BUSINESS AND AUDIT RISKS ASSOCIATED WITH ERP:
TO WHAT EXTENT SHOULD FINANCIAL AUDITORS RELY ON
IT AUDIT SPECIALISTS TO RECOGNIZE AND ASSESS THEM?
A BELGIAN STUDY

Masterproef voorgedragen tot het bekomen van de graad van
Master in de Toegepaste Economische Wetenschappen

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onder leiding van
Professor Dr. I. De Beelde
PERMISSION

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Acronyms used in the study

CAAT  Computer automated auditing techniques
CIS  Computer information system
CRM  Customer relationship management
ERP  Enterprise resource planning
FA  Financial auditor
GLM  General linear model (SPSS)
ISA  International standards on auditing
ISACA  Information Systems Audit and Control Association
IT  Information technology
ITA  IT audit specialist
SAS  Statement on auditing standards
SCM  Supply chain management
SME  Small and medium enterprises
SOX  Sarbanes-Oxley Act
SPSS  Statistical Package for Social Sciences
WIPO  World Intellectual Property Organization

(certificates)
CFE  Certified Fraud Examiner
CIA  Certified Internal Auditor
CISA  Certified Information System Auditor
CISSP  Certified Information Systems Security Professional
CPA  Certified Public Accountant

(dependent variables)
ASR  Application security risk
BIR  Business interruption risk
DSR  Data security risk
NSR  Network security risk
PIR  Process interdependency risk
CR  Overall control risk
FR  Fraud risk
IR  Inherent risk
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1 Introduction

In the last decades, the complexity of everyday business structures and processes has increased so dramatically that extended computer information systems have become indispensable to manage and control the business processes. Enterprise resource planning systems (ERP) facilitate this evolution by making vertically and horizontally integrated businesses and real-time processing of transactions possible. In the nineties, audit practitioners became aware of the growing complexity and thus of the increasing risks that accompanied the implementation of ERP systems. Nonetheless, accounting and auditing researchers were only marginally interested in the problem. Although this phenomenon had a huge impact on the reliability of the financial statements since these are based on information computed through the systems. At the start of the millennium, international auditing standards have been revised thoroughly to better compensate the significant lack of knowledge and understanding of complex IT systems, especially for independent auditors. In 2006, the International Journal of Accounting Information Systems (IJAIS) expressed the explicit desire for more accounting based research on ERP systems (Sutton, 2006). As a consequence of all the attention the problem has received, we can assume that there has been an evolution in audit procedures in Big-four firms\(^1\) and in the way financial auditors are trained so that by now they should have a better understanding of the risks and ask more frequently for consultation of IT auditors. On the other hand, the technology is continuously improving by elimination of weaknesses in the system and training of implementers to get the system’s processes streamlined. As a result, it is expected that we reach a new situation with improved security, less implementation troubles, larger IT services at the disposal of financial auditors and increased tendency of the latter to seek for IT consultation. These assumptions make it interesting to investigate and explore through experimentation what the situation really is today and in Belgium.

This paper focuses on the risk assessment differences between financial and IT auditors in ERP versus non-ERP environments and the confidence they both have in financial audit teams to assess such risks. Also within the scope is to measure the propensity of financial auditors to consult with IT auditors when required by the auditing standards. This will be realized through an experiment with a two-by-two-between-subject design. Ninety four participants from Big-four companies in Belgium participated in the experiment. The first half of that group is comprised of financial auditors, the second half consists of IT audit specialists. The

\(^1\) Big-four companies today are Deloitte, Ernst & Young, KPMG and PricewaterhouseCoopers. In the last years Arthur Anderson (former Big-six) went bankrupt and Coopers was taken over by Pricewaterhouse. The former Big-six turned into the Big-four companies.
case study is similar to the one of Hunton, Wright & Wright (2004) in 2000 in order to make multiple comparisons. The case materials integrally come from them.

The contributions to this study are particularly interesting given the fact that no one has previously studied this situation in Belgium and also given the assumption that the climate in and around ERP environments is changing.

In this experimental paper, you will first find a literature background of the subject and research question development, followed by the research method, the interpreted results of the experiment and finally some general conclusions.
2 Background and literature review

2.1 ERP systems

“ERP stands for Enterprise Resource Planning, and the term is used for any software system designed to support and automate the business processes of medium and large businesses” (Chand et al, 2005). The system “integrates information and information-based processes within and across functional areas in an organization” (Kumar and Hillegersberg, 2000). An ERP system is used to accomplish the business transactions and data processing needs of the company (Ashcroft & Bae, 2004), and to produce consistent and reliable information in a real-time environment (“Towards Information Systems Governance”, 2005). Such a computer information system (CIS) usually resides on multiple computers with different software, and is at least an order larger than any traditional business application software.

Data-integration is the heart of the ERP concept, meaning that there is only one input signal needed to start a chain of automated transactions through integrated entities of modules. Largely integrated systems usually cover SD (Sales & Distribution), MM (Materials Management), PP (Production Planning), CS (Customer Services), QM (Quality Management), FI (Financial Accounting), CO (Controlling), AM (Fixed Asset Management) and even HR (Human Resources) if only the payroll is big enough (“Een ERP in een KMO: utopie of realiteit”, 2006). The framework of the system is the same for every company, but the modules are programmed following the specific needs and processes of each company.

The latest trend is to expand the ERP market to small and medium enterprises (SME’s) by providing them with ‘ERP services’ instead of complete systems. The databases and applications are then stored, run and maintained on the servers of the ERP provider.

Well-known ERP providers are SAP AG as a market leader, Oracle (PeopleSoft, J.D. Edwards etc.), Microsoft and Infor (Baan etc). External implementers and ERP consultants are Accenture, IBM, CSC, Deloitte, Cap Gemini, Crowe Chizek, Bearingpoint and others. Deloitte is the only Big-four company that still provides all services, including product (ERP) implementation. The other Big-four audit firms all hived off their ERP implementation services2 in the last decade.

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2 Apart of the IT departments, more specifically the ERP implementation services, of the former Big-five companies, except for Deloitte, were hived off. PwC sold its product implementation services to IBM, Arthur Anderson sold it to Accenture, KPMG to Unisys and Ernst & Young to Cap Gemini.
2.2 Business and audit impacts associated with ERP

Introducing ERP in a business has a large spectrum of impact: business processes, data quality, security, upgrading and audit issues. O’Leary (2000) claims that the “interdependent nature of system applications and the reliance on relational databases, expose a company to significantly different business interruption, process interdependency and system security risks than traditional non-ERP systems”. This is the basis for several of the dependent variables used in this study. Wright & Wright (2002) interviewed 30 IS specialists about their views on ERP implications and client experiences. Their results indicate that “ERP implementation importantly impacts system reliability. Common implementation problems that result in heightened risks are: improperly trained personnel and inadequate process reengineering efforts and a lack of process adherence. These risks differ across applications and vendor packages”. Arnold (2006) completes that list with support and commitment of top management as well as alignment of people, process and technology.

ERP experts say that one of the keys to a smooth and relatively trouble-free implementation is to customize the ERP software as little as possible (Ashcroft & Bae, 2004). This entails in most cases a reengineering of the business processes. For groups of companies there is an inherent risk in consolidating their different accounting systems and databases unless they integrate them. Redesigning allows the streamlining of the internal business processes and facilitates aiming for top performance and efficiency by eliminating former separate information systems and increasing the integration of support modules in the company such as SCM (supply chain management) or CRM (customer relationship management). In reality there will still remain customization of the off-the-shelf modules based on the existing business practices of the organization (Chand et al, 2005). Sometimes this is due to the resistance to change and the lack of buy-in of business people, but also to particular business needs. Customization leads to maintenance risks and lengthy implementation times which reduce upgrade flexibilities. A good change management should minimize these customizations and their impact.

The integration of modules and data is expected to downsize the number of faults and to improve data reliability and information quality. Though there are different opinions among professionals and researchers about centralized data management. For instance, Sutton defended in 2000 that, in a world where information technology has made information accessibility a given, the information reliability increases while the relevance of the information continues to diminish. On the other hand, Brazel & Dang (2005) found that “ERP adoptions lead to a trade-off between increased information relevancy and decreased information reliability (for external users of financial statements)”, due to a decrease in reporting lag and an increase in
the level of discretionary accruals. The accounting data is complete and accurate if the ERP system fully integrates all business transactions that were entered from all the operational areas of a company (Ashcroft & Bae, 2004).

Special care is undoubtedly needed for system security management. Besides the (re-) design of the business processes, the implementation of an adequate internal controls mechanism is required to end up with a strong ERP system (“Towards Information Systems Governance”, 2005). User profiles and access authorization to data and applications should be carefully planned and supervised as well as be reviewed on a regular basis. The more employees in various parts of the company are authorized to enter data concerning company activities, the greater the risk that data loses its authenticity (Ashcroft & Bae, 2004) with decreased information quality as a result.

The customizations, integration level and system security have an unmistakable impact on the data integrity and reliability of the ERP system and are therefore leading to new audit challenges. Hahn (1999) highlighted this already, before 2000, and pointed out that auditors would need a high level of understanding of ERP systems and a great ability to use them. In order to minimize audit impact, the auditor should be involved in the implementation phase of the system by giving his consideration of the project risks, business process risks and the controls design for the new system.

The use of ERP definitely changes the scope of an audit like Sutton (2006) says: “ERP systems have fundamentally re-shaped the way business event data is collected, stored, disseminated and used. This change in information processing orientation fundamentally affects every area of accounting and should drive radical changes in audit processes”. Since about 2000, there has been an exponential growth in the number of IT auditors engaged in an audit project. Much of the traditional audit trail is disappearing. More and more documents and items of evidence are only stored electronically. A more ongoing control oriented approach is needed. When ERP systems are properly used by auditors, they are able to extract a huge amount of information with a minimum amount of effort. As a result, the roles and responsibilities of financial and IT audit become more integrated as an increased level of technical ERP knowledge becomes necessary. To cope with the developments in IT and to meet the increasing demands of users of accounting professions, effort is being made to improve and expand computer assisted auditing techniques (CAAT’s) (Temesgen, 2005). And heavy query-languages, built-in in ERP packages, are being used to search the whole population for faults (for example for an audit of the authorization), which result in an exhaustive list of exceptions, for which auditors then can apply target testing, trough sampling³.

³ Conversation with an IT manager of Big-four office B, the 14th of may 2008.
Some tools can be installed around the general ledger to execute continuous controls (SAP manager)\(^4\). Implementing a controlling module (CO) in the ERP system directly linked with the general ledger (FI) increases the confidence level in the financial statement. If this is the case, the executive management is bound to base its balance sheet, income statement etc. on the rule-compliant databases (SAP manager). The General Ledger function in the FI module provides a comprehensive record of all information needed for external financial reporting (Ashcroft & Bae, 2004).

Specific risks with regard to enterprise resource planning systems that can be found in the experimental case later in this study, are the following:

**Business interruption** is an exposure common to all businesses regardless of type or size. A breakdown in automated workflow procedures caused by endogenous or exogenous factors, such as computer hardware or software failures, but also non-IT related factors like labor strikes or natural disasters can drive a company right out of business (e.g. production can come to a sudden halt). The company’s ability to accurately process and record economic transactions in a timely manner is then disrupted (Gomaa & Lynch (2003) and Hunton et al (2004)). Yet, according to the research firm Gartner, fewer than thirty percent of the Fortune 2000 companies actually have a full business continuity plan in place, one that extends beyond their IT environment (March, Risk Consulting).

**Process interdependency risks** represent the likelihood that disturbances in automated or manual process flows, such as non-compliant, unsecured, suboptimal and/or conflicted links between the business processes of the enterprise, will fail to transmit information from upstream processes (e.g., sales orders) to related downstream processes (e.g., procurement, production, shipping and billing) (Hunton et al (2004) and WIPO-website\(^5\)).

**System security** is comprised of network security, data security and application security. System security risks reflect the likelihood that a variety of possible undesirable actions committed by dishonest employees or outside hackers will compromise the integrity of a company’s information system (Hunton et al, 2004).

**Overall control risk** is defined as the risk that the client’s controls will fail to prevent or detect material misstatements (Hunton et al, 2004). Bierstaker, Janvrin & Lowe (2005) examined the relation between control risk and computer related audit procedure usage. They found that only forty per cent of financial auditors rely on internal controls and as a consequence they assessed control risk at less than maximum. The other sixty per cent don’t rely on internal controls and they assess control risk at maximum. However, this percentage

\(^4\) Meeting with Mr. Marc Henkens (Customer Engagement Manager, SAP), the 11\(^{th}\) of December 2007, Brussels.

\(^5\) World Intellectual Property Organization (WIPO)
decreases significantly when we consider auditors of Big-four firms. Those that assess control risks at less than maximum are more likely to use computer related audit procedures and to consult with IT specialists than auditors who do not rely on controls.

2.3 IT knowledge requirement: literature and guidance

Agoglia & Brazel (2004), Ashcroft & Bae (2004), Bedard, Ettredge, Jackson & Johnstone (2003) (2006a) (2006b), Greenstein, McKee & Quick (2004), Hahn (1999), Helms (1999), Lind and Pathak (2003) and Wright & Wright (2002) all find it vital that financial auditors should gain relevant IT knowledge of the complex systems they are confronted with during an external audit. They must be aware of the heightened risks in different circumstances and they must seek for consultation of IT specialists and rely on their controls. In addition, financial auditors should accept the informatization trend in business and not resist auditing the ERP systems of the client by working around them (Bedard et al, 2006b). Neither should they ignore the computer automated auditing techniques (CAAT) that facilitate their job. This, of course, has a serious impact on the audit planning (Temesgen, 2005). Several studies on the ease of use and usefulness of electronic audit work systems show that the self-perception of financial auditors is rather low in general, which leads to resistance in using the systems (Bedard et al, 2003, 2006a, 2006b). IT knowledge requirements for independent auditors are higher than for the average accountant since they typically serve a wide variety of clients (Greenstein, McKee & Quick, 2004).

Auditing standards that provide guidance on the client’s audit environment have been adapted thoroughly since the beginning of the third millennium, and one of the very important aspects thereof, is the client’s computer information system. ERP systems are considered to be extended CIS systems so they integrally fall under the specifications of all relevant US and international auditing standards that focus on the role of client’s information systems in controlling business processes:

In 2001, SAS No. 55 in the US was amended by SAS No. 94, and guides on “The effect of IT on Auditor’s Consideration of Internal Control in a Financial Statement Audit”. SAS No. 94 instructs auditors to ‘understand’ the client’s automated and manual procedures used to prepare the financial statements and related disclosures, and also to consider how errors and irregularities could occur in the client’s computing environment (AICPA)\(^6\).

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\(^6\) AICPA (American Institute of Certified Public Accountants)
International Standards on Auditing (ISA) have also been revised seriously in the last decade. ISA No. 401 no longer exists and is absorbed by ISA No. 315 December the 15th of 2003 on. This standard covers a wide range of audit issues, one of which is the IT environment. ISA No. 315 is entitled: “Understanding the Entity and its Environment and Assessing the Risks of Material Misstatement” (IAASB, 2008) and it emphasizes both system security and the quality of management information in case of IT risks occurring in an entity’s internal controls (Bedard et al, 2005).

Paragraph 57, 81, 90 and 93 of ISA No. 315 contain aspects to take into account for the external audit. In essence, ISA No. 315 tells us that in a mixed environment of manual and automated system elements, “the independent auditor should obtain an understanding of the entity and its environment, including its internal control, sufficient to identify and assess the risks of material misstatement of the financial statements whether due to fraud or error, and sufficient to design and perform further audit procedures” (IAASB, 2008).

2.4 Motivation for this study

When in 2000, Hunton, Wright & Wright did an experiment in the US to assess the ERP knowledge differentials from financial auditors and IT-specialists, they identified that financial auditors were significantly less concerned than IT audit specialists with heightened risks due to ERP. Additionally, the financial auditors did not identify the risks hidden in the case, although they were highly confident in their own ability to assess risks in both ERP and non-ERP environments. IT audit specialists, on the contrary, were less confident in financial auditors’ abilities to assess unique risks posed by ERP systems. In 2000 financial auditors were unlikely to engage the internal services of the IT risk management practice to assist them in assessing the computer system and ERP environment at the client, suggesting that potential financial statement and audit risks may go unidentified.

According to Greenstein & McKee (2003), enterprise resource planning (ERP) systems are at the first position of five technologies (followed by generalized audit software, electronic data interchange, embedded audit modules and database design & installation) about which auditing educators would most like to learn more. They ranked their self-reported knowledge of ERP systems at a mean of 2.86 on a one-to-seven point Likert scale (1 = no knowledge and 7 = expert knowledge) while auditing practitioners only rated themselves at 1.85 (mean). These practitioners were all American auditors. In a subsequent study of the same researchers, German audit practitioners ranked themselves at a mean of 1.59 (Greenstein et al, 2004). This suggests a very low self-perception of their capabilities and knowledge related to ERP systems.
Moreover, one fourth of the German and US audit practitioners rated their overall information technology knowledge at “less than adequate”.

What’s more, the International Journal of Accounting Information Systems (IJAIS) explicitly expressed in 2006 the desire to publish extended research on the impact ERP has had and will have across the various disciplines of accounting because the academic research in accounting has largely ignored this phenomenon. “This is a clear and strong call for research in this domain” noted Sutton (2006).

Given the existing literature on the subject, it is clear that the IT knowledge level has a substantial impact on the audit quality, though there are no studies available in Belgium on the matter. Therefore, inspired by the findings of Greenstein et al. (2004) and Hunton et al. (2004), this paper will investigate whether the current situation (2008) and a different location (Belgium) shows any evolution compared to the US in 2000. This study is realized by means of the same experimental case as Hunton et al (2004) used in 2000 kindly provided by the authors.

2.5 Research question development

The general research question is embedded in an ERP environment with business and audit risks and runs as follows: “To what extent should or do financial auditors rely on IT audit specialists to recognize and assess the risks?”

The question is ‘if’ financial auditors rely on IT audit consultation or not, and if they do, ‘to what extent’? More specifically, there are three detailed research items that cover this subject. First, are there ‘knowledge differences of specialists in ERP versus non-ERP settings’? Secondly, what is the ‘need for consultation with IT auditors’ that financial auditors experience versus the conviction of IT audit specialists that their consulting is needed in that specific case? And thirdly, what is the ‘confidence level’ of the financial auditor assessing an extended ERP environment on his/her own versus the confidence that IT specialists have in their colleagues in handling the situation alone?

The independent variables in the experiment are ‘Auditor type’ (financial auditors versus IT audit specialists) and ‘System type’ (ERP versus non-ERP system). For some analytical tests, auditor type and system type are recoded into one new independent variable that shows the four experimental conditions in the experiment.

These conditions are:

- Financial auditor (FA) + ERP system
- Financial auditor (FA) + non-ERP system
- IT audit specialist (ITA) + ERP system
In this study, the hypothesis of the study of Hunton et al (2004) is used literally in order to be able to compare the results and see the analogies and/or differences.

2.5.1 The ERP knowledge differences of specialists

The study of Hunton, Wright and Wright (2004) found significant differences in financial auditors’ insight in heightened risks of an ERP or a non-ERP environment versus IT specialists’ insight. In accordance to Hunton et al (2004), the following equation has been used to indirectly measure the knowledge differences of specialists by measuring the risk differentials they assess between ERP and non-ERP settings:

\[
[\mu_{IT(ERP)} - \mu_{IT(non \, ERP)}] > [\mu_{FA(ERP)} - \mu_{FA(non \, ERP)}]
\]

This equation stipulates that, in the means, IT audit specialists assessed, in 2000, a significantly greater risk difference between ERP and non-ERP settings than financial auditors did. The results of the current study will show if this is still the case.

Since we are about eight years further than when the experiment of Hunton et al (2004) took place (in the US), there is reason to think that auditors in the Big-four companies might now be better trained, informed and aware of the risks associated with ERP environments than before. Although they are not prepared to audit the computer system itself, they probably are more aware of the complexity of these systems and the heightened risks that can occur in these areas. Also, because of the clear recommendations of the standards on this theme, Big-four auditors cannot deny the subject anymore. Therefore, a solid shift from total significance in the results of 2000 to less significant results today is expected, meaning that the risk differentials assessed by the two types of auditors are disappearing.

**Hypothesis 1**: Holding all non-system business interruption and process interdependency risk factors constant, IT audit specialists will assess significantly greater risk differentials between the non-ERP and ERP system than financial auditors in the following areas: (Hunton et al, 2004)

- H 1a: business interruption risk (BIR)
- H 1b: process interdependency risk (PIR)
- H 1c: network security risk (NSR)
- H 1d: database security risk (DSR)
H 1e: application security risk (ASR)
H 1f: overall control risk (CR)

2.5.2 The perceived need for consultation
This hypothesis examines the extent to which financial auditors seek for consultation when needed according to the International Auditing Standards. If the financial auditor does not possess the required skills to properly evaluate and test automated internal controls, he is recommended by the ISA’s to seek the advice of IT audit specialists. As ERP settings are considered as extended and complex computer information systems, financial auditors would be expected to always seek help in case the client has an ERP system.

In follow-up of the first hypothesis, the perceived need for consultation will probably result in the same direction. If the expectation about hypothesis one is correct, then logically financial auditors are more aware of the need for advice from specialists in these circumstances.

From the IT auditors’ perspective, it is difficult to say whether they think that financial auditors make a strong enough appeal to their expertise. From conversations, with several Big-four IT managers in the previous months, it has transpired that on the one hand financial auditors are supposed to call upon the IT department for every situation as described in the auditing standards, but on the other hand, there are budget restraints and other sources of resistance. According to the IT auditors, it sometimes all depends on older financial auditors being less acquainted with IT while their younger colleagues are more familiar with it and therefore more daring in dealing with ERP related issues.

Hypothesis 2: When comparing the perceived need for consultation with IT audit specialists, differential assessments (ERP versus non-ERP) will be significantly higher for IT audit specialists than for financial auditors (Hunton et al, 2001).

2.5.3 Confidence level in the financial audit team
This hypothesis has not been formulated in advance by Hunton et al (2004) but nevertheless has been examined afterwards.

Four confidence items with a high internal reliability score were computed into one new construct called ‘Confidence construct’. This confidence of the financial auditors in themselves will be tested across all experimental conditions. On the other hand, the IT audit specialists’ confidence in the capability of the financial auditors to assess the specific heightened risks in...

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7 This hypothesis comes from the working paper of Hunton, Wright & Wright in 2001, because in the published paper, of 2004, they only considered the financial auditors’ side.
this case will also be tested. We can expect this confidence level to be different from the two perspectives. The results will now be compared to those of eight years ago.

Apparently, the study Hunton et al (2004), in 2000, resulted in financial auditors feeling very confident in assessing complex ERP environments on their own, although they had just been proven to be unknowledgeable in that area according to other studies. Bedard et al (2003) said they neglected and worked around the system. Hunton et al (2004) concluded that financial auditors were overconfident with complex ERP settings. While on the other hand, IT audit specialists had great confidence in the capabilities of the financial audit team in a non-ERP environment. Hopefully, as of today, one of the conclusions of this study will be that the Belgian Big-four financial auditors do appeal to their internal IT risk advisory department in every complex IT situation on a regular basis.

**Hypothesis 3:** There will be no significant difference between the confidence level that financial auditors have in themselves versus the confidence level that IT audit specialists have in the financial audit team regarding the assessment capability of risks in an ERP setting.
3 Research method

3.1 Design

The case Hunton, Wright & Wright (2004), used in their study of 2000, has also been used in this study. Knowledge differences between auditor types (financial auditors versus IT auditors) in two different system environments (ERP versus non-ERP) will be measured in this case study. This two-by-two-between-subject design involves four experimental conditions that will be compared pairwise:

- IT auditor (ITA) + ERP system
- IT auditor (ITA) + non-ERP system
- Financial auditor (FA) + ERP system
- Financial auditor (FA) + non-ERP system

The independent variables are ‘Auditor type’ and ‘System type’ and the risks that arise in complex ERP environments can be split up into six dependent variables:

- Business interruption risk
- Process interdependency risk
- Network security
- Data security
- Application security
- Overall Control risk

The system security items (network, data and application security) are mainly traceable in the control weakness (Appendix C) embedded in the company background of the case. These six variables are comprised of eighteen items that will be combined into separate and consistent dependent variables (infra 4.3 in this paper).

3.2 Task

The participants had to read a realistic case regarding a pharmaceutical manufacturer and they assessed various risks for the client’s computerized system.

The two versions of the experimental case (ERP versus non-ERP) were distributed randomly across participants and resulted in the following observational numbers in each experimental condition:
Table 1: Experimental conditions

<table>
<thead>
<tr>
<th>Experimental conditions:</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>FA + non ERP</td>
<td>24</td>
</tr>
<tr>
<td>ITA + non ERP</td>
<td>23</td>
</tr>
<tr>
<td>FA + ERP</td>
<td>24</td>
</tr>
<tr>
<td>ITA + ERP</td>
<td>23</td>
</tr>
<tr>
<td>Total</td>
<td>94</td>
</tr>
</tbody>
</table>

The case materials contain background information of the client and the auditing firm’s past experience with the company is portrayed as positive. In the background description of the fictitious company you can also find the ‘system type’ manipulation which is presented in Appendix A. The business processes surrounding the ERP system are designed as tightly integrated throughout the company, while the non-ERP system consists of independent business processes with manual controls (Hunton et al, 2004). The case also includes a comprehensive business process map presented in Appendix B. Hunton et al (2004) used the process map as a base to develop the computer system manipulations. They intended to provide an overall similar level of inherent risk and fraud risk for the two versions of the case. They successfully achieved their intention, as the participants in this study confirmed once again that the inherent risk and fraud risk perceptions are equal in both system environments. (Anova test for ‘inherent risk’: $F = 1.384$ and $p = 0.253$ Thus no significant differences between experimental conditions. Anova test for ‘fraud risk’$^8$: $F = 1.535$ and $p = 0.211$).

By means of three focus group meetings with IT specialists, Hunton, Wright & Wright (2004) decided on the dependent variables they would use in the case and also that seven-

---

$^8$ Fraud risk: (Gomaa & Lynch, 2003) “Although the infusion of progressively advanced IT into business organizations can improve the capturing, processing and reporting of critical decision-making information across the enterprise, such technology can also create an environment that is more vulnerable to fraud”. The Virginia Computer Crimes Act (VCCA) defines computer fraud as “Any person who uses a computer or computer network without authority and with the intent to (1) obtain property or services by false pretenses, (2) embezzle or commit larcency and (3) convert the property of another”.

Employee fraud: (Gomaa & Lynch, 2003) “There is a negative relationship between the perceived level of task interdependency and intentions to commit computer fraud. Gaining unauthorized access to computer systems can be as easy as getting someone’s password or understanding the flaws associated with a particular program, or as complex as having a group of sophisticated technical experts brainstorm various ways to accomplish the intrusion (Jordan & Taylor, 1998). The more complex the system, the more difficult it is for potential fraud perpetrators to successfully gain unauthorized access to the system."
point-Likert scales with semantic midpoints and anchors would be best to assess the system-related risks.

To preclude an order effect, the order of the questions has been randomized just as Hunton et al (2004) did in 2000, and two versions of the case within each treatment condition have been distributed. The Chi-square test for ‘question order’ is definitely insignificant ($p = 0.854$), meaning that the question order is not influencing the participant’s answers.

### 3.3 Seeded control weakness

In order to identify a weakness that would potentially result in significant greater security risks in the ERP as compared to the non-ERP environment, Hunton et al. embedded a weakness into the case. Appendix C presents the control and security weakness in both versions of the case. This weakness allows testing indirectly for a knowledge differential between specialists. It is of special concern in an ERP setting where a relational database consolidates enterprise-wide information, tightly coupled business processes exist and improper access may lead to significant risks and exposures.

An important weakness that is put into the case is that only one network manager cannot know every departmental supervisor of the nine locations world-wide who are in charge of the authorization of access and privileges. The network manager has to follow blindly the directives of the departmental supervisors and cannot discern whether the supervisors are correct and loyal to the company or whether they are playing their own game. They could easily ask the network manager to give access to incompatible functions like the segregation of duties requirements.

Also, this network manager is a computer hardware specialist and has not necessarily the required knowledge about security systems, processes and policies. He also has too much technical knowledge of the system to be potentially dishonorable in his function of system security, especially as he is alone in his function without peer evaluation or support. He has a lot of power to manage the system in the direction he wants and therefore should be supervised and supported.

A combination of technical network issues and passwords issuance throughout the entire company leads to neglecting the least urgent and important matters, in this case the access provision. Passwords and user ID’s might not be seen as a priority next to network and technical problems.

There is also a security problem in the ERP setting with access to the Internet. Hackers or intruders can easily break into the system and create faulty transactions because there is no segregation between the internal network and the Internet usage. Via one account you have
access to the internal network and the Internet. Internet and intranet actions are not separated and not foreseen by internal controls. One wrong action immediately leads to a flow of wrong transactions. As in a manual system, there still should be some checks, which require authorization to continue the flow.

### 3.4 Administration of the experiment

The experiment took place in the headquarters of all of the Big-four audit firms in Belgium together with two somewhat smaller but international audit firms that are ranked just under the Big four. In alphabetic order, the participating firms are Deloitte, Ernst & Young, KPMG and PricewaterhouseCoopers complemented with BDO Atrio and Grant Thornton. Further in the experiment the names of the firms will be encrypted in order to be delicate with office-specific differences. The resulting group of participants is comprised of an almost equal number of financial auditors (48) and IT audit specialists (46).

![Table 2: Crosstabulation of 'Experimental conditions' x 'Audit-firm'](image)

The experiment was held during several sessions, depending on the audit firm. In audit-firm B the experiment was organized in a way that all participants were present in the restaurant of their headquarters at 2.30 pm on the 18th of March. They were 32 and thus the biggest provider of participants. In office E the experiment took place between 11 am and 5 pm on the 11th of April, also in a meeting room in their headquarters. 21 participants of office E passed by before they logged in at their office that day. This makes 53 controlled participations of the 94 in total. In office A, C, D and F the participants (respectively 19, 4, 14 and 4) were unable to gather at one particular moment. In these offices I had thorough conversations with every responsible manager about the requirements for validity of the experiment. We agreed upon the elimination of four key possible effects by means of the following arrangements. One, the participants do not know there were both financial and IT auditors involved in the study. Only after the experiment every participant got an explanation about the ‘purpose of the experiment’
(Appendix D) and in June all participating firms will receive an outline of the global and respective office-specific results. Two, they aren’t aware of the participation of the other Big-four firms in this experiment. Three, they don’t realize that the experiment is in fact about risk assessments in ERP versus non-ERP environments and certainly not that knowledge differentials between specialists would be measured. And four, the participants must open the envelop and solve the problem immediately. They close it again so that they don’t have time to reflect, discuss with others or get informed about the subject. I believe there was a clear understanding and in respect of this they returned all answered cases by Monday the 7th of April at the latest, 41 in total. The controlled versus semi-controlled aspect of the experiment only has a minimal impact on two of the twenty one dependent variables (‘DSR b’ and ‘Perceived Need for Consultation’). We can assume this result to be insignificant for the analysis of the model.
4 Results of the experiment

All data analysis in this experiment has been performed by means of the SPSS software.

4.1 Participants

Ninety four (94) specialists participated in the study of which eighty six (86) came from a Big-four audit firm. In total there were forty eight (48) financial auditors and forty six (46) IT audit specialists.

More than 55 % of the participants have much experience in their field (more than 6 years up to 20 years) and a great responsibility in the external audit or in an IT audit. Only 10 of the participants are rather young in their position and most of them are IT auditors. Nevertheless, 5 of the 8 IT auditors with staff-positions (less than 4 years experience) have a CISA certification. CISA stands for Certified Information Systems Auditor and is a very well-known certificate and appreciated world-wide. Wright & Wright (2002b) note that ‘experience’ of older experts with higher positions does not necessarily lead to ‘expertise’ but it is rather ‘task-specific experience’ that leads to superior performance. And even if O’Leary (2002) discusses the use of ‘experts’ of Wright & Wright (2002) explaining they were using the term in a very heterogeneous way (a mixture of three different positions) which they find is less feasible, I decided to keep the staff-participants, with only some years of experience on the job in this study, because they are well trained for the specific task they are given. If the ten ‘staff’ members had been eliminated from the study, there would still only be one of twenty one dependent variables that experience a significant effect from ‘position’ at 5% significance level and two other variables at 10% significance level (Anova: ASRa: \( p = 0.024 \), NSR b: \( p = 0.084 \) and CR: \( p = 0.078 \)). So, we will continue in this study with ninety four (94) valuable participants which all have relevant job experience. Further, in the ‘results’ (infra 4.3), we see that ASRa only plays a minor role in the model and can be ignored.

<table>
<thead>
<tr>
<th>Experimental condition</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>staff</td>
</tr>
<tr>
<td>FA + non-ERP</td>
<td>1</td>
</tr>
<tr>
<td>ITA + non-ERP</td>
<td>6</td>
</tr>
<tr>
<td>FA + ERP</td>
<td>1</td>
</tr>
<tr>
<td>ITA + ERP</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>10</td>
</tr>
</tbody>
</table>

Table 3: Crosstabulation of 'Experimental conditions' x 'Position'
Is there a significant difference between auditor types for any of the demographic variables? A Chi-Square test examines these demographic variables.

Panel A:

<table>
<thead>
<tr>
<th>Demographic variables:</th>
<th>Means</th>
<th>Std dev</th>
<th>Means</th>
<th>Std dev</th>
<th>Chi-Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years of auditing experience</td>
<td>6.56</td>
<td>3.494</td>
<td>6.17</td>
<td>3.492</td>
<td>0.360</td>
</tr>
<tr>
<td>% experience in pharm. industry</td>
<td>6.44</td>
<td>11.265</td>
<td>10.76</td>
<td>13.903</td>
<td>0.102</td>
</tr>
<tr>
<td>% of client-base with ERP</td>
<td>54.94</td>
<td>31.827</td>
<td>66.41</td>
<td>25.444</td>
<td>0.056**</td>
</tr>
<tr>
<td>% overall computer assessment</td>
<td>13.96</td>
<td>14.372</td>
<td>75.46</td>
<td>23.201</td>
<td>0.000*</td>
</tr>
</tbody>
</table>

Panel B:

<table>
<thead>
<tr>
<th>Nominal demographic variables:</th>
<th>FA's</th>
<th>ITA's</th>
<th>Chi-Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPA certification</td>
<td>16</td>
<td>4</td>
<td>0.000*</td>
</tr>
<tr>
<td>CFE certification</td>
<td>0</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>CIA certification</td>
<td>0</td>
<td>6</td>
<td>0.010*</td>
</tr>
<tr>
<td>CISA certification</td>
<td>0</td>
<td>31</td>
<td>0.000*</td>
</tr>
<tr>
<td>CISSP certification</td>
<td>1</td>
<td>1</td>
<td>0.563</td>
</tr>
<tr>
<td>Other certification</td>
<td>2</td>
<td>7</td>
<td>0.069**</td>
</tr>
<tr>
<td>Accounting/Business degree</td>
<td>45</td>
<td>31</td>
<td>0.000*</td>
</tr>
<tr>
<td>Computer Science degree</td>
<td>1</td>
<td>31</td>
<td>0.000*</td>
</tr>
<tr>
<td>Other degree</td>
<td>4</td>
<td>4</td>
<td>0.534</td>
</tr>
</tbody>
</table>

* Significant at 5% significance level
** Significant at 10% significance level

Table 4: Pearson Chi-Square of demographic variables

Only the ‘Percentage of overall computer assessment’ is significantly lower for financial auditors than for IT auditors (table 4, panel A). The ‘Percentage of overall computer assessment’ is the only variable which is also significant across all four experimental conditions (Anova: p < 0.01). Financial auditors do little IT auditing compared to IT audit specialists (average of 75% of their time). This is of course a logical conclusion. The ‘Experience in pharmaceutical industry’ and the ‘Client-base with ERP’ are insignificant, meaning that the distribution amongst auditor types is similar.
'CPA certification' is significantly higher for financial auditors (Chi-Square: \( p < 0.01 \)). Mostly financial auditors are certified, but also four of the IT auditors. Here we see that IT auditors gain a certain background of financial auditors’ know-how. On the other hand, we don’t see this in the opposite direction. Financial auditors have no CIA or CISA certifications. 67.4% of all IT auditors hold the CISA certification and 13% of them hold the CIA certification, while none of the financial auditors do.

The same phenomenon appears regarding the degrees of specialists. The ‘Accounting/Business degree’ is widespread amongst both IT audit specialists (31) and financial auditors (45), where the ‘Computer Science/Science degree’ is only at the IT auditors’ side. Again we see that shared knowledge is mainly in one way and that financial auditors have few or no IT background. Already in Hunton et al (2004), IT audit specialists indicated they had taken at least one professional training course in IT auditing while none of the financial auditors had participated in such trainings.

Based on all this, we may take for granted that IT audit specialists have a sufficient background of external audit while financial auditors have little IT background. This reasoning is what I regularly heard on the field while exploring the subject through several contacts with IT and financial audit practitioners in the Big-four companies. IT managers were advocating that both groups should have a better understanding of each other’s expertise.

### 4.2 Manipulation check

Since the consultation of IT experts during an external audit mainly depends on the evaluation capacity of the independent auditor, which mostly comes from a non-IT background, he or she should possess a minimum of insight in the characteristics of ERP system. That is at least what the standards require. To check this, the ‘system type’ manipulation in the ‘Medical Solutions’ case is extreme. The business processes, in the ERP version, are as good as completely integrated while the non-ERP version has computerized as well as manual processes. Through this manipulation check we can ascertain how different both auditor types assess the extent of integration and we can see whether they recognize the integration level or not.

Anova testing on the manipulation check across all four experimental conditions is significant for what is concerned ‘system type’, thus differs strongly for the two system environments. The (mean) [standard deviation] response for the ERP condition (5.51) [1.18] is significantly greater (Anova: \( F = 103.078 \) and \( p < 0.01 \)) than the non-ERP condition (2.68) [1.50]. The main effect of ‘auditor type’ is not significant (Anova: \( F = 1.206, p = 0.275 \)), meaning that financial and IT auditors’ evaluation of the system manipulation is nearly the same. The
interaction term of system and auditor type is not significant as well. Thus, the manipulation of ‘system type’ has been successful.

In other words, both auditor types evaluate a significant difference between the two settings but IT audit specialists see a greater difference in integration between ERP and non-ERP environment ($5.57 - 2.17 = 3.4$) than the financial auditors ($5.46 - 3.17 = 2.29$). Results today show approximately the same as Hunton et al (2004) reported, although the integration differentials are smaller then in 2000. IT auditors assess the integration level of ERP environments more moderately than in 2000 and financial auditors recognize more difference in integration levels than eight years ago. IT auditors have become more knowledgeable and familiar with complex IT systems in the last five years. Financial auditors, from their side, have become more aware (conversation with IT managers)\(^9\) of the risks associated with complex IT systems.

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>FA + nonERP</td>
<td>3.17</td>
<td>1.551</td>
</tr>
<tr>
<td>ITA + nonERP</td>
<td>2.17</td>
<td>1.302</td>
</tr>
<tr>
<td>FA + ERP</td>
<td>5.46</td>
<td>1.285</td>
</tr>
<tr>
<td>ITA + ERP</td>
<td>5.57</td>
<td>1.080</td>
</tr>
</tbody>
</table>

Table 5: Manipulation check

### 4.3 Response measures and reliability of the constructs

The six dependent risk categories (BIR, PIR, NSR, DSR, ASR and CR) used in the model for hypothesis one, all are comprised of one, two or three risk items. Hypothesis three starts from four items to establish one dependent variable. The wording of the questions can be found in Appendix E and F.

In order to be able to measure single risk indices/categories, the multiple items that measure the same are averaged into several risk constructs. Therefore, all response measures of these items have to be oriented in the same direction. Items PIR b, NSR c, DSR c and ASR b must be formulated in the opposite direction to correspond with the other items of the construct. That is why these four questions need to be rescaled. Only then is every item of the construct compatible and can eventually be taken together. The reliability of the new constructs is tested to identify the internal consistence of the items of a construct, measured by Cronbach alpha.

---

\(^9\) Conversation about the outcomes of this study with IT manager of Big-four firm A and B, the 12\(^{th}\) and the 14\(^{th}\) of may 2008.
Following the model of Hunton et al (2004) for Hypothesis 1:

- Business interruption risk (a+b): cronbach alpha = 0.746
- Process interdependency risk (a+b rescaled): cronbach alpha = 0.580
- Network security risk (a+b+c rescaled): cronbach alpha = 0.465
- Data security risk (a+b+c rescaled): cronbach alpha = 0.441
- Application security risk (a+b rescaled): cronbach alpha = 0.470
- Overall Control risk: n/a (only 1 item)

In this model, there is actually only one construct (BIR) that fits really well. The others seem to be internally inconsistent. Applying small adjustments to the model could enhance it as follows:

Alternative model Hypothesis 1:

- Business Interruption risk (a+b): cronbach alpha = 0.746
- Process interdependency risk (a+b rescaled): cronbach alpha = 0.580*
- Network security risk (a+b): cronbach alpha = 0.617
- Data security risk (a+b): cronbach alpha = 0.608
- Application security risk (a+b rescaled): cronbach alpha = 0.470**
- Security risk construct (NSR c + DSR c + ASR b): cronbach alpha = 0.797***
- Overall control risk: n/a

In this alternative model, BIR, NSR and DSR scored relatively high. The NSR and DSR constructs are comprised only of the two strongest items. The third item of each has to be combined into a new construct ***.

* PIR construct has a borderline value but still will be kept in the model.
** ASR is too unreliable and will be left out of the model.
*** With the remaining security items, a new construct can be made: Security construct (NSR c, DSR c and ASR b). Since all three items cover a specific part of system security, and given the wordings of the items and the subject, this new ‘Security risk construct’ scores high for internal reliability and can be taken into account for the new model.

Hypothesis 2:

For hypothesis two, there is only one item as a dependent variable: ‘Perceived Need for Consultation’. Thus, no reliability to check.
Construct for Hypothesis 3:

- Confidence questions (a+b+c+d): cronbach alpha = 0.885

Via the ‘Compute’ function in SPSS, the reliable items have been averaged:
- ‘Business interruption risk construct’ (BIR construct)
- ‘Process interdependency risk construct’ (PIR construct)
- ‘Network security risk construct’ (NSR construct)
- ‘Data security risk construct’ (DSR construct)
- ‘Security risk construct’ (SEC construct)
- ‘Confidence construct’

4.4 Preliminary testing

In light of some extra factors other than ‘auditor type’, ‘system type’ and their interaction term, Anova tests on all dependent variables whether there are disturbing side effects. For example, ‘CPA firm’, ‘Question order’ and ‘Percentage of the Client-Base with ERP’ could cause such effects.

The results in 2000 of Hunton et al (2004) were straightforward and easy to interpret. The complete model was significant for auditor type, system type and their interaction. This is not the case this time in the pretesting. ‘Auditor type’ is slightly significant for ‘process interdependency’ and ‘network security’ and highly significant for ‘security’ and ‘confidence’, while neither system type nor the interaction between auditor and system type are significant.

‘CPA-firm’ is significant for data security (Anova: $F = 3.601$ and $p < 0.01$). The multiple comparisons in the Post Hoc tests show us a significant difference between office B and E, and the same effect but weaker between office D and E. Offices B and E have the biggest IT department of the Big-four companies and yet they assess Data Security Risks very differently. Office D apparently follows the risk assessment of B.

4.5 Results of H1: Knowledge differences of specialists

First of all, we compare the means of the model with six dependent variables (constructs) across the four treatment conditions (table 6; panel A2), afterwards we apply the equation below and calculate the risk differentials of IT auditors and financial auditors (table 6; panel C). We compare these differentials with those of Hunton et al (2004) in 2000 (table 6; panel A1) and extract only descriptive results since unfortunately, SPSS does not provide the statistical test needed for testing the ‘risk differentials’ of independent samples. We do this for the original model of Hunton et al (2004) and for the alternative model.
The dependent variables across treatment conditions have been tested for normality (Lilliefors-test in SPSS) and nearly all items meet normality. Thus, we can also conduct Anova tests on all dependent variables for both models (table 6; panel B).

Original model:

### Panel A1

<table>
<thead>
<tr>
<th>Year 2000:</th>
<th>Non-ERP system</th>
<th>ERP system</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IT auditors</td>
<td>Financial auditors</td>
</tr>
<tr>
<td></td>
<td>mean</td>
<td>std dev</td>
</tr>
<tr>
<td>BIR a,b</td>
<td>1.76</td>
<td>0.880</td>
</tr>
<tr>
<td>PIR a,b</td>
<td>3.24</td>
<td>1.070</td>
</tr>
<tr>
<td>NSR a,b,c</td>
<td>4.40</td>
<td>0.710</td>
</tr>
<tr>
<td>DSR a,b,c</td>
<td>3.64</td>
<td>0.890</td>
</tr>
<tr>
<td>ASR a,b</td>
<td>3.31</td>
<td>1.090</td>
</tr>
<tr>
<td>CR</td>
<td>3.48</td>
<td>1.640</td>
</tr>
</tbody>
</table>

### Panel A2

<table>
<thead>
<tr>
<th>Year 2008:</th>
<th>Non-ERP system</th>
<th>ERP system</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IT auditors</td>
<td>Financial auditors</td>
</tr>
<tr>
<td></td>
<td>mean</td>
<td>std dev</td>
</tr>
<tr>
<td>BIR a,b</td>
<td>4.39</td>
<td>1.345</td>
</tr>
<tr>
<td>PIR a,b</td>
<td>4.98</td>
<td>1.327</td>
</tr>
<tr>
<td>NSR a,b,c</td>
<td>4.77</td>
<td>0.873</td>
</tr>
<tr>
<td>DSR a,b,c</td>
<td>4.91</td>
<td>0.900</td>
</tr>
<tr>
<td>ASR a,b</td>
<td>5.20</td>
<td>1.346</td>
</tr>
<tr>
<td>CR</td>
<td>5.04</td>
<td>1.065</td>
</tr>
</tbody>
</table>

### Panel B

<table>
<thead>
<tr>
<th>ANOVA</th>
<th>System type</th>
<th>Auditor type</th>
<th>Interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>p</td>
<td>F</td>
</tr>
<tr>
<td>BIR</td>
<td>0.829</td>
<td>0.365</td>
<td>0.021</td>
</tr>
<tr>
<td>PIR</td>
<td>3.041</td>
<td>{f 0.085}</td>
<td>2.189</td>
</tr>
<tr>
<td>NSR a,b,c</td>
<td>0.057</td>
<td>0.812</td>
<td>8.141</td>
</tr>
<tr>
<td>DSR a,b,c</td>
<td>0.023</td>
<td>0.879</td>
<td>10.975</td>
</tr>
<tr>
<td>ASR</td>
<td>0.677</td>
<td>0.413</td>
<td>4.093</td>
</tr>
<tr>
<td>CR</td>
<td>9.995</td>
<td>{f 0.002}</td>
<td>0.115</td>
</tr>
</tbody>
</table>

### Panel C

<table>
<thead>
<tr>
<th>ERP - non ERP Index Means</th>
</tr>
</thead>
<tbody>
<tr>
<td>current differences:</td>
</tr>
<tr>
<td>differences in 2000</td>
</tr>
<tr>
<td>Hunton et al:</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>ITA</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>BIR</td>
</tr>
<tr>
<td>PIR</td>
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<tr>
<td>NSR</td>
</tr>
<tr>
<td>DSR</td>
</tr>
<tr>
<td>ASR</td>
</tr>
<tr>
<td>CR</td>
</tr>
</tbody>
</table>

Table 6: Risk differentials of specialists - original model (2000 & 2008)
A t-test for measuring differences between the means of financial auditors and IT auditors is significant for **NSR** (T-test: $t = -2.876$, $p < 0.01$), **DSR** (T-test: $t = -3.353$, $p < 0.01$) and **ASR** (T-test: $t = -2.034$, $p = 0.045$). This means that all items of system security test significantly higher for IT auditors, thus they assess higher risks for system security.

A t-test for measuring differences between the means of ERP and non-ERP systems is significant for **PIR** (T-test: $t = -1.727$, $p = 0.088$) and **CR** (T-test: $t = 3.17$, $p < 0.01$). Process interdependency risk is assessed to be higher in ERP environments while control risk is found to be lower in an ERP setting. This matches with the statement of Bierstaker et al (2005) that the more a specialist is familiar with ERP systems and its consequences, the more he relies on the client’s internal controls and thus the lower they indicate control risk.

Anova-tests show **BIR** to be marginally significant in the interaction term of auditor and system type, although it is not visible in the multiple comparisons. But BIR also has the biggest risk differentials when we look at panel C of table 6. PIR is marginally significant for the system type (Anova: $F = 3.041$, $p = 0.085$). Furthermore, Anova testing confirms overall what the t-test for ‘system security’ already has showed in detail.

Panel C of table 6 shows the risk differentials, calculated according to the equation (supra 2.5.1). The distance between them is rather small, especially compared to Hunton et al (2004). We can say that, except for BIR, IT auditors assess risk differences between ERP and non-ERP systems quite similarly as financial auditors do these days. This is a strong evolution since 2000.

**Alternative model:**

A t-test for measuring differences between the means of financial auditors and IT auditors is significant for **NSR** (T-test: $t = 2.264$, $p = 0.026$), **DSR** (T-test: $t = 1.787$, $p = 0.077$) and **Security** (T-test: $t = -3.108$, $p < 0.01$). The same conclusion as in the original model of Hunton et al, can be made that all items of system security test significantly higher for IT auditors, therefore they assess higher risks for system security.

A t-test for measuring differences between the means of ERP and non-ERP systems is significant for **PIR** (T-test: $t = -1.727$, $p = 0.088$) and **CR** (T-test: $t = 3.17$, $p < 0.01$). This matches completely with the original model since PIR and CR are unchanged in this model.

Anova-tests are also equal to the original model and are shown in the table 7, panel B. The same story counts for panel C of table 7. So, in fact, the alternative model is redundant. All conclusions can be drawn from the original model.
Panel A

<table>
<thead>
<tr>
<th>dep. var.</th>
<th>Non-ERP system</th>
<th>ERP system</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IT auditors</td>
<td>Financial auditors</td>
</tr>
<tr>
<td></td>
<td>mean</td>
<td>std dev</td>
</tr>
<tr>
<td>BIR</td>
<td>4.39</td>
<td>1.345</td>
</tr>
<tr>
<td>PIR</td>
<td>4.98</td>
<td>1.327</td>
</tr>
<tr>
<td>NSR a+b</td>
<td>4.59</td>
<td>1.164</td>
</tr>
<tr>
<td>DSR a+b</td>
<td>4.63</td>
<td>1.350</td>
</tr>
<tr>
<td>Security</td>
<td>2.57</td>
<td>1.047</td>
</tr>
<tr>
<td>CR</td>
<td>5.04</td>
<td>1.065</td>
</tr>
</tbody>
</table>

Panel B

<table>
<thead>
<tr>
<th>System type</th>
<th>Auditor type</th>
<th>Interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>p</td>
</tr>
<tr>
<td>BIR</td>
<td>0.829</td>
<td>0.365</td>
</tr>
<tr>
<td>PIR</td>
<td>3.041</td>
<td>0.085</td>
</tr>
<tr>
<td>NSR a+b</td>
<td>0.117</td>
<td>0.733</td>
</tr>
<tr>
<td>DSR a+b</td>
<td>0.000</td>
<td>0.990</td>
</tr>
<tr>
<td>Security</td>
<td>0.001</td>
<td>0.978</td>
</tr>
<tr>
<td>CR</td>
<td>9.995</td>
<td>0.002</td>
</tr>
</tbody>
</table>

Panel C

<table>
<thead>
<tr>
<th>ERP - non ERP Index Means</th>
<th>ITA</th>
<th>FA</th>
<th>difference:</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIR</td>
<td>0.76</td>
<td>&gt;</td>
<td>-0.28 =&gt; 1.04</td>
</tr>
<tr>
<td>PIR</td>
<td>0.57</td>
<td>&gt;</td>
<td>0.29 =&gt; 0.28</td>
</tr>
<tr>
<td>NSR a+b</td>
<td>0.43</td>
<td>&gt;</td>
<td>-0.28 =&gt; 0.71</td>
</tr>
<tr>
<td>DSR a+b</td>
<td>0.15</td>
<td>&gt;</td>
<td>-0.14 =&gt; 0.29</td>
</tr>
<tr>
<td>Security</td>
<td>0.23</td>
<td>&gt;</td>
<td>-0.24 =&gt; 0.47</td>
</tr>
<tr>
<td>CR</td>
<td>-0.56</td>
<td>&gt;</td>
<td>-0.91 =&gt; 0.35</td>
</tr>
</tbody>
</table>

Table 7: Risk differentials of specialists - alternative model (2008)

Conclusions of the tested first hypothesis are solid.

Firstly, the model of Hunton et al (2004) stays relevant because the conclusions of both models are similar, with only some differences in observed power. The alternative model emphasizes once more in its own way that every item concerning system security assessed by the IT auditors, bears higher risk than the financial auditors’ assessment. Thus, we can say that, compared to the year 2000 in the US, IT auditors still recognize better control weaknesses in an ERP system than financial auditors although the gap has become smaller. System Security as a whole (network, data and application security) has been assessed differently across system type conditions. In general we can conclude here that IT audit specialists assess greater risk differences between ERP and non-ERP environments than financial auditors do, concerning Network Security, Data Security and Security items.

Secondly, IT auditors show lower risk assessments for almost every item in ERP conditions than in 2000 (panels A1 and A2 of table 6) and the opposite is true for the non-ERP conditions. This makes the risk differentials of IT auditors in ERP – non ERP environments
smaller. Financial auditors’ ERP risk assessment has increased as much as the IT auditors decreased, resulting in a nearly closed gap between auditor types in ERP setting.

Furthermore, in the non-ERP condition, financial auditors’ risk assessment has dramatically increased. They are also closing their differential gap and at the same time moving into the IT auditors’ assessment direction. This is probably the most significant change in the whole study. Financial auditors are closing the gap between themselves and the IT audit specialists. This is illustrated in panel C of table 6 where comparison of the current differences (IT versus financial) in risk differentials (ERP – non ERP) and those of 2000 reveal a general move towards equal differences assessed by IT and financial auditors. In other words, the ‘distance’ between ERP and non-ERP risk assessment measured by IT auditors and financial auditors on the other hand, is converging. In 2000, all the risk differentials between ERP and non-ERP environments assessed by IT auditors were significantly greater (up to 3.5 on a seven-point scale) than those assessed by the financial auditors, today these differentials tend to converge (maximum 1.04). However, the fact is that IT auditors still assess the risks themselves higher than financial auditors do, but also this aspect is slowly disappearing.

4.6 Results of H2: Perceived need for consultation

Anova testing on ‘Perceived Need for Consultation’ is used and the two independent variables, auditor type, system type and their interaction term, are measured. Only system type is significant (Anova: $F = 9.475$ and $p < 0.01$, observed power = 0.861). However, multiple comparisons tell us that the significant difference is situated between the conditions ‘ITA + ERP’ and ‘FA + non-ERP’. In fact this difference is not relevant for comparison. More relevant to mention are the decreasing differences between ERP and non-ERP conditions for both auditor types. It means that both auditor types come closer to each other in their intuition about the need to consult with IT audit specialists in ERP environments and even in less complex IT environments.

These results show the growing trend towards a standard collaboration between financial and IT auditors, and this is what the standards require. But this fact on its own does not necessarily mean that financial auditors really know more about the risks in complex IT areas than eight years ago. They might know more, but these results don’t suffice to take that conclusion. From other studies (Greenstein et al, 2004) we know that financial auditors (both educators and practitioners) are now more aware of their lack of knowledge in the area and this could stimulate them to play safe and work together.

Also an independent-samples t-test is used to compare the means of financial auditors’ perceived need for consultation. In fact financial auditors assess now high need for consultation
in both non-ERP and ERP settings and the difference is marginally significant (T-test: $t = -2.036$ and $p = 0.047$).

In 2000, financial auditors showed little ‘perceived need for consultation’ in ERP and in non-ERP environments. The difference in attitude is astonishing (table 8).

<table>
<thead>
<tr>
<th></th>
<th>2000 mean</th>
<th>2000 std dev</th>
<th>2008 mean</th>
<th>2008 std dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERP</td>
<td>2.36</td>
<td>1.640</td>
<td>6.29</td>
<td>0.550</td>
</tr>
<tr>
<td>non-ERP</td>
<td>1.97</td>
<td>1.510</td>
<td>5.58</td>
<td>1.613</td>
</tr>
</tbody>
</table>

Numbers of 2000 (Hunton et al, 2004)

Table 8: Perceived Need for IT Consultation (2000 & 2008)
(View of financial auditors only)

The same t-test for IT audit specialists reveals a slightly higher perceived need for consultation than the financial auditors had expressed. The mean (standard deviation) responses are 6.61 (0.583) for the ERP condition and 5.91 (1.269) for the non-ERP condition. Again they assess slightly higher need for consultation in the ERP condition and this difference is significant (T-test: $t = -2.359$ and $p = 0.025$). Numbers of 2000 for the IT auditors are not available.

4.7 Results of H3: Confidence levels

Anova testing is conducted on the ‘confidence’ construct and measures the two independent variables, auditor type, system type, and their interaction term. Auditor type is significant for both ERP and non-ERP conditions. System type is marginally significant in both areas and the interaction term is overall significant (Anova: $F = 7.945$ and $p < 0.01$).

Also an independent-samples t-test is used to compare the means of specialists’ confidence level in the two environments (table 9).

<table>
<thead>
<tr>
<th></th>
<th>2000 mean</th>
<th>2000 std dev</th>
<th>2008 mean</th>
<th>2008 std dev</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Financial auditors</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ERP</td>
<td>6.39</td>
<td>0.670</td>
<td>3.64</td>
<td>1.240</td>
</tr>
<tr>
<td>non-ERP</td>
<td>6.30</td>
<td>0.800</td>
<td>4.12</td>
<td>1.397</td>
</tr>
<tr>
<td><strong>IT auditors</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ERP</td>
<td>1.32</td>
<td>0.600</td>
<td>2.50</td>
<td>1.063</td>
</tr>
<tr>
<td>non-ERP</td>
<td>5.55</td>
<td>0.580</td>
<td>2.91</td>
<td>1.267</td>
</tr>
</tbody>
</table>

Numbers of 2000 (Hunton et al, 2004)

Table 9: Confidence levels (2000 & 2008)
Conclusions here are crystal-clear. Financial auditors have become much less confident in their own assessment of ERP environments (1 = very low confidence, 7 = very high confidence) even in simpler IT environments while IT audit specialists keep a relatively low confidence level in their financial colleagues. Although for the ERP settings, confidence increased a little compared to 2000, but for other environments the level decreased dramatically.

Overall, both auditor types still have different confidence levels, in the capability of financial audit teams to assess computer system risks in the two system environments, while the system type doesn’t really play a key role in this. IT audit specialists still are less confident in financial audit teams (without IT specialists) to assess computer system environments than the financial auditors themselves. Although, compared to the year 2000, financial and IT auditors have a different opinion today about the composition of an audit team. Many participants, IT and financial, had difficulty in the case accepting the idea of an audit team that exclusively consists of financial auditors. The cooperation of IT and financial people in an audit team is almost indelibly printed in their mind, which is a finding that is quite new. So far, I couldn’t find academic research that supports this statement, but for practitioners it seems to be as clear as the nose on their face. Probably this is a recent (new) phenomenon and maybe not general in all countries. There seems to be a gap between the research on one hand, the reality on the other hand and the changing opinions of practitioners in between.

4.8 Summary of the results

The evolution since 2000 and the comparison between ITA’s versus FA’s

4.8.1 For hypothesis 1: Risk assessment

H1: Holding all non-system business interruption and process interdependency risk factors constant, IT audit specialists (ITA) will assess significantly greater risk differentials between the non-ERP and ERP system than financial auditors (FA) in the following areas: (Hunton et al, 2004)

- ITA’s show lower risk assessments than in 2000 for almost every item in the ERP condition, and higher risks in the non-ERP condition. Logically, the risk differentials [ERP – nonERP] for ITA’s are shrinking.
- In the non-ERP condition, the FA’s risk assessments have dramatically increased. They are closing their own differential gap for ‘system type’ and at the same time they are moving towards the ITA’s assessment direction.
➢ Just like in 2000 in the US, ITA’s recognize control weaknesses (network, data and application security) in an ERP system more accurately than FA’s. However, FA’s ERP risk assessment has increased as much as the ITA’s assessment decreased, resulting in a nearly closed gap between auditor types in an ERP setting. This has probably been the most significant change since the year 2000 in the whole study.

4.8.2 For hypothesis 2: Perceived Need for Consultation

H2: When comparing the perceived need for consultation with IT audit specialists (ITA), differential assessments (ERP versus non-ERP) will be significantly higher for IT audit specialists (ITA) than for financial auditors (FA) (Hunton et al, 2001).

➢ Interestingly, differences between the ERP and non-ERP condition are decreasing for both auditor types. This means that both auditor types come closer to each other in their intuition for the need of IT consultation in almost every kind of environment, both complex and less complex. These results show a growing trend towards a standard collaboration between FA’s and ITA’s, and this is what the standards require.

4.8.3 For hypothesis 3: Confidence in financial audit team

H3: There will be no significant difference between the confidence level that financial auditors (FA) have in themselves versus the confidence level that IT audit specialists (ITA) have in the financial audit team regarding the assessment capability of risks in an ERP setting.

➢ FA’s have become remarkably less confident in their own assessment of ERP environments compared to 2000, and the same shift is shown in simpler IT environments.
➢ ITA’s keep a relatively low confidence level in FA’s. Although for the ERP setting, their confidence level in FA’s increased little compared to 2000, but for other environments, this confidence level decreased dramatically.
➢ Overall, the system type does no longer play a key role in the confidence level. ITA’s are still less confident in financial audit teams, exclusively comprised of financial auditors, to assess computer system environments rather than the FA’s themselves.
➢ Since 2000, FA’s and ITA’s opinion about the composition of an audit team has thoroughly changed. The cooperation of ITA’s and FA’s in one audit team is almost indelibly printed on their minds.
4.8.4 Demographic variables

An important aspect that arises from the demographic results is that FA's have generally little IT background while ITA's possess more overall external audit insights. However, FA's reached a high level of risk awareness in all kinds of IT environments.
5 Discussion, limitations and suggestions

5.1 Discussion

IT managers from Big-four companies indicated, through conversations\textsuperscript{10}, that the budget for IT consulting, as part of an external audit, might be restricted. If awareness is growing and external pressure pushes financial auditors towards safety, meaning that financial statements should be without important material mistakes, then the total budget for the external audit therefore might remain a constraint. The budget allocation ‘could’ be dependant on the conservatism of the responsible external auditors, who do not feel the need for an extensive IT consultation and prefer mainly to work with financial auditors in a team. There might be a correlation between the level of conservatism and the age and/or the position of financial auditors. From several remarks of IT managers\textsuperscript{11}, it has transpired that older external auditors might be less worried about IT-associated risks than the younger generation that grew up with it. However, this is just hypothetical. To be sure of the effect of age and/or position, a larger number of older auditors and senior managers and partners, with a minimum of 15 up to 30-35 years of auditing experience, should be examined. In this experiment there are too few to make any conclusion about this statement.

5.2 Limitations of the study

A first limitation of the analysis in the study is that the program SPSS cannot perform one particular statistical test for hypothesis one (risk differentials between IT auditors and financial auditors), so I was forced to describe this without a statistical result.

A second shortcoming is that part of the group that cooperated in the experiment participated in an only semi-controlled way because of organizational reasons. However, this has no significant effect on the global results (supra 4.1).

A third aspect is the point of view of O’Leary (2002) about the problem of HEO (heterogeneous expert opinion) in an auditing context. He claims that studies with financial auditors should happen within the same position levels (staff, senior, manager, and partner). But with strong arguments of Wright & Wright (2002b), all the participants in this study are seen as valid.

\textsuperscript{10} Conversations with IT managers of Big-four offices A, B and D, during multiple meetings and phone calls in february, march and april 2008.

\textsuperscript{11} Conversations with IT managers of Big-four offices A, B and D, during multiple meetings and phone calls in february, march and april 2008.
5.3 Suggestions for further investigation

Besides possible age- and/or position-effects or conservatism of certain external auditors on the use of IT consultation, also other aspects are interesting for further investigation. For instance, there is a hidden risk in restricted IT consultation budgets in an external audit project. What are the reasons for this?

The evolution of ERP systems on the matter of security, training of financial and IT auditors on risk assessment, the changes in auditing procedures in ERP environments of Big-four firms and the evolution of embedded audit modules are worthy to be investigated. What is also interesting to study deeper is whether the conclusions of this paper can be confirmed in other countries of the EU, US and Asia.

Finally, the current trends, in ERP product development these days, to diminish risks associated with a real-time environment, the implementation troubles and fraud risks are interesting fields to investigate.
6 General conclusions

Eight years ago and in an American context, the experimental conclusions of Hunton et al (2004) were mainly telling us that financial auditors (FA) were as good as indifferent towards business and audit risks associated with ERP or other computer system environments. They almost didn’t rely on IT audit specialists (ITA) at all to assist them. We can assume, although it has not been investigated at that time, that the Belgian situation was quite similar.

The risks associated with ERP systems have been extensively identified since the end of the nineties. ITA’s started examining this new area and they took training courses. In the meantime, also ERP providers and implementers learned from those risks. Since the last five years, ERP providers have been offering more embedded internal controls in the system packages and implementers have continuously been improving their implementation practice, meaning that they are managing risks in implementation in a more controlled way.

In this new context, the experimental two-by-two-between-subjects design, described in this paper, compared the assessment differences, in Belgium, of FA’s and ITA’s in an ERP versus non-ERP environment. Also the assessed risk differences between specialists have been evaluated. Ninety four financial and IT auditors of the Belgian Big-four firms participated in this experiment, which is a duplicate of the experiment done in the US in 2000 by Hunton, Wright & Wright.

Based on the results of both papers, 2000 and 2008, the following conclusions can be made.

From the results of this current study, it has transpired that ITA’s assess overall ERP-environment risks less extremely than in the year 2000. They have moderated their assessments a little and the reason for this might be¹² that they have become more familiar with the increased built-in internal controls, offered by ERP providers in their product packages. In the last five years they have learned to exploit these controls and this way they surpassed their fear of not controlling the risks.

On the other hand, ITA’s assess risks in non-ERP environments much higher than in 2000, or in other words, they don’t trust so-called low-risk environments any more. In the ITA’s minds, all computer environments (ERP and non-ERP) today hold high risks, and therefore, ITA’s nowadays always play it safe by considering high risks until the opposite is proven. And Big-four clients all rely on IT settings in their business.

¹² Conversations with IT manager of CPA firm A, B and D, spring 2008.
The two former conclusions result in a very small differential gap of ITA’s own risk assessments in different settings.

Furthermore, it is clear that FA’s, from their side, are now more aware of the computer-environment-related risks and that a striking contrast in the risk assessments of FA’s today compared to the year 2000, has appeared. Also FA’s assess an overall high level of risks and this almost disregarding the system type. It seems that the risk difference between ERP and non-ERP settings has become obsolete, or at least, neither ITA’s nor FA’s dare to make the difference. Again, the differential gap of the FA’s, this time, has also become minimal.

Overall, converging risk assessments between specialists, disregarding the status of the IT environment, have been observed. The overall gap in awareness of risks between ITA’s and FA’s has evolved from very large, in the year 2000, to very narrow today. This means that ITA’s and FA’s both are similarly aware of the occurring risks in highly computerized settings. However, a gap in knowledge between ITA’s and FA’s remains in the area of system security. Roughly speaking, FA’s fail to recognize those control weaknesses.

As a matter of fact, we can state that ITA’s have a little more confidence in financial audit teams, exclusively comprised of FA’s, than in 2000, although this level remains very low. But on the other hand, in non-ERP environments, their confidence level has crashed, probably because of the same reason mentioned before. Namely, both ITA’s and FA’s automatically start from high-risk consideration, certainly for Big-four clients, because manual environments have become very rare. Furthermore, FA’s are much more severe towards themselves and have low confidence levels in both system areas.

And finally, due to changed auditing standards, and consequently adjusted audit manuals in the Big-four companies, IT services now force themselves upon every external audit. The pressure from International Auditing Standards as well as SOX compliancy have forced Big-four companies to organize their external audits in such a way that every possible weakness in the audit statement, which could lead to major mistakes (like certain risks that go unidentified), would be eliminated. We can say that collaboration, between IT audit specialists and financial auditors in an external audit project, has become common in Big-four audit practices. This must result in a better understanding and acceptance of each other’s expertise, and therefore, this must contribute to an improved and more reliable financial audit statement. These findings are in line with the evolution of the auditing standards and that is a good sign. Consequently, financial auditors have become used to work with IT auditors as one team and therefore they systematically rely on their internal IT audit services, as they should do.
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- World Intellectual Property Organization (WIPO)
Appendix A

Manipulations for Nature of the Computer System (Hunton et al, 2004)

Non-ERP system:

The computerized accounting system used by Medical Solutions, Inc. includes general ledger, accounts receivable, accounts payable, joint venture accounting, cash management, payroll, fixed assets, and various cost/managerial accounting applications. The accounting system applications at Medical Solutions are integrated with each other, as are the computerized applications within each business process category. However, company information is not integrated across the company's business processes, as databases for each process are maintained separately. Thus, workflow procedures across business processes are, for the most part, performed manually. For example, when a customer places an order (face-to-face with a salesperson, over the telephone, or via the Internet) with Medical Solutions, the following events take place:

1) a sales person enters the customer order in the sales order system (SOS),
2) the salesperson notifies customer relationship management (CRM) of the order,
3) a CRM employee records the order in the CRM system,
4) the sales person notifies accounting of the order,
5) an accounting employee records the sale in the accounting system,
6) the sales person notifies the warehouse of the order,
7) a warehouse employee records the order in the warehouse management system (WMS),
8) the warehouse employee notifies packing & shipping of the order,
9) a shipping employee records the order in the packing & shipping system (PSS),
10) the shipping employee notifies procurement of the order,
11) a procurement employee records an order for replacement raw materials in the procurement management system (PMS),
12) the procurement employee notifies production of the need to replenish the sold goods, and
13) a production employee records a manufacturing order in the production planning system).
Appendix A (continued)

Manipulations for Nature of the Computer System (Hunton et al, 2004)

ERP System:

The computerized accounting system used by Medical Solutions, Inc. includes general ledger, accounts receivable, accounts payable, joint venture accounting, cash management, payroll, fixed assets, and various cost/managerial accounting applications. The accounting system applications at Medical Solutions are integrated with each other, as are the computerized applications within each business process category. Also, company information is integrated throughout the company’s business processes via an enterprise resource planning (ERP) system that is built on a relational database. Thus, workflow procedures across business processes are, for the most part, performed automatically. For example, when a customer places an order (face-to-face with a salesperson, over the telephone, or via the Internet) with Medical Solutions, the ERP automatically executes the following events:

1) a sales person enters the customer order in the sales order system (SOS),
2) the SOS notifies customer relationship management (CRM) of the order,
3) the SOS records the order in the CRM system,
4) the SOS notifies accounting of the order,
5) the SOS records the sale in the accounting system,
6) the SOS notifies the warehouse of the order,
7) the SOS records the order in the warehouse management system (WMS),
8) the WMS notifies packing & shipping of the order,
9) the WMS records the order in the packing & shipping system (PSS),
10) the PSS notifies procurement of the order,
11) the PSS records an order for replacement raw materials in the procurement management system (PMS),
12) the PMS notifies production of the need to replenish the sold goods, and
13) the PMS enters a manufacturing order in the production planning system (PSS).
## Business Process Map of Medical Solutions, Inc.

(Hunton et al., 2004)

<table>
<thead>
<tr>
<th>Business Process Categories</th>
<th>Business Processes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer Relationship Management</td>
<td>Prospecting, Selling, Servicing, Retaining</td>
</tr>
<tr>
<td>Research &amp; Development</td>
<td>Drug Discovery, Preclinical &amp; Clinical Trials, Regulatory Approval, R &amp; D Administration</td>
</tr>
<tr>
<td>Technical Service</td>
<td>Applied R&amp;D, Quality Management, Operational Analysis, Regulatory Compliance, Product Launch</td>
</tr>
<tr>
<td>Plant Engineering</td>
<td>Facilities Management, Maintenance Planning, Maintenance Execution, Regulatory Compliance</td>
</tr>
<tr>
<td>Sales &amp; Services Execution</td>
<td>Sales Force Automation, Order Management, Technical Service, Internet Sales &amp; Service, Customer Service</td>
</tr>
<tr>
<td>Operations</td>
<td>Production Planning, Regulated Manufacturing, Quality Management, Procurement, Process Control</td>
</tr>
<tr>
<td>Distribution</td>
<td>Logistics Planning, Transportation Execution, Regulatory Compliance, Storage &amp; Warehouse Management, Packaging &amp; Shipping</td>
</tr>
<tr>
<td>Business Support</td>
<td>Accounting, Environmental Health &amp; Safety, Procurement, Human Resource Management, Finance</td>
</tr>
</tbody>
</table>
Appendix C

Seeded control weakness (Hunton et al, 2004)

Medical Solutions has a client-server computer network, with access to the Internet. A network manager handles computer security throughout the company. The network manager started out with the company 15 years ago. Over the years, he built an outstanding reputation throughout the company as a computer hardware specialist. He was promoted to network manager three years ago. His technical knowledge of Medical Solutions’ computer hardware and communication systems is excellent. While most of his day is consumed with handling technical network issues, the network manager is also responsible for the issuance of passwords throughout the entire company. The passwords given to each employee provide access to the company’s client-server network and the Internet, as well as to authorized software applications (such as order entry, accounts receivable, accounts payable, etc.). When new employees are hired, the network manager initially establishes their network and application password privileges, and then he shows them how to create their own unique passwords. Employees are allowed to change their passwords (but not their privileges) anytime they desire while employed at Medical Solutions, Inc. Only the network manager can make changes to user privileges, and he only makes such changes when authorized by the users’ departmental supervisor.
Appendix D

Purpose of the experiment you participated in:

Before participation you had little or no information about my experiment. The reason was to exclude any form of influence. But here it is:

The first objective of the study is to examine the extent to which financial auditors recognize heightened risks associated with an ERP system as compared to a non-ERP system, in the presence of a control seeded weakness over access privileges.

The second objective is to assess the propensity of financial auditors to consult with IT audit specialists within their firm when assessing ERP and non-ERP system risks in the planning stage of the audit.

The study takes place in the Big-four audit firms in Belgium and two other international audit firms. In total about 100 financial auditors or IT-auditors will have participated.

In the study we manipulate system type (ERP versus non-ERP: 2 versions of the case) and measure auditor type (financial and IT).

The results of this study will be sent to your responsible manager in June.

Thanks again for your participation!
Appendix E

Wording of Dependent Variable Items of Hypothesis 1: (Hunton et al, 2004)

Business Interruption Risk

How concerned are you about material, negative financial consequences of business interruptions that could occur at Medical Solutions due to computer systems problems? (1 = Very Unconcerned, 7 = Very Concerned)

How concerned are you that Medical Solutions could experience a major business interruption due to computer systems problems? (1 = Very Unconcerned, 7 = Very Concerned)

Process Interdependency Risk

How concerned are you that a problem in one business process (e.g., an improperly input customer sales order) will lead to problems in other processes? (1 = Very Unconcerned, 7 = Very Concerned)

I believe there are sufficient controls to prevent a problem in one business process from affecting other processes? (1 = Totally Disagree, 7 = Totally Agree)

Network Security Risk

How concerned are you that outside intruders (hackers) can get into Medical Solution’s computer network and perform illegal activities, such as stealing company information or planting computer viruses? (1 = Very Unconcerned, 7 = Very Concerned)

How concerned are you that Medical Solution’s employees can get into the computer network and perform illegal activities, such as stealing company information or planting computer viruses? (1 = Very Unconcerned, 7 = Very Concerned)

I believe that the current situation of having a network security manager provides a secure firm-wide network environment. (1 = Totally Disagree, 7 = Totally Agree)
Database Security Risk

How concerned are you that outside intruders can gain unauthorized access to highly proprietary computerized information at Medical Solutions, Inc.? (1 = Very Unconcerned, 7 = Very Concerned)

How concerned are you that employees can gain unauthorized access to highly proprietary computerized information at Medical Solutions, Inc.? (1 = Very Unconcerned, 7 = Very Concerned)

I believe that the current situation of having a network security manager provides a secure firm-wide information environment. (1 = Totally Disagree, 7 = Totally Agree)

Application Security Risk

How concerned are you that employees can legitimately gain entry into software applications and then be able to view unauthorized information at Medical Solution's? (1 = Very Unconcerned, 7 = Very Concerned)

I am satisfied with the way in which application passwords are issued and controlled at Medical Solutions. (1 = Totally Disagree, 7 = Totally Agree)

Control Risk

CONTROL RISK is defined as the risk that the client’s controls will fail to prevent or detect material misstatements (SAS 55 & 78). Provide an assessment of the CONTROL RISK associated with the accounting system applications of Medical Solutions by circling the appropriate number on the scale below: (1 = Low Risk, 7 = High Risk)
Appendix F

Wording of Consultation and Confidence Items of Hypothesis 2 (and 3): (Hunton et al, 2004)

Perceived Need for Consultation

The engagement partner also wants your opinion with respect to the necessity of conferring with the practice within your CPA firm that specializes in security and control risks associated with computerized systems. Given the need for efficient audits, such specialists are not consulted on every engagement, but rather when the engagement team believes the audit program may not reduce audit risk to a tolerable level. Please provide your assessment of the necessity to consult with your CPA firm’s computer specialists before finalizing the audit plan for Medical Solutions by circling the appropriate number below. (1 = Absolutely Unnecessary, 7 = Absolutely Necessary)

Confidence in Financial Auditor’s Risk Assessment Ability

I believe that members of the financial audit team are qualified to assess the internal controls over Medical Solution’s computer network security. (1 = Totally Disagree, 7 = Totally Agree)

I believe that members of the financial audit team are qualified to assess the internal controls over Medical Solution’s data files. (1 = Totally Disagree, 7 = Totally Agree)

I believe that members of the financial audit team are qualified to assess the internal controls over Medical Solution’s computerized application security. (1 = Totally Disagree, 7 = Totally Agree)

Assume that the engagement partner wants your opinion concerning the ability of the financial audit team to properly consider the firm’s exposure in addressing the risks that may be present with the computerized applications at Medical Solutions. On the scale below, please circle your level of confidence that the financial audit team is capable of assessing the audit risks associated with the computer systems used at Medical Solutions. (1 = Very Low Confidence, 7 = Very High Confidence)