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Open innovation in managerial innovation:

the case of internal audit

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Open innovation in managerial innovation: the case of internal audit

Abstract

Research on innovation has grown into a substantial body of literature and has drawn attention to knowledge sources. However, little is known about the drivers of audit innovation. This article seeks to identify, delineate and categorize knowledge sources' impact on internal audit innovation. We implement an econometric model and find that internal audit departments developing search capabilities to modify their processes can innovate in their practices. Using the original measures of internal search capabilities and innovation, our findings highlight the effects of search, intrafirm and external knowledge sources on internal audit innovation: among intrafirm knowledge sources, management's reviews of internal audit functions are key factors that foster innovation. Among external sources, professional associations play a prominent role in firms' propensity to innovate. Most noticeably, firms with high absorptive capabilities deliberately deviate from compliance to innovate using professional associations' and ICT consultants' knowledge. Our study contributes to the literature on open innovation and auditing by illuminating internal audit functions' innovative potential.

Keywords: internal audit; open innovation; search; internal knowledge sources; external knowledge sources; absorptive capacity.

***JEL* codes**: O3

1. Introduction

Studies in the innovation field often focus on technological innovations. Some scholars, however, extended the theoretical and empirical models to non-R&D-based innovation, technique innovation or nontechnological innovation (Hervas-Oliver et al., 2014; Černe et al., 2016; Hienerth, 2016). The research on management innovation is prominent in this systematic effort to expand the scope of innovation analysis. Defined as "the generation and implementation of a management practice, process, structure, or technique that is new to the state of the art and is intended to further organizational goals" (Birkinshaw et al., 2008, p. 829), management innovation indeed produces changes in the organization's managerial procedures and administrative systems (Vaccaro et al., 2012) where they can be combined with technological innovation to achieve superior performance (Hervas-Oliver et al., 2014).

Ongoing efforts to identify and categorize the antecedents of innovation in managerial activities and systems have focused on the role of organizational resources, financial management strategies, environmental factors or internal and external actors (Schweisfurth, 2017). Such inquiry can not only be found at the firm level but also at a lower level, considering legal, marketing, accountancy or auditing practices, departments and systems. In management accounting, innovations and their diffusion are found to be driven by regulation (Chiwamit et al., 2017; Gardner and Bryson, 2021), environmental uncertainty (Otley, 2016) or organizational culture compatibility (Ax and Greve, 2017). Researchers have documented accounting language's standardized role in facilitating innovation (Brown and Martinsson, 2018). In internal auditing, innovations are viewed as relying more on the availability of new ICTs, such as data analytics (Perols et al., 2016), artificial intelligence and machine learning (Davenport, 2018; Perols, 2011), embedded audit software (Lombardi and Dull, 2016), blockchain (Rooney et al., 2017), remote auditing (Teeter et al., 2010) and drones (Appelbaum and Nehmer, 2017), which influence auditing processes and outputs. Concerning auditing, the literature still explains, however, that auditors are not always seen as professionals using their critical thinking (Bucaro, 2019) but rather as mechanistic workers, strictly following rules and standards, even causing audit quality to be associated with lower innovation outputs (Nguyen et al., 2020) and adopting technologies that suppliers and consultants propose. This view is supported by studies that deal with the lack of human capital hampering innovation adoption (Maroun, 2018).

Whereas managerial activities are known to adapt to their environmental changes using external knowledge to remain competitive, the innovation process may not be that passive and innovation that incremental. However, little is known about how firms craft their knowledge sourcing strategies regarding managerial innovations. As many works on open innovation (OI hereafter) show, firms indeed deliberately organize knowledge acquisition and disclosure. Therefore, it is expected that innovation is not submissively derived from these environmental changes but that OI practices are rather deployed inside firms to manage internal or external knowledge inflows or outflows to foster knowledge acquisition and learning processes, exploit opportunities and solve technological and nontechnological problems. However, the available literature on managerial innovation scarcely encompasses OI strategies (Huizingh, 2011; Khosravi et al., 2019).

Mol and Birkinshaw (2009) show that inbound innovation practices emphasize the role of knowledge coming from both the market (customers, suppliers, competitors, consultants) and other business sources (professional associations) in adopting a managerial innovation. However, little is known about firms' ability to trigger incoming knowledge or, in other words, to organize inbound OI. Still, little information shows how firms build up their absorptive capacity (AC hereafter) for nontechnological knowledge or how they organize this capacity. First, AC for managerial innovation is often reduced to managerial experience (Mol and Birkinshaw, 2014) or mixed with usual R&D capabilities (Huang and Rice, 2012). Second, AC's influence on incoming knowledge is not systematically considered in the literature on managerial innovations (Huang and Rice, 2012; Mol and Birkinshaw, 2014). Third, when is it done, as in Damanpour et al. (2018), AC's influence is found to be negative, which is surprising because it opposes what is observed in the technological innovation literature (Cohen and Levinthal, 1990; Cassiman and Veugelers, 2006) and the subsequent OI literature.

Taking the precise example of managerial innovation that is audit innovation, the present article aims at filling the different problems. The first research question concerns how internal auditors produce

knowledge for audit innovation. A second question points out how to seize the importance of OI strategies for internal auditors who rely on internal and external bodies as information and knowledge sources. A third research question concerns examining to what extent the internal auditors' search capabilities enable them to identify and use the information and knowledge coming from outside the internal audit team. To the best of our understanding, no research has attempted to empirically delineate, categorize, and identify the impact and articulation of different knowledge sources on internal audit innovation. Our article is the first attempt at identifying the roles that influence internal audit innovation.

We propose to identify knowledge sourcing strategies by implementing a standard econometric knowledge production function model (Griliches, 1990) already used in the econometric literature on managerial innovation (Huang and Rice, 2012; Damanpour et al., 2018) to determine the relative impact of internal audit search activities, of other intrafirm knowledge sources and of external innovation sources on internal audit innovation. Using the 2015 Common Body of Knowledge survey (CBOK 2015) from the Institute of Internal Auditors (IIA) Research Foundation and the responses from more than one thousand internal audit practitioners, we identify to what extent internal audit teams innovate, considering their internal search capabilities, and the different internal and external knowledge sources that they can absorb.

Our results confirm that internal audit departments rely mainly on their own search capabilities to innovate. Internal sources outside the audit department are also found to have a significant triggering role for innovation. The results are more scattered regarding external sources of innovation. The role of ACs is contingent. When relevant, it shows that regulators play a complex role in implementing novel auditing practices.

We add to inbound OI literature, expanding the scope of knowledge sourcing analysis to the case of internal audit functions, by disentangling among external knowledge source regulators from professional associations, by taking into account internal sources of knowledge and by using original measures of internal auditors' search capabilities and innovation output. In doing so, we contribute to the literature on auditing, challenging the traditional view of auditing as a guardian (Malsch and Gendron, 2011) and depicting internal audits as a complex and innovative profession.

The remainder of this article is organized as follows: In Section 2, we examine the relevant literature that relates to innovation in auditing to identify internal audit innovation sources, and we propose our research hypotheses. Section 3 presents the data used and our methodology. In Sections 4 and 5, we disclose and discuss our results. Section 6 shares our conclusions and provides avenues for further research.

2. Sources of audit innovation: background and hypotheses

2.1. Search activities by internal audit

Serendipity can explain many radical innovations. However, innovation and its success are most often based on intentional "problem-solving activities that involve the creation and recombination of technological ideas" (Katila and Ahuja, 2002, p. 1184). These problem-solving activities arise in companies when changes in technologies or in regulation occur (Knudsen and Levinthal, 2007; Kaplan and Tripsas, 2008). Through problem-solving activities, firms renew their activities and maintain their performance (Tripsas and Gavetti, 2000; Helfat and Peteraf, 2015). Problem-solving activities not only depend on firms' perceptions of their environment but also on their previous experiences. These capabilities are thus core in identifying and deploying routines and solutions.

The literature insists on different forms of problem-solving strategies and capabilities that firms own: firms' efforts can be based on local or distant searches (Cyert and March, 1963; March, 1991). The empirical literature indicates that firms tend to use local searches to fix their problems, using the current knowledge base accumulated by their industry and by their past experiences to innovate in an incremental way (Stuart and Podolny, 1996) and that too many problem-solving activities may damage innovation capabilities (Laursen and Salter, 2006). Distant or exploratory searches are performed when the required knowledge bases are not available on an organization's shelves and when the problem

requires access to various external competencies (such as artificial intelligence), which individuals or organizations embody.

Whereas analyzing the strategic renewal of a firm's activities through problem-solving activities is often broadly defined, the conceptual framework can be applied to different activities and functions within a company. The primary internal audit innovation source mainly derives from an experienced-based mode of learning, while the conscious production and use of new codified scientific and technical knowledge remains quite scarce. Influenced by their environment, internal auditors must master a large body of technical and complex analytical knowledge and managerial processes as well as utilize communication skills in their teams and operational divisions. Following Cyert and March (1963), internal auditors' behaviors are expected to adopt a "problematic search" when auditors' decision making through traditional rules and procedures is found to be insufficient to reach satisfactory audit quality. As a result, original audit practices and techniques are expected.

As expected from the literature on problem-solving activities, auditors' problematic searches evolve with perceived risks in complex environments. Auditors' learning abilities are particularly relevant when evaluating the internal control system (Bryant et al., 2009) and when conducting a balanced information search when managing a high-risk client, resulting in a more objective judgment (Kadous et al., 2008). The literature emphasizes that even in high-risk situations, internal auditors may, however, be tempted by local searches: following rules and favoring learning by doing and similar responses, in lieu of encouraging the use of alternative innovative procedures to facilitate auditing practices (Kang et al., 2020). Several scholars thus insist on searches' importance alongside related improvements in auditors' structured thinking (Backof et al., 2016), critical thinking (Bucaro, 2019) or skepticism (Nelson, 2009). These auditors' traits may enable search capabilities that better appraise the risks involved and deploy new practices to address contradictory information, which lead to enhanced descriptions of situations and their alternative outcomes.

Finally, auditors who are able to move away from their routine and knowledge bases often attain better job performance (McKnight and Wright, 2011). Auditors endowed with problem-solving capabilities are also found to be more likely to obtain superior performance evaluations (Tan and Libby, 1997). Whereas search activities' impact on implementing novel auditing practices or novel technologies while improving performance is unexplained, the findings support the idea that auditors' search capabilities primarily drive audit innovation within firms.

The search processes achieved by internal audits are not yet well documented and are not systematically related to novel audit processes or outputs. However, scholars have already acknowledged the critical importance of the search process used to solve problems, which leads to superior performance. We contend that innovation in internal audits aligns with other management innovations and relies on internal auditors' search capabilities. We thus posit the first empirical hypothesis as follows:

H1: Audit innovation capabilities will be positively associated with internal audit departments' search capabilities.

2.2. The role of internal knowledge sources

Problem-solving activities encompass searching for additional knowledge activities that can be used and/or recombined with existing knowledge. Firms tend to solve their problems using local searches, reaching knowledge available within the organization, from other units or functions (Bogers and Lhuillery, 2011). Organizations benefit from interactions among employees since innovative resources are much more widely distributed than before (Chesbrough, 2006). Accessing and assimilating innovation-related information from employees outside the specific innovation unit is an ability that organizations must develop to succeed in the innovation process (Vaiman, 2010). If one department's employees can access, appraise, combine and value other departments' knowledge, they will be aware of new practices, learn from their usefulness and implement new ideas in their own departments in order to generate innovations (Lai et al., 2016).

In the case of internal audits, interactions and coordination exist with three types of knowledge sources available in the internal auditors' day-to-day work. Knowledge flows received from peers,

management and audit committees are put forward in the literature (Lenz et al., 2014; Lenz and Hahn, 2015) and may be considered internal sources of internal audit innovation.

Within organizational groups and subgroups, scholars have documented how peers influence innovation diffusion (Dahl et al., 2014). Specifically, peer interactions allow the development of routines and procedures within a group, which facilitates a continuous flow of knowledge (Tsai, 2001). Within internal audit departments, informal discussions with peers often take place prior to formal discussions to review audit work with supervisors (Thorne and Hartwick, 2001). During this process, peers can either trigger ideas and new practices to improve audit quality (Duh et al., 2020) or foster standardized routines and hinder innovation. The empirical literature provides only a few insights into the fostering role of peers' experience. Internal audit departments may explore peers' insights to implement novel practices for improving their predictions and avoiding audit failures (Casterella et al., 2009). If innovations arise from the heterogeneity of individuals in audit teams and departments (Young, 2009), then the leading role of senior auditors endowed with technical and problem-solving abilities is emphasized (Tan and Libby, 1997; Gissel and Johnstone, 2017), improving junior auditors' technical and search skills (Westermann et al., 2015).

Internal auditors also implement sourcing strategies from management. Innovation seems to improve when managers actively disseminate knowledge to other units (Lai et al., 2016). The ability to leverage knowledge coming from different units has become a source of competitive advantage for organizations (Kogut and Zander, 1992; Schulz, 2003). Similarly, the literature on auditing stresses the importance of interactions between internal audit departments and senior management to increase internal audit effectiveness (Mihret and Yismaw, 2007; Cohen and Sayag, 2010). If they are able to manage auditees' concerns about the information spillover involved in the auditing process (Aobdia, 2015), then internal auditors can contribute to implementing innovative solutions for other departments within the organization (Tsai et al., 2015). The internal audit department also contributes to firm-level innovation by supporting managers by offering improvement strategies and recommendations to address unexpected risks, which helps managers understand the logic behind the business processes. As a result, traditionally considered a formal structure, the internal audit function provides management with "a wide range of contextual information designed to help them interact creatively with the broader organization and environment" (Adler and Borys, 1996, p. 74). To leverage employee-provided knowledge, chief audit executives may be willing to hire nonaccounting business professionals from other departments within the organization to obtain and absorb new information and apply it to their own business strategy to develop new practices (Bartlett et al., 2017). This information absorption involves, for instance, integrating practitioner-driven (e.g., executives, compliance officers, and administrative staff) information systems, which allows organizations to venture into new opportunities, such as using positive incidents to drive innovation or risk management, or to process abstract innovation (Schermann et al., 2012).

Audit innovation literature aligns with governance literature when it insists on the audit committee's role as one of the subcommittees of the board that oversees the internal audit function (Barua et al., 2010). Audit committee supervision helps internal audit departments identify issues within their own practices and offers further improvement opportunities (Arena and Azzone, 2009; Bedard and Gendron, 2010; Zaman and Sarens, 2013). Regular formal and informal meetings between audit committees and chief audit executives enable communication among participants, using the knowledge flowing from audit committee members to improve internal audit practices (Turley and Zaman, 2007; Eulerich et al., 2017). For instance, the audit committee increases the likelihood of adopting technology-based innovations for strategic information disclosure (Hsu et al., 2018). At the top of organizations, the board of directors is often considered an internal driver of innovation decisions (Wu and Wu, 2014). Because internal audit departments ultimately report to the board and, to align with the literature on interlocking directors and their role in disseminating innovation, internal audit innovation may further benefit from the information and knowledge coming from outside the organization through committees with multiple chairs and alternate information sources (Shropshire, 2010; Sharma et al., 2020).

Therefore, other organizational actors' acquired knowledge may either fill a department's existing knowledge gap (Almeida and Phene, 2004) or create new knowledge combinations, using existing knowledge to foster innovation (Kyriakopoulos and De Ruyter, 2004). While internal knowledge

sources can somehow reinforce standardized routines for promoting internal audit quality, the literature shows that internal audit departments also tend to benefit from information and knowledge, triggering innovation that a cluster of actors provide when they interact inside the organization. Therefore, we posit our second general hypothesis:

H2: Audit innovation capabilities will be positively associated with the cluster of internal actors with whom internal audit departments interact in their daily work.

2.3. The role of external knowledge sources

In addition to internal knowledge sources, the literature on search activities emphasized the search for external knowledge sources to diversify and deepen the knowledge base developed internally (see Ehls et al., 2020 for a survey). The external knowledge sources at stake in incoming spillovers usually encompass clients, suppliers, competitors, public labs and consultants (Lundvall, 1992; Rodriguez et al., 2017). Indeed, an organization's ability to recognize, assess and exploit knowledge outside its boundaries, for instance, with strategic acquisitions, is found to generate innovation (Caloghirou et al., 2004; Lin and Wu, 2010). Following previous works on managerial innovations (e.g., Mol and Birkinshaw, 2009, 2014), we can elaborate on the case of internal auditing, where the external knowledge source spectrum may encompass original intermediaries, such as professional associations, external audit firms, ICT consultants, and external regulators.

Earlier studies' findings suggest that innovation may stem from pressures arising from professional associations to which chief audit executives belong and through which they can exchange practices with their peers. Exchanges between internal auditors within these associations may be instrumental in challenging and altering the organization's institutionalized behaviors and identities (Brunsson et al., 2012). Professional associations such as the IIA (IIA, 2017), Association of Certified Fraud Examiners (ACFE) and National Association of Corporate Directors (NACD) are good examples of institutions that trigger the introduction of occupational fraud detection and efficiency (Westhausen, 2017) in internal audits. More attention is being devoted to the IIA, which is the most specialized and relevant association for the internal audit profession. Harnessing its various committees[1], the IIA is the cornerstone of all aspects of the profession, such as academic relationships, exams and certifications granted or in implementing and developing professional standards. It acts both as a standard setter and a knowledge provider, promoting good and novel practices as well as issuing professional certifications (IIA, 2017).

In line with studies on innovation sources, academic research sometimes becomes a sporadic source of audit innovation (Baldvinsdottir et al., 2010) that seems remarkably influential in organizations (Díez-Vial and Montoro-Sánchez, 2016). For internal auditing, it seems nevertheless difficult to identify and isolate the direct source of academia on innovation. Organizations and internal audit departments sometimes cooperate with universities and public labs, for instance, in designing accounting information systems (Geerts and McCarthy, 2000), performing audit ERP systems (Vasarhelyi and Greenstein, 2003) and improving audit techniques (Bell and Carcello, 2000; Bell et al., 2002; Rezaee et al., 2002). Academic research's role is, however, rather indirect, and auditors rely more on intermediaries for knowledge transfers. Some works also identify the role of consultant researchers and consultants who act as gatekeepers between academia and practice (van Helden et al., 2010) in areas such as risk assessment (Johnstone and Bedard, 2003), internal control (Ashbaugh-Skaife et al., 2008), and fraud detection (Asare and Wright, 2004). As a result, it seems rather relevant to appraise academic sources of innovation for internal auditing through the direct lens of professional organizations.

External third parties, such as advisory departments within Big 4 auditing firms, are also found to be service providers that support internal audits, access specific skills that are unavailable in-house (Galanis and Woodward, 2006) and increase their efficiency (Mubako, 2019). Internal audit departments thus strategically use external audit firms as critical information and knowledge providers when they craft or adopt new auditing practices (KPMG, 2016; Wieczynska, 2016; Bae et al., 2017).

[1] https://na.theiia.org/about-us/Pages/Committees.aspx

As companies address increasingly complex issues, internal auditors' involvement in ICT audits has increased simultaneously (Abdolmohammadi and Boss, 2010). An often-cited example of their involvement is reliance on audit procedure automation and big data to perform audit tests on 100 percent of the audit population (Cao et al., 2015). However, most firms simply do not have the necessary human resources to cope with additional burdens and look for external support in overcoming internal limitations (Haour, 1992; KPMG, 2016; Wieczynska, 2016; Bae et al., 2017). According to Vasarhelyi et al. (2015), chief audit executives will increasingly rely on external information and technologies for blockchain or big data analysis. Internal audit departments indeed use external ICT providers or suppliers due to the small pool of sufficiently ICT-qualified internal auditors involved in developing new systems and critical projects (Pyzik, 2012; Mubako, 2019). Regarding technology-based audit techniques, internal auditors can, for example, be certified by many certifying organizations, such as the ISACA[2] (Lord 2004), or obtain CISA[3] certification (Abdolmohammadi and Boss, 2010). These information system audits and security certifications have been found to be positively associated with developing cybersecurity risk management programs in internal audit departments (Islam et al., 2018); using these programs, chief audit executives (CAEs hereafter) can find a preferred source of external knowledge.

Finally, as a 'compliance' profession, recent institutional analysis reminds us that intermediaries such as external regulators play an important role in auditing innovation processes (Curtis et al., 2016; Boland et al., 2019). Contrary to what might be expected from a 'control' function, producing and adopting innovations also occur in a highly regulated profession (Fogarty and Rigsby, 2010), but complying strictly to standards may impede the use of innovative procedures (Kang and Piercey, 2020). Previous findings show that audit and financial reporting processes are triggered and shaped by a rising number of regulations and professional guidelines. For instance, using lie detection techniques during forensic audits remains controversial (Grubin and Madsen, 2005) and depends on national regulations (Greely and Illes, 2007). The new ICT-based technological auditing processes are regulated (Appelbaum and Nehmer, 2017) due, for example, to privacy concerns related to big data analytics (e.g., GDPR in Europe). Nevertheless, such regulations may offer opportunities for CAEs to develop novel practices in compliance and in creating opportunities for further audit innovations (Wang and Cuthbertson, 2015). As such, issuing new frameworks drives the efficiency of information and communication processes (Balakrishnan et al., 2017), especially in uncertain environments (Blind et al., 2017).

The ranked results on the role of external sources lead us to posit this ordered hypothesis:

H3: Audit innovation capabilities will be positively associated with the knowledge sources arising from (1) professional associations, (2) external audit firms, (3) ICT consultants and (4) external regulators.

2.4. The mediating role of ACs

Whereas organizations increasingly depend on external knowledge sources to foster innovation success (Love and Roper, 2004), they face difficulties in leveraging such sources (Lhuillery and Pfister, 2009). To overcome such difficulties, organizations must develop costly AC that enables firms to identify, acquire, assimilate, transform and apply external knowledge (Cohen and Levinthal, 1990; Zahra and George, 2002). AC is an organizational capability that can be achieved through different modes (Lane and Lubatkin, 1998) depending on the cognitive distance between the knowledge that is available and likely to be absorbed, the intraorganizational traits and the appropriation regimes influencing spillover levels (Volberda et al., 2010). In the management innovation literature, AC no longer centers on R&D knowledge and expertise, as in Cohen and Levinthal (1989): capabilities to learn can be identified and organized across different departments and functions (Brunswicker and Vanhaverbeke, 2015), managing all types of knowledge. Accumulating research indicates that AC first encompasses learning skills that are embedded in specific individuals who are, within their organization, in charge of external knowledge sourcing activities and named gatekeepers (Ter Wal et al., 2017), internal agents (Birkinshaw et al., 2008) or boundary spanners (Dekker, 2016). Alternatively, AC is

[2] ISACA: Information Systems Audit and Control Association
[3] CISA: Certified Information Systems Auditor

considered a set of specific routines developed inside companies to absorb and secure knowledge from outside sources (Lewin et al., 2011).

Management innovation literature has enriched AC literature, showing that management control systems constitute a capability that provides firms with an advantage in identifying external innovation partners (Dekker, 2016). These findings further confirm that AC depends on organizational structure and culture as, for example, top management's role in driving AC (Elbashir et al., 2011) and the influence of organizational culture and background as well as proximity between the adopter's values and beliefs and those linked to external knowledge (Ax and Greve, 2017). Finally, some contributions expand the scope of AC activities and the routines gatekeepers deploy to achieve absorption, such as representation activities to perpetuate firm networks, including legitimation efforts and reputation management (Zhang et al., 2015), appropriation skills, and rules that promote arbitrage between communication and secrecy during social interactions (Puyou, 2018). Nevertheless, no econometric result can identify AC's role in absorbing different simultaneous external knowledge sources that lead to managerial innovations (see, however, Damanpour et al., 2018).

Some arrangements necessary for managing different external knowledge sources to enable audit innovation are, however, documented: the literature on technology adoption by audit teams insists on competencies' critical role in traditional auditor teams (Boiral et al., 2019), their related needs for training (Vasarhelyi and Romero, 2014) and collaborative competencies' necessity (Dekker, 2016). Second, the observed rise in permanent or temporary IT experts in audit teams (Kotb et al., 2014) also highlights their role in absorbing ICT-based knowledge, such as business intelligence systems, provided by suppliers, experts and consultants (Fayard et al., 2012). Third, the literature insists on the influence of standards and thus professional associations, leading to a conservative view of audit procedures that may hamper innovation (Knechel, 2013) and deter auditors from leveraging AC to find new and innovative audit practices. Standards can, however, initiate transformations within or outside regulatory boundaries: internal audit departments can leverage external information sources rather than standardized sampling techniques to collect evidence (Commerford et al., 2017) or can consider specialists' advice for complex accounting estimates (Backof et al., 2016).

Whereas scholars usually identify different knowledge sources (Lewin et al., 2011), the focus is usually placed on AC's determinants and content or on interfirm relationships' control (Caglio and Ditillo, 2020). Subsequently, little is known about the role and efficiency of AC in managing knowledge from interactions with different external knowledge sources, such as competitors, suppliers, academic labs, consultants, professional associations or external regulators. The link between absorption ease and the distance between internal and external knowledge is indeed unclear, hampering a distinct ranking between the roles of the different external sources that influence audit innovation. Following the attention scholars give to the roles of ICT or professional associations, we expect that the two types of sources have more influence than other types of knowledge sources. In our study, we contend that internal audit departments' search capabilities enable the absorption of external knowledge sources to influence internal audit innovation capabilities. Thus, we posit our last hypothesis as follows:

H4: Innovation capabilities are higher when external knowledge sources are associated with greater internal audit departments' search capabilities.

3. Methods

3.1. Data

The data for our article stem from the 2015 IIA's Global Internal Audit Survey, conducted by the IIA Research Foundation known as the CBOK[4]. It is the world's largest study of the internal audit profession (Islam et al., 2018). The CBOK questionnaire focuses on internal audit activities across the globe, covering topics such as staffing, planning, standards, tools, risk management and internal auditors' competencies. Many academic studies use the CBOK database to investigate the attributes related to the internal audit function (e.g., Jiang et al., 2018).

[4] https://global.theiia.org/iiarf/Pages/Common-Body-of-Knowledge-CBOK.aspx

The 2015 questionnaire was launched in 23 languages and gathered responses from approximately 14,500 auditors. The sampling response rate is lower than 10% in South Asia and Sub-Saharan Africa and higher than 20% in Central and East Asia, the Pacific and Europe, which comprises a heterogeneous sample. Although North American, Chinese, or Indian respondents are dominant, some countries are considered overrepresented (e.g., Spain, South Africa, UAE or Switzerland). Among respondents, 27% and 9% work in the public and nonprofit sectors, respectively. Furthermore, CAEs (or their equivalent) represent 26% of respondents.

Some items included in our different measures are, however, proposed only to the CAEs and are unavailable for the CBOK survey's other respondents. After eliminating observations with missing data, retired respondents, nonprofit-oriented companies, public administration companies, firms with no employees or no employees in the internal audit function, and firms with more than 50% declared internal auditors, our final sample comprised 1,013 observations.

3.2. Explained variables

An original feature of the CBOK questionnaire is its inquiry into innovation in internal audit practices. The questionnaire does not measure the different outputs of the innovation process, such as technological process, product innovations or nontechnological innovations, as in standard innovation questionnaires (e.g., the Community Innovation Survey in Europe[5]). Remarkably, it measures the internal audits' competency in initiating and developing innovative approaches for enhancing internal audits: it thus encompasses both the technological and nontechnological types of innovation likely to be introduced at the internal audit level. Compared to previous indicators, the CBOK innovation variable also allows for evaluating innovation capabilities when no innovation project exists. CAEs declare levels of audit innovation competencies using a five-point Likert scale (Table 1). To enable precision in computing our econometric model's marginal effects, we merge the first, second and third levels due to the restricted number of observations in levels one and two. The explained variable is thus a three-point Likert scale.

3.3. Explanatory variables

Search activities are the first driver of innovation in organizations (Laursen, 2012), and they can be restricted to either local or distant knowledge as well as internal or external knowledge. Along with R&D activities, search activities can be systematized in companies even in an informal or online way. To date, many papers use R&D as a proxy for search, explaining managerial innovation (Mol and Birkinshaw, 2009). The CBOK survey uses, however, an original five-point Likert scale to identify internal audit competency levels regarding the use of problem-solving techniques. We use this variable to approximate internal auditors' search capabilities.

INSERT TABLE 1

The CBOK questionnaire allows us to measure the interactions that internal auditors may have with different types of knowledge sources that are likely to influence their innovation activities, which in turn allows us to identify and disentangle external knowledge sources from internal knowledge sources (listed in Table 1), as in Mol and Birkinshaw (2009) or Damanpour et al. (2018). External knowledge sources provide insights into internal audits in a voluntary or involuntary way or in a formal or informal way. The CBOK questionnaire focuses on suppliers or intermediaries, identifying four different types of external sources on which they can rely: external audit firms providing advisory services, ICT consultants and suppliers, professional associations and external regulators. Internal sourcing is identified around three different entity types: (1) peers are internal auditors within the internal audit function, reviewing the activities of their fellows; (2) interactions in teams provide a variety of insights and criticisms that are likely to modify audit practices; and (3) outside the internal audit function, the

[5] https://ec.europa.eu/eurostat/web/microdata/community-innovation-survey

CBOK questionnaire allows us to identify sourcing and/or interactions with management but also, of course, with the audit committee when it does exist.

The internal audit function's characteristics may influence the level and types of innovative activities. We control for the relative size of internal audit teams in a business firm (as in Islam et al., 2018). We further control for internal audit quality by introducing an index based on 6 dichotomic variables (Prawitt et al., 2009) and an ordered variable measuring the ICT level implemented during internal audit activities (Table 1). Following prior works on innovation, we further control for firm-level traits: first for size (proxied by the total number of employees) to control for potential effects related to larger companies (Sarens and Abdolmohammadi, 2011) and second for whether the organization is listed to control for the specific local regulatory requirements and the related scrutiny likely to influence auditing practices. We also use a set of fixed effects to control for the possible influence of country and sector on audit practices (Jiang et al., 2018). We finally control for respondents' personal traits that may both influence their perception of firms' use of and compliance with IIA standards or competences (Abdolmohammadi, 2009) and trigger or hamper innovation depending on their own characteristics, as evidenced for CFOs (Naranjo-Gil et al., 2009).

3.4. Econometrics

The probability that innovation capabilities, $Innovation_i$, are equal to the declared value v_d with d=1, 2, 3 for our three-point Likert scale, where v_0=1, v_1=2 or v_2=3, is provided by the probability that $x_i \gamma + \varepsilon_{1i}$ falls between the cutoff points k_0 and k_1, k_1 and k_2, and k_2 and k_3, respectively, yields the formula $Pr(Innovation_i = v_d) = Pr(k_{d-1} < x_i \gamma + \varepsilon_{1i} \leq k_d)$ where x_i is the independent variable, ε_{1i} is a random error term (Wooldridge, 2010), and k_0 and k_3 are set to $-\infty$ and $+\infty$, respectively. The maximum likelihood estimator for this ordered probit model provides the coefficients of interest γ and the k_1 and k_2 values. We then compute marginal effects for each Likert-scale value to evaluate the magnitude of the parameters of interest, which are all expected to positively driveinternal audit innovation. The triggering effect of AC is evaluated by introducing cross-effects between the problem-solving variable and the different external sources. Search capabilities enable internal auditors to search either for internal or external knowledge or technological or nontechnological knowledge. Such auditor behavior is controlled for their experience as well as their training in auditing (see the IAQ variable).

Several auditors from different affiliates of a single business group may respond. However, we cannot consider unobserved correlations among residuals, clustering residuals as in Chen et al. (2018), because the CBOK dataset is provided without respondents' firm-level identity.

A first issue is to control for firms' heterogeneity, whereas we use fixed effects in our core specification. A second issue relates to the differences between countries in national legal and regulatory requirements and national governance systems or cultures (Seol et al., 2011). We further propose controlling for possible sample selection bias by introducing a selection equation — $s_i = 1(z_i \beta + \varepsilon_{2i} > 0)$ — where $s_i = 1$ when, for 1,013 observations, we observe all the variables introduced in our core equation, and 0 otherwise (for 5,573 observations with the selection equation covariates available); z is the set of variables explaining the sample selection; β is the coefficient of interest that we want to identify using the maximum likelihood estimator; ε_{2i} is a random error term following a normal distribution; and $(\varepsilon_{1i}, \varepsilon_{2i})$ follows a bivariable normal distribution with a mean of zero and a variance matrix, with ρ as the correlation between ε_{1i} and ε_{2i}. When the hypothesis that $\rho \neq 0$ is rejected, our simple ordered probit model should provide consistent, asymptotically efficient estimates for our parameters of interest. Other econometric issues are explored in a robustness subsection.

4. Results

4.1. Descriptive statistics

The descriptive statistics are listed in Table 2. First, they show innovation's significance in internal audits, with 43% and 26% of firms reporting being advanced or expert in their audit innovation skills, respectively. The most frequent external sources identified are external audit firms and ICT consultants,

while professional associations and external regulators seem to more rarely influence audit innovation. Regarding internal sources, the audit committee exists in 82% of observations and, when it does exist, is found to be a frequent source of information and knowledge for audit innovations, while management and peers are most rarely cited as sources or partners. 30% of companies consider search methods to be expertly implemented by auditors.

INSERT TABLE 2

A sectoral breakdown analysis (not reproduced but available on request) shows a dominance of banking insurance service firms (39%) and manufacturing firms (17%). Approximately 15% belong to agriculture, mining, utilities and construction industries, and 14% are trade, transportation and information firms. The headquarters of companies are located in Europe (35%), on the US/Canada/Caribbean islands (22%) and in Asia (21%). 50% of the firms conduct international activities, 30% conduct national activities, and more than half of the firms are listed.

4.2. Econometric results

Table 3 presents innovation competencies' econometric results used to innovate during internal audits.

The results concerning search ability's impact confirm its positive and significant impact (at p-value<0.01%) on firms' ability to innovate. The internal audit department capable of looking for solutions to its problems or exploring ideas to modify its processes and production is, as expected, found to be more able to discover solutions and to innovate its practices and contributions. Calculating the marginal effect shows that being advanced or expert in search activities leads to an increased probability of being an expert in innovation, approximately 29% higher than being simply novice-trained or competent in search activities. This result, which provides support for H1, aligns with the results usually obtained on technological innovation, where internal R&D is found to be the main source of innovation. The marginal effect's magnitude is much higher than the individual impact of internal and external sourcing activities' magnitudes that we discuss hereafter.

Internal audit innovations are first influenced by internal knowledge sources. The econometric results from our main model reported in column (1) of Table 3 show that different internal sources positively influence innovation: a Wald test confirms that the set of internal sources is significantly lower than our model's log likelihood (the critical value is 16.93, with a p-value<0.01), supporting our argument that internal sources of information and knowledge improve internal audit innovation capabilities (H2). More precisely, management is an internal knowledge source that is positively related to audit innovation, with a p-value<0.01%, whereas the impact of peers is found to be positive but not significantly different from zero (with a p-value=0.55). Audit committees' impact is also found to be positive when the committees already exist, with a p-value<0.10. However, the sole existence of an audit committee is found to be negatively related to audit innovation. Hence, formally organized authority negatively impacts the capabilities to innovate in internal audits, but once implemented, it fosters innovation and is likely to compensate for its negative effect. Our data do not allow us to identify whether a difference exists between the types of innovation triggered by an audit committee and those triggered by its absence.

Our results also support our argument that external sources positively influence innovation in internal audits, which support (H3): aligned with internal sources, the coefficients of external sources are found to be positive, and the null hypothesis regarding these coefficients is rejected, with a p-value<0.01 (the critical value is 20.34). The coefficients identified for external audit firms, ICT consultants and external regulators are, however, not significantly different from 0. Professional associations are the sole external source identified as being positive and significantly linked to innovation. The coefficients for other external sources (external audit, ICT consultant, regulator) are found to be positive, as expected, but not significantly different from 0. Introducing external sources one by one allows us to confirm that no collinearity problem lies among the external sources. Hence,

whereas professional associations' direct role aligns with the literature, ICT consultants' lack of impact is more surprising and not aligned with the idea that innovation is mainly driven by IT suppliers or intermediaries.

INSERT TABLE 3

Computing marginal effects after the ordered probit allows us to comment on such effects' magnitude. If, for brevity's sake, we comment on the marginal effect regarding only the impact on the probability for an internal auditor to be an expert or advanced in innovation, i.e., for Pr(innovation=3), we find that the probability is 8% higher when information and knowledge are derived from interactions with management and approximately 4% higher when the audit committee is used as a resource. Note that the lack of an audit committee fosters innovation by 5%, suggesting that an audit committee's net effect on innovation expertise is reduced or even negative. When internal audit departments comply with IIA standards, it positively boosts their innovation expertise by 11%. Hence, despite the difficulty in comparing marginal effects due to the heterogeneity of the indicators implemented, our results suggest that internal sources are more numerous than external sources but that professional associations are a dominant source of innovation for internal audits. However, firms that are experts in problem-solving activities are 29% more likely to be innovative, showing that innovation in internal audit departments relies first on internal auditors and their search capabilities. This result aligns with the literature on innovation and the dominant role of internal knowledge production (R&D) as a source of innovation compared to external sources.

Introducing cross-effects allows us to test H4, which describes AC. The results are reported in column (2) of Table 3. A Wald test on the simultaneous nullity of cross-effect coefficients leads us to not reject the null hypothesis (critical value is 7.21 with a p-value=0.13); thus, we do not find support for H4 on AC. Hence, the cross-effect's impact does not significantly improve our model, suggesting that internal auditors' search activities are not critical for absorbing external knowledge. Out of the four coefficients introduced, however, two significant cross effects emerge: a cross-effect between external regulators and search capabilities, which suggests that external regulators positively influence innovation in firms but negatively influence the innovative activity of firms with a search capability. This result indicates that firms with low search capabilities adopt innovation initiated or negotiated with external regulators to boost their innovation capabilities by 5% (the marginal effect in column (2)), whereas firms with problem-solving capabilities do not use off-the-shelf regulations and even avoid external regulators as an innovation source, which deters innovation by 4% (that is 0.05 – 0.09 = -0.04 in marginal effects in column (2)).

The cross-variable between search and ICT consultants is found to be positive and significant but only at the 10% level. This finding reveals that firms that are experts in problem solving are more prone to benefit from this type of external knowledge source. Computing the marginal effects of the interaction terms between search and external sourcing in the ordered probit model (available upon request) confirms that a high search capacity boosts knowledge sourcing from ICT consultants by +0.8% compared to firms with a low search capacity.

Turning to the control variables, the results depicted in Table 3 confirm that firms with the highest internal audit quality and the highest technological level are more likely to innovate. Whereas large firms and listed firms are not found to be more likely to innovate, the internal audit department's size significantly affects its likelihood of being innovative.

Introducing the set of sectoral fixed effects significantly lowers our model's log likelihood (the chi-square critical value is 29.73, with a p-value<0.05). The coefficients of sectoral dummies (not reported) suggest that innovation is significantly higher in sectors such as utilities, construction or transportation and warehousing businesses. The geographic localization of headquarters is important for innovation. Testing the nullity of the different coefficients of headquarters geographic localizations leads to a critical value of 17.34 for the Wald test and the rejection of the hypothesis at risk p-value<0.01. Internal audit departments located in Asia and Latin America are found to be less innovative. Firms with headquarters

in Oceania, Africa and Asia are found to be more innovative in internal audits, whereas no differences are found among Europe, the US and Latin America. The geographic scope of activities is, overall, not found to influence internal audit innovation (the critical value is 2.61, with a p-value=0.46).

Finally, among respondents' personal traits, only the level of education is found to influence innovation, suggesting that graduated CAEs are more prone to consider changes in internal audits as innovative. The localization of the audit team is not found to be influential overall (the Wald test critical value for working areas is 7.83, and the nullity is not rejected with a p-value=0.17). Respondents working in Asia, the Pacific, and Middle and East Africa are found, however, to be less likely to find their audit team innovative.

4.3. Robustness

To test the robustness of our results, we conducted several additional econometric tests. A common econometric problem related to the ordered variable is the parallel regression assumption (Wooldridge, 2010). Using a Brant test, the equality of slopes is not rejected for any explanatory variable at 5%. The test performed using a generalized logistic regression model leads to similar results: only the equality of the slope for the external regulator coefficients is rejected at the 5% significance level.

The results are also robust when the sample is reduced to 919 firms, excluding firms conducting business in services and thus consulting activities (with 2-digit North American Industry Classification System codes higher than 56)[6]. Our results are also robust to the removal of country or industry fixed effects. We further test whether our results are robust to sample selection effects since out of the 1,877 CAEs who responded, only 1,013 were selected in our final sample: we introduced a Heckman ordered probit model with a selection equation, where the likelihood of belonging to our final sample relies on CAEs' characteristics (age, gender, master level and specialization) and firms' characteristics (firm size, IA size, industry, country, headquarters country, and geographic scope). Introducing such variables reduces the number of responding CAEs from 1,877 to 1,501. We then tested the potential selection bias derived from selecting 1,013 observations out of the 1,501 CAEs. We do not reject the nullity of the correlation among residuals for the two equations (the Wald critical value is 2.12, with a p-value=0.145). Hence, no evidence shows that our core results are biased by sample selection effects, as shown by column (3) in Table 3: the ordered probit part of the Heckman model disclosed delivers very similar results to those in Table 3, supporting H1, H2 and H3. H4's results (not listed) are also similar, with the nullity of interaction effects not being rejected (the Wald critical value is 6.82, with a p-value=0.15).

Missing variables may also hamper identifying the parameters of interest. Standard innovation models usually consider the appropriation variable as a proxy for the incentive to derive rewards from innovation. To tackle this dimension, we introduced the expert level of internal auditors at maintaining confidentiality throughout the audit process, assuming that this capability is a good proxy for the ability to keep new audit practices secret. Confidentiality's positive role in audit innovation is found to be positive and significant (at p-value<0.01), with a marginal impact on the probability of being an innovation expert near 14%. The result does not modify the other coefficients of interest on internal and external sources of information and knowledge.

For H4, we chose to identify ACs' role by introducing cross-variables into our core model and to explore their role in absorbing external knowledge. In doing so, however, we neglected to examine its potential role in absorbing internal knowledge. To check our core specification's relevance, we introduced into our model the interactions between the search variables and different internal sources, which are likely to inform internal auditors. The results (not presented here) are similar to those obtained from cross-effects between searches and external sources: the coefficients are not found to be significantly different from 0. Hence, internal audit innovation depends on internal and external knowledge sources, but search capabilities are more useful for producing knowledge internally than for absorbing it from outside the internal audit department.

In a similar way, we explored peers, management and audit committees' roles as potential gatekeepers inside firms (see Bogers and Lhuillery, 2011 for a functional view of such learning),

[6] https://www.census.gov/eos/www/naics/2017NAICS/2017_NAICS_Manual.pdf

introducing the three variables in lieu of searching for interaction variables. The results (available on request) show that AC is located in the audit department and that other internal employees or groups of employees do not play a significant role in absorbing the knowledge dedicated to audit innovation: firms that are endowed with high ICT capabilities are more likely to absorb external knowledge, but the coefficients are not significantly different from 0 at usual risk levels. Firms are more likely to use ICT consultants (at the 10.3% risk level of risk), whereas they are less likely to use regulator insights (at the 11% risk level). The only significant result obtained is that peers are more prone to foster the absorption of knowledge from regulators, inducing incremental innovation or conservative innovation (the Wald critical value is 1.741, with a p-value=0.082).

5. Discussion

Our original econometric study first supports the finding that internal audit departments' search capabilities critically drive innovation. Internal sources also influence innovation propensity, but with a distinction between different actors: whereas the impacts of the insights from other departments are legitimized as a valuable knowledge source, the impacts of audit committees on internal audit innovation are more scattered. Our findings are also conflicting regarding the external sources of innovation, since only professional associations allow innovation to be fostered in internal audit departments and because internal search capabilities fail to absorb all external knowledge sources.

Our results align with the innovation literature because they examine search capabilities' influence on firms' innovation trends (Criscuolo et al., 2013). Because we use a variable linked to problem-solving capabilities to measure search activities, our work complements previous studies that investigate auditors' professional judgment. In this respect, the prior research focused on building on alternate perspectives to restructure audit tasks and adopting less routine-based audit approaches to better appraise and gather information when faced with complex situations (Bucaro, 2019).

Surprisingly, our results show that peers do not significantly influence fostering innovation, while prior studies often indicate peer reviews' positive role in disseminating innovation (Dahl et al., 2014). Our findings suggest that peer reviews are limited to providing feedback on established practices to increase audit quality (Gold et al., 2014). An interpretation is that peers are endowed with knowledge that is too similar to trigger distant searches by auditors or that peers may also not allow internal audit departments to go beyond compliance with standardized auditing practices in order to foster innovation. Our results further suggest that peers are rather gatekeepers for regulators' knowledge, fostering novel practices for compliance purposes.

Our results also provide evidence of the influence of internal knowledge sources on innovation practices' development in internal audit departments. We supplement the few studies that have already indicated the benefits of quality assurance and improvement programs to improve internal audit departments' legitimacy (Coetzee et al., 2015) by showing the positive role of the internal and independent reviews management performs to assess the internal audit function's innovation work. Although not significant, our results align with those of studies on governance mechanisms' positive impact on innovation (e.g., Krafft et al., 2011) since we find that overall, audit committees foster innovation. Nevertheless, our refined findings show that the sole existence of the audit committee impairs the innovation process and suggest that its formal authority is considered an obstacle to innovation. In contrast, our results confirm audit committees' impact on innovative behaviors and on adopting technology-based innovations for strategic information disclosure (Hsu et al., 2018). Once audit committees are implemented, the knowledge flow arising from the interactions between the internal audit department and the audit committee has positive outcomes for developing innovation.

Our investigation of external knowledge sources' impact leads us to demonstrate the prominent influence of professional associations on internal audit innovation. Thus, we complement the literature that has shown the impact of certifications in performing IT audit assignments (Almadhoob and Valverde, 2014) or involving internal audit departments in cybersecurity risk management programs (Islam et al., 2018). Our results confirm that interactions with practitioners are also a key driver of innovation, reinforcing the interest in professional literature providing an overview of the current internal audit profession (e.g., reports that include CBOK survey results), of the conference regularly

organized by the IIA, and of informal meetings between practitioners. Surprisingly, the influence of external audit firms and ICT consultants, for which IT audit reviews may be outsourced, is not found to be significant, which contrasts sharply with the innovation literature that underlines ICT outsourcing's impact on the innovation process (Ciappini et al., 2008). Despite a growing need for computer audit specialists (Brazel and Agoglia, 2007), our findings challenge the benefits of outsourcing internal audit activities prior studies have found when a lack of qualified in-house staff exists (Mubako, 2019). However, an interesting result is that internal audit departments with higher search capabilities are able to absorb the knowledge provided by external audit firms and ICT consultants more than internal audit teams with lower search capability levels. Consistent with studies in the audit field, we first find evidence that external regulators are not a source of innovation for internal audit departments. Interestingly, our study also indicates that firms developing higher search capabilities are more prone to derive practices from external regulators' requirements compared to those with weak search capabilities. Smart auditors do not comply when they innovate. These findings align with studies that have evidenced that some organizations deliberately deviate from standards (Witt and Fainshmidt, 2018) because compliance with such standards does not seem to add value (Breger et al., 2020) and because management appears to provide little support for compliance (Burnaby et al., 2009).

6. Conclusions

Our study attempts to explore the theoretical foundations of internal audit innovation. By distinguishing search capabilities and internal and external knowledge sources as distinct sources leading to innovation, we point out which category of actors significantly influences innovation in internal audit departments. Our article goes beyond traditional views in considering 'control' functions as essentially detrimental to innovation (Davila et al., 2009), and we complement the growing body of literature that has recently begun to grasp such functions' innovative potential.

Our results are limited by the variables we introduced into our model, as mentioned. Innovation competencies are measured in 2015, and the explanatory variables are also measured for the same period. As in many studies on innovation (e.g., Mol and Birkinshaw, 2009), the lag between innovative activities and their outcomes along with the use of novel audit practices and technologies is not controlled for. The literature on innovation persistence (Tavassoli and Karlsson, 2015) finds, however, that firms that invest in search activities keep pace with investing over time as well as introducing innovations, which suggests that introducing a lag would not change the results.

A second caveat is that some missing variables in our specification may hamper a proper identification of coefficients. The CBOK survey does not disclose its questions, allowing us to measure academic researchers' rare role in the knowledge-sourcing strategies internal auditors deploy as an external information source (Ratzinger-Sakel and Gray, 2015). In addition, within the organization's internal sources underlined by previous studies (Steinbart et al., 2012), we were not able to grasp the IT department's role as an information provider allowing the internal audit department to facilitate innovation. We restricted our variables of interest to the data disclosed in the CBOK survey, and we call for further research to examine these two dimensions.

A third caveat is that our innovation proxy does not allow us to distinguish between the types of innovation, as in Mol and Birkinshaw (2009), or to identify the degree of novelty of managerial innovations. We cannot identify whether knowledge sourcing, mediated or not by search capabilities, triggers product innovation more than process innovation or radical innovation instead of incremental innovation. Regarding the variables included in our innovation production function, a related and more serious problem is, however, the causal relationship between the innovation competencies of internal auditors and the internal or external links they design for innovation. Internal auditors may indeed also find knowledge sources because they signal that they are an innovative internal audit unit. Audit innovation's impact on internal audit networking is, however, beyond the scope of a cross-sectional model.

Finally, our article takes the internal audit function as a single focal point, whereas complementarities can exist between different managerial control systems and control practices inside

multinational corporations (Bedford, 2015), a dimension for which we cannot control using the 2015 version of the CBOK questionnaire.

Despite these limitations, we are confident that our paper has important implications for stakeholders of internal audit functions and managing inbound OI. For CAEs, our study provides insights into the beneficial sources of knowledge that fosters innovation and allows them to identify where resources and efforts should be allocated to grasp information that boosts innovation practices. Our findings also support professional associations' initiatives to encourage internal audit professionals to adopt best practices through dedicated reviews, guides and professional literature and to share their experiences with respect to innovation in both formal and informal ways. As internal auditing standards do not disclose any requirements regarding innovation, external regulators should pay attention to internal audit departments' willingness to innovate in order to foster internal audit practices. In addition, external regulators may consider the different behaviors regarding innovative activities since some internal audit functions adopt only those innovations initiated and validated by external regulators, whereas others tend to avoid external regulators as an innovation source, perhaps considering that regulation hampers innovation. Finally, we encourage researchers to narrow the gap between academia and professional practice by reconsidering the view that the auditing profession relies only on standards and cannot think outside the box to innovate. Our findings allow researchers in the audit field to more closely examine internal audit activities and to be involved in the practices developed to foster internal audit innovation.

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Table 1
Variable definitions

Variables	Definition
Explained Variable	
Innovation [a]	Internal audit develops innovative approaches to enhance internal audit activity in a novice, a trained or competent way (set to 1), an advanced way (set to 2), or an expert way (set to 3).
Explanatory Variables	
Peers [a*]	Set to 1 when the internal audit uses peer reviews.
Management [a*]	Set to 1 when the internal audit uses at least 2 of the 3 following tools: a balanced scorecard, internal quality assessments or reviews by the internal quality assurance function; 0 otherwise.
Audit Committee Yes [a*]	Set to 1 when an audit committee exists.
Audit Committee [a*]	Set to 1 when the audit committee is a resource for an internal audit; 0 otherwise.
External Audit [a*]	Set to 1 when internal audit uses external auditors to support or perform internal audit; 0 otherwise.
ICT Consultant [a*]	Set to 1 when internal audit uses consultants for data analysis; 0 otherwise.
Professional associations [a*]	Set to 1 when internal auditors are expert at maintaining knowledge of the IIA standards; 0 otherwise.
External regulator [a*]	Set to 1 when internal audit uses external regulator reviews; 0 otherwise.
Search [a*]	Set to 1 when internal audit applies problem-solving techniques to address issues in an advanced way or expert way; 0 otherwise.
Control Variables	
IAQ [a]	Prawitt quality index, as the sum of 6 dichotomic variables measuring internal auditor experience, certification, objectivity, specialization in finance, training and relative size.
ICT Level [a*]	Set to 1 when the internal audit extensively uses information technology; 0 otherwise.
Internal Audit Size [a]	Share of internal auditors in the total number of FTE employees.
Firm Size (log) [b]	Number of FTE employees (in logarithm).
Listed [b*]	Set to 1 when the firm is listed; 0 otherwise.
Age [c]	Declared age of the respondent.
Gender [c*]	Set to 1 when the respondent declares himself/herself male; 0 otherwise.
Master Level [c*]	Set to 1 when the respondent holds a master's degree or PhD.
Industries[*]	Set of dummies defined at the 2-digit level of the CITI classification.
Geographic Localization[*]	A set of 6 indicators set to one when the firm is in Africa, Asia, Europe, Latin America, US/Canada/Caribbean, or Oceania.
Geographic Scope[*]	A set of 4 indicators set to one when the firm is local, regional, national or international.

[a] Internal audit level, [b] Firm level, [c] Respondent level, * Dichotomic variables.

We follow Prawitt et al. (2009) to build an IAQ index as the sum of 6 dichotomic variables. These variables are internal audit experience, certification, objectivity, specialization in finance, training and relative size and are approximated in our article as follows: the internal audit's relative size in its industry by the declared sufficient level of resources for the internal audit department relative to the extent of its audit responsibilities. The internal audit focus on financial tasks is set to one when the internal audit department considers financial risks as being among the top five priorities for 2015; training is set to one for a value higher than the median of the average number of hours of training of internal auditors per year; the weight of financial audits in internal audit activities is also considered; and objectivity is set to one when the internal audit is declared with an expert level in objectivity by the respondent. Certification is set to one when firms are higher than the median, regarding the share of auditors with CIA or CPA certifications. Experience is set to one when the respondent declares an increase in the number of internal auditors over the last year.

Table 2
Descriptive variables

	Mean	S.D.	By Innovation Level			H_0 :1≠2		H_0 :2≠3	
Variable			1	2	3				
n	1,013		310	439	264				
Innovation [a]	1.95	0.75	31%	43%	26%				
Peers [a*]	0.17	0.38	0.13	0.18	0.20	2.086	**	0.526	
Audit Committee Yes [a*]	0.82	0.38	0.80	0.85	0.82	1.685	*	0.791	
Audit Committee [a*]	0.63	0.48	0.55	0.66	0.68	3.119	***	0.538	
Management [a*]	0.20	0.40	0.11	0.22	0.27	4.256	***	1.243	
External regulator [a*]	0.17	0.38	0.10	0.20	0.22	3.911	***	0.864	
Professional association [a*]	0.20	0.40	0.06	0.17	0.42	4.584	***	7.235	***
External Audit [a*]	0.40	0.49	0.39	0.39	0.45	0.174		1.552	
ICT Consultant [a*]	0.26	0.44	0.24	0.25	0.31	0.372		1.703	***
Search [a*]	0.29	0.45	0.07	0.19	0.69	4.964	**	14.635	***
IAQ[a]	2.23	1.32	1.66	2.29	2.79	6.797	***	5.147	***
ICT Level [a*]	0.14	0.35	0.06	0.16	0.19	4.786	***	0.969	
Firm Size (log) [b]	7.44	1.88	7.18	7.55	7.54	2.742	***	0.042	
Internal Audit Size [a]	0.01	0.01	0.01	0.01	0.01	1.468		0.162	
Listed [b*]	0.49	0.50	0.47	0.49	0.50	0.358		0.321	
Age [c]	46.03	8.52	45.63	46.01	46.55	0.589		0.846	
Gender [c*]	0.74	0.44	0.72	0.74	0.75	0.565		0.465	
Master Level [c*]	0.53	0.50	0.45	0.57	0.57	3.221	***	0.124	

Sectoral and geographic indicators are not presented for the sake of brevity. The largest size is over 2 million employees. Ages range between 25 and 69 years old. T-tests on the difference between means are two-sided. ***, ** and * indicate significance at $p < 0.01$, 0.05, and 0.10, respectively.

Table 3 : Factors influencing audit innovation (ordered probit)

Column	(1)		(2)		(3)	
Estimator	Ordered Probit		Ordered Probit		Heckman Ordered Probit	
Variable	Coef.	Marg. Eff.	Coef.	Marg. Eff.	Coef.	Marg. Eff.
Peers	0.059		0.046		0.056	
	(0.100)		(0.100)		(0.098)	
Management	0.341***	0.08	0.345***	0.08	0.325***	0.07
	(0.097)		(0.097)		(0.094)	
Audit Committee Yes	-0.233*	-0.05	-0.236*	-0.05	-0.221*	-0.05
	(0.134)		(0.135)		(0.129)	
Audit Committee	0.171*	0.04	0.181*	0.04	0.166*	0.04
	(0.101)		(0.101)		(0.098)	
External Audit	0.082		0.095		0.078	
	(0.078)		(0.086)		(0.075)	
ICT Consultant	0.076		-0.024		0.072	
	(0.089)		(0.100)		(0.085)	
Professional association	0.477***	0.11	0.569***	0.13	0.455***	0.10
	(0.112)		(0.143)		(0.109)	
External regulator	0.115		0.236**	0.05	0.109	
	(0.105)		(0.117)		(0.101)	
External Audit × Search			-0.102			
			(0.192)			
ICT Consultant × Search			0.361*	0.08		
			(0.215)			
Prof. association × Search			-0.213			
			(0.219)			
External regulator × Search			-0.392*	-0.09		
			(0.219)			
Search	1.296***	0.29	1.383***	0.31	1.247***	0.26
	(0.103)		(0.162)		(0.121)	
IAQ	0.147***	0.03	0.144***	0.03	0.142***	0.03
	(0.034)		(0.034)		(0.033)	
ICT	0.152		0.157		0.149	
	(0.111)		(0.111)		(0.110)	
Listed	0.103		0.106		0.097	
	(0.086)		(0.087)		(0.083)	
Internal Audit Size	6.926**	1.56	6.924**	1.56	6.723**	1.41
	(3.344)		(3.417)		(2.982)	
Firm Size	0.026		0.028		0.034	
	(0.029)		(0.029)		(0.027)	
Age	0.003		0.002		0.003	
	(0.005)		(0.005)		(0.005)	
Male	0.035		0.035		0.053	
	(0.087)		(0.088)		(0.087)	
Master	0.137*	0.03	0.144*	0.03	0.148*	0.03
	(0.080)		(0.080)		(0.079)	
Geographic Scope Fixed Effects	Yes		Yes		Yes	
Headquarter Country Fixed Effects	Yes		Yes		Yes	
Working Country Fixed Effects	Yes		Yes		Yes	
Selection Equation	No		No		Yes	
Log Likelihood	859.04		-855.37		-1,753.0	
H_0: All coeff. = 0	386.49***		390.31***		359.24***	
H_0: $\rho = 0$					2.12	
Selected	1,013		1,013		1,013	
Non selected					488	
Pseudo R^2	0.21		0.21			

The table presents the coefficients of the ordered probit model in columns (1) and (2) and the Heckman probit model in column (3).

***, ** and * indicate significance at $p < 0.01$, 0.05, and 0.10, respectively. Standard errors are in parentheses and are heteroscedasticity-consistent. Listed marginal effects are those computed for P(Innovation = 3) for the three specifications. They are computed at the mean for continuous variables. z variables such as age, sex, master's degree, specialization, geographic scope fixed effects, headquarter country fixed effects, and working country fixed effects are introduced as explanatory variables into the sample selection equation. Specialization is set to one when the respondent declares himself/herself as being specialized when introduced. The selection equation results in the Heckman ordered probit model (Col. (3)) are not reported here. ρ is the correlation among residuals from the selection and ordered probit model in the Heckman ordered probit model. The log likelihood and the Wald test on the simultaneous nullity of all explanatory variables are obtained for the two equations of the Heckman model.