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KRiskSM: A Computerized Decision Aid for Client Acceptance and Continuance Risk Assessments

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SUMMARY

This paper describes the development and implementation of KRisk, an innovative technology-enabled auditor decision aid for making client acceptance and continuance risk assessments. KRisk, developed and designed by KPMG LLP, is part of the firm's audit quality control and risk management processes. In this paper, we discuss the environmental and technological forces that affect auditor business risk management. We also describe important aspects of the development, functionality, and implementation of KRisk. We discuss possible impediments to realizing the full potential of decision aids that have been reported in prior auditing research, and describe how KRisk and related audit quality control procedures implemented at KPMG were designed to overcome such impediments. Also, we present some ideas for scholarly research dealing with auditor business risk management issues, and issues related to the design and use of decision aids in general.

Keywords: auditor business risk; client acceptance; client continuance; risk management.

INTRODUCTION

This paper reports on an innovative client acceptance and continuance decision aid known as KRisk that was recently developed by the risk management unit at KPMG LLP (hereafter KPMG). KPMG developed this decision aid in response to changes in the audit environment and the existence of industry guidance emphasizing client acceptance and continuance decisions as key phases in audit quality control.

In response to changes occurring in the auditing industry such as increasing competition, litigation, and complexity in client business activities, audit firms' objectives in today's environment include effective control of auditor business risk¹ as well as audit risk. Authoritative guidance also

¹ Auditor business risk is the risk that the audit firm will suffer a loss resulting from the engagement, via litigation, loss of reputation, or engagement costs exceeding fees (AICPA 1983, AU 312.02). Increases in audit risk (the risk of failing to modify the audit opinion on materially misstated financial statements) and client business risk (the risk that the client's economic condition will deteriorate) increase auditor business risk (Johnstone 2000).

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recognizes the relationship between both types of risk.² For example, the Auditing Standards Board (ASB) has promulgated guidance for establishing and maintaining effective audit quality control through client acceptance and continuance policies and processes (ASB 1997, QC 20.14–20.16). Additionally, the Public Oversight Board (POB) stresses the importance of effective auditor business risk assessment in client acceptance and continuance decisions and the possible effects of such assessments on the nature, timing, and extent of audit testing.³ For example, the POB recommends that “audit firms consider adopting sophisticated, computerized systems for identifying engagement risk that involve both quantitative and qualitative factors, including a search for potentially derogatory or other information about the entity and its principal owners and officers, and integrating those systems into their audits” (POB 2000, paragraph 2.39, pp. 17–18).

In response to these changes in the audit environment and professional guidance, audit firms continue to improve their processes for quality control in all phases of audit engagements, including risk management in client acceptance and continuance decisions. Recent technological advances and the growth of the Internet are facilitating the continuous improvement of these processes (e.g., Manson et al. 2001). New technologies provide opportunities for collecting and sharing information on a cost-effective basis that enables audit professionals to closely monitor client, industry, and market data. For example, digitized processes reduce the cost of collecting and analyzing data, thereby facilitating validation and refinement of risk assessment and audit quality control processes. In addition, computer portability, increased storage capacity, wired or wireless networks, and increased computer and database literacy on the part of audit professionals allow data collection at and from remote sites and the transfer of these data (and risk assessments made using such data) to central repositories for review and analyses.

Continued improvements in risk management strategies and processes are the logical result of changes in the audit environment, authoritative guidance, and information technology (Levitt 1999, 2000; POB 2000; Winograd et al. 2000). As they learn from past risk management experiences, and as new information technologies provide opportunities for cost-effective data collection and knowledge sharing, audit firms can now more quickly adapt their risk management strategies and processes to improve decision-making regarding their client portfolio choices.⁴ Effective portfolio risk management in today’s dynamic and complex business environment is critical to audit firms’ long-term financial success and to the public interest at large (e.g., Simunic and Stein 1990). KRisk was designed by KPMG to assist partners in assessing and managing client acceptance and continuance risks and enabling firm-wide analysis of auditor business risk for its portfolio of audit clients.

² Readers interested in learning more about prior research that describes how audit firms address their business risk can examine the following papers. For papers investigating the impact of litigation risk on audit pricing, see: Johnstone and Bedard (2001), Bell et al. (2001), Menon and Williams (1994), Pratt and Stice (1994), St. Pierre and Anderson (1984), Simunic and Stein (1996), and Stice (1991). For papers investigating the impact of competition on audit pricing, see: Johnstone et al. (2002), Elitzur and Falk (1996), Ettredge and Greenberg (1990), Garsombke and Armitage (1993), Johnson and Lys (1990), and Maher et al. (1992). For papers investigating the effect of competition and litigation on client acceptance and continuance decisions specifically, see: Bockus and Giger (1998), Huss and Jacobs (1991), Johnstone (2000), Johnstone and Bedard (2002), Krishnan and Krishnan (1997), and Raghunandan and Rama (1999).

³ *The Panel on Audit Effectiveness Report and Recommendations* (POB 2000, paragraph 2.34, pp. 16–17) states “The process ordinarily is designed to enable the engagement team to identify and consider the risks associated with the overall engagement—such as the risk that the entity will fail, the risk that the entity’s management lacks integrity, the risks inherent in the entity’s industry, and the capabilities and track record of senior management—and then to use the resulting information to make an engagement risk assessment. The risks, individually and in the aggregate (or absence of risks), also should affect the inherent, control and fraud risk assessment...and in turn the nature, timing and extent of the auditor’s tests.”

⁴ Risk management strategies facilitate quality control within audit firms, and include: personnel management policies (e.g., hiring, assignment, professional development, promotion policies), acceptance and continuance policies, engagement performance (e.g., tools to facilitate planning, performing, supervising, reviewing, documenting, and communicating results), and monitoring policies (e.g., internal peer review) (see Robertson and Louwers 1999.)

In order to improve audit practice and education, and support research dealing with the auditor business risk assessment and management processes, it is important that audit firms, policy setters, regulators, and scholars share knowledge on best practices using a collaborative approach.⁵ In this spirit, this paper provides a “best-practice” example of a comprehensive auditor business risk assessment process and an innovative technology-enabled decision aid and risk management tool. It is our hope that the paper will stimulate ideas for future research on this topic. We also believe the description of KRisk can serve as a valuable teaching aid, illustrating auditor business risk management.

DEVELOPMENT, FUNCTIONALITY, AND IMPLEMENTATION OF KRISK

KRisk Development

Effective assessment of auditor business risk requires knowledge acquisition for two dimensions of the audit engagement: (1) unique features of the client and its industry, e.g., its business environment, financial condition, management characteristics, and control environment, and (2) the expected profitability of the engagement, which considers both the cost of the collective set of procedures required to reduce audit risk to an acceptably low level, and additional costs associated with residual auditor business risk, e.g., litigation and reputation costs.

In today’s competitive audit services market, auditors face downward pressures on audit fees. Therefore, the long-run profitability of a given audit firm depends, among other things, on the firm’s ability to recover total audit costs, including costs associated with auditor business risk. Auditors manage business risks by first making a joint assessment of the unique features of the client and the expected total cost of the audit in light of these features. Following risk assessment and initial audit cost estimation, auditors manage business risk by (1) *risk avoidance*—declining to accept high-risk clients; (2) *risk elimination*—deciding not to retain clients where risk is judged to be unacceptably high; (3) *risk reduction*—mitigating risk by changing the nature, timing, and extent of audit procedures, or by transferring risk, e.g., insurance; or (4) *risk acceptance*—accepting residual portfolio risk commensurate with expected return, and accompanying portfolio risk management (Johnstone and Bedard 2002).

In 1999, KPMG formed a team to develop a new decision aid to help audit professionals obtain the knowledge required to make informed choices about which of the aforementioned risk management techniques are most appropriate for various audit clients. The team contained 12 people, including: (1) KPMG professionals involved in client acceptance/continuance decisions in the firm’s Department of Professional Practice (DPP);⁶ (2) accounting experts from the firm’s DPP; (3) a high-level peer-review partner and a consultant from another firm who had helped that firm design its risk management system, and (4) an outside mathematical consultant. Next, we describe the roles of the team members.

The team began its work by establishing the following objectives for the KRisk system: (1) improve past client acceptance and continuance decision-making processes; (2) automate the associated data collection, risk assessment, and approval processes; (3) calculate a weighted risk score for each assessed client; and (4) provide a database for portfolio risk management activities at the local

⁵ *The Panel on Audit Effectiveness Report and Recommendations* (POB 2000, footnote 10, p. 18), states “the Panel recommends that the AICPA develop, or promote the development of, a technology-driven tool that small firms can use to enhance the effectiveness of their client acceptance and continuance processes.” See also Gramling et al. (2001). Smaller firms may be able to purchase such tools from larger firms or develop their own tools with consultation from other firms and knowledge gained from the literature.

⁶ Some of these professionals were former Business Unit Professional Practice Partners within KPMG. Professional practice partners’ responsibilities include the following: (1) serve as key consultants on professional practice matters, (2) identify changing risk characteristics and communicate with risk management partners, (3) approve engagement assignments, (4) assign concurring and second partners, (5) coordinate professional practice (QPRP and IQR In-Flight Quality Review) and peer reviews, (6) approve prospective clients, and (7) lead annual client reevaluations.

office, regional, and firm-wide levels. Therefore, KRisk is helpful to the firm in terms of assisting with risk avoidance and risk elimination strategies. KRisk is also helpful to the firm's acceptance and conscious management of portfolio risk. For example, the information collected within KRisk may assist the firm in comparing various sub-portfolios of its clients: comparing newly accepted vs. continuing vs. newly rejected clients, comparing higher vs. lower risk clients, comparing clients in various industries, comparing clients in various geographic regions or individual offices, or comparing the portfolios of individual partners. Finally, the system informs the firm's risk reduction efforts because it ensures uniform collection and aggregation of risk information across all clients in the firm, which is expected to assist the firm in making consistent choices about subsequent audit planning actions in response to those risks.

The KRisk development team applied an iterative knowledge-acquisition process involving data mining from existing workpapers, interviews, statistical modeling, model testing, adjustment, and more testing. Specifically, the team began by gathering a large set of possibly relevant risk factors based on prior practice aids, literature searches, recent experiences, and knowledge possessed by members of the team. Also, the development team identified a sample of 80 client acceptance and continuance cases where the decision to accept or retain the client was deemed to be of high quality. This sample represents clients for which assessed auditor business risks spanned the entire range of risk from very low to very high. The development team interviewed the engagement teams for each of the 80 cases to obtain an understanding of which factors most influenced their risk assessments, and to evaluate how their final assessments were formed.

Using these collective inputs, development team members selected risk factors they deemed relevant in today's business environment and also developed new risk factors for inclusion in KRisk. Deliberations among team members during this collaborative phase of the development process focused on discussing why these factors were important for today's business environment and determining the relative importance of each factor.

Next, a roundtable session was convened to acquire the knowledge needed to develop initial weights for the proposed set of risk factors. KPMG personnel from the development team attended the session that was led by the outside mathematical consultant. The objective was to provide the mathematical consultant with the knowledge required to assign factor weights that would yield a good *screening* model, rather than focusing on developing a *predictive* model (i.e., a model that predicts whether a client will or will not be accepted/retained). During the session, the development team classified the risk factors into meaningful risk categories (see Table 1 for categories) and made judgments about the relative importance of risk categories and individual risk factors within the categories.

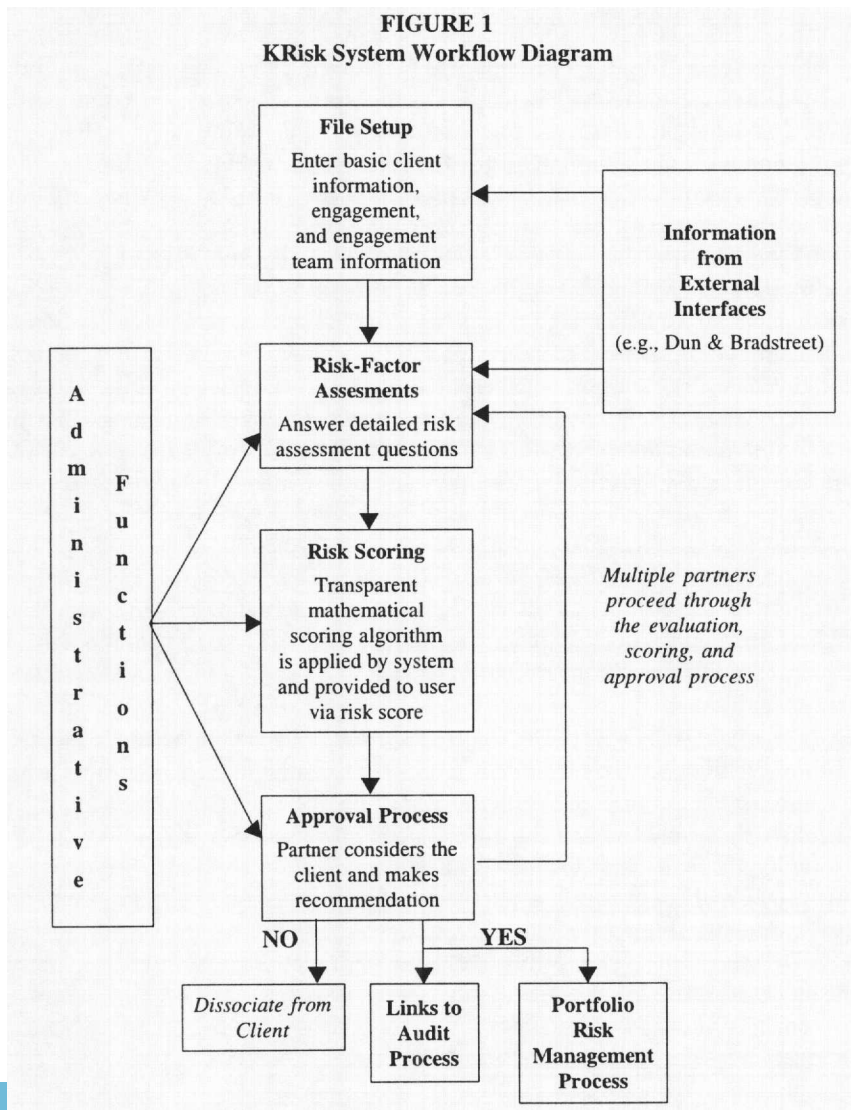
Using the information obtained from the 80 sample cases and related interviews, together with the knowledge acquired during the roundtable session, the mathematical consultant created an initial algorithm that best fit the data in terms of (1) actual risk assessments made by auditors, and (2) whether a client was accepted or retained. Initial factor weights were assigned judgmentally by the mathematical consultant, with the primary decision criterion being the identification of those risk profiles that would warrant further analysis and potential intervention by higher-level partners.

Next, engagement team personnel for the 80 sampled client acceptance and continuance cases performed "field tests" using the algorithm. With involvement by the mathematical consultant and oversight from the development team, engagement team members examined the effects of the individual risk factors and associated weights and compared outputs of the algorithm to their own assessments. After several iterations and model refinements, the development team and the mathematical consultant agreed on the first official version of the KRisk system. The final model represented the consensus views of the panel of KPMG experts comprising the KRisk development team and the 80 engagement teams involved in field tests of the model. It is expected that modifications to the set of risk factors and weights will be made on an ongoing basis as experience is gained using the model, and as actual outcomes of the client relationships are evaluated.

The full set of risk factors contained in the KRisk system includes both data from external sources (e.g., public company status, Dun & Bradstreet ratings) and judgments by firm personnel (e.g., relative independence of the audit committee, supply chain risks, and business model viability). Although the KRisk algorithm is proprietary intellectual property owned by KPMG, further information about system functionality, individual risk factors, and the risk-scoring algorithm is presented in the sections that follow.

KRisk Functionality

Figure 1 provides an overview of the workflow for the KRisk system. The process begins when an engagement partner sets up the client information file. Engagement team members then collaborate to assess the presence or absence of risk factors. A detailed explanation of the tasks involved when making the risk assessments follows.



File Setup

The client file includes basic descriptive information such as the client's name and location, industry, business description, and information about key management personnel. An interface with Dun & Bradstreet (D&B) enables access to financial data that is extracted from D&B and electronically loaded into the file when available. A completed file also contains engagement information, including the nature of all services that the firm will provide to the client, engagement timing, fee information, and planned engagement team members' names and their roles and responsibilities during the engagement. Email addresses are included to facilitate interfaces during the review process.

Risk-Factor Assessments

The electronic risk assessment questionnaire asks leaders of the engagement team to assess the presence or absence of a comprehensive set of risk factors, across a broad range of categories. Questions request a variety of responses including "yes/no" responses, category selection (i.e., low to high risk), and commentary from the engagement team. The system is "smart" in that new risk factors are displayed based on users' responses to previous questions. For example, if the client is publicly traded, then questions relating to that status appear (e.g., stock price performance), whereas those questions do not appear for privately held companies. This feature of the system helps personnel save time by removing questions not relevant to the engagement under evaluation.

Table 1 presents examples of risk factors in abbreviated form for the client continuance risk assessment. The first category of risk factors (Entity Information) includes client entity characteristics that can affect auditor business risk (e.g., see Bonner et al. 1998; Latham and Linville 1998; St. Pierre and Anderson 1984). Some of the risk factors relate to the SEC's recent concerns over earnings management by publicly traded clients (e.g., analyst comments and expectations, history of the client in meeting/failing to meet market expectations, and high price/earnings multiples). Other risk factors in this category focus on whether the client has had difficulty in its relationships with prior auditors or regulators (e.g., auditor changes, auditor disagreements, and SEC enforcement actions). Risk factors pertaining to high-risk client business models are also included in this category (e.g., e-commerce business models, initial public offerings, Internet gaming, and managed-care companies).

The second category of risk factors (Engagement Information—Independence/Relationship Issues) focuses on regulatory oversight of audit firms and the potential for political exposure if regulators' (e.g., SEC, Independence Standards Board) requirements are not met. These factors highlight the link between auditor reputation and auditor business risk.⁷ In addition, this portion of the KRisk system directs firm personnel to complete KPMG's auditor independence quality control procedures.

The third category of risk factors (Third Party Information/Due Diligence) focuses primarily on the quality of the relationship with the client. For a continuing client, a poor prior auditor-client relationship can constrain the auditor's ability to assess the risk of material misstatement and obtain sufficient and competent audit evidence. Also, a poor relationship will raise concerns about the likelihood of future problems with the client, including litigation and impaired auditor reputation (see Carcello et al. 1992). For prospective clients, risk factors in this category pertain to information from third parties and due diligence inquiries (e.g., felonies committed by management). Also, this portion of the KRisk system directs firm personnel to complete requirements for communication with the predecessor auditor.

⁷ See Johnstone, Sutton, and Warfield (2001) for a framework and literature review on these types of risk factors.

TABLE 1
Examples of KRisk Client Continuance Risk Factors

Stock price factors:	Earnings management factors:	SEC factors:	I. Entity Information	General entity factors:	Relationship with prior auditors:
<ul style="list-style-type: none"> Recent significant stock price fluctuations Company has unusually high price/earnings multiple for its industry 	<ul style="list-style-type: none"> Company has history of exactly meeting estimates Analysts expect high earnings growth Consensus earnings or other estimates not achieved 	<ul style="list-style-type: none"> Intention to sell securities over the Internet Securities are registered in a foreign jurisdiction SEC enforcement actions brought against entity within the last 5 years Entity's 1934 Act filings have comments by the SEC or other regulatory agency 	<ul style="list-style-type: none"> Public company status Single operating segment Will merge into public shell Will register IPO Business model viability is questionable Is a managed-care company 	<ul style="list-style-type: none"> Form 8-K reports a change in auditor during past two years Filings report disagreements with auditors or other reportable events 	
II. Engagement Information — Independence/Relationship Issues/Other					
<u>Independence/relationship factors:</u>					
<ul style="list-style-type: none"> Auditor has family relationship or business activity with client Auditor performs consulting or other non-audit work Existing alliances, affiliations, or other relationships with client Auditor has not reviewed restricted entity list Client decision-makers (e.g., board of directors, officers) were former partners in auditing firm 					
<u>Other factors:</u>					
<ul style="list-style-type: none"> Auditor agrees to report on consolidated financial statements when auditing less than 50 percent of consolidated assets or gross revenue Auditor expected to report on MD&A 					
III. Third-Party Information/Due Diligence					
<u>Third party factors:</u>					
<ul style="list-style-type: none"> Client has problems, or changed relationship within past two years, with: <ul style="list-style-type: none"> Law firm Commercial bank Other principal advisor 					
<u>Predecessor auditor factors:</u>					
<ul style="list-style-type: none"> Predecessor auditor, principal contact, and/or length of association is unknown Reason for change in auditors unknown Predecessor auditor refused to continue to provide services to the entity, or to reissue its reports in the event of a public offering No discussions with predecessor auditor 					
<u>Due diligence factors:</u>					
<ul style="list-style-type: none"> Individuals are in positions to significantly influence the financial results (e.g., Chairman of the Board, CEO, CFO, major shareholders or partners) Negative factors or felonies surfaced during due diligence work Web site reveals information that is inconsistent with other facts gathered by the auditor 					
<u>Bond rating factor:</u>					
<ul style="list-style-type: none"> Poor rating 					
IV. Quantitative Information					
<u>Market capitalization factors:</u>					
<ul style="list-style-type: none"> Entity is over or under capitalized Price/earnings ratio unrealistic 					
<u>Financial statement factors:</u>					
<ul style="list-style-type: none"> Line items not consistent with expectations, industry data, transaction analysis, other tests Significant change in revenue/income Cash flow, working capital ratio, debt to equity ratio reveal viability problems 					
<u>Depository institution factors:</u>					
<ul style="list-style-type: none"> Poor total capital ratio, total risk-based capital ratio, tier 1 capital ratio, and/or leverage ratio 					

(Continued on next page)



TABLE 1 (Continued)

V. Qualitative Information

<p>Macro-economic & industry factors:</p> <ul style="list-style-type: none"> • Industry is mature and on decline • Non-traditional competitors • Early-stage products • Minimal barriers to entry • Lacks ability to control costs with the major risk of unforeseen costs • Low profit margins • Products or services that have multiple substitutes 	<p>Competitive factors:</p> <ul style="list-style-type: none"> • Concentration of the industry's customers/ users/ supplier/vendors • Threat of entry of alternative products, services, competitors, or providers • Significant supply chain risks • Workforce/union-dependency risks • Low switching costs for customers, clients, or patients • Significant complexity of production and delivery processes 	<p>Regulatory factors:</p> <ul style="list-style-type: none"> • Regulatory environment presents business risks • Entity presently under a regulatory or other supervisory order
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VI. Entity's Organization/Operations

<p>Organizational structure factors:</p> <ul style="list-style-type: none"> • Entity's organizational structure or operational risk is not appropriate for its size and activities • Entity controlled by another entity or individuals located in a country where business ethics are questionable • Entity has operations that have evidenced significant ethical shortfalls • Lack sufficient numbers of people with the requisite skills to achieve organizational objectives • Actual or pending inquiries, investigations, or actions by a regulatory agency that impedes operations 	<p>Internal control factors:</p> <ul style="list-style-type: none"> • Poor controls in specific countries/ locations • Difficult to determine or gain access to the organization or individuals who own and/or control the entity • Little interaction between senior management and operating staff • Geographically removed locations • Management's incentive compensation is tied to entity's performance • Entity has no D&O liability insurance • Untimely reporting 	<p>Management factors:</p> <ul style="list-style-type: none"> • Management personally guarantees debts of the entity • Overly autocratic • Recently resigned under suspicion • Propensity to fire or sue professional advisors • Legal actions against management or entity • Undue influence over audit, audit committee, or board of directors • Inaccurate estimates made by management • Aggressive accounting • Incentive to minimize tax exposure
<p>Management competence factors:</p> <ul style="list-style-type: none"> • Inappropriate knowledge for responsibilities • Inappropriate authority • Poor past performance • Experience/skill mix is low • No depth/succession planning 	<p>Board of Directors factors:</p> <ul style="list-style-type: none"> • No governing body • Unusual resignations • Independence issues • BOD does not interact with CFO • Infrequent meetings • BOD not updated on entity's operations/ agreements/ sensitive issues 	<p>Internal audit factors:</p> <ul style="list-style-type: none"> • No internal audit function/respect for function • Professional standards not followed • No audit mission statement from audit committee/management • Access restrictions to records/scope of activities • Cannot establish effective controls—complex business structure not grasped by inadequate staff • Weak controls identified by external auditor/agency
<p>Management competence factors:</p> <ul style="list-style-type: none"> • Inappropriate knowledge for responsibilities • Inappropriate authority • Poor past performance • Experience/skill mix is low • No depth/succession planning 	<p>Other control environment factors:</p> <ul style="list-style-type: none"> • No business plan or knowledge of business plan • No code of conduct • Disregard for regulations/no prevention for illegal acts • Controls not considered important • No backup control by CFO • Ineffective budget process • Audit knowledge of management used to impair audits • Inadequate accounting staff • Inadequate IS • Growth exceeds infrastructure 	<p>Internal audit factors:</p> <ul style="list-style-type: none"> • No internal audit function/respect for function • Professional standards not followed • No audit mission statement from audit committee/management • Access restrictions to records/scope of activities • Cannot establish effective controls—complex business structure not grasped by inadequate staff • Weak controls identified by external auditor/agency

(Continued on next page)

TABLE 1 (Continued)

VII. Entity's Financial Reporting & Recent Audit Results

<u>Prior/current audit factors:</u>	<u>Prior audit report factors:</u>	<u>Transaction factors:</u>	<u>Other factors:</u>
<ul style="list-style-type: none"> • Inaccurate estimates • Inappropriate policies • Significant findings • Restated financial statements • Intentional errors • Manipulation • Anticipated difficulty in obtaining audit evidence • Indication of aggressive and creative accounting practices • Inadequate disclosures • Assets, liabilities, revenues, or expenses based on significant estimates that involve unusually subjective judgments or uncertainties 	<ul style="list-style-type: none"> • Prior audit report contains, or it is thought that the current report may contain: <ul style="list-style-type: none"> • Explanatory paragraph regarding "going concern" • Disclosure regarding "enterprise-threatening litigation" • Disclosure regarding "significant violation of laws and regulations" • Adverse opinion • Disclaimer of opinion 	<ul style="list-style-type: none"> • Unusual transactions with outsiders or significant related party transactions • Entity engages in transactions for which most or all of the revenue or expense is recognized at inception of the transaction • Large year-end transactions • Entity engages in significant transactions involving derivative financial instruments or other highly complex and difficult to understand transactions • Restructuring charges • Revenue recognition involving up-front fees or multi-element arrangements • Purchase business combinations in which a significant portion of the purchase price was allocated to in-process research and development costs • Significant asset impairment charges or issues • Bill-and-hold transactions 	<ul style="list-style-type: none"> • Earnings management • Solvency problems • Debt covenant non-compliance • Negative cash flow • Insufficient cash • Investors and lenders are no longer fund sources

The fourth and fifth categories of risk factors (Quantitative and Qualitative Information, respectively) focus primarily on information that is relevant to the auditor's assessment of client business risk.⁸ The Quantitative Information category includes risk factors that pertain to client financial information and financial condition, including financial statement line items that are not consistent with auditor expectations, unrealistically high market capitalization and price/earnings ratios, poor bond ratings, and weak capital ratios for financial institutions. The Qualitative Information category includes risk factors that pertain to client operating characteristics (e.g., industry life cycle issues, industry sensitivity to broader economic cycles, barriers to entry by competitors, the entity's cost structure relative to its industry, factors that impede the entity's ability to control costs, risks associated with relationships with customers, users, suppliers and vendors, degree of complexity of production and service delivery processes, and regulatory risks).

The sixth category of risk factors (Entity's Organization/Operations) focuses on the client's control environment. A weak internal control environment can increase the likelihood of occurrence of undetected material errors and can present opportunities for fraud or defalcation, both of which can increase the likelihood of litigation against the auditor. In addition, weak client controls can increase the cost of the audit, which will reduce the profitability of the engagement if the increased cost cannot be passed on to the client. Risk factors included in this category focus on extent of geographical dispersion of client operations, existence and terms of management incentive compensation plans, level of management and employee competence, and specific control environment factors (e.g., quality of the control environment, internal audit operations, and corporate governance).

The seventh category (Financial Reporting and Recent Audit Results) includes risk factors pertaining to the client's financial accounting and reporting and prior audit results. Risk factors in this category focus on difficult-to-audit transactions and accounting estimates, transactions currently under regulatory scrutiny, existence and nature of significant year-end transactions, and problematic past audit results (e.g., financial statement restatements, errors, interpretive accounting policies, and audit reports other than the standard unmodified opinion) (e.g., see Hackenbrack and Knechel 1997; Mock and Wright 1993).

Risk Scoring

After the engagement team completes the electronic risk-factor questionnaire, KRisk automatically applies mathematical risk-scoring algorithms to calculate risk scores for subsets of risk factors, and for an overall auditor business risk assessment. The algorithm is not visible to engagement team members (i.e., engagement partners are not told which individual questions, or which combinations of questions, are more/less important in the algorithm). During this process, KRisk weights more heavily those factors associated with litigation risk and those that indicate that a client is inconsistent with KPMG's overall client portfolio goals. Particularly "critical" risk factors automatically generate a higher risk assessment. For example, clients for which bankruptcy is imminent, and those for which an accounting disagreement with the prior auditor has been reported, are assigned a higher risk assessment even when the absence of other risk factors indicates a low risk profile.

The KRisk algorithm is complex and involves the cascaded application of different weighting schemes for (1) individual questions, (2) subsections comprising specified groups of individual questions, (3) sections comprising subsections, and (4) overall scores for the following four "top-level" dimensions of auditor business risk: (i) a qualitative risk assessment, (ii) a control risk assessment,

⁸ As discussed above (see footnote 1), auditor business risk is heightened with increases in client business risk—the risk that the client's economic condition will deteriorate. Heightened client business risk can bring pressures to bear on managers to engage in fraudulent financial reporting, and often is associated with precipitous declines in stock price that can prompt capital suppliers to initiate litigation against both clients and auditors (e.g., Carcello and Palmrose 1994; St. Pierre and Anderson 1984; Palmrose 1987).

(iii) a financial risk assessment, and (iv) an overall risk assessment. The more heavily weighted subsections contain risk factors dealing with management competency and integrity, the entity's organization and operations, internal control weaknesses, corporate governance, and public-company financial-reporting issues. Less heavily weighted subsections contain qualitative risk factors dealing with the industry and entity, certain factors dealing with internal audit, and private-company accounting and reporting issues. Raw scores for the four dimensions of auditor business risk (i) through (iv) listed above are mapped into categorical scores ranging from 1 to 5, which is the ultimate output of the system.⁹

As discussed above, KRisk automatically overrides calculated raw risk scores for overall auditor business risk when "critical" risk factors are present. If the engagement has no "critical" risk factors, then the overall categorical risk assessment is unchanged. If the engagement has one "critical" risk factor, then the overall categorical risk assessment is increased by one level (e.g., from 3 to 4). If the engagement has two or more "critical" risk factors, then the overall categorical risk assessment is set to the maximum (i.e., 5). KRisk allows the engagement team to increase (i.e., override) the categorical risk assessment if it seems inappropriately low, but as a control, the system does not allow the engagement team to decrease the categorical risk assessment if it seems inappropriately high. This control is in place to encourage consideration of all potential engagement costs. Once all judgments about the presence or absence of the risk factors have been entered into the system, and final categorical risk assessments have been determined, the engagement and reviewing partners collaborate to make final accept/continue decisions. KRisk was purposefully designed not to include an accept/retain judgment as its "final" output. Rather, it is intended to serve as a resource and initiator for group decision making.

Approval Process

The KRisk system automatically determines the appropriate level of review, depending on the overall risk assessment computed by the system. As such, more decision makers are brought into the process as the level of assessed risk or risk score increases. KRisk also monitors electronic deliberations during the review process and sends emails to the engagement partner and other reviewing partners as reviews are completed. Each partner in the review "chain" can view the status of the review process at any time. A client that has a high risk score or that does not fit the target portfolio profile of KPMG clients will be accepted only if the engagement partner prepares and submits a persuasive "business case" to the appropriate reviewing partner(s). The business case presents evidence to support an acceptance or continuance decision, as well as plans as to how auditor business risk will be reduced to an acceptable level.

Links to the Audit Process

Currently, KRisk can automatically link some risk assessments to other phases of the audit. As discussed above, risk assessments made during the client acceptance or continuance decision process should (ideally) feed forward into the planning, testing, and review phases of the audit. For example, assessments made for certain KRisk risk factors are automatically entered into a SAS No. 82 audit workpaper dealing with *Consideration of Fraud in a Financial Statement Audit* (AICPA 1997). While such integration is possible with a paper-based system, a computer-based system

⁹ Labels for the categorical risk assessments are: 1 = Low, 2 = Low/Moderate, 3 = Moderate, 4 = Moderate/High, and 5 = High. The risk scores themselves are not used to inform specific decisions in audit planning. Rather, the actual risk factors inform planning decisions. KRisk is helpful in terms of risk reduction because it ensures uniform collection and aggregation of risk information across all clients in the firm, which should assist the firm in making consistent choices about subsequent audit planning in response to those risks. Therefore, the risk scores are best viewed as a meta-level, attention-directing device, rather than as a specific precursor to particular audit planning strategies.

makes integration less costly for the engagement team, and can aid in determining that important risk assessments made during one phase of the audit are linked to other phases. Future versions of KRisk may feature links to the firm's audit planning and other workpapers, as well as more links to outside databases that contain information relevant to the auditor business risk assessment and management process. Development in this regard is ongoing.

Portfolio Risk Management Process

In addition to its uses as a decision aid for client acceptance and continuance, KRisk also is a useful portfolio risk management tool. Using the system, partners can easily obtain information on all clients within their sphere of responsibility. Because partners within the firm each have specific roles in the firm's overall risk management process, access privileges to the portfolio management capabilities of KRisk are defined by each partner's role. For example, an individual engagement partner can evaluate the risk assessments for his or her portfolio of clients. The office managing partner can do the same, but for the portfolio of clients at that office. Risk management partners at the national level can evaluate portfolio risk by office, geographic region, industry, etc. Additional functionality with respect to portfolio risk management is under development for future versions of KRisk.

There are two limitations on our ability to provide further information about KPMG's portfolio risk management practices. First, although the system provides the capability to perform portfolio analyses, it has not been in place long enough to gain significant experience with using it for this purpose. Second, while KRisk aggregates data on individual clients into portfolios as described, the decision processes by which portfolio decisions are made at each level are not prescribed by the firm. These decisions are based on interaction among engagement partners and firm management. The role of KRisk is to provide data to support those decisions. The risk management unit at KPMG has plans to investigate the applicability of top-down approaches for assessing and managing portfolio risks. For instance, a portfolio risk management approach may be applied whereby the riskiest clients among the set of current and prospective clients are identified for further attention by risk management personnel.

KRisk Implementation and Maintenance

Partners and managers received training on the initial version of KRisk during August 2000, and implementation began shortly thereafter for client continuance decisions. Risk management personnel made minor modifications to the system during 2001, including minor wording changes and adjustments to accommodate the system for use in both client continuance and client acceptance decisions.

The risk management unit of KPMG performs various administrative functions necessary to maintain KRisk. For example, risk management personnel monitor external interfaces for data gathering and answer questions from the field about using KRisk and interpreting its output. System administrators update the KRisk system for changes in reviewer roles and access privileges to levels of the KRisk database for portfolio management as promotions occur. They also monitor the system for breaches in system integrity and security. Finally, the risk management unit plans to monitor and evaluate the risk scores produced by the system, revising KRisk risk factors and associated weights when warranted (e.g., when changes in the business environment or input from engagement partners suggest the need for new risk factors or for changes to the weights on existing risk factors).

RISK MANAGEMENT TOOLS: IMPLICATIONS FOR RESEARCH AND EDUCATION

In this section, we first discuss the relationship between prior research on decision aids and KRisk system features and functions. Next, we propose research opportunities where collaboration between audit professionals and scholars could help advance knowledge in the areas of auditor business risk assessment and management.

KRisk Features and Functions and Prior Research on Decision Aids

Decision aid research in auditing generally addresses decision quality, user reliance, and knowledge acquisition (Rose 2002). The features and functions of KRisk are illustrative of many of the findings in that research area. In terms of decision quality, prior research suggests that mathematical models, such as the one embedded within the KRisk decision aid, can outperform human decision makers (even subject-matter experts) in complex decision tasks involving many pieces of evidence (e.g., Dawes 1971; Dawes and Corrigan 1974; Einhorn 1972; Goldberg 1970; Blattberg and Hoch 1990; Kleinmuntz 1990). Human decision makers have difficulty determining optimal cue weights and combining the weighted evidence in an unbiased manner to form an overall judgment.¹⁰ As stated earlier in the paper, one of the primary objectives established by the development team for the KRisk system was that it should calculate a weighted risk score for each assessed client. Prior research findings, coupled with knowledge about other entities' experiences using mathematical models in decision processes, provided the rationale for the development team's decision to include a mathematical model in the KPMG risk management process.

In terms of user reliance, prior research also investigates the influence of decision aids on decision-making behavior and suggests the existence of possible impediments to users' reliance on decision aids (e.g., Kachelmeier and Messier 1990; Biggs et al. 1993; Boatsman et al. 1995; Eining et al. 1997; Messier et al. 2001; Bedard et al. 2002).¹¹ For example, Kachelmeier and Messier (1990) and Messier et al. (2001) investigate the possibility that auditors might "work backward" from a desired end point when using sampling decision aids. In addition, Eining et al. (1997) investigate specific impediments to decision aid use and the effects of various features, referred to collectively as *constructive dialogue*, that can overcome these impediments.

The KRisk development team was concerned about many of the same issues reported in the literature and consequently built features into the KRisk system to reduce the likelihood of user nonreliance. The KRisk system and the broader audit quality control process at KPMG contain features similar to the constructive dialogue techniques studied by Eining et al. (1997). For example, overall auditor business risk is decomposed within the system into components dealing with financial risk, control risk, and a qualitative risk category. Auditors are allowed to change individual risk-factor assessments when completing the questionnaire. Also, the system allows users to increase the system-derived overall risk assessment. Users cannot decrease the system-derived assessment, but they can initiate a dialogue with the appropriate reviewing partner(s) to discuss the "business case" for continuing or accepting a client with a high risk score.

In terms of knowledge acquisition, KRisk is useful because it offers consistency and documentation benefits and because its design reflects the views of a panel of experts. KPMG does not view the system as a means to "train" its managers and partners—client acceptance and continuance decisions are made by highly trained professionals, so this aspect of the decision aid literature is less relevant to KRisk's features and functions. Rather, the firm views KRisk as providing information and a focal point to initiate discussion among partners at various levels in the review chain for particularly difficult client acceptance and continuance decisions, especially for those situations in which a business case is required.

¹⁰ For example, human judges may inadvertently introduce biases when they mentally process a set of cues. Research suggests that decision makers sometimes weigh more heavily the evidence that is obtained closer to the time that the final judgment is made, compared to evidence obtained earlier (i.e., the recency effect). Also, research suggests that decision makers sometimes weigh more (less) heavily the evidence that confirms (disconfirms) their prior beliefs (i.e., confirmation bias).

¹¹ Several studies address the issue of decision makers' reliance on decision aids. For example, Arkes et al. (1986) find that decision makers provided with a formal decision rule for a probabilistic task would have improved their performance if they had relied on the decision rule exclusively, rather than only partially. Boatsman et al. (1995) observe substantial nonreliance by auditors on a statistical model developed to aid fraud likelihood assessment. Still other studies find that decision-aid users perform better than non-users, but worse than if they had relied on the tools exclusively (Ashton 1990, 1992; Peterson and Pitz 1986; Whitecotton 1996). Reasons suggested by researchers for underreliance on decision aids include (1) overconfidence on the part of decision makers, and (2) the "black-box" effect—underreliance or nonreliance on a model-based prediction due to the need of the decision maker to be able to explain or justify to others how the actual decision was formed.

Future Research Possibilities

The implementation of collaborative and digitized systems like the KRisk system presents many research opportunities for advancing knowledge and improving such systems. Some important questions that could be addressed by future research are presented below, organized in terms of research questions that might be directly derived from our discussion of KRisk and those that are more generally related to the topic of portfolio risk management.

Questions Directly Related to KRisk

- What is the relationship between system-generated risk assessments and client acceptance/continuance decisions?
- How has the implementation of technology affected the firm's portfolio risk assessment processes and the composition of its portfolio?
- What patterns of risk factors are associated with decisions to continue or discontinue the firm's association with particular clients?

General Questions Related to the Use of Decision Aids for Client Acceptance and Continuance Decisions

- What is the impact of decision aid use on auditor behavior, e.g.,
 - Does the use of computerized client acceptance or continuance decision aids significantly change the client portfolio business risk profile?
 - What patterns of risk factors (i.e., states of nature) are associated with risk avoidance, elimination, reduction, or acceptance?
 - What methods of risk reduction (e.g., specific changes in the nature, timing, and extent of audit procedures) are associated with different auditor business risk profiles?
- What are the similarities and differences across firms in the processes of client acceptance and client continuance, and the decision aids used to support those decisions? What firm-specific factors may be associated with differences in those processes?
- What is the impact, if any, of risk management decision aids on the litigation exposure of a firm, or the profession taken as a whole?
- What is the impact of the use of decision aids and other audit quality control procedures on the decisions made by judges and jurors in litigation involving auditors?
- How do firms manage the possible misalignment between incentives at the local level and practice-wide business risk control objectives?
- How do firms address implementation difficulties and how effective are the various strategies used in these efforts?

Educational Implications

In addition to having implications for research, we believe that this paper will be useful to educators as a teaching aid for a variety of courses that focus on auditing, risk management, or decision making. The paper complements textbook coverage of client acceptance and continuance risk assessment practices and procedures by presenting an example of a sophisticated, technology-enabled system currently in use in practice. Educators may use this paper to illustrate concepts and issues dealing with the use of decision aids (e.g., motivations for their use, issues concerning their design, development and use, and implementation difficulties), and to discuss the relationships among auditor business risk, client business risk, and audit risk.

CONCLUDING REMARKS

Auditor business risk assessment is a complex knowledge acquisition process. It is naive (if not infeasible) to think that a mathematical algorithm can perfectly capture all of the intricacies and interactions inherent in the mental processes of a seasoned auditor who may have years of experience auditing a client and other clients operating within the same industry. Effective auditor business risk management requires achieving a delicate balance between local level (i.e., engagement partner level or the local office level) decision making and effective top-down business risk assessment and quality control on a practice-wide basis. An overemphasis on top-down control can negatively impact the growth and profitability of an audit practice, which in turn can lessen audit quality over the long run, for example, when talented people migrate to more lucrative careers outside of the profession. Also, engagement partners have the most intimate knowledge of the "states of nature" that impact auditor business risk at the engagement level, necessitating a high degree of business risk control from the bottom up. Alternatively, allowing self-interest to run unchecked can cause a misalignment between individuals' incentives and practice-wide business risk control objectives.

For these reasons, effective audit quality control and auditor business risk management require a system that (1) does not dampen entrepreneurship at the local level, (2) extracts the comprehensive and accurate knowledge of states of nature impacting auditor business risk and audit quality from the local level, (3) imposes discipline on decision makers at the local level with respect to the breadth and depth of knowledge acquisition about such states of nature, and the actions taken to avoid, eliminate, reduce, or accept business and audit risks, and (4) allows for mutual monitoring among partners and fosters dialogue between partners for questionable business cases. The value of the KRisk system and related quality control procedures at KPMG is determined not solely from the mathematical scores produced by the system, but more importantly from the discipline it imposes on the auditor's business risk assessment process and the feedback that it provides to others charged with practice-wide risk management and audit quality control responsibilities.

In conclusion, we hope that by sharing knowledge about the KRisk system, its potential benefits, and implications as to its use, we will foster continuous improvement in auditor business risk management processes and practices on a profession-wide basis. Also, we hope that this paper fosters additional scholarly research to advance knowledge in areas dealing with auditor business risk management and the design and use of decision aids.

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