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IT capabilities, firm performance and the mediating role of ISRM: A case study from a developing country

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Abstract

Purpose – The purpose of this paper is to develop and test a research model that looks at the direct impact of information technology (IT) capabilities on firm performance and the mediating effects of the information security management system (ISMS) on this relationship.
Design/methodology/approach – The study uses a hypothetico-deductive approach based on quantitative data collected from 136 surveyed professionals in the field of IS, IT and the related security environment.
Findings – The results confirm the direct impact of IT capabilities on firm performance and the mediating effects of ISMS on this relationship.
Originality/value – The study draws on the resource-based view theory to develop a model that assesses the direct impact of IT capabilities on firm performance and the mediating effects of ISMS on this relationship in Cameroon, a developing country in Africa.

Keywords IT capability, IS success model, ISRM, Maturity level, Firm performance
Paper type Research paper

Introduction

In the current IT-dominated age, information has become the primary asset of any ambitious organization, and the quality of management decision is completely dependent on information. Information capabilities span a wide array of domains: enhancing business operations; facilitating management decision making; and deploying business strategies (Silva *et al.*, 2014). Moreover, IT capacities bring performance to business (Lee *et al.*, 2007; Yeh *et al.*, 2012). Yet, companies that have integrated relevant IT capabilities may experience other serious challenges to their performance, especially when it comes to value creation. Computer attacks are known to be among the causes of these challenges, as maintaining and safeguarding the confidentiality, integrity and availability of information is a tough assignment for firms which are eager to protect their strategic value (ISO/IEC, 2013; Silva *et al.*, 2014).

According to Knowdys Consulting Group, cybercrime has a very negative impact on the economic development of Sub-Saharan African enterprises. For example, in 2014, cybercrime costs between $12,000 and $13,000 per day to businesses based in West Africa (Knowdys Consulting Group, 2014). In fact, the literature confirms that SMEs in Africa face numerous obstacles to their development, notably as regards information security, because there is a shortage of skilled human resources, IT resources and support (Dubelaar *et al.*, 2005). Moreover, the today's global connectedness and the quickly evolving nature of ITs have made technology-driven security solutions inadequate to meet information security challenges (Hall *et al.*, 2011). In this context, an organization can be cyber-attacked even when its IT capabilities are good. Examples of common cyber-attacks include login usurpation of non-IT employees by means of social engineering, which harms the organization and undermines its performance, and targeting and attacking a dismissed

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employee whose login information was not withdrawn from the list of authorized users. Therefore, protecting IT information has become a key economic challenge for organizations seeking to ensure a permanent security of both their information and the related technology (Weishäupl *et al.*, 2015). Additionally, even though firms have been investing increasingly in information security and in their strategic role in today's business success, an effective implementation of information security strategy remains one of their top challenges (Ernst & Young, 2011). It should be recalled that while information security is crucial to the survival of any serious organization, it can only be guaranteed by the information security risk management (ISRM) (ISO/IEC, 2013), whose importance is always remarkable when IT capabilities naturally expose the organization to information security risks or IT risks (Carcary, 2013; Ernst & Young, 2011).

Thus, in this study, we investigate the impact of integrating an information security system into enterprise performance. Is an information security system embedded into the IT structure of an organization enough to trigger its performance? The literature on IS indicates that the relationship between information technology (IT) capabilities and organizational performance appears to be a widely studied topic and related findings are being used by decision makers (Huang *et al.*, 2009). Despite the importance of IT capabilities within an organization nowadays, it is difficult to link them with the anticipated benefits for an organization (Wade and Hulland, 2004). The resource-based theory (RBT) was developed to sustain that a company with resources has a competitive advantage that can be maintained for a long term to enhance performance. This is a key theoretical perspective that explains the relationship between IT capabilities and firm performance (Addas and Pinsonneault, 2007; Bharadwaj, 2000; Wade and Hulland, 2004). According to RBT, resources are static while our environment is dynamic. Taking into consideration that a company must always fit one's surroundings, RBT alone cannot explain the impact of IT capabilities on firm performance (Huang *et al.*, 2009).

Some scholars suggest that a positive link between information system investments and firm performance may be explained by several other factors that aim at identifying the indirect benefits of ITs (Akter *et al.*, 2016; Huang *et al.*, 2009; Wamba *et al.*, 2017). Hence, IT capabilities cannot fully explain the performance of an organization. In particular, different mediator constructs are being used in the link between IT capacities and firm performance, such as total quality management, the ability to use resources and process-oriented dynamic capabilities (Anand *et al.*, 2013; Huang *et al.*, 2009; Mooney *et al.*, 1995; Wamba *et al.*, 2017). We have not identified any study about the mediation effect of information security in relation to IT capabilities and firm performance conducted in a developing country in Africa, this confirms the originality of this study. On the presumption that IT capabilities cannot only have a direct impact on firm performance, our study aims to examine the following research question:

RQ1. Does ISRM mediate the relation between IT capabilities and firm performance?

To address this research question, this study draws on the literature on IT capabilities, RBT and dynamic capability (DC) to build a research model, hypotheses and a research design. Other sections deal with data analysis, the presentation of findings, the discussion for the study and implications for research and practice.

Background

RBT and IT capabilities

Numerous authors (Pratono, 2016; Niehaves *et al.*, 2014; Rahimi *et al.*, 2016; Brocke *et al.*, 2014) approve the primary statement of contingency theory which supposes that the organizational structure of an enterprise is determined by the scientific, economic and technological characteristics of its environment. Thus, Tan *et al.* (2016), in the context of

supply chain management, corroborated that information and knowledge are both critical resources which are determinant of enterprises that intend to gain essential value from their relationship with business partners. To address the technology characteristic in this study, two complementary theories are used: RBT and IT capability.

Within the IS discipline, IT business value is one of the most discussed topics, and RBT appears as an in-depth perspective for its analysis. RBT considers the firm as a complex set of assets, humans, knowledge and processes. RBT was developed to argue that a company endowed with resources is able to have a sustainable competitive advantage for the firm's performance (Bharadwaj, 2000; Wade and Hulland, 2004). This advantage can be maintained because any company is able to protect itself against skills and technology transfer or imitation. RBT categorizes IT resources in six major domains (Wade and Hulland, 2004), namely assets, core competencies, marketing resources, IT infrastructure, managerial IT skills and IT capabilities (Huang *et al.*, 2009). On the other hand, Bharadwaj (2000) suggested and validated six dimensions for measuring firm IT capabilities: IT/business partnerships, external IT linkages, business IT strategic thinking, IT business process integration, IT management and IT infrastructure. Her study revealed the reliability of each dimension and this was validated by a psychometric test on a sample of IS executives. Therefore, using RBT to assess the impact of IT capabilities on firm performance makes sense.

IT capabilities and firm performance

The positive link between IT capability and firm performance has been tested in several contexts, especially in developing countries, as it is the case in this study, with a wide range of results (Behera *et al.*, 2015; Lee *et al.*, 2007; Daulatkar and Sangle, 2015; Wong and Wong, 2011). Thus, it is now accepted that IT capabilities are now considered as a competitive advantage enabler within an organization because of their high operational and strategic potential. Many study argue that IT technological resources and IT managerial resources have a significant positive effect on firm performance (Addas and Pinsonneault, 2007; Akter *et al.*, 2016; Anand, 2013; Bharadwaj, 2000; Lee *et al.*, 2007; Yeh *et al.*, 2012; Chuang and Lin, 2015; Mithas *et al.*, 2011; Awasthi and Sangle, 2012; Daulatkar and Sangle, 2015; Liang *et al.*, 2010; Wamba *et al.*, 2017). For example, IT capabilities have a significant positive effect on financial performance (Anand *et al.*, 2013; Bharadwaj, 2000; Santhanam and Hartono, 2003), marketing performance (Anand *et al.*, 2013; Mithas *et al.*, 2004), administrative performance (Anand *et al.*, 2013; Mithas *et al.*, 2004) and efficiency performance (Liang *et al.*, 2010). According to Kim *et al.* (2012), IT management, IT personnel and IT infrastructure are dimensions of IT capability in the sociomaterialistic perspective. Characterized IT capability is, in terms of "unidirectional and unrelated conceptualization," a major highlight of sociomaterialistic-based modeling and completes the IT capabilities identified.

Based on some studies, only acquired IT resources seem to ensure good firm performance, but Wade and Hulland (2004) sustained that IT resources are necessary but not sufficient for good firm performance. Moreover, regarding the RBT and IT capabilities, it appears that resources are static while our environment is dynamic. The fact that a company should always fit its surroundings has raised the need for dynamic capability (DC) theory, according to which resources should be developed and integrated within a company. Teece *et al.* (1997), pioneers of this theory, defined the DC as the ability to integrate, build and reconfigure internal and external skills to adapt to rapid environmental changes. It is well agreed that the RBT facilitates the choice of resources while DC enables development and renewal of these resources (Eisenhardt and Martin, 2000; Teece *et al.*, 1997). As such, the DC theory fills the gap dynamically with a process orientation between resources and the environment; Teece *et al.* (1997) said that this issue is closely tied to the firm's business processes, market positions and expansion paths. In the IT domain, ISRM is one of the

activities that are being used to develop, renew and improve IT technology resources and IT management resources (ISO/IEC, 2011). Regarding the ISO/IEC 27005:2011 standard, ISRM is process based and can be used further as an input for operating firm business processes, market positions and expansion paths. Because ISRM is process based as a standard and as a tool (ISO/IEC, 2011, 2013), the DC theory permits its utilization for studying the effect of IT capabilities.

Research model and research hypotheses

Drawing on the literature on IT capabilities, this study proposes the research model shown in Figure 1 using RBT and DC. This study proposes IT capabilities as three second-order constructs: IT management capability, IT personnel capability and IT infrastructure capability, based on the sociomaterialistic theory (Kim *et al.*, 2012; Wamba *et al.*, 2017), as well as five first-order constructs: planning and design, planning for IT standards and controls, tangibility, flexibility and capability (Bharadwaj *et al.*, 1999). This study also argues that IT capabilities impact firm performance in two ways: directly and indirectly with the mediation of ISRM.

In relation to RBT, IT management capability, IT personnel capability and IT infrastructure capability are the three key components of firm IT capabilities. Former studies argue that IT capabilities have a positive significant effect on firm performance. For example, Anand *et al.* (2013) exploited 100 case studies documented between 2002 and 2012, and concluded that firm IT capabilities (IT management capability, IT personnel expertise and IT infrastructure flexibility) have a significant positive effect on performance improvement at the organizational level (financial performance, marketing performance and administrative performance).

Other authors have studied the mediating effect of processes on the relationship between IT capabilities and firm performance. For example, Lin (2007), Anand *et al.* (2013) and Wamba *et al.* (2017) found that process-oriented DC mediates the relation between IT capabilities and firm performance. Likewise, Huang *et al.* (2009) designed a method to validate the positive mediating effect of IT innovation on the link between IT capabilities and firm performance. Regarding the process-oriented DC and cyber criminality (in constant evolution), ISRM is a good candidate to act as a mediator construct between IT capabilities and firm performance. In this case, ISRM should be considered as a process drawing on the ISO/IEC 27005:2011 standards which identify six activities: context establishment, risk

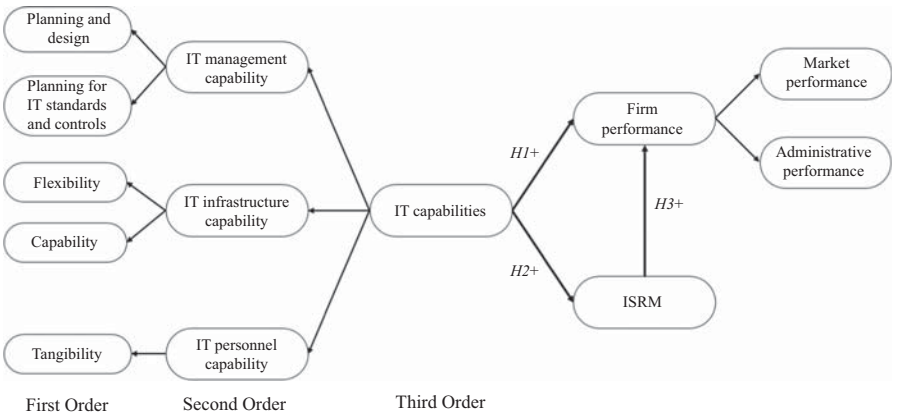


Figure 1.
Research model

assessment, risk treatment, risk acceptance, risk communication and risk monitoring and review. These six activities were assessed to determine the maturity level of ISRM.

Based on these observations, our study suggests to test not only the direct effect of IT capabilities and firm performance but also the mediating effect of ISRM on the relationship between IT capabilities and firm performance. Therefore, our research hypotheses are:

H1. IT capabilities have a significant positive effect on firm performance.

H2. IT capabilities are positively connected to ISRM.

H3. ISRM is positively connected to firm performance.

Research method

To verify our different hypotheses, we used a hypothetico-deductive approach using quantitative data collected during a survey. Such an approach has proven its efficiency and reliability in the field of social sciences, through the structural equation modeling (SEM) method and the partial least square (PLS) method. The PLS-SEM method has been successfully used to analyze our models and theories when developing our research model.

Our sample comprised IT professionals and managers from selected enterprises. Our survey, with 41 questions, was structured into two parts: 35 questions using a seven-point Likert scale to measure IT capabilities and firm performance, and 6 questions using a five-point Likert scale were formulated and administered to measure the ISRM maturity level. Out of the 485 online questionnaires that were sent to potential respondents, a total of 136 were found with zero missing value by online survey. This number was appropriate for our study according to Cohen (1992) and Hair *et al.* (2014). The demographic profile of respondents is given in Table I. Also, no difference was found between early respondents and late respondents.

Data analysis was being carried out using SmartPLS software, and comprised three steps. First, we realized quality analysis of our different constructs using outer loadings (Hair *et al.*, 2017), discriminant validity (Henseler *et al.*, 2015), composite reliability (Nunnally and Bernstein, 1994), AVE (Hair *et al.*, 2017), Cronbach's α (Hair *et al.*, 2017) and Fornell–Larcker criteria (Fornell and Larcker, 1981; Hair *et al.*, 2013, 2017). Second, we tested the significance of each relation so as to confirm the different formulated hypotheses. Thus, we applied the SmartPLS bootstrapping method with 5,000 bootstrap samples, as

Dimensions	Category	%
Industry	Telecommunications	41
	Banking sector	30
	E-commerce	10
	Insurance	9
	Transport and logistics	4
	Work public	1
	Other sectors	5
Company type	SME	51
	Large company	49
Gender	Male	84
	Female	16
Officer position	Managers	60
	Officers	22
	Top managers	18
Information security formal training (seminar, certification)	Yes	55
	No	45

Table I. Demographic profile of respondents

recommended by Hair *et al.* (2017). The significance indicator is the Student *t*-statistic and *p*-value (Hair *et al.*, 2017). Finally, we will analyze mediation effect of ISRM in order to address the nature of indirect relationships between IT capabilities and firm performance (Baron and Kenny, 1986; Nitzl *et al.*, 2016; Preacher and Hayes, 2008; Sobel, 1982).

Results (confirmatory factor analysis using PLS-SEM)

In order to assess the high-order IT capabilities model, this study applies PLS-SEM in order to estimate the hierarchical models by removing the uncertainty of inadmissible solutions by means of its flexible assumptions (Hair *et al.*, 2014, 2017). We apply PLS-SEM with a view to obtain very reliable results using a few data samples. Wamba *et al.* (2017) used the PLS path modeling to estimate a third-order reflective big-data analytics capabilities model. In the reflective model, the manifest variables are affected by the latent variables, contrary to the normative model. Reflective constructs are generally viewed as giving rise to its indicators.

Measurement model

In order to assess our research high-order model, we used the SmartPLS v3.2.6 (Hair *et al.*, 2014) software, which enables an estimate of parameters in the inner and outer models. We applied PLS-SEM using the PLS algorithm and bootstrapping with 5,000 subsamples (Fassott *et al.*, 2016; Hair *et al.*, 2013, 2017; Henseler *et al.*, 2016). Prior to assessing the structural model, descriptive statistics on the constructs were described (see Table II) and the measurement model was evaluated in terms of indicator reliability, internal consistency reliability, convergent validity and discriminant validity (Hair *et al.*, 2013).

In the first place, we confirmed the indicator reliability as all the items were significantly loaded on their elected constructs. The confirmatory factor analysis showed that all the item loadings were greater than the threshold of 0.7 (Fornell and Larcker, 1981), except IIT1 (0.637) and IIT2 (0.698) for IT capabilities constructs. These values are also acceptable because they are greater than 0.4 (Hair *et al.*, 2013). Second, the internal consistency reliability was also validated using the Cronbach's α and composite reliability, which exceeded the threshold of 0.7 for all the constructs (Nunnally and Bernstein, 1994). Third, the convergent validity was established by the average variance extracted (AVE) of each construct, which exceeded 0.5 (Hair *et al.*, 2017). The high AVE of our constructs indicated that the observed items explained more variance than the error terms. Finally, we confirmed the discriminant validity of each construct, which suggested that the measurement model (using the Fornell-Larcker criterion) was good for this study. We found that the square root of the AVE's first-order construct was higher than its correlation with other first-order constructs (Table III). This means that any first-order construct is different from another in our research model.

Structural model

The structural model established a significant effect of IT capabilities and ISRM on firm performance with path coefficients of 0.433 ($p < 0.001$) and 0.358 ($p < 0.001$), respectively, explaining 47.7 percent of the variance (see Figure 2). IT capabilities enhanced ISRM with a path coefficient of 0.522 ($p < 0.001$), explaining 27.2 percent of the variance. Therefore, all three hypotheses (*H1–H3*) were supported as the path coefficients were significant at $p < 0.001$ (Hair *et al.*, 2017). The F^2 concerning *H1* (0.261) and *H3* (0.179) indicated a moderate effect size, while *H2* (0.374) indicated a strong effect size. The R^2 values (0.477 for firm performance and 0.272 for ISRM) indicated a good model's predictive accuracy, which was confirmed by a good predictive relevance of effects on both firm performance ($Q^2 = 0.325$) and ISRM ($Q^2 = 0.185$) (Hair *et al.*, 2013).

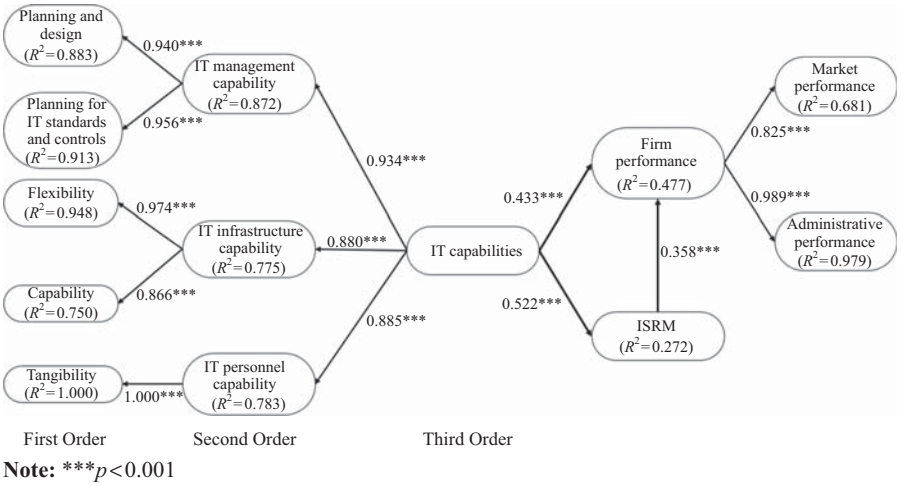
Constructs	Sub-constructs	Items	Indicators	Mean	SD
ISRM ($\alpha = 0.933$; CR = 0.947; AVE = 0.751)	–	Context establishment process is mature	RM1	3.309	1.228
		Risk assessment process is mature	RM2	3.419	1.216
		Risk treatment process is mature	RM3	3.456	1.162
		Risk acceptance process is mature	RM4	3.368	1.212
		Risk communication process is mature	RM5	3.397	1.319
		Risk monitoring and review process is mature	RM6	3.257	1.295
IT infrastructure ($\alpha = 0.859$; CR = 0.905; AVE = 0.704)	Flexibility ($\alpha = 0.807$; CR = 0.888; AVE = 0.726)	Network architecture is appropriate	IIT1	5.735	1.273
		Data architecture is appropriate	IT2	5.493	1.356
		IT software and hardware are standardized	IT4	5.346	1.825
	Capability ($\alpha = 1$; CR = 1; AVE = 1)	Processing capacities is appropriate	IIT3	5.882	1.261
IT personnel ($\alpha = 0.809$; CR = 0.913; AVE = 0.840)	Tangibility ($\alpha = 0.809$; CR = 0.913; AVE = 0.840)	IT personnel are encouraged to learn new technologies	PIT1	5.066	1.623
		IT personnel are able to interpret business problems and develop appropriate technical solutions	PIT1	5.632	1.241
IT management ($\alpha = 0.923$; CR = 0.946; AVE = 0.816)	Planning for IT standards and controls ($\alpha = 0.978$; CR = 0.989; AVE = 0.979)	IT services are standardized	MIT1	5.022	1.695
		IT evaluation and control system is practiced	MIT2	5.029	1.576
	Planning and design ($\alpha = 0.808$; CR = 0.912; AVE = 0.838)	IT planning and/or IT project management is practiced	MIT3	5.103	1.800
		IT planning for disaster recovery is well defined	MIT4	5.449	1.613
Firm performance ($\alpha = 0.964$; CR = 0.969; AVE = 0.741)	Market performance ($\alpha = 0.931$; CR = 0.966; AVE = 0.935)	IT capabilities help us to enhance customer satisfaction	PMA1	5.096	1.361
		IT capabilities help us to protect company image	PMA2	5.382	1.266
	Administrative performance ($\alpha = 0.965$; CR = 0.970; AVE = 0.781)	IT capabilities help us to identify alternative supply sources	PAD1	4.404	1.864
		IT capabilities locate substitute products/services	PAD2	4.493	1.732
		IT capabilities minimize uncertainty in ordering lead time	PAD3	4.434	1.714
		IT capabilities help us to make products/services-related information available to customers	PAD4	4.434	1.653
		IT capabilities help us to add value to existing products/services	PAD5	4.654	1.574
		IT capabilities helps us to ensure high efficiency in internal meetings and discussions	PAD6	4.949	1.341
		IT capabilities help us to ensure high efficiency in decision-making process and high quality of final decision	PAD7	5.199	1.398
		IT capabilities helps us to ensure good co-ordination among organization's functional areas	PAD8	4.971	1.485
		IT capabilities help us to maximize company's strategic planning efficiency	PAD9	4.897	1.530

Notes: α, cronbach's α; CR, construct reliability; AVE, average variance extracted

Table II. Constructs characteristics

	Capability	Flexibility	ISRM	Planning and design	Planning for IT standards and controls	Administrative performance	Market performance	Tangibility
Capability	*1.000*							
Flexibility	0.731	*0.852*						
ISRM	0.207	0.400	*0.866*					
Planning and design	0.566	0.708	0.615	*0.916*				
Planning for IT standards and controls	0.594	0.537	0.510	0.798	*0.989*			
Administrative performance	0.327	0.411	0.572	0.522	0.663	*0.884*		
Market performance	0.390	0.467	0.501	0.481	0.583	0.735	*0.967*	
Tangibility	0.665	0.673	0.388	0.676	0.771	0.553	0.493	*0.916*

Table III.
Inter-correlations of first-order constructs



Note: ***$p<0.001$

Figure 2.
Full structural model

Mediating effect

Our research model, answering one of our research questions, showed a possible mediating effect of ISRM on the relationship between IT capabilities and firm performance. Mediation analysis based on the Preacher and Hayes method (Hair *et al.*, 2013, 2017) assessed the significance of the direct effect on the relationship between IT capabilities and firm performance without including the mediator variable ISRM. This effect was significant, with a path coefficient of 0.433 ($p < 0.01$). Thus, we proceeded by validating the significant indirect effect on the relationship between IT capabilities and firm performance including the mediator variable with a path coefficient of 0.187 ($p < 0.01$). Finally, we calculated the variance accounted for VAF in order to determine the size of the direct effect in relation to the total effect. Results showed a partial mediation of ISRM in the relationship between IT capabilities and firm performance with a VAF of 30.1 percent. In addition, the Sobel (1982) test showed that ISRM mediated the relationship between IT capabilities and firm performance with a *z*-statistic of 4.08.

Discussion

This study aims to examine the direct impact of IT capabilities on firm performance and the mediated effect of ISRM on the relation between IT capabilities and firm performance. The results reveal that all the causal links theorized by our model are strongly supported and that the high-order IT capabilities construct has a stronger effect on both ISRM and firm performance. More precisely, IT capabilities and ISRM explained 47.7 percent of the variance of firm performance, 30.1 percent of which is explained by the mediator ISRM. The positive effect of this mediator was confirmed using VAF (30.1 percent), ranging from 20 to 80 percent and indicating a partial mediation (Hair *et al.*, 2017). This suggests that by improving both IT capabilities and ISRM, firm performance is also enhanced. Among three dimensions of IT capabilities, IT management capability ($\beta = 0.934$) was comparatively more important than IT personnel capability ($\beta = 0.885$) and IT infrastructure capability ($\beta = 0.880$). This suggested the importance of IT management when establishing a firm. Nevertheless, should this difference be thinner, it would suggest giving equal importance to these constructs when building IT capabilities. The results also show a significant positive association of each second-order construct with their first-order constructs.

Implications for research

This study has some research implications regarding IT capabilities. One of them is that this research work features among the first to evaluate the mediating role of information security with ISRM in the relationship between IT capabilities and firm performance, and therefore, to set out the important role of IT capabilities in the performance of a firm/organization. Despite the rich background literature on IT capabilities, firm performance and the relationship between these, studies on information security constructs and on their impact on firm performance, especially those using PLS-SEM, remain insufficient. Our study tested the mediating effect of ISRM on the relationship between IT capabilities and firm performance using data collected from Cameroonian firms. The effects of IT capabilities and ISRM are rarely been studied in the literature. Finally, we have been able to adopt a high-order IT capability construct in our research model, and this enabled us to go deeper into its impact on firm performance.

Implications for practice

The findings of this study provide several guidance outlets to managers who are engaged in the implementation or improvement of IT capabilities in a firm. As the three components of IT capability strongly impact firm performance, managers need to set IT management using IT planning, design, standard and control, before embarking on an effective tangibility of IT personnel as well on the flexibility and capability of IT infrastructure. In addition, an adequate implementation of IT capabilities will positively impact ISRM while guaranteeing corporate information security. The mediating role of ISRM is clearly commensurate with our highly dynamic environment. Furthermore, an ISRM system within firm is well indicated for sustaining the competitive advantage deriving from the use of IT capabilities.

The main recommendations are concerned with the impact of ISMS on firm performance which is the originality of this study. The findings showed the need to focus on the continuous improvement of the maturity level of the information security risk management process, which is expected to produce an enhanced quality of ISMS. Therefore, IT-related stakeholders such as chief information officers are expected to master the ISMS process and particularly the risk management according to the ISO 27005 standard. At this level, the following recommendations are therefore formulated:

- Create key positions for the internal implementation and management of ISMS; they include an information security manager, an information security risks manager and an ISMS auditor.

- The information security manager should hold a certification in information security management and or the ISO 27001 Lead Implementer certification, and be able to measure the security return on investment, drawing on relevant security information for the firm's performance.
- The information security risks manager should hold an ISO 27005 Risk Manager certification and have an expertise in the use of risks management tools such as MEHARI (*Méthode Harmonisée d'Analyze des RIsques*).
- The auditor of ISMS should hold a certification in information security audit and/or the ISO 27001 Lead Auditor certification.
- On a regular basis, organize further training sessions for managers to update their knowledge and adapt to the daily security demand of their working environment.
- Enable the IS department to formalize the ISMS process and constantly maintain a security dashboard, to accurately measure the performance of their activity and the achievement of objectives.
- Develop a communication plan to facilitate the acceptance and implementation of security measures.

At the level of the information security manager, the incumbent should be given a greater mission such as counseling, support, security-related information management, training and supervision. Moreover, he/she should be empowered to intervene directly in all or part of the company's IS system. Therefore, the information security manager is expected to:

- have a full grasp of the various activities of the company's departments;
- master change management;
- manage the information security risk;
- develop solutions for information security problems;
- implement or monitor the implementation of these solutions;
- implement the business continuity plan;
- establish and manage an information security dashboard; and
- calculate the information security return on invest.

Limitations and future directions

Our conceptual model was based on a theory and then tested with reliable survey instruments and data. Yet, some limitations to this study exist. First, the fact that this study was carried out in the specific domain of IT capability in a developing country constitutes a limitation. Only a replication of our conceptual model using other parameters can enable any generalization of the topic. Second, our findings were based on PLS-SEM, with 136 questionnaires administered and collected. Such findings should be retested using not only a greater number of collected data (more questionnaires) and a multi-group analysis but also using qualitative data analysis to confirm generalizations of the findings. Third, we adopted perceptual measures rather than objectives measures, which can better highlight the effects of IT capabilities on firm performance and the mediating role of ISRM. Fourth, while the RBV has emerged as one of the most used theories in various fields of research, some scholars argued that it is not "a useful perspective for strategic management research" (p. 22) given that it "is not currently a theoretical framework" (Priem and Butler, 2001).

Future studies should consider using more robust perspectives including the dynamic capabilities (Teece, 2012; Teece and Pisano, 1994). Fifth, in this study, we only look at the difference between early respondents and late respondents to account for common method bias. Future studies should explore new techniques, including the method–method pair technique (Sharma *et al.*, 2009). Finally, we could not consider the organizational culture and the top management commitment to adopt IT capabilities and information security, which could be used as moderating variables to extend knowledge for organization benefits.

Conclusion

In this study, by taking support from RBT and IT capability theories, we have developed a theoretical model that looks at the direct impact of IT capabilities (that is taking in third order with sub-constructs IT management, IT infrastructure and IT personnel) on firm performance and the mediating effects of the ISMS on this relationship. Like many other authors, such as Huang *et al.* (2009), we confirm that there is a positive relationship between IT capabilities and the performance of a firm. However, it is not enough to explain the whole firm performance. In fact, intermediation of ISMS is relevant to completely predict the firm performance. Our study also highlights the importance of the context (e.g. Africa) for theory testing. The results of this study provide strategies to enhance the use of IT capabilities with the objective of better firm performance. Also, managers are informed that ISMS is a critical resource to enhance firm performance. Finally, this study points to a better use of ISMS and RBT model in future research on firm performance.

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Appendix

		Strongly disagree	Moderate disagree	Slightly disagree	Undecided	Slightly agree	Moderately agree	Strongly agree
RM1	Process establishment is mature (basic criteria, scope and boundaries, organization for information security risk management)	1	2	3	4	5	6	7
RM2	Process Risk assessment is mature (risk identification, risk estimation, risk evaluation)	1	2	3	4	5	6	7
RM3	Process Risk treatment is mature (reduce, retain, avoid or transfer the risks)	1	2	3	4	5	6	7
RM4	Process Risk acceptance is mature (accept or reject residual risks)	1	2	3	4	5	6	7
RM5	Process risk communication is mature (exchange and/or share information about risks)	1	2	3	4	5	6	7
RM6	Process risk monitoring and review is mature (monitor and review risks and their factors to identify any changes)	1	2	3	4	5	6	7

Table AI.
RM-CMM

		Strongly disagree	Moderate disagree	Slightly disagree	Undecided	Slightly agree	Moderately agree	Strongly agree
SYQ1	ISMS has your best interest at heart	1	2	3	4	5	6	7
SYQ2	ISMS operates and performs reliably	1	2	3	4	5	6	7
SYQ3	ISMS is well integrated	1	2	3	4	5	6	7
SYQ4	ISMS activities are easy to learn	1	2	3	4	5	6	7
SYQ5	ISMS is flexible to make changes easily (legal, conformity, adoption, merging, etc.)	1	2	3	4	5	6	7
SYQ6	ISMS provides information in a timely fashion	1	2	3	4	5	6	7

Table AII.
System quality

		Strongly disagree	Moderate disagree	Slightly disagree	Undecided	Slightly agree	Moderately agree	Strongly agree
INQ1	ISMS information outputs are useful in our daily jobs	1	2	3	4	5	6	7
INQ2	ISMS information outputs are relevant for decision making	1	2	3	4	5	6	7
INQ3	ISMS information outputs are easy to understand	1	2	3	4	5	6	7

Table AIII.
Information quality

		Strongly disagree	Moderate disagree	Slightly disagree	Undecided	Slightly agree	Moderately agree	Strongly agree
SEQ1	ISMS services are dependable	1	2	3	4	5	6	7
SEQ2	ISMS has up to date equipment	1	2	3	4	5	6	7
SEQ3	ISMS is well integrated	1	2	3	4	5	6	7
SEQ4	ISMS employees have the knowledge to do their job well	1	2	3	4	5	6	7
SEQ5	Employees of ISMS understand the specific needs of its users	1	2	3	4	5	6	7

Table AIV.
Service quality

		Strongly disagree	Moderate disagree	Slightly disagree	Undecided	Slightly agree	Moderately agree	Strongly agree
SEQ1	Network architectures are appropriate	1	2	3	4	5	6	7
SEQ2	Data architectures are appropriate	1	2	3	4	5	6	7
SEQ3	Processing capacities are appropriateness	1	2	3	4	5	6	7
SEQ4	IT software and hardware are standardized	1	2	3	4	5	6	7

Table AV.
IT infrastructure

		Strongly disagree	Moderate disagree	Slightly disagree	Undecided	Slightly agree	Moderately agree	Strongly agree
PIT1	IT personnel are encouraged to learn new technologies	1	2	3	4	5	6	7
PIT2	IT personnel are able to interpret business problems and develop appropriate technical solutions	1	2	3	4	5	6	7

Table AVI.
IT personal skill

		Strongly disagree	Moderate disagree	Slightly disagree	Undecided	Slightly agree	Moderately agree	Strongly agree
MIT1	IT services are standardized	1	2	3	4	5	6	7
MIT2	IT evaluation and control systems is practiced	1	2	3	4	5	6	7
MIT3	IT planning and/or IT project management is practiced	1	2	3	4	5	6	7
MIT4	IT planning for disaster recovery is well defined	1	2	3	4	5	6	7

Table AVII.
IT management

		Strongly disagree	Moderate disagree	Slightly disagree	Undecided	Slightly agree	Moderately agree	Strongly agree
PMA1	ISMS helps us to enhance customer satisfaction	1	2	3	4	5	6	7
PMA2	ISMS helps us to protect company image	1	2	3	4	5	6	7

Table AVIII.
Marketing performance

		Strongly disagree	Moderate disagree	Slightly disagree	Undecided	Slightly agree	Moderately agree	Strongly agree
PAD1	ISMS helps us to identify alternative supply sources	1	2	3	4	5	6	7
PAD2	ISMS locates substitute products/services	1	2	3	4	5	6	7
PAD3	ISMS minimizes uncertainty in ordering lead time	1	2	3	4	5	6	7
PAD4	ISMS helps us to make products/services information available to customers	1	2	3	4	5	6	7
PAD5	ISMS helps us to add value to existing products/services	1	2	3	4	5	6	7
PAD6	ISMS helps us to ensure high efficiency in internal meetings and discussions	1	2	3	4	5	6	7
PAD7	ISMS helps us to ensure high efficiency in decision-making process and high quality of final decision	1	2	3	4	5	6	7
PAD8	ISMS helps us to ensure good co-ordination among organization's functional areas	1	2	3	4	5	6	7
PAD9	ISMS helps us to maximize company's strategic planning efficiency	1	2	3	4	5	6	7

Table AIX. Administrative performance

Constructs	Sub-constructs	Items	Averages	SD
ISMS	RM-CMM	RM1	3.324	1.194
		RM2	3.434	1.168
		RM3	3.5	1.05
		RM4	3.382	1.118
		RM5	3.522	1.157
		RM6	3.324	1.212
	System quality	SYQ1	5.625	1.323
		SYQ2	5.147	1.348
		SYQ3	4.676	1.46
		SYQ4	4.471	1.317
		SYQ5	4.632	1.366
		SYQ6	4.375	1.548
	Information quality	INQ1	5.309	1.303
		INQ2	5.353	1.24
		INQ3	4.779	1.012
	Service quality	SEQ1	5.206	1.301
		SEQ2	4.551	1.599
		SEQ3	4.868	1.519
		SEQ4	5.007	1.417
		SEQ5	5.11	1.464
IT CAPABILITY	IT infrastructure	IIT1	5.713	1.266
		IIT2	5.456	1.339
		IIT3	5.831	1.252
		IIT4	5.301	1.804
	IT personal skills	PIT1	5.037	1.602
		PIT2	5.618	1.231
	IT management	MIT1	5.015	1.671
		MIT2	5.037	1.521
		MIT3	5.088	1.792
		MIT4	5.426	1.603
PERFORMANCE	Marketing performance	PMA1	5.118	1.306
		PMA2	5.397	1.196
	Administrative performance	PAD1	4.478	1.766
		PAD2	4.559	1.63
		PAD3	4.515	1.59
		PAD4	4.507	1.539
		PAD5	4.735	1.426
		PAD6	4.985	1.254
		PAD7	5.228	1.323
		PAD8	5	1.419
		PAD9	4.897	1.53

Table AX. Descriptive characteristics of sub-constructs

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