

# Measuring the Impact of Absorptive Capacity and Internal Auditing on Firm Performance

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## ABSTRACT

This study aimed to investigate the impact of absorptive capacity (AC) and internal auditing on firm performance. Specifically, it had three main objectives. The first was to investigate the internal auditing characteristics affecting potential AC. The second was to investigate the mediating effect of the internal control system on the relationship between potential and realised AC. The third was to examine the mediating effect of internal auditing processes on the relationship between realised AC and firm performance. This study employed a quantitative method i.e. survey questionnaires distributed to internal auditors and secondary data collection from annual reports of companies listed the Amman Stock Exchange. Return on assets and return on equity were extracted from 2014 to 2018 annual reports. The results indicated that internal auditing characteristics influence potential AC, which impacted the internal control system; the internal control system mediated the relationship between potential and actual AC and realised AC influences internal auditing processes, which in turn served as a mediator between realised AC and firm performance. This study applied the AC theory to internal auditing to provide insights. The evidence also highlights the benefits of utilising information technology in internal auditing.

**Keywords:** Absorptive Capacity Theory, Information Technology, Internal Auditing.

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## INTRODUCTION

With the increasing reliance on technology and the internet, organizations are becoming increasingly vulnerable to cyber-attacks (Antunes et al., 2022). Internal auditors need to be aware of the potential risks and have the ability to assess the effectiveness of an organization's cybersecurity controls (Slapnicar et al., 2022). Another issue facing internal auditors is the growing use of data analytics. With the vast amounts of data being generated by organizations today, internal auditors need to have the skills and tools to analyze this data in order to identify potential risks and control deficiencies (Huang et al., 2022). This may involve using data visualization and machine learning techniques to identify patterns and anomalies in the data (Krieger et al., 2021). Additionally, regulatory changes are another challenge for internal auditors. As laws and regulations continue to evolve, internal auditors need to stay up to date with changes that may impact their organization (Christensen et al., 2022). They must assess the effectiveness of controls in place to comply with these regulations and ensure that their organization is in compliance (Brushwood et al., 2020).

The importance of the absorptive capacity theory (AC) has been acknowledged by many people due to its ability to provide an overview of a company's various processes (Lane et al., 2006). It is also widely used to enhance a company's competitive advantage (Daspit et al., 2019). When firms focus on technological development, they often encounter the issue of innovation in the form of AC (Vlačić et al., 2019). According to Tzokas et al., 2015, the correlation between an organization's performance and technological capabilities can be explained by the company's understanding of its customers' loyalty. The importance of effective AC is acknowledged by policymakers and business leaders as a vital component of their strategy to ensure long-term success and survival (Cenamor et al., 2019). It is additionally known to develop individuals' problem-solving and learning capabilities, which can help them improve their innovation performance (Daspit et al., 2019; Zahra and George, 2002). According to Daspit et al., (2019), the importance of AC is acknowledged in the competitive environment. It can help companies develop a deeper understanding of their customers and improve their performance. Also, this method can also be regarded as a routinized learning.

Internal auditors benefit from using information technology (IT) in their work, especially in terms of audit efficiency and effectiveness. Developments in IT support internal auditing, but they come with challenges and introduce more complex IT. Consequently, if businesses, large or small, fail to adopt new technologies, they become exposed to more risks, including fraud, abuse, and inefficiency. The challenges internal auditors face involving the use of data analytics to identify threats and provide value to management. Further, most internal auditors struggle with the lack of sufficient resources to address the high-risk areas within their internal audit departments (Schmitz and Leoni, 2019). These challenges are a result of new technologies that have made it necessary to rethink how businesses are structured and how they operate (Abbaszadeh et al., 2019). Absorptive capacity (AC) theory has been approached from various perspectives in the literature. Cohen and Levinthal (1990) argued that AC provides the ability to recognise the value of information, assimilate it, and apply it to commercial ends. Zahra and George (2002) asserted that AC indicates a set of routines and processes to acquire, assimilate, transform, and exploit knowledge to produce dynamic capability. For example, in the context of the need for businesses to develop educational training programs that can boost employee creativity, absorptive skills can strengthen employees' ability to analyse, integrate, and apply external knowledge to their industries. AC is important to better understand the integration of IT and internal audit because it offers a framework to understand the ability to recognise the value of information and to assimilate and apply it.

This study is novel in three aspects. First, it contributes to the existing knowledge on internal auditing characteristics related to AC theory. According to Abdolmohammadi and Boss (2010), a significant increase in IT audits requires investment in recruiting, training, and professional certification because these variables are positively and significantly associated with IT audits. Technology topics make up an ever-increasing percentage of auditors' professional knowledge and skill set, and although this is important in understanding new developments and directions, it is of little use without the continuous acquisition of new knowledge (Lenz et al, 2011). Li et al. (2018) highlighted the influence of technological competence, standards, and professionals in helping internal auditors improve their overall performance. Khan et al. (2019) argued that knowledge characteristics can influence a firm's potential AC, such as skills and

experience. It is necessary to determine internal audit employees' ability to acquire and assimilate knowledge when adopting new technology.

Second, this study contributes to the existing knowledge on internal control systems related to the AC theory. The internal control system has substantially expanded and is no longer limited to checking accounting records and monitoring: it now includes assessing risks related to the application of IT, also reported that the Committee of Sponsoring Organisations (COSO) framework broadly categorises IT control activities in two: application controls designed within the application to prevent or detect unauthorised transactions and general controls designed for all information systems to support secure and continuous operation (Rae et al., 2017). Thus, the COSO framework recommends monitoring activities to evaluate and improve the design, execution, and effectiveness of internal controls. It also recommends other periodic evaluations such as self-assessments and internal audit, which usually result in a formal report on internal controls (COSO, 2013). Abbaszadeh et al. (2019) suggested further exploring the IT environment and its effect on internal control systems. Cenamor et al. (2019) and Ince et al. (2016) highlighted the need to investigate other potential mediating mechanisms to explain the AC theory.

Third, this study contributes to the literature on internal auditing processes related to the AC theory. As the pace of IT changes increases, internal auditors must keep pace with emerging technological changes and their impact on their data processing, as well as their own internal audit procedures (Mahzan and Veerankutty, 2011). Internal auditors adjust their audit plan to take various factors into consideration: new IT risks, associated IT controls, security measures, and appropriate testing techniques (Kotb et al., 2014). In the final phase of the knowledge integration process governed by AC, the firm can synergistically transform and exploit new knowledge via its realised AC (Daspit et al., 2019). Thus, internal auditors are motivated to use IT knowledge because it shortens internal auditing processes (Mustapha and Lai, 2017). Aliasghar et al. (2019) and Kale et al. (2019) suggested exploring how companies can be helped in developing and introducing new knowledge and innovation processes using AC theory in different fields.

The benefit of this study is to introduce a new vision into the field of internal auditing by developing a theoretical framework that will allow us to

better understand the various aspects of AC. In addition, it aims to enhance the capabilities of the internal auditor by developing a new approach to managing technology. The remainder of this paper is structured as follows: Section 2 provides a review of the literature on the implementation of IT in internal auditing and AC theory. Section 3 presents the research hypotheses and framework. Section 4 describes the research methodology. Section 5 presents the data analysis and results. Finally, Section 6 presents the discussion and conclusion.

## LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

### The Absorptive Capacity theory

Zahra and George (2002) defined AC as a dynamic capability with “a set of organizational routines and processes by which firms acquire, assimilate, transform, and exploit knowledge”. Zahra and George, (2002) discussed the two dimensions of AC: potential (acquisition and assimilation) and realized (transformation and exploitation). Acquisition, the process of acquiring knowledge is a critical component of a company’s operations. It involves identifying and acquiring knowledge that is needed to improve its efficiency (Lane et al., 2006). Assimilation, the process of assimilation refers to the routines and processes utilized by a firm to process, interpret, and analyze information that it has acquired from external sources (Zahra and George, 2002). Transformation, the process of transformation refers to development and refinement of procedures that help organizations combine their existing knowledge with that of their newly acquired counterparts (Zahra and George, 2002). This can be done by either deleting or adding knowledge (Lane et al., 2006). Bisociation is a process that changes the character of knowledge by merging two conflicting sets of information (Ince et al., 2016). Exploitation, according to Levinthal and Cohen (1990), the application of knowledge is a central component of AC. This concept is further reinforced by the idea that exploitation can be a part of an organization’s operations (Cohen and Levinthal, 1990). It allows firms to develop and enhance their existing competencies by taking advantage of their knowledge (Lane et al., 2006).

## **Internal Audit Characteristics and Absorptive Capacity theory**

The domain-dependent nature of AC means that its characteristics, such as technicality and complexity, vary depending on the domain (Cohen and Levinthal, 1990). This suggests that different antecedents would be involved in the transmission of knowledge, depending on the domain in question (Schweisfurth and Raasch, 2018). What is constant across domains is that the required technical knowledge can be acquired when professionals possess the necessary background, experience, and communication skills (Zahra and George, 2002). Moreover, Khan et al. (2019) argued that knowledge characteristics can affect potential and realised AC and that future studies should therefore include another knowledge type to fill this research gap. Specifically, AC supports learning, critical thinking, and problem-solving skills, which in turn impact innovation performance (Daspit et al., 2019; Zahra and George, 2002). The significance of AC for creating value in knowledge-based competition is widely known (Daspit et al., 2019). The relationship between technical expertise and knowledge acquisition and assimilation (potential AC) is based on the knowledge that is accessible within the organisation (Schweisfurth and Raasch, 2018). Based on the above, the characteristics of the internal auditors determine their (or the company's) ability to acquire and assimilate the best IT knowledge. Thus, the present study examined the AC theory in the internal audit context and hypothesised the following:

*H1: Internal auditing characteristics have a positive influence on potential AC.*

## **Internal Control System and Absorptive Capacity Theory**

The Committee of Sponsoring Organizations of the Treadway Commission (COSO) recognises IT as a tool for developing internal control systems through specific 'control monitoring tools' or 'process management tools' (COSO, 2013). The internal control system aims to improve global visibility to risk and performance through the successful use of IT (Rae et al., 2017). In today's environment, firms must integrate IT into their internal control activities to evaluate critical aspects of their operations across five components: control environment, risk assessment, control activities, information and communication, and monitoring. Cohen and

Levinthal (1990) defined the AC theory as ‘an ability to learn from external knowledge through processes of knowledge identification, assimilation, and application’. Khan et al., (2019) demonstrated that global and sustainable companies achieve competitive advantage only when they consider AC knowledge, which promotes competitive advantage by facilitating the acquisition and assimilation of external knowledge (potential AC) before transforming and exploiting it (realised AC). While leaders’ chosen staff can internalise potential AC, they can also develop social trust, language skills, and dependability through their communication. Therefore, potential AC requires change, flexibility, and creativity (Newey and Zahra, 2009). Assimilation can enhance the internal control system by allowing potential AC to discover competition between new technology and the internal control system. This enables the internal control system to observe which technology should be shared. Furthermore, acquiring external technology helps organisations understand the internal system environment and teaches them how to improve it. Thus, the ability to acquire knowledge enhances the internal control system. Thus, we proposed the following:

*H2: Potential AC has a positive influence on the internal control system.*

The mechanisms of AC refer to the processes and structures organizations use to effectively absorb and utilize new knowledge, information, and resources (Cenamor et al., 2019). By utilizing these mechanisms, organizations can effectively absorb and integrate new information into their operations, share it with relevant stakeholders, and continuously improve their performance (Liu et al., 2013). The relationship with internal control system is that the internal control system helps to enhance the organization's absorptive capacity by providing a mechanism to effectively manage and utilize new information, resources and knowledge (Rae et al., 2017). The internal control system ensures that the new information and resources are properly integrated into the organization, allowing it to better absorb and utilize them to achieve its objectives.

Potential and realised AC differ significantly; as such, they involve different plans and structures. The subsequent strain between the two investigation directions are hard to accommodate (Newey and Zahra, 2009). Organisations must maintain the new knowledge generated by innovative

advancement and render it accessible to relevant organisational members (Cepeda-Carrion et al., 2012). Potential AC is critically important to acquiring relevant information from associated partners who possess developed skills and information (Khan et al., 2019). Potential AC is positively related to realised AC, as firms try to transform and exploit external information to develop useful innovations (Leal-Rodríguez et al., 2014). Yang and Tsai (2019) opined that future studies should test the role of other contextual features or external knowledge requirements to understand AC innovation. To do so, they suggested examining other possible mediating mechanisms that explain how AC results in innovation. This study regards the internal control system as a mediation tool in the context of AC. Based on the view that potential AC captures new knowledge and realised AC uses valuable knowledge, internal control system structures classify and give space to implement what has already been learned and applied effectively. An internal control system presents the strengths and weaknesses of several options (e.g. better flexibility, improved control, and more time savings). Consequently, the internal control system acts as a mediator in the relationship between potential and realised AC, since it allows new technology to be merged with past technology. Thus, to examine AC theory in the internal control system context, we hypothesised the following:

*H3: The internal control system has a mediating effect on the relationship between potential and realised AC.*

## **Internal Audit Processes and the Absorptive Capacity Theory**

In recent decades, the use of internal auditing has grown as it gained increasing importance in the wake of dramatic scandals and failures. Eulerich et al. (2019) identified internal auditing functions as an essential component of high-quality reporting, while Al-Sukker et al. (2018) found that objectivity, competence, and work performance improve internal auditing functions. Bauer et al. (2019) recommended future research on whether auditors' motivation to include IT specialists in the audit process depends on the value of IT expertise. Internal auditing processes offer reasonable assurance regarding the extent of an institution's achievement of its objectives, including operational, financial, and compliance with laws and systems (Mustapha and Lai, 2017). Pursuing technological developments is essential for any profession and includes preparing an electronic report



(Dowling and Leech, 2014). IT helps auditors complete their work more efficiently, effectively, and faster by enhancing their overall productivity (Mustapha and Lai, 2017). Realised AC is allied to events that enable the combination of newly acquired knowledge with existing knowledge to leverage or generate new opinions (Zahra and George, 2002). Situation-specific realised AC is the extent to which a firm can use its AC in a specific situation (because of its internal processes) to assimilate and commercially apply external knowledge (Aliasghar et al., 2019). Realised AC indicates an organisation's capacity to transform and exploit assimilated knowledge by merging it into its processes (Kale et al., 2019). According to Aliasghar et al. (2019), future research should also examine how open innovation helps organisations improve process innovations and present new innovations in different areas. In this study, realized AC would be able to transform internal auditing processes, for instance, internal audit departments should be able to transform their strategies, support technology changes and capable of organising all the necessary audit procedures in order to help achieve a good performance in business. Furthermore, internal auditing processes' decision quality is enhanced to assist audit plan development and the organisation of internal audit reporting. This relationship is developed by applying AC theory. Thus, we hypothesised the following:

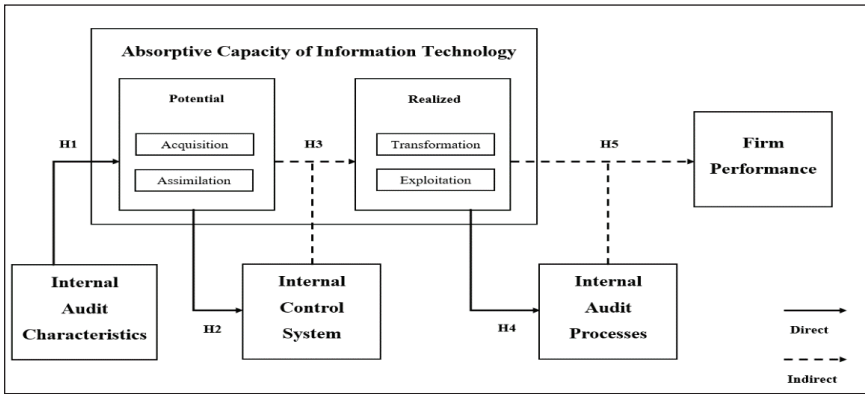
*H4: Realised AC has a positive influence on internal auditing processes.*

AC is often associated with companies focused on technological development (Vlačić et al., 2019). AC also maps and brings to the fore firms' technological capabilities and uses them to improve firm performance and cultivate customer loyalty; there is a favourable relationship between AC and firm performance (Tzokas et al., 2015) and its technological and customer relationship capability contributes to its overall performance. Using structural equation modeling in a sample of 158 firms (316 questionnaires, two respondents per firm). AC helps create more useful information, which is essential for firms' continued success (Cenamor et al., 2019). Concerning AC theory, Cohen and Levinthal (1990) argued that an organisation's ability to recognise the value of new, external data, assimilate it, and apply it to commercial ends is critical to their innovative capabilities. To address a research gap in the AC theory by, Kale et al. (2019) recommended further research to examine total firm performance and

another kind of performance (e.g. financial data, customer satisfaction, or innovation performance) using multi-method or multi-measure approaches instead of gathering information from a single source. Furthermore, Vlačić et al. (2019) suggested that future research should connect the AC theory to key interdisciplinary economic business areas. However, once potential AC has transferred external knowledge into the firm and assimilated it into its processes, the information is then kept for use at a future opportune moment. The transformed knowledge is leveraged through exploitation capability (Zahra and George, 2002). When knowledge is transformed and exploited by realised AC, the organisation uses it to improve and generate value (Daspit et al., 2019). The abilities of knowledge transformation and exploitation (realised AC) could position a business to improve performance through cost-saving and advancement. Internal auditing processes in most organisations use the IT function to support management with the insurance that its control responsibilities over data assets are actuality met (Mustapha and Lai, 2017). The internal auditing department is interested in using IT to conduct internal auditing processes so as to improve firm performance (Dowling and Leech, 2014). These technologies cater to businesses by promising to create new value by increasing efficiency, developing the internal auditing process, and increasing audit performance strength. In this study, IT is considered to develop a critical input for the success of overall and sustainable innovation performance. It can be assumed that the AC of IT is tied to firm performance. Internal auditing processes improve a firm's ability to detect and prevent fraud by providing a consistent plan for all company processes. Internal auditing processes include all audit procedures, from planning to fieldwork and reporting. IT is used to create internal auditing working papers and audit financial statements and select samples during internal auditing processes. Thus, we proposed the following hypothesis:

*H5: Internal auditing processes have a mediating effect on the relationship between realised AC and firm performance.*

The conceptual framework of this study is in Figure 1.



**Figure 1: Conceptual Framework**  
(Source: Own)

## METHODOLOGY

### Target Population and Sample of the Study

The target population of the study were internal auditors from companies listed on the Amman Stock Exchange (ASE) in the Kingdom of Jordan. Auditors from foreign companies were excluded as these companies are not registered in Jordan and are not listed on the ASE which totalling 231 companies in total; however, only 121 agreed to distribute the questionnaires to their internal auditors. The random sampling method was applied in order to generalize the findings on the whole population of internal auditors. Hence, 625 questionnaires were distributed to internal auditors within the 121 responsive firms. Of those, 332 were returned, leading to a response rate of 53%. This relatively high response rate is attributable to the firms that support research and development. The actual number of surveys used in the analysis was 332, since 36 surveys were incomplete and 257 were not returned. Table 1 summarises the final sample of internal auditors per sector.

**Table 1: Study Sample and Analysis of Respondents**

Sectors	Questionnaires distributed	Questionnaires unreturned	Uncompleted questionnaires returned	Completed questionnaires returned	
<b>Financial</b>	Banks	111	(42)	5	64
	Insurance	83	(36)	6	41
	Diversified Financial Services	45	(28)	2	15
	Real Estate	39	(22)	4	13
<b>Industrial</b>	Electrical	0	0	0	0
	Engineering and Construction	19	(9)	1	9
	Chemical	21	(11)	1	9
	Pharmaceuticals and Medical	11	(5)	0	6
	Tobacco and Cigarettes	8	(3)	0	5
	Food and Beverages	46	(17)	4	25
	Textiles, Leathers, and Clothing	10	(5)	1	4
	printing and packaging	15	(6)	1	8
	paper and cardboard	8	(3)	0	5
	mining and extraction	24	(7)	1	16
	Technology and Communications	8	(5)	0	3
	Commercial	16	(4)	1	11
<b>Services</b>	Utilities and Energy	58	(24)	4	30
	Transportation	32	(12)	2	18
	Hotels and Tourism	24	(6)	0	18
	Health and care	7	(1)	0	6
	Media	0	0	0	0
	Educational	40	(11)	3	26
<b>Total</b>	<b>625</b>	<b>(257)</b>	<b>(36)</b>	<b>332</b>	

Table 2 shows the results of a descriptive analysis of respondents’ demographic variables. Concerning the variable of position, about half the sample is currently employed as internal auditors, 31% are heads of departments, 10.2% internal audit managers, and 7.8% have other positions such as assistant of the internal audit and assistant of the head of the department of internal audit. The difference in positions allowed for a diversity of perspectives in this study.

**Table 2: Demographic Profile of Respondents**

	Categories	Frequency	Percentage
Gender	Male	233	70.2%
	Female	99	29.8%
Total		332	100%
Age	24 – 29	89	26.8%
	30 – 34	106	31.9%
	35 – 39	73	22%
	More than 39	64	19.3%
Total		332	100%
Education Level	less than the Bachelors	11	3.3%
	Bachelors	219	66%
	High Diploma	32	9.6%
	Master	53	16%
	Ph.D.	17	5.1%
Total		332	100%
Position	Internal auditor Manager	34	10.2%
	Head of the Department	103	31%
	Internal Auditor	169	50.9%
	Other	26	7.8%
Total		332	100%
Experience	Less than 2 years	51	15.4%
	2 – 4 years	93	28%
	5 – 7 years	100	30.1%
	More than 7 years	88	26.5%
Total		332	100%

## Survey Design and Data Collection Procedure

This study adopted a quantitative method and collected original data from two sources. The first source was a questionnaire divided into two parts. The first part included questions about the respondents' demographic profile. The second part focused on the participants' use of internal control system variables (control environment, risk assessment, control activities, information and communications, and monitoring), and these were measured using 33 questions adopted from Länsiluoto et al. (2016). Further, internal auditing processes were measured using 18 questions at different decision levels to explain the procedures behind internal auditing processes (i.e. plan, fieldwork, report), adopted from Tarek et al. (2017). Internal auditing characteristics were also measured using 16 questions adopted from

Alzeban and Gwilliam (2014). In addition, the AC variables (acquisition, assimilation, transformation, and exploitation) were measured using 26 questions, adopted from Vlačić et al. (2019). Finally, the non-financial data were measured using 8 questions adopted from Martinez-Conesa et al. (2017) to evaluate the organisation's strategy and profitability. Responses were collected on a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5). The questionnaire was validated through eight (8) expert reviewers i.e. academicians from different Jordanian universities. Based on their recommendations, a few items were added, deleted, or modified in the initial questionnaire. The second source of data was annual reports issued by the ASE for the period 2014–2018, from which financial data on two ratios (return on assets, ROA, and return on equity, ROE) were extracted.

## RESULTS

The selection of software and techniques for analysing the data collected from a survey was made. The study was conducted using SmartPLS, a version 4 software. It was used to perform various tasks, The data were examined using partial least squares structural equation modelling (PLS-SEM), which is a variance-based technique used to validate the examination system for data analysis (Hair et al., 2017).

### Measurement and Structural Model Assessment

This study used higher-order constructs (HOC), known as hierarchical component models (HCM), which allow academics to model a construct and its more complex subdimensions (referred to as lower-order components [LOC]) on a more abstract level. HOC helps minimise the number of relationships in the path model, thus obtaining model parsimony and solving the bandwidth-fidelity dilemma (Johnson et al. 2011). Finally, by providing a vehicle to rearrange the indicators or constructs through various subdimensions of the more abstract construct in order to obtain more specific data, HOC provides a means to minimise collinearity between formative indicators (Hair et al., 2018). In this study, potential and realised AC, internal control system, and firm performance were used as HCM. According to the calculated reflective-reflective model, these are all HOC related to LOC.

The measurement model was evaluated through both construct reliability and validity (including convergent and discriminant validity). The  $\alpha$  coefficients were analysed to calculate each core variable’s reliability in the measurement model. The findings show that all the  $\alpha$  values, ranging from 0.700 to 0.932, were higher than the suggested threshold of 0.6, and all the CR values, ranging from 0.798 to 0.939, were higher than the suggested threshold of 0.7 (Hair et al., 2014). This sufficiently suggests that construct reliability was achieved, as shown in Table 3. Table 4 indicates the included and excluded factor loading items, which were used to analyse indicator reliability; they must be 0.70 and above (Hair et al., 2014).

The next step in assessing the reflective measurement model addresses convergent validity, which is the extent to which a construct converges in its indicators by explaining the items’ variance (Sarstedt et al., 2019). In this study, the PLS-SEM run this step automatically. In the HCM, the AVE is the mean of the HOC squared loadings for the relationships between the LOC and the HOC (Hair et al., 2018).

**Table 3: Measurement Model Assessment**

HOC	LOC	$\alpha$ (> 0.6)	CR (> 0.7)	AVE (> 0.5)
Internal Audit Characteristics	Individual Characteristics	0.894	0.917	0.615
	Organization Characteristics	0.815	0.871	0.576
		0.896	0.913	<b>0.700</b>
	Control Environment	0.908	0.935	0.783
	Risk Assessment	0.771	0.854	0.594
	Control Activities	0.851	0.899	0.691
	Information/Communication	0.834	0.878	0.546
Internal Control System	Monitoring	0.861	0.900	0.645
		0.932	0.939	<b>0.502</b>
	Plan	0.868	0.905	0.657
Internal Audit Processes	Fieldwork	0.901	0.922	0.628
	Report	0.825	0.884	0.656
		0.917	0.928	<b>0.604</b>
	Acquisition	0.834	0.878	0.547
	Assimilation	0.870	0.906	0.661

Potential Absorptive Capacity		0.877	0.900	<b>0.778</b>
	Transformation	0.878	0.908	0.622
	Exploitation	0.862	0.906	0.708
Realized Absorptive Capacity		0.899	0.917	<b>0.796</b>
	Non-Financial Data	0.885	0.916	0.687
	Financial Data	0.700	0.819	0.694
Firm Performance		0.723	0.798	<b>0.516</b>

**Table 4: Factor Loading**

Construct	Item Code	Factor Loading ≥ 0.70	Factor Loading < 0.70
Individual Characteristics	I.C	2,3,4,5,6,7,8	1
Organization Characteristics	I.O	1,4,5,6,7	2,3
Control Environment	CE	1,2,3,4	5,6,7,8
Risk Assessment	R	1,3,5,6	2,4,7
Control Activities	CA	2,3,4,5	1,6
Information/Communication	IC	1,2,3,4,5,6	7
Monitoring	M	1,2,3,4,5	
Plan	P	1,2,3,4,6	5
Fieldwork	F	2,3,4,5,6,7,8	1
Report	RE	1,2,3,4	
Acquisition	Acq	1,2,4,6,7,8	3,5,9
Assimilation	Ass	2,3,4,5,6	1
Transformation	Tra	2,3,4,5,6,7	1
Exploitation	Exp	1,2,3,4	
Non-Financial Data	NF	4,5,6,7,8	1,2,3
Financial Data	ROA ROE	ROA ROE	

Three criteria—cross-loads, the Fornell–Larcker criterion, and the heterotrait-monotrait ratio (HTMT)—were employed to evaluate the measurement model’s discriminant validity. The Fornell–Larcker Criterion is measured by examining the outcome of the comparison between the square roots of AVEs and the correlation constructs, both vertically and diagonally. Hair et al. (2017) noted that a valid measurement using Fornell–Larcker Criterion is found when the square root of AVE of a construct is greater than the correlation between the construct with another construct and the HTMT of each variable is not exceeding 0.9. See Table 5 and 6.



The structural model was assessed by observing the beta ( $\beta$ ),  $R^2$ ,  $R^2$  adjusted, and the corresponding t-values via a bootstrapping technique with a resample of 5,000. Hair et al. (2017) recommended testing the predictive relevance ( $Q^2$ ) and when the  $Q^2$  value is larger than zero, the exogenous constructs have predictive relevance for the endogenous constructs in the model. As shown in Table 7 the  $Q^2$  values of the model were all above 0. Hair et al. (2017) recommended testing the change in the  $f^2$  value. And they suggested a guideline measure, if  $f^2$  is less than 0.02, it depicts no effect size; if  $f^2$  is between 0.02 to 0.15, it depicts small effect size; if  $f^2$  is between 0.15 to 0.35, it depicts medium effect size; and if  $f^2$  is above 0.35, it depicts large effect size.

**Table 5: Results of Discriminant Validity by Fornell-Larcker Criterion**

Construct	Firm Performance	Internal Audit Characteristics	Internal Audit Processes	Internal Control System	Potential Absorptive Capacity	Realized Absorptive Capacity
Firm Performance	0.670					
Internal Audit Characteristics	0.262	0.701				
Internal Audit Processes	0.396	0.330	0.611			
Internal Control System	0.421	0.355	0.587	0.566		
Potential Absorptive Capacity	0.339	0.208	0.505	0.476	0.711	
Realized Absorptive Capacity	0.491	0.190	0.478	0.461	0.467	0.720

**Table 6: Results of Discriminant Validity by HTMT**

Construct	Firm Performance	Internal Audit Characteristics	Internal Audit Processes	Internal Control System	Potential Absorptive Capacity	Realized Absorptive Capacity
Firm Performance						
Internal Audit Characteristics	0.357					
Internal Audit Processes	0.472	0.402				
Internal Control System	0.528	0.441	0.640			
Potential Absorptive Capacity	0.436	0.274	0.571	0.521		
Realized Absorptive Capacity	0.596	0.246	0.532	0.518	0.533	

## Hypotheses Testing

Hair et al. (2017) recommended that researchers adopt the testing procedures of Preacher and Hayes (2004, 2008) when examining mediating effects. The first examined the direct effect of the dimensions of H1, H2, and H4. The second examined the mediating effect of the internal control system (H3) and internal auditing processes (H5).

### Direct Effect

The SmartPLS bootstrapping process results showed that the internal auditing characteristics significantly predicted potential AC. Hence, H1 was supported with  $\beta = 0.599$ ,  $T = 12.723$ ,  $p < 0.000$ . Likewise, potential AC significantly predicted the internal control system. Hence, H2 was supported with  $\beta = 0.650$ ,  $T = 15.658$ ,  $p < 0.000$ . Additionally, realised AC significantly predicted internal auditing processes. Hence, H4 is supported with  $\beta = 0.601$ ,  $T = 13.793$ ,  $p < 0.000$ . The results are shown in Table 7.

**Table 7: Structural Path Analysis Result**

Hypotheses	$\beta$	M	SD	T	P-value	Confidence interval		R2	Q2	F2	Decision
						LL 2.5%	UL 97.5%				
H1 I.A.C → P.A.C	0.599	0.599	0.047	12.723	0.000			0.162	0.551		Supported
H2 P.A.C → I.C.S	0.650	0.650	0.041	15.658	0.000			0.422	0.166	0.730	Supported
H3 P.A.C → I.C.S → R.A.C	0.256	0.255	0.049	5.231	0.000	0.161	0.353	0.468	0.243	0.168	Supported
H4 R.A.C → I.A.P	0.601	0.601	0.044	13.793	0.000			0.361	0.159	0.564	Supported
H5 R.A.C → I.A.P → F.P	0.261	0.263	0.042	6.189	0.000	0.185	0.349	0.421	0.206	0.210	Supported

### Indirect Effect

Mediation occurs when a third variable intervenes between two related constructs. Testing for the type of mediation in a model requires running a series of analyses. The first addresses the significance of the indirect effect via the mediator variable. If the indirect effect is not significant, we conclude that there is no mediating effect (Hair et al., 2017). The mediating effect of the internal control system supposes a positive and significant relationship between potential and realised AC; Table 7 confirms this relationship at  $p > 0.000$ . Consequently, H3 and H5 were supported. Then, followed by the testing procedures of Preacher and Hayes (2008) to test the mediating effects. The mediating effects (H3 and H5 respectively) suppose that the indirect effect must be significant and the confidence interval must not contain zero [LL = 0.161, UL = 0.353; LL = 0.185, UL = 0.349] (Preacher and Hayes, 2008). Table 8 shows that only specific indirect effects for H3

and H5 did not contain zero. Thus, this study confirmed that the internal control system's mediation effect was statistically significant between potential AC and realised AC, indicating support for H3 whereas internal auditing processes' mediation effect was statistically significant between realised AC and firm performance, indicating support for H5.

## **DISCUSSION AND CONCLUSION**

### **Discussion of Finding**

This approach is likely to maintain the stable development of the AC theory in the IA context. First, there was a positive relationship between the internal audit characteristics and their role in the development of the AC theory (H1 is supported). It will involve the environment's diversity and the multiple sources of potential AC. An internal auditor's technology search is a process that helps them identify areas of their expertise that they can improve in order to acquire more knowledge. This process can be carried out through the development of their future acquisition capabilities. Moreover, our findings are consistent with a study by Mahzan and Veerankutty, (2011) which noted that the increasing number of computer auditors and the establishment of new systems are some of the factors that have been identified as contributing to the increasing number of IT audits associated with the internal auditors' IT control evaluations. The findings support existing studies that suggest that organizations should develop training programs that can help improve the creativity of their employees (Vlačić et al., 2019). In addition, a recent study revealed that assessing the software requirements of each function could help identify areas where further improvement could be made (Ali and Park, 2016).

Second, there was a positive relationship between AC theory in the internal control system context in which H2 was supported. It is a step toward developing a more accurate definition of AC variables that can be used to improve the efficiency of an organization. In addition to being able to identify trends in their environment, this study also shows that potential ACs are more likely to adopt a continuous approach to improving their IT stock by continuously monitoring and analysing their external environment. The development of a potential AC helps internal auditors to

monitor changes in their industries and deploy necessary capabilities, such as IT competencies and control. The components of an AC can help them improve their capabilities and increase their effectiveness, which can result in long-term economic benefits. This is because the combined resources and capabilities of an internal auditor can help them perform their duties more effectively. Similar results are achieved in a study by Vieira et al. (2015) revealed that IT capabilities can help firms acquire knowledge. These findings are in line with other studies e.g., Bolívar-Ramos et al., (2013) that suggest that technological systems can promote information flows related to production and innovation.

Third, there was a positive relationship between the internal control system and AC theory.. Specifically, H3 was supported in this study. In order to promote comprehension and mutual understanding, the members of the firm should share information related to the exploitation of IT. The internal control system contributes to IT assimilation and facilitates the distribution of information within the firm as well as gathering interpretations and identifying trends. The mediation of the internal control system is purely defensive in nature and contributes to realized AC besides possibly reinforcing it. The internal control system should be more focused on developing its own innovation capabilities instead of relying on information disclosure from other firms. This will help improve the relationship between the potential and realized AC. This is important because, once an organization has acquired and assimilated new technology, it needs a system that can better manage its exploitation and transfer of new technology. The findings of this study support the idea that firms should transform their acquired knowledge and use it to their advantage (Lee et al., 2014). On the other hand, IT can help them create repositories that can contain both external and internal knowledge (Flor et al., 2018). The findings support the idea that IT capability can help employees improve their communication skills and promote the exploitation and integration of their knowledge (Petti et al., 2019).

Forth, there was a positive relationship between realized AC and internal audit processes by which H4 is supported. The study aimed to analyze the realized AC that internal audit processes to improve their performance. One of these is their ability to effectively manage and exploit technology. This is a critical resource that can be used to enhance the internal

audit processes. This is because technology can help them improve their efficiency and increase their reports' effectiveness. This study is in line with the findings of Raymond et al., (2016) that indicated that the use of IT in an organization can help improve the efficiency of its processes. Also, the findings of these studies support the idea that an organization's information security is evaluated through an IA, which helps firms develop a risk profile for their projects. The IA will then assess the company's overall experience with certain technologies (Alkebsi and Aziz, 2017).

Fifth, there was a positive relationship between AC theory and internal audit processes. Thus, having internal audit processes is very important to ensure that the firm's technology is used effectively and efficiently. This process can help improve the firm's performance and enhance its competitive advantage. In addition to being able to access the company's technology base, internal auditors can also take advantage of the system's various features to improve the organization's performance. The findings of this study (H5 was supported) indicate that an adequate IT system is required for the successful completion of internal auditor. This is because the performance of the internal auditor is very important for the success of the process (Havelka and Merhout, 2013). Finally, the study is in line with the findings of a study conducted by D'Onza et al. (2015), which suggests that an internal auditor should create an audit plan that includes a comprehensive assessment of the risks associated with the use of technology.

## **CONCLUSION**

The results have practical implications for internal auditing using IT. The internal audit profession is fast evolving in response to changes in the surrounding environment. Internal auditors must stay up to date with the latest technical advancements and their influence on organisations' data processing system as well as their own internal audit procedures, since these developments take place at an increasing pace. Thus, it can be concluded that there is a strong relationship between internal auditing and IT, which can be understood using AC theory and must identify qualities that exist concurrently with the capacity of the internal audit department to acquire and integrate new IT expertise. Internal auditors with a greater ability to recognise and digest the value of new knowledge for unit IT use should be

better able to apply it to their business operations in the AC environment. Conversely, if they lack the ability to recognise or assimilate information, they will find it difficult to use IT for productive goals in a novel way. Furthermore, the successful use of IT mechanisms is critical to successful internal auditing, but it is only one step toward accepting the changes that IT presents to a corporation and the internal auditing profession. This study has some limitations. First, the study was conducted in the Kingdom of Jordan, and specifically focussed on public shareholding companies. Second, the research sample included only those companies that agreed to the distribution of questionnaires to their internal auditing staff. Therefore, it would be interesting to reproduce this study in other countries to confirm the results in different regulatory and economic contexts and offer additional suggestions on the examined topics.

## REFERENCES

- Abbaszadeh, M. R., Salehi, M., & Faiz, S. M. (2019). Association of information technology and internal controls of Iranian state agencies. *International Journal of Law and Management*, 61(1), 133–150.
- Abdolmohammadi, M. J., & Boss, S. R. (2010). Factors associated with IT audits by the internal audit function. *International Journal of Accounting Information Systems*, 11(3), 140-151.
- Al-Sukker, A., Ross, D., Abdel-Qader, W., & Al-Akra, M. (2018). External auditor reliance on the work of the internal audit function in Jordanian listed companies. *International Journal of Auditing*, 22(2), 317–328.
- Aliasghar, O., Rose, E. L., & Chetty, S. (2019). Where to search for process innovations? The mediating role of absorptive capacity and its impact on process innovation. *Industrial Marketing Management*, 82, 199–212.
- Ali, M., & Park, K. (2016). The mediating role of an innovative culture in the relationship between absorptive capacity and technical and non-technical innovation. *Journal of Business Research*, 69(5), 1669–1675.

- Alkebsi, M., & Aziz, K. A. (2017). Information Technology Usage, Top Management Support and Internal Audit Effectiveness. *Asian Journal of Accounting and Governance*, 8(Special Issue), 123–132.
- Antunes, M., Maximiano, M., & Gomes, R. (2022). A customizable Web Platform to Manage Standards Compliance of Information Security and Cybersecurity Auditing. *Procedia Computer Science*, 196, 36–43.
- Bauer, T. D., Estep, C., & Malsch, B. (2019). One Team or Two? Investigating Relationship Quality between Auditors and IT Specialists: Implications for Audit Team Identity and the Audit Process. *Contemporary Accounting Research*, 36(4), 2142–2177.
- Bolívar-Ramos, M., García-Morales, V. J., & Martín-Rojas, R. (2013). The effects of Information Technology on absorptive capacity and organisational performance. *Technology Analysis and Strategic Management*, 25(8), 905–922.
- Brushwood, J., Hall, C., & Rapley, E. (2020). Unintended costs of a dual regulatory environment: Evidence from state-level cannabis legalization and bank audit fees. *J. Account. Public Policy*, 39, 106736.
- Cenamor, J., Parida, V., Oghazi, P., Pesämaa, O., & Wincent, J. (2019). Addressing dual embeddedness: The roles of absorptive capacity and appropriability mechanisms in subsidiary performance. *Industrial Marketing Management*, 78, 239–249.
- Cepeda-Carrion, G., Cegarra-Navarro, J. G., & Jimenez-Jimenez, D. (2012). The effect of absorptive capacity on innovativeness: Context and information systems capability as catalysts. *British Journal of Management*, 23(1), 110–129.
- Christensen, B., Lei, L., Shu, S., & Thomas, W. (2022). Does audit regulation improve the underlying information used by managers? Evidence from PCAOB inspection access and management forecast accuracy. *Accounting, Organizations and Society*, 13, 101403.

- Cohen, W. M., & Levinthal, D. A. (1990). Absorptive Capacity: A New Perspective on Learning and Innovation. *Administrative Science Quarterly*, 35(1), 128.
- COSO. (2013). COSO Internal Control – Integrated Framework (2013). In The Committee of Sponsoring Organizations of the Treadway Commission (COSO) – Integrated Framework.
- Daspit, J. J., Long, R. G., & Pearson, A. W. (2019). How familiness affects innovation outcomes via absorptive capacity: A dynamic capability perspective of the family firm. *Journal of Family Business Strategy*, 10(2), 133–143.
- D’Onza, G., Lamboglia, R., & Verona, R. (2015). Do IT audits satisfy senior manager expectations? A qualitative study based on Italian banks. *Managerial Auditing Journal*, 30(4/5), 413–434.
- Dowling, C., & Leech, S. a. (2014). A big 4 firm’s use of information technology to control the audit process: How an audit support system is changing auditor behavior. *Contemporary Accounting Research*, 31(1), 230–252.
- Eulerich, M., Kremin, J., & Wood, D. A. (2019). Factors that influence the perceived use of the internal audit function’s work by executive management and audit committee. *Advances in Accounting*, 45, 1–7.
- Flor, M. L., Cooper, S. Y., & Oltra, M. J. (2018). External knowledge search, absorptive capacity and radical innovation in high-technology firms. *European Management Journal*, 36(2), 183–194.
- Hair, J.F., Sarstedt, M., Ringle, C.M., Gudergan, S.P. (2018). *Advanced Issues in Partial Least Squares Structural Equation Modeling (PLS-SEM)*. Sage, Thousand Oaks, CA: Sage.
- Hair Jr, J. F., Sarstedt, M., Ringle, C. M., & Gudergan, S. P. (2017). *Advanced issues in partial least squares structural equation modelling*. Los Angeles, CA: Sage.



- Hair, J. F., Tomas, G., Hult, M., Ringle, C. M., & Sarstedt, M. (2014). A primer on partial least squares structural equation modeling (PLS-SEM). Thousand Oaks, CA: Sage.
- Havelka, D., & Merhout, J. W. (2013). Internal information technology audit process quality: Theory development using structured group processes. *International Journal of Accounting Information Systems*, 14(3), 165–192.
- Huang, F., No, W., Vasarhelyi, M., & Yan, Z. (2022). Audit data analytics, machine learning, and full population testing. *The Journal of Finance and Data Science*, 8, 138-144.
- Ince, H., Imamoglu, S. Z., & Turkcan, H. (2016). The Effect of Technological Innovation Capabilities and Absorptive Capacity on Firm Innovativeness: A Conceptual Framework. *Procedia - Social and Behavioral Sciences*, 235, 764–770.
- Johnson, R. E., Rosen, C. C., & Chang, C. H. (2011). To Aggregate or Not to Aggregate: Steps for Developing and Validating Higher-Order Multidimensional Constructs. *Journal of Business and Psychology*, 26(3), 241–248.
- Kale, E., Aknar, A., & Başar, Ö. (2019). Absorptive capacity and firm performance: The mediating role of strategic agility. *International Journal of Hospitality Management*, 78, 276–283.
- Khan, Z., Lew, Y. K., & Marinova, S. (2019). Exploitative and exploratory innovations in emerging economies: The role of realized absorptive capacity and learning intent. *International Business Review*, 28(3), 499–512.
- Kotb, A., Sangster, A., & Henderson, D. (2014). E-business internal audit: The elephant is still in the room! *Journal of Applied Accounting Research*, 15(1), 43–63.
- Krieger, F., Drews, P., & Velte, P. (2021). Explaining the (non-) adoption of advanced data analytics in auditing: A process theory. *International Journal of Accounting Information Systems*, 41, 100511.

- Lane, P. J., Koka, B. R., & Pathak, S. (2006). The reification of absorptive capacity: A critical review and rejuvenation of the construct. *Academy of Management Review*, 31(4), 833–863
- Lämsiluoto, A., Jokipii, A., & Eklund, T. (2016). Internal control effectiveness – a clustering approach. *Managerial Auditing Journal*, 31(1), 5–34.
- Leal-Rodríguez, A. L., Roldán, J. L., Ariza-Montes, J. A., & Leal-Millán, A. (2014). From potential absorptive capacity to innovation outcomes in project teams: The conditional mediating role of the realized absorptive capacity in a relational learning context. *International Journal of Project Management*, 32(6), 894–907.
- Lee, J., Lee, H., Park, J.-G., Ochara, N. M., Kandiri, J., & Johnson, R. (2014). Exploring the impact of empowering leadership on knowledge sharing, absorptive capacity and team performance in IT service. *Information Technology & People*, 27(3), 366–386.
- Lenz, R., Sarens, G., & D’Silva, K. (2014). Probing the discriminatory power of characteristics of internal audit functions: Sorting the wheat from the chaff. *International Journal Auditing*, 18(2), 126–138.
- Li, H., Dai, J., Gershberg, T., & Vasarhelyi, M. A. (2018). Understanding usage and value of audit analytics for internal auditors: An organizational approach. *International Journal of Accounting Information Systems*, 28, 59–76.
- Liu, H., Ke, W., Wei, K. K., & Hua, Z. (2013). The impact of IT capabilities on firm performance: The mediating roles of absorptive capacity and supply chain agility. *Decision Support Systems*, 54(3), 1452–1462.
- Mahzan, N., & Veerankutty, F. (2011). IT auditing activities of public sector auditors in Malaysia. *African Journal of Business Management*, 5(5), 1551–1563.
- Martinez-Conesa, I., Soto-Acosta, P., & Palacios-Manzano, M. (2017). Corporate social responsibility and its effect on innovation and firm performance: An Empirical Research in SMEs. *Journal of Cleaner Production*, 142, 2374–2383.

- Mustapha, M., & Jin Lai, S. (2017). Information Technology in Audit Processes: An Empirical Evidence from Malaysian Audit Firms. *International Review of Management and Marketing*, 7(2), 53-59.
- Newey, L. R., & Zahra, S. A. (2009). The evolving firm: How dynamic and operating capabilities interact to enable entrepreneurship. *British Journal of Management*, 20(SUPP.1), 81-100.
- Petti, C., Tang, Y., & Margherita, A. (2019). Technological innovation vs technological backwardness patterns in latecomer firms: An absorptive capacity perspective. *Journal of Engineering and Technology Management*, 51, 10–20.
- Preacher, K., & Hayes, A. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior Research Methods, Instruments, & Computers*, 36(4), 717–731.
- Preacher, K., & Hayes, A. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*, 40(3), 879–891.
- Rae, K., Sands, J., & Subramaniam, N. (2017). Associations among the Five Components within COSO Internal Control-Integrated Framework as the Underpinning of Quality Corporate Governance. *Australasian Accounting, Business and Finance Journal*, 11(1), 28–54.
- Raymond, L., Bergeron, F., Croteau, A.-M., & St-Pierre, J. (2016). IT-enabled Knowledge Management for the Competitive Performance of Manufacturing SMEs: An Absorptive Capacity-based View. *Knowledge and Process Management*, 23(2), 110–123.
- Riikkinen, R., Kauppi, K., & Salmi, A. (2017). Learning Sustainability? Absorptive capacities as drivers of sustainability in MNCs' purchasing. *International Business Review*, 26(6), 1075–1087.
- Schmitz, J., & Leoni, G. (2019). Accounting and Auditing at the Time of Blockchain Technology: A Research Agenda. *Australian Accounting Review*, 29(2), 331–342.

- Schweisfurth, T. G., & Raasch, C. (2018). Absorptive capacity for need knowledge: Antecedents and effects for employee innovativeness. *Research Policy*, 47(4), 687–699.
- Slapnicar, S., Vuko, T., Cular, M., & Drascek, M. (2022). Effectiveness of cybersecurity audit. *International Journal of Accounting Information Systems*, 44, 100546.
- Strese, S., Adams, D. R., Flatten, T. C., & Brettel, M. (2016). Corporate culture and absorptive capacity: The moderating role of national culture dimensions on innovation management. *International Business Review*, 25(5), 1149–1168.
- Tarek, M., Mohamed, E. K. A., Hussain, M. M., & Basuony, M. A. K. (2017). The implication of information technology on the audit profession in developing country: Extent of use and perceived importance. *International Journal of Accounting and Information Management*, 25(2), 237–255.
- Todorova, G., & Durisin, B. (2007). Absorptive capacity: Valuing a reconceptualization. *Academy of Management Review*, 32(3), 774–786.
- Tzokas, N., Kim, Y. A., Akbar, H., & Al-Dajani, H. (2015). Absorptive capacity and performance: The role of customer relationship and technological capabilities in high-tech SMEs. *Industrial Marketing Management*, 47, 134–142.
- Vieira, C., Briones-Peñalver, A.-J., & Cegarra-Navarro, J.-G. (2015). Absorptive Capacity and Technology Knowledge: Enhancing Relational Capital. *Knowledge and Process Management*, 22(4), 305–317.
- Vlačić, E., Dabić, M., Daim, T., & Vlajčić, D. (2019). Exploring the impact of the level of absorptive capacity in technology development firms. *Technological Forecasting and Social Change*, 138, 166–177.
- Yang, S. Y., & Tsai, K. H. (2019). Lifting the veil on the link between absorptive capacity and innovation: The roles of cross-functional integration and customer orientation. *Industrial Marketing Management*, 82(March), 117–130.

Zahra, S. A., & George, G. (2002). Absorptive capacity: A review, reconceptualization, and extension. *Academy of Management Review*, 27(2), 185–203.