuers cannot meet the high requirements of information transparency, they must pay a high price, being delisted by foreign exchanges, having their auditors resigned, being sued by investors or being investigated by the regulatory authorities.

Chinese lenient regulatory standards and poor auditing practices maintained low level of corporate transparency (François, 2003), resulting in large number of lawsuits

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against Chinese companies. Most of the cases involve false or misleading financial statements and deceptive presentations. In 2004, a class-action lawsuit was filed against China Life Insurance Co., China's top life insurer, over violations against its US investors under the Securities Exchange Act of 1934. The US shareholders accused it of not being timely and adequately disclosing sensitive information – an audit by China's National Audit Office that had uncovered irregular or illegal behavior at China Life's predecessor company involving 5.4 billion Yuan (US$652 million) – during its 2003 listing. Despite New York Southern District Court had dismissed the claims as being without merit in 2008, the group lawsuit still sparked plunges in its shares in New York and Hong Kong markets.

Chinese enterprises should learn a lesson from this. As the supervision of Chinese regulatory agencies for unlisted enterprises is very weak, once listed on overseas capital markets, enterprises have entered a transparent "glass room": every move of them is under public supervision. In other words, the strict corporate disclosure rules in foreign stock markets significantly heighten the pressure of Chinese MNCs to find a solution to improve the financial reporting and disclosure system. China Life is not the only example that has increased the skepticism of foreign investors toward overseas listed Chinese companies due to information disclosure issues. As more and more Chinese MNCs went public on the foreign stock exchanges such as Singapore, USA and Canada, the number of companies whose financial statements were riddled with irregularities or frauds is growing. To foreign investors, regulators and other interested parties, the common impression of Chinese companies is that they lack transparency and corporate governance because of the opaque decision-making process, frequent corrupt business practice and the often-fraudulent accounting procedures (Shambaugh, 2012). As a result, overseas listed Chinese MNCs, despite enjoying relatively high domestic levels of consumer confidence, need to make effort in bridging the trust gap abroad for lack of information transparency and credibility. Another example is Longtop Financial Technologies, a popular software enterprise, who had been exposed as a colossal fraud. On May 23, 2011, Longtop's auditor, Deloitte, quit, and a US regulator opened a related probe. The "cash balance" on its balance sheet was found as forged. According to an extraordinary letter from Deloitte when it resigned, its banks provided fake statements attesting to the company's fake cash balances. In August, NYSE removed the company from listing on the Stock Exchange because it did not meet listing standards.

These cases serve as a good reminder that current audit systems must be changed because one important cause of these frauds is the deficiencies in the audit approach used by the internal or external auditors of these companies. As CA consists of the automated collection of audit evidences and indicators by an auditor from an organization's transactions, operation processes and internal controls on a frequent or continuous basis, it is able to provide greater transparency into the operations and more timely reporting of concerns than under traditional approaches (KPMG, 2008; "Continuous Auditing and Continuous Monitoring: Transforming Internal Audit and Management Monitoring to Create Value"). As a result, using CA, auditor capabilities will be significantly enhances, and all irregularities and frauds will be uncovered. Therefore, the pressure faced by Chinese MNCs to improve information transparency, timeliness and reliability is another driver for CA implementations.

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4. The audit environment for CA adoption

As for the audit environment, we mainly concern two aspects: regulations and the role of internal audit in organizations because the first factor is the regulatory prerequisite for CA adoption, whereas the second one ensures that internal auditors have enough power and support to implement CA. The reason why we focus on internal audit is that CA, at the current stage, is mainly used in internal auditing.

4.1 CA-related regulations

As listed in Table II, AICPA, The IIA, Information Systems Audit and Control Association (ISACA) and other professional organizations have been working hard to prompt the move of CA. They issued CA (or related) standards, released regulations and guidance and published reports, which established a good professional environment for the implementing of CA. To explore new opportunities for audit and assurance services, the AICPA established a Special Committee on Assurance Services ("Elliott Committee") in 1994. At an assurance symposium in Canada in 1998, Robert K. Elliott, Chairman of Elliott Committee, addresses that:

> […] the factors leading to more heavily computerized reporting to investors will eventually lead to user access to corporate databases with real-time assurance by 'auditors'. Such access will take the place of paper reports. Transforming financial reporting in this way will necessitate a transformation in auditing (Elliott, 1998).

In addition, a report (AICPA, 1997) made by the Elliott Committee discussed assurance service expansion and how to make continuous assurance on the function of a company's information systems for both internal and external auditors[5]. Furthermore, in 1999, AICPA in conjunction with the CICA issued another research report (often referred to as "red book") (CICA/AICPA, 1999). The red book focuses on CA and discusses the nature, purpose, scope and fundamentals of CA, and addresses more complex CA issues.

To provide guidance for Chief Audit Executives on implementing CA, the IIA (Coderre, 2005) released a Global Technology Audit Guide No.3. It assists Chief Audit Executives to make effective use of technology in support of CA and benefits enterprises by:

Table II.
Audit regulation comparison: the USA versus China

USA (CA-related regulations)	China (Information system audit-related regulations)
Elliott Committee (1994) (Elliott Report) (1997)	SCC: Public Circular on Relevant Issues regarding IT Supported Audit(2001); New version of Audit Law (Articles 31 and 32) (2006)
AICPA "Red book" (1999)	CICPA : Internal Control Audit Guidelines (draft for comment) (2011)
IIA GTAG No. 3 (2005)	CIIA: Specific Internal Auditing Standard–Article No. 28 (2008)
ISACA IT audit and assurance guidelines No. 42 (2010)	CNAO: IT Audit Practice Announcements No. 34 "Information System audit guidance " (2012, p. 2); "Information System audit Practice" (2012, p. 11); National Standards on Interface of ERP Software (Draft for Comments) (2013, p. 8)

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> […] considerably increasing operational efficiency, reducing financial error and fraud, and improving bottom-line results through a combination of cost savings and a reduction in overpayments and revenue leakage.

Released by ISACA, IT Audit and Assurance Guidelines article No.42 (ISACA, 2010) centers on issues of continuous assurance, auditing and monitoring. It provides essential guidance and thorough interpretation for IT audit and assurance professionals in applying relevant standards during the procedure of planning, implementation and maintenance of continuous assurance (e.g. IT audit and assurance standard No.5[6], No.6[7], No.7[8] and No.14[9]). It defines what CA and continuous monitoring is, points out the process of CA, explains the scope and frequency of continuous assurance test, etc. It has been followed by practitioners worldwide. In addition, ISACA published its Information System Standards, Guidelines and Procedures for Auditing and Control Professionals[10].

Unlike the USA, China has no specific regulation or guideline on CA. However, some government authorities and professional organizations have been working hard to prompt the development of IT audit (also called information system audit) (Table II). In November 2001, the State Council of China (SCC) promulgated an IT audit-specific regulation, entitled Public Circular on Relevant Issues regarding IT Supported Audit, specifying the responsibilities and powers of auditors in conducting IT audit and requires that auditees must cooperate with the auditors by providing their electronic information. At the same time, auditees are asked to use standardized interfaces for their electronic information systems. Five years later, the SCC revised its Audit Law. The new version of Audit Law has the rules of IT audit expanded by two rules (Article No. 31 and No. 32). As stipulated in Article No.31, auditees should provide electronic data of fiscal revenue and expenditure which is stored and processed by computer and other necessary documents. In Article No.32, auditors have the right to examine their auditees' information system of managing the financial revenues and expenditures through computer technology. This is the first time that the relevant content of IT audit is legally required in China (SCC, 2006).

As a member of the INTOSAI IT Audit Committee, the CNAO has dedicated to standardize Chinese IT audit practice by establishing series of IT audit regulations and guidelines. In 2004, the CNAO releases a set of national standards of IT accounting software interface[11]. The set of standards, in accordance with the requirements of the State Council, outlines the data interface requirements for accounting software, consisting of business accounting data elements and data interface output file content and formats (text formatting and XML formatting). It provides a crucial basis for IT auditing. It has been implemented nationwide starting January 1, 2005. Since 2006, the CNAO has been working on the IT Audit Practice Announcements; and it has developed 36 announcements[12] until 2012. Among those announcements, the No.34, "information system audit guidance" (CNAO, 2012a), provides support for the auditing activities of the control of enterprises information system; data input, process and output; and information sharing and integrity, etc. Moreover, the "Information System Audit Practice" (CNAO, 2012b) and the "National Standards on Interface of ERP Software (Draft for Comments)" (CNAO, 2013) are the latest guidelines for information system audit issued by CNAO.

Although the enacting of SOX as well as a series of CA regulations and guidance provide a basis for the implementation of CA, the concept of CA has been brought out

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through the process of perfecting the Chinese internal control audit standards framework. The China Institute of Internal Auditing (CIIA) promulgates Article No.28[13] of Specific Internal Auditing Standards in 2008 – the information system audit, divided information system audit into the three stages: audit planning, audit implementation, as well as audit report and follow-up. In 2011, CICPA released the Enterprise Internal Control Audit Guidelines (Draft for Comments) (Guidelines), using the term "Continuous Auditing" for the first time. In the fourth section, the guide interprets the benefits of automated technology in auditing process, suggests CPAs to consider the implementation of a standard automated application control, and explains the implementation strategy of automated application control in details.

4.2 The role of internal audit

As a result of increasingly unpredictable uncertainties in the business circumstance, the role of internal audit in an entity is continually evolving. Stakeholders and senior management have placed great emphasis on the function of internal audit in corporate governance. The responsibilities of internal auditors in USA are not limited in monitoring critical controls. Internal auditors have been involved in activities such as providing insights into the effectiveness of risk management and offering guidance regarding effective corporate governance. As revealed by the result of a 2009 survey[14] conducted by IIA, 41 per cent of the CAEs claim that internal auditors place a higher priority on risk management. Furthermore, the survey shows that internal auditors have been empowered to evaluate companies' overall operation strategies, assess the accountability of management and perform other risk-related activities (Askelson *et al.*, 2009; IIA, 2009). Internal auditors enjoy significant opportunity to strengthen their foundation through adequate communication and cooperation with the organization's senior management to develop and deliver risk-based plans and report to audit committee on how those plans are performed. By contrast, the role of internal audit in corporate governance has been undervalued by senior management in China.

Internal auditing started late in China. There was no internal auditing in Chinese entities until CNAO proposed a plan of establishment of an internal auditing and monitoring system (CNAO, 1983) in 1983. The China State Council forwarded this report and encouraged Chinese enterprises and organizations to build internal auditing departments as needed. In September 1983, Chinese first audit department was built in China Petroleum & Chemical Corporation. CNAO and CIIA have promulgated and modified a series of internal auditing-related regulations and standards (e.g. China Institute of Internal Audit, 2013) in the past 30 years, mandating state organs, financial institutions, enterprises and institutions, social organizations and other units to establish internal auditing departments.

Despite this, many Chinese enterprises, without sufficient understanding of the important function of internal auditing, established these internal audit department or offices merely for the purpose of regulatory compliance. Many chief executives consider internal audit as dispensable because it has no direct relationship with organizations' objectives (either economic or political). Some blame internal audit for wasting resources and reducing the efficiency of business operation. For example, stipulated by "The regulations of CNAO on the Practice of Internal Auditing" (CNAO, 2003), internal auditors must receive qualification training and follow-up education, which should be supported and guaranteed by organizations (Article No. 5). Regulations also point out

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that the expenditures of internal auditing department must also be included in the financial budget of organizations (Article No.8). Others even mistakenly believe that internal auditing restricts their decision-making power and weakens their authority (Song, 2011), especially when a conflict of opinions occurs between the management and the internal auditor. For instance, before making the final decision, a chief executive officer (CEO) must convince the internal auditor that a business strategy perceived by the auditor as a waste of resource is profitable in the long-term, as internal auditors have the administrative authority to temporally stop any activities that they perceived as illegal and wasteful (Article No.11).

In other words, although regulations and standards have empowered Chinese internal auditors with certain administrative authorities (which are limited and not sufficiently powerful), they have not fully explicated the function of internal auditing in adding value and improving organizations' governance and risk management (Askelson *et al.*, 2009; IIA, 2009), and have not provided detailed guidance to further explore the value of internal auditing. As a result, Chinese management has not become aware that an effective internal audit can significantly improve earnings and strengthen risk control with regard to help companies achieving their economic objectives, which lead to the fact that the scope of Chinese internal audit is relatively narrow, mainly involving areas such as financial revenues and expenditures, the compliance with laws and regulation and so on. An interview (Corre, 2012) discusses the pitfalls of internal auditing in today's China and how do these pitfalls impact the practice of internal audit. Jean Yves Le Corre alleges that the internal auditing in China has fallen into "the 'over-compliance approach' resulting from excessive compliance gaining attitudes". As a matter of fact, the scope of internal audit should be expanded to areas outside of their traditional focus, but owing to the lack of support from senior managers, internal auditors in China are still struggling for authorities and roles they deserved. Therefore, compared with US senior management, who encourages internal auditor to apply CA to provide a systematic and disciplined approach to evaluate and improve the effectiveness of the overall internal control environment, Chinese executives do not expect that a costly new auditing method can deliver great value for their organizations (Song, 2011).

Another issue faced by internal auditors is how to remain independent. In US publicly traded companies, an internal audit department must work under the supervision of Audit Committee (Table III). As regulations, especially SOX (Sections 301 and 407), increasingly strengthen the importance of audit committee (DeZoort *et al.*, 2002), the independence as well as the authority of internal audit are significantly ensured. In China, The Code of Corporate Governance for Listed

Table III. The role of internal audit in organizations comparison: USA versus China

Internal audit characteristics	USA	China
Organizational structure	Working under audit committee	Working under the committee for discipline inspection or BOS/CEO/BOD/finance department
Independence	Strong	Weak
Scope of working	Wide	Narrow
Support from management	Sufficient	Insufficient

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Companies, issued by CSRC in 2002, suggests that the Board of Directors of a listed company establish an Audit Committee (Article No. 52). This is the first time that the suggestion of setting an Audit Committee is included in a China official guideline. Six years later, "China SOX" defines the internal control oversight function of Audit Committee. It points out that Audit Committee should be responsible for monitoring and evaluating of the effectiveness and the self-assessment of internal control. Nevertheless, lacking specific and detailed guidance, the operation of Audit Committee for listed companies has not been sufficiently standardized. Therefore, currently, Chinese companies mainly have the following four types of internal auditing structure:

(1) The internal audit department is set up parallel to other departments (i.e. finance, R&D and HR departments) and is under the administration of the Committee for Discipline Inspection or Board of Supervisors.

(2) The internal audit department is set up parallel to other departments and is under the administration of CEO.

(3) The internal audit department is set up parallel to other departments and is under the administration of the Board of Directors.

(4) The internal audit department exists only as a part of finance department.

No matter in what type of structure, the internal audit department loses its independence and the authority. As such, it is extremely difficult for internal auditors to examine the financial activities of other departments which are at the same or even higher level. Having been controlled by Board of Directors or finance department, etc., even their judgments and opinions might be biased, let alone the right to switch to a new auditing approach.

5. The technological environment for CA adoption

Over the last two decades, advances in ERP systems, CA software for governance, risk and compliance (GRC), data modeling and data analytics and other tools and techniques have made accurate, detailed and timely financial information and data available, which create a technological infrastructure for the use of CA. That the implementation of ERP systems and related technologies precede CA implementation follows from the fact that the cost of such systems precludes its use for auditing purposes alone. However, ERP systems, the investment in which is justified for management control purposes, are dual-use and are adaptable to support CA. For reasons of both cost and effectiveness, add-on software developed by independent vendors was needed to facilitate the use of ERP systems by auditors. The development of software by startup firms created, thanks to venture capital, is one of the strengths of the USA, and hence, it is not surprising that it gave that country a head start in CA. Furthermore, although business technology freely travels across borders, there are distinct patterns in the extent and timing of its implementation across nations. A key factor is the location of a critical mass of vendors of CA software with the marketing of their products to customers who previously may not even have considered their need for the capabilities they offer, as well as support for implementation and post-sales service.

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5.1 Leveraging the ERP system

During the first few years after the passage of the SOX in 2002, US public companies acquired/installed ERP systems to obtain cost-effective compliance with its provisions. This completed the transition to such all-encompassing IT systems that had begun in the lead up to the Y2K transition at the turn of the previous century. ERP systems integrate accounting, finance, manufacturing, human resources, sales and service, supply chain management and other functionalities across the organization into a single database to streamline information among many business processes within the organization and facilitating information transformation outside the organization. Through ERP systems, organizations could easily access and effectively manage data on a real-time basis, and its process of financial data access and storage provides CA capabilities. Over the last two decades, most Fortune 500 companies whose annual revenue is over 100 million dollars have implemented ERP systems (Boxer, 2010).

More importantly, ERP systems facilitate CA. Leading vendors of Continuous Auditing/Continuous Monitoring (CA/CM) such as ACL and CaseWare IDEA provide ERP systems with CA-type capabilities. These systems enable enterprises to lower their compliance costs, strengthen financial governance and improve operational performance.

After experiencing a series of internal control failures, Chinese enterprises have placed much more emphasis on the resource consuming, efficiency, quality, operation management, etc. There are needs for effective enterprise operation systems and advanced management tools. Chinese enterprises have gradually raised their expectation and requirement to ERP system. Besides, since the business expanding of global groups such as Haier and Lenovo, new demand is raised: ERP systems have to be internationally compatible and should meet the requirements from subsidiaries of multinational groups in different countries.

Although the ERP market is continuously booming, the development of ERPs in China still represents a major challenge. Chinese local ERP market has not actually matured. There exists a great gap in the demands of Chinese users and the supply of ERP products and services. Although Chinese users demand highly customized products, a great majority of local ERP systems are not sufficiently flexible (Table IV). For example, those developed by leading vendors like Kingdee and UFIDA are usually focused on finance and administration systems with great limitation in ex-ante and real-time control, and are more adaptable to small and median businesses. Because of the limitation of Chinese vendors' understanding of their customers' industry and operating characteristics and, thereby, the lack of deep and industry-specific manufacturing and supply chain functions, their ERP products can only be applied in

Technologies	USA	China
ERP system	Flexible Applied in complex process Suitable for big business	Inflexible Applied in simple process
Knowledge of management on IT	Good	Limited
CA-related tools and technique	GRC systems Data modeling and data analytics techniques	Network audit systems

Table IV. Technology environment for the adoption of CA comparison: USA versus China

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several simple processes, and few of them covers the entire operating process of customers. In fact, Chinese enterprise management software was firstly developed as early as the 1960s. Why does it develop slower than that of the USA? The reason is that, there are fewer vendors or users who fully understand the operation characteristics of Chinese enterprises in different industry while having a good knowledge of IT. The deficiency in skills and technology makes users feel more comfortable to work on their original processes and unwilling to command advanced IT tools (Juan and Liao, 2006; Hua, 2007).

Market monopoly is another factor slowing the extension of ERP in China. On the one hand, global leading ERP vendors keep expanding their scales through frequent mergers and acquisitions, and broadening their coverage of the ERP market for various industries. On the other hand, the professional experience, reputation and customer resource that the leading vendors owned become another barrier. For instance, the outstanding reputation that SAP gained in China ERP market helps it become a clear leader in the market. Because of the excellent popularity of its database, Oracle's ERP products could be sold together with its database and middleware. Although the market share of big business customers is monopolized by international vendors, these systems still cannot fully satisfy the special need of Chinese local enterprises. As the main responsibility of many SOEs lies not in driving great proficiency into their organizations, but rather in making organizations serve for government policies, there are great differences in the systems of production, operation, management, personnel and income distribution, etc. between SOEs and foreign companies (Wang, 2008), and therefore, ERP systems have to meet the special need in every stage of the entire business process of these enterprises.

On the other hand, regular ERP training and education may not be enough for Chinese enterprises. Compared with their foreign counterparts, Chinese management is unfamiliar with these foreign ERP products. What is more; because of their serious IT knowledge deficiency, it is necessary to enrich some basic IT knowledge and skill that their workforce need to meet enterprises' strategic objectives. Therefore, foreign vendors have to offer a full suite of comprehensive education courses and certifications which are specifically designed for Chinese users to help them leverage the power of ERP products. In addition, because of the high price, only limited enterprises could afford the products. For those smaller customers, as their operating process is relatively simple, a great number of them "prefer to use the system to automate current processes rather than change processes to fit in an ERP system" (Deng, 2005). Many companies have encountered unexpected failures. For example, the Sanlu & Legend "divorce" in 1998 is called China's first ERP implementation failure case. Because of the incomplete localization of ERP software (Intentia), Beijing Sanlu factory and Lenovo (later classified into Digital China) have to end their ERP implementation partnership.

5.2 CA-related tools and techniques

Recently, ERP software vendors gradually realized that customers are increasingly reluctant to purchase SOX compliance function of ERP system, as it is not perceived as mission-critical. Third-party software vendors seized this opportunity and developed CA compliance tools to monitor the effectiveness of internal controls in the financial

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systems along with the system settings that facilitate control processes (Kuhn and Sutton, 2010). GRC software market is formed. GRC software is considered as "a technology solution to support the oversight and operation of enterprise-wide risk management and compliance programs" (Caldwell *et al.*, 2011), aiding in improving the CA capability in enterprise system (Kuhn and Sutton, 2010).

Once the underlying technology of ERP systems and their add-ons were in place in US companies, attention could shift toward the development of new analytic techniques that could exploit the ready access to data and the computer power that they offered. Data modeling and data analytics techniques are of critical importance in CA environment, which are typically used in audit analytical procedures. To help detecting and avoiding potential frauds and errors, auditors monitor and test data from transactions and account balances. with the assistance of data modeling and data analytic techniques (Kogan *et al.*, 2010; Vasarhelyi and Chan, 2011). During the data modeling process, auditors establish models by using historical data and applying data monitoring techniques. Benchmarks are created from these models and are compared with current unaudited observations.

Today, data modeling and analytics techniques and related software packages abound to assist auditors in taking a proactive role in detecting and preventing fraud (Askelson *et al.*, 2009; IIA, 2009). Current CA tools (e.g. ACL's CA solution) used in the USA are powered by data modeling and data analytics technologies, allowing audit teams to conduct automated continuous monitoring and testing. Given this, transactions and balances can be investigated continuously throughout the financial year (Flowerday *et al.*, 2006), and alarms are generated and sent to auditors immediately (Srinivas, 2006). With automated modeling and analytics technology, CA tools can immediately identify outlying transactions and account balance that could be indicative of fraudulent activities.

As shown in Table IV, in China, there is no local CA-specific tool. Leading local vendors have developed various network audit systems, which have been implemented by government audit departments, national ministries, public security departments, listed firms, SOEs, CPA firms and universities for the use of government auditing, internal auditing and academic research. System like these, once positioned properly and operated timely, could function as does CA. UFIDA network audit system, for example, offers a comprehensive solution to help government and enterprises automate the business analysis and early warning procedures. The system is technically supported by an application platform called UAP-A, which incorporates a wide variety of technologies such as data mining and machine learning. It is claimed that the system revolutionary improves the oversight functions and builds a complete supervision system. Using this platform, the automation of data modeling, analysis and testing can be achieved. Early alert of suspicious activities or transactions can be generated and sent to related personnel. Real-time tracking of government/business management process can be realized. It makes the monitoring of internal controls embedded in the actual process of business execution, so that the operating and management process of government/enterprises is considerable, measurable and controllable. Nevertheless, it is obvious that the development of CA software tools and their utilization by clients lags the USA with its larger critical mass of vendors and greater installed ERP base.

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6. Summary of the economic architecture

Tables I to IV summarize our comparative analysis on the effect of what Alles *et al.* (2002) labeled the economic architecture that determines demand for assurance. Contrasting the experiences of China and the USA over the past decade confirms their hypothesis that CA adoption is driven not merely by technology but by a range of factors that shape the incentives of managers and auditors. From the business environment point of view (as analyzed in Table I), despite the time lag of the release of internal control standards between USA and China, both USA and China SOX establish a regulatory basis for CA adoption. In addition, the influence of global financial crisis, the accelerated increasing of outsourcing service and the increased need for information transparency of Chinese MNCs are the three main drivers of the USA that raise the need for CA, whereas less competitive Chinese business, as well as the excessive interference of government on the operation of Chinese SOEs, hinders the adoption of CA in China. However, which cannot be ignored is that the need of Chinese MNCs to increase the information transparency is another driver for the implementation of CA.

From the perspective of the overall auditing environment, the lack of management support and the deficiency in the organizational structure of internal audit departments has led to the fact that Chinese internal auditors are less independent and do not have enough freedom and power to expand their working scope and change existing auditing approaches (Table III). By comparing with the contributions made by professional organizations or governmental authorities, we found that there is no CA-specific regulation or guideline in China (Table II). As for the technology environment, we analyzed ERP systems, which made possible accurate, detailed and timely information and data in the USA and China, respectively (Table IV). Compared with its US counterparts, Chinese local ERP products can only be applied to a limited range of industry or simple processes because of low level of flexibility, creating great imbalance between supply and demand.

We also found that the lack of comprehensive knowledge on IT and management information systems for different industries is the key barrier that Chinese vendors and users must surmount. Despite Chinese ERP market is still monopolized by international leading companies, these systems still cannot fully satisfy the special need of Chinese local enterprises, as they have many special features. For example, as many Chinese SOEs have not established sound modern enterprise systems, the majority of shareholders of Chinese SOEs, particularly those administered by the central government, are state ministries at the provincial or the municipal level. Their leading officers are appointed by the government. The authority, salaries and welfares of them must match their specific political or administrative level. Facing great pressure to comply with political regulations, strategies or policies, their production, operation, management, personnel and income distribution process are different from companies aimed at maximizing profits (Wang, 2008). In addition, the operational procedure of them is divided by departments with specific administrative functions. Data cannot be shared among the departments, or flow from one to another, making the information become incomplete and inaccurate. If domestic vendors simply copy the existing ERP systems designed for enterprises with a high degree of information integrity and consistency, it will be doomed to fail (Wang, 2008). From the aspect of CA-related tools, we discussed the GRC systems, as well as the data modeling and data analytics techniques used in current CA packages in the USA. Although there is no local CA tool

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in China, leading local vendors have developed various network audit systems, which have the potential to function as CA.

7. Concluding comments

By summarizing our analysis of the three determinants of the economic architecture driving demand for CA in China and the USA, we draw the following conclusions:

7.1 Competition is an important incentive

US enterprises face more fierce competition than do Chinese enterprises, stimulating the need of CA. As the initiator of the 2008-2012 global financial crisis, the USA has been suffering much more than China. The Dow Jones Industrial Average index dropped over 50 per cent in 17 months. In 2010, the International Monetary Fund forecasted that US bank losses from the financial crisis would be US$885 billion. As revealed by Gallup, since the crisis, Americans' confidence in US banks has reached new lows, dating to the late 1970s. Eight in 10 Americans do not have too much confidence in US financial institutions, and 40 per cent of Americans have little confidence in US banks (Jacobe, 2010). To survive in such a risky environment, remaining US companies have to strive to compete with their rivals. Auditors have gradually realized the importance of risk management and the critical role that CA plays in risk management process. Its advantages in performing a faster, cheaper and more effective risk monitoring and controlling has driven a widely use of CA approach.

7.2 Government interference is a key obstacle

Different from that in USA, the demand for CA is less prevalent in China because of the long-term industry monopoly and internal control deficiency. Mainly by means of SOE, Chinese government interferes in companies' routine business activities and even becomes the real "operator" behind the scenes. Companies do not have enough authority to make their own decisions on executive affairs such as changing auditing method and using new managerial technologies. Because of this, many Chinese enterprises have lost their aggressiveness and competitiveness. Another reason why SOEs lack competition is that SOEs can access natural resources and capital at a much lower cost than private enterprises; thus, SOEs can easily make huge profits.

Another factor that impedes CA is that senior executives attempt to fulfill personal agenda. Having enjoyed existing benefits for so many years, many officers of Chinese SOEs tend to take advantage of the current auditing method to cover their fraudulent activities. They are unwilling to switch the periodical auditing to CA. What is worse; the corruption is prevalent from top to bottom insider China's enterprises, which hampers the adoption of CA. Reform of SOEs in China has been a high priority of the country for more than three decades. Although achieving a remarkable success, the reform is not thorough enough. The monopoly held by the country's SOEs has not been broken. To promote CA in SOEs, China must give SOEs more freedom in decision-making and increase competition. As a result, China should increasingly encourage private companies and directors to acquire larger shares of SOEs[15], endeavor to avoid excessive government intervention into their operation, promote the full implementation of modern enterprise systems and improve the internal control.

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7.3 Chinese internal auditors are less independent

With the loosening of the requirement of SOX and the rapid development of independent regulation compliance software developed by third-party vendors, US auditors finally could switch their working emphasis to more mission-critical services to maximize enterprises profits. Services such as fraud detection and prevention, risk management and financial planning have furthered the demand for CA technology to assist auditors in accessing real-time data, and exert proper analysis among full population of data. On the contrary, mainly because of the imperfections in the internal audit structure setting, Chinese auditors are less independent and have not gained enough freedom they deserved to broaden the working scope as well as to employ new auditing methods. Successful experience of corporate governance in the USA presents internal audit in China an excellent opportunity to change current internal audit structures to strengthen or even reposition its role in entities by providing timely and valuable oversights and insights. At the same time, internal auditors are able to make good use of advance technology and tools such as CA to work toward adding value onto their companies while meeting the expectations of regulators.

7.4 Support from management of organizations matters

Compared with its US counterpart, there is less support from Chinese management for CA because of their long-time negligence to the function of internal auditing, in terms of its positioning in organizations, resource allocation and the authority inside the internal control system. Senior management needs to understand the key role that internal audit could play in supporting the board in assuring the efficacy of internal control and in adding value for shareholders. The scope of internal audit needs to be extended to encompass wider range of services that are beyond the compliance work and more inclined to managerial issues. Internal audit is able to assist the board discharge its responsibilities by delivering the following services: evaluating the performance of the current risk and internal control framework, monitoring and analyzing the business procedures, monitoring, detecting and tracing the potential frauds and irregularities, assessing the accomplishment of company's goals and objectives, etc. (KPMG, 2003).

The lack of knowledge of CAEs and senior management on CA is the roadblock for adopting CA in China. Before adopting CA, CAE and senior management need to have a thorough understanding of CA. For example, they should understand what exactly CA is and how it differs with IT audit they are using. It is essential to make a comprehensive analysis on the cost and benefit of implementing CA from a long-term perspective. In addition, CAE and management should take in account the characteristics of business and operation processes of their companies while considering adopting CA and develop a plan for how to and where to implement CA, so that they will know whether it is worth to invest in CA.

7.5 China needs legal and professional guidance for CA

Governmental authorities and professional organizations in both countries have endeavored to pave a way for the future development of CA. Chinese government authorities and professional organizations, such as SCC, MOF, CNAO, CSRC, etc., have been dedicated for IT auditing and internal control auditing, in terms of revising Audit Law to include IT audit content, issuing IT audit standards and guidance, setting up framework for internal control auditing and drafting internal control audit guide.

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Nevertheless, there is no CA-specific regulation and guidance. To standardize and correctly guide the adoption of CA, government authorities and professional organizations are urged to strive to draft standards, regulations and guidance.

7.6 There is an obvious technology gap between China and the USA

By comparing the technology environment for the adoption of CA in the USA and China, we found that there exists significant technology gap between two the countries driven less by the availability of technology, which moves freely across borders in this area, but rather by the lack of a technological ecosystem in China that matches what Silicon Valley provides to the USA in terms of venture capital fostering innovative new vendors of CA products. Chinese local ERP systems have not kept pace with the development and complexity of enterprises' business processes. Most of local developed ERP systems lack of flexibility to satisfy the demand of users for highly customized products. The ERP products they developed can only be applied in limited business procedures and focus on a few simple targets (e.g. accounts payable, payroll, manual journal entries). By contrast, products like SAP ERP could help enterprises maximize their profitability, free up their limited resources and budget, so that they could gain competitive advantage. Concerning that Chinese local ERP system are unable to satisfy their requirements and foreign ERP system is unaffordable, Chinese enterprises, especially small and median business enterprises, would prefer to maintain their current information system. The deficiency of Chinese ERP system impedes the progress of the ERP application in China, and thereby, impacts the adoption of CA.

As for CA tools, there is so far no local software designed specifically for CA in China, whereas the CA software marketplace is booming in the USA. Although there are various network audit systems in Chinese market, which could function as CA systems if it is properly applied in organizations, a great majority of these network audit systems look more like a Chinese version of foreign Computer Aided Audit Techniques and Tools than products with Chinese business characteristics. Because of the Lack of independent research and development capability, some Chinese local developers even mechanically imitate products developed by their foreign rivals.

As a result, CA vendors need to make more effort in researching and developing CA packages that can fulfill the special demands of Chinese enterprises of various industries. More time and resource is needed for them to bridge the technical gap between China and the USA, and make their own products be with more flexibility. The comparison of CA implementation in China versus the USA is a fascinating case study in how technology by itself is not deterministic, exactly as Alles *et al.* (2002) predicted a decade ago when considering the economics and feasibility of CA in the USA. But given the extraordinary rise in the Chinese economy in both its size and its sophistication, it has be to assumed that its "leapfrog" into parity if not outright leadership in continuous assurance is still a matter of "when" and not of "if".

Notes

1. As cited in Wikipedia, term "list of acquired or bankrupt United States banks in the late 2000s financial crisis", (available at: http://en.wikipedia.org/wiki/List_of_banks_acquired_or_bankrupted_in_the_United_States_during_the_2007%E2%80%932012_global_financial_crisis). It is adapted from "Committee for a Responsible Federal Budget: Stimulus Watch".

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2. The Conference Board is a global business membership and research association. For more information, please visit www.conference-board.org/
3. Data source: a summary table released by SASAC on October 21, 2011. The table disclosed the operation of state-owned assets controlled by 102 central enterprises in 2010.
4. Regulation FD, on August 15, 2000, provides that when an issuer discloses material nonpublic information to certain individuals or entities – generally, securities market professionals, such as stock analysts, or holders of the issuer's securities who may well trade on the basis of the information – the issuer must make public disclosure of that information. In this way, the new rule aims to promote the full and fair disclosure.
5. In this report, the committee develops business plans for six new services (these assurance services concern cases about elderly individuals care, electronic commerce, entity's performance measures, health care, risk information for internal decision makers and system control).
6. ISACA (effective beginning January 1, 2005) IT audit and assurance standard No. 5: Planning.
7. ISACA (effective beginning January 1, 2005) IT audit and assurance standard No. 6: Performance of Audit Work.
8. ISACA (effective beginning January 1, 2005) IT audit and assurance standard No. 7: Reporting.
9. ISACA (effective beginning July 1, 2006) IT audit and assurance standard No.14: Audit Evidence.
10. It includes "IS Auditing Standards", "IS Auditing Guidelines", "IS Auditing Procedures" and "IS Control Professionals Standards".
11. Entitled "National *Standards on Interface of IT Accounting Software*".
12. It involves auditing process, electronic data plan, pre-audit investigation, methodology flow chart and computer language, etc.
13. Entitled "Information System Audit".
14. In March 2009, the IIA hosted a roundtable in Washington, D.C., to discuss the function of internal auditors in organizations. The survey is based on the CAEs from 28 Fortune 250 companies participated in the roundtable.
15. Read a Speech of Wen Jiabao, Former Prime Minister of China, in China's 2012 government work report in March 2011. Available at: http://english.cntv.cn/special/2013twosessions/hottopic/soesreform/index.shtml

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