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The mediating role of absorptive capacity on the relationship between entrepreneurial orientation and technological innovation capabilities

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Abstract

Purpose – The purpose of this paper is to empirically examine the relationships between entrepreneurial orientation (EO), absorptive capacity (ACAP), and technological innovation capabilities (TIC) among industrial SMEs operating in an unstable environment. The research also aims to determine whether ACAP has a mediating role in the relation between EO and TIC.

Design/methodology/approach – A structural equation model was designed to examine the relationships. On the basis of a research framework, a self-administered questionnaire was used to gather data from SMEs owners in the Kurdistan region of Iraq. There were 432 out of 676 questionnaires returned and subsequently used for statistical analysis.

Findings – The outcomes of the present research indicate both EO and ACAP have significant effects on TIC. Furthermore, the outcomes suggest that ACAP has a mediation role in the nexus between EO and TIC and that indicates the ability of EO to strengthen TIC via ACAP.

Originality/value – The research contributes to the literature through three aspects. First, it provides some empirical evidence on the relationships between EO, ACAP and TIC of SMEs. Second, the research sheds light on the insights that firms can use externally generated knowledge as a mechanism to enhance their proactivity and willingness toward innovation. Third, for the innovation literature, it is valuable contribution to placing ACAP within the frame of EO. Thus, they can be advantageous to more development in innovation literature.

Keywords Entrepreneurial orientation, Absorptive capacity, Technological innovation capabilities

Paper type Research paper

Introduction

In an age of globalized markets and production, the ability to innovate is increasingly important to the success of firms (Belderbos *et al.*, 2015; Camisón and Villar-López, 2012). In fact, the strategic status that enables a firm to embark on an entrepreneurial project is considered an essential catalyst to activating innovation capabilities (Messersmith and Wales, 2011; Pérez-Luño *et al.*, 2011). However, in light of the resource-based view (RBV), scholars have shown that the relationship between entrepreneurial orientation (EO) and technological innovation capabilities (TIC) is not inclusive but is affected by controlled and uncontrolled factors. These include the availability of related knowledge and resources (Sciascia *et al.*, 2014) and the nature of competition (Engelen *et al.*, 2015; Li, 2011). Indeed, knowledge as an inherent power (Cohen and Levinthal, 1990; Javalgi *et al.*, 2014; Liao *et al.*, 2003) and as a potential resource to enhance other intangible resources (i.e. EO) has been researched extensively (Sciascia *et al.*, 2014). The entrepreneurial literature have proposed that the EO is suggested to determines the extent to which firms innovate, act proactively, and tolerate risks (Lumpkin and Dess, 1996; Miller, 1983). In this sense, EO is considered as a potential factor that leverages knowledge sensing and seizing processes (Altimay and Wang, 2011; Jiang, 2005). Therefore, having a high level of EO may enhance firm's absorptive capacity (ACAP) to

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absorb new required knowledge from other partners and translate it into new innovations (Flatten, Greve and Brettel, 2011; Gellynck *et al.*, 2015; Kreiser, 2011; Wales *et al.*, 2013). At the same time, researchers (Flatten, Greve and Brettel, 2011; Li, 2011; Liao *et al.*, 2003) have proposed that firms with a high ability to acquire externally generated knowledge tends to outstrip firms facing scarceness in such abilities. As such, the effectiveness of ACAP as a mechanism to enhance EO, especially in the context of SMEs, remains unclear and in need of further research.

SMEs in the Kurdistan region of Iraq provide an excellent research case. In fact, the Center for International Private Enterprises (CIPE) declared that in comparison to neighboring countries, the private industrial sectors in the Kurdistan region of Iraq, particularly SMEs, are seriously underdeveloped in terms of professional human resources, legislation, technology, appropriate knowledge of the current industrial evolution and production (CIPE, 2007). At the time that the industrial SMEs in the Kurdistan region constitute about 95.5 percent of all working businesses, they contribute about 4.08 percent to the gross domestic product of the region and provide approximately 13,331 jobs. These low contributions may be a reflection of their weak ability to innovate new products and implement manufacturing processes (RDSKR, 2011). In addition, many strategic challenges that may hinder the entrepreneurial attitudes and knowledge transfer activities. For example, the weakness of banking sector in terms of providing credit facilities and supporting risky projects, poor integration between private and public industrial sectors results in weak knowledge exchange among these enterprises, and poor exploitation of non-oil resources reflected in weak innovation capabilities in the other industrial sectors (RDSKR, 2011). Thus, current study argues that ACAP enhances both TIC directly and enhances the influence of EO on TIC indirectly.

In doing so, this study contributes to the literature through three aspects. First, this study examines and elucidates to what extent the EO and ACAP influences TIC of SMEs. The majority of the extant literature utilized models investigating SMEs innovation have focused on innovation performance and the consequences of innovation without considering if such innovations stem from a firm's orientation or is the result of adopted knowledge from outside the firm (Hung *et al.*, 2010; Lang *et al.*, 2012; Ngo and O'Cass, 2013; Otero-Neira *et al.*, 2009). Therefore, an analysis of the nexus between EO as an internal catalyst of innovation capabilities and ACAP as a resource for externally generated knowledge may provide significant insight for SMEs. Second, although the notion that firms can intensify their efforts on the adoption of existing knowledge or generate their own is not entirely new, this study discusses it from another vintage point. Current study sheds light on the insights that firms can use externally generated knowledge as a mechanism to enhance their proactivity and willingness toward innovation. Thus, this study explores the influence of firms' ability to adopt external knowledge on their entrepreneurial attitudes toward developing their TIC. Third, for the innovation literature, it is valuable contribution to placing ACAP within the frame of EO. Thus, they can be advantageous to more development in innovation literature.

This study is arranged in the following sections: after this Introduction, Literature review, Detailed hypotheses and Research framework have been elaborated. Then, this study presents the methodological grounds that support the adopted analysis. Thereafter, the study presents the findings and their implications and finally discusses the limitations and avenues for future researches.

Literature review

TIC

The most widely accepted classification of innovation is the one brought forth by Damanpour (1991), wherein he differentiates between technological and administrative innovation. Technological innovation refers to new processes, products, and services,

whereas administrative innovation refers to novel procedures and policies covered under the umbrella of non-technological innovation (Jiménez-Jiménez and Valle, 2011; Ngo and O'Cass, 2013). The increasing pressure of global competitiveness, decreased product life cycle and ease of imitation makes it necessary for firms to innovate in order to remain competitive. In other words, innovation has become the platform for productivity enhancement, growth of sales volume, and firm competitiveness. Such conditions also urge firms to be innovative in order to improve their product competitiveness in terms of design, quality, and service reliability. As such, firms have to upgrade their innovation capability to develop and commercialize new technologies effectively and bring about the development of technological innovations throughout the firms to reinforce their competitive advantage (Börjesson *et al.*, 2014; Wang *et al.*, 2008).

In order to conceptualize TIC, this study follows Damanpour's (1991) definition, which defines it as a special kind of resource that needs to effectively enhance an existing product, manufacturing process and to create new ones. In this sense, TIC includes product innovation capability that refers to the sets of interrelated steps that are employed to engage a distinct product innovation, such as new product development and existing product improvement (Laforet, 2011; Tuominen and Hyvönen, 2004). Meanwhile, process innovation capabilities refer to manufacturing technologies that are used in developing innovation capability and in enabling firms to select and utilize these technologies strategically (Zawislak *et al.*, 2012) to develop novel techniques, processes, and production methods. This is based on the premise that process innovation capability stems from the learning process upon which firms can internalize new knowledge to bring about technological change and eventually new processes (Brem *et al.*, 2016; Lall, 1992). Such a learning process comprises acquisition, imitation, adaptation, modification and/or the creation of new knowledge bundles to be used within the firm. Consequently, this process leads to potential products and having new technical patterns because those are in fact technological innovations (Zawislak *et al.*, 2012).

Drucker (1954), as the pioneering scholar regarding innovation, discussed the importance of innovation capability within firms and argued that firms must innovate in order to survive in an ever-changing environment. Therefore, innovation capabilities are considered to be fundamental components to fulfill optimal innovation outcomes. In a related study, Wang *et al.* (2008) described innovation capability as the employment of several scopes and levels to achieve a firm's strategic requirements, to accommodate a firm's unique circumstances and the proactively postured to deal with the fluctuating operating environment. Meanwhile, Lall (1992) emphasized the fundamental role of technological capability as the way in which firms absorb, create, modify, and produce feasible technical applications in the form of new technologies, new processes, new products, and new routines in the realm of knowledge (Zawislak *et al.*, 2012). Adler and Shenhar (1990) identified innovation capabilities through the following dimensions: ability to develop new products that meet market needs; ability to apply appropriate process technologies to producing these new products; ability to develop and adopt these new products and process technologies to satisfy future needs; and ability to respond to related technological activities and unexpected activities created by competitors. Firm capabilities to launch a successful product cover the abilities of the firm to obtain and spread externally generated knowledge, transform this knowledge into distinct competencies and notions, and then produce and commercialize products that are new and improved (Cohen and Levinthal, 1990; Zhi-guo, 2012).

EO

Since Miller and Friesen (1982) first published their study nearly 35 years ago, EO has become a broadly accepted way of enhancing firm innovation and performance (Huang and Wang, 2011;

Lumpkin and Dess, 1996; Rani, 2016; Resnick *et al.*, 2016). According to Miller (1983), EO is defined as "the simultaneous exhibition of innovativeness, proactiveness, and risk taking" (Engelen *et al.*, 2015, p. 1072) and represents the firm's priority to the identification and exploitation of market opportunities (Baker and Sinkula, 2009; Huang and Wang, 2011; Pérez-Luño *et al.*, 2011). The first dimension, innovativeness, is represented in a firm's inclination to advocate new ideas, creative processes, and new products and services (Boso *et al.*, 2012a, b; Lumpkin and Dess, 1996; Morris *et al.*, 2007). Proactiveness, on the other hand, refers to a firm's ability to exploit market opportunities and develop a first-initiative preference compared to rivals (Baker and Sinkula, 2009; Lumpkin and Dess, 1996). Finally, risk-taking is related to the tendency to devote considerable resources to high-risk projects (Baker and Sinkula, 2009; Huang and Wang, 2011).

Similarly, Lumpkin and Dess (1996) brought forth another two dimensions, namely: competitive aggressiveness and autonomy. These two dimensions go beyond the former three and provide a detailed description of the EO domain. Lumpkin and Dess described competitive aggressiveness as the efforts of the firm to overtake its market competitors through the maintenance of a confrontational stance; autonomy was described as the ability of the firm members to independently promote promising entrepreneurial ideas and plans (Baker and Sinkula, 2009; Wales *et al.*, 2011; Zellweger *et al.*, 2011). However, researchers have argued that the competitive aggressiveness dimension overlaps with the proactiveness concept, whereas autonomy is argued to be a contextual variable that fortifies entrepreneurial activities. That may explains why the innovativeness, proactiveness and risk-taking have been considerably relied upon in studying EO (Huang and Wang, 2011; Morris *et al.*, 2007). In addition, Miller's scale was basically constructed and labeled depending on what theoretical concept was proposed, whereas the Lumpkin and Dess scale was built on what factors analysis revealed in their environment (Covin and Wales, 2012). As such, this study adopts the three main components for the reasons that set out above.

A firm's EO importantly constitutes its outgrowth and adaptation to environmental changes (Covin and Miller, 2014; Lumpkin and Dess, 1996) and these depend on entrepreneurial opportunities that stem from innovation and technological changes, industrial crisis, changes in demography and macroeconomics (Boso *et al.*, 2012a; Zahra, 2008). EO plays a significant role in affecting a firm's behaviors and beliefs, stressing on the proactive acquisition of entrepreneurial opportunities (Huang and Wang, 2011; Zeffane, 2014). Therefore, understanding EO as a blend of cultural, strategic and organizational aspects may reveal its role in enhancing firms' ability to react to the external environmental fluctuations through the development of diverse types of innovations (Morgan *et al.*, 2015; Otero-Neira *et al.*, 2013). Hence, EO has potential implications for a firm, especially in light of the contraction of product lifecycles that produce an uncertain future and threaten profits, driving present operations to constantly look for novel opportunities. In addition, entrepreneurial firms develop and launch new products and technology which may produce superior performance and be considered as the engine of development for the economy (Hughes *et al.*, 2007; Otero-Neira *et al.*, 2013). On the whole, EO represents the firm's tendency to deviate from the normal path and travel through the unknown (Zahra, 2008).

ACAP

External knowledge transfer has been receiving increasing interest among researchers for the past five decades (Sparrow *et al.*, 2009). Following Cohen and Levinthal (1990), the concept of ACAP has emerged and has been used successfully in several studies that investigate knowledge transfer among firms (Andersén and Kask, 2012; Flatten, Greve and Brettel, 2011). An abundance of literature (Andersén, 2012; Andersén and Kask, 2012; Martinkenaite, 2012; Tseng *et al.*, 2011) has defined ACAP as the capability to recognize,

assimilate and apply external knowledge. In addition, Zahra and George (2002) provided another turn to this concept by categorizing ACAP structure into two dimensions, namely: potential ACAP (the capability for knowledge acquisition and assimilation); and realized ACAP (the capability for knowledge transformation and exploitation). They argue that the transition from the assimilation phase to the transformation phase is considered to be a shift from potential ACAP to realized ACAP. The literature of ACAP argues that the relations between two firms may influence the nature and the amount of transferred knowledge (Andersén and Kask, 2012; Cohen and Levinthal, 1990). While the concept calls for the evaluation and acquisition of knowledge from the external environment, especially the inter-organizational relationships, it also highlights the internal processes of learning from prior experience and present actions (Cohen and Levinthal, 1990; Nagati and Rebolledo, 2012). Therefore, a firm's ACAP is affected by both whom it cooperates with and how the learning process is conducted (Zhang *et al.*, 2015).

This study proposes that ACAP involves both external interaction with knowledge sources and internal processes of knowledge distribution across firm levels. Considering the innovation capabilities context, this study conceptualized ACAP as a set of capabilities and qualifications of the firm by which it acquires, assimilates, transforms and exploits external knowledge from various partners and integrates it with previous knowledge to generate dynamic capabilities for innovation. Hence, in light of the above debates, ACAP includes four essential components. First, knowledge acquisition from external sources involves firm's ability to both diagnose and acquire the distinct knowledge that is decisive to operations (Jiménez-Jiménez and Valle, 2011; Jung-Erceg *et al.*, 2007; Sun and Anderson, 2010). Acquisitions of new knowledge can bring in value to the firm's competitive advantage because innovation is enhanced through the obtained knowledge (Deng, 2010). This in turn enhances both organizational performance and internal R&D to produce new knowledge (Liu, 2010). Second, knowledge assimilation refers to the firm's procedures to process, analyze, elucidate and understand the information, knowledge and skills obtained from external sources (Camisón and Forés, 2010; Flatten, Greve and Brettel, 2011; Kamal and Flanagan, 2012; Sun and Anderson, 2010). Assimilated knowledge of a firm is not confined to one individual in it, but it hinges on interactions and knowledge sharing among many individuals and across departments (Aljanabi and Noor, 2015a; Caccia-Bava *et al.*, 2006). In other words, it is individuals and not organizations who transfer knowledge, although the former requires access to certain organizational resources (Sparrow *et al.*, 2009). This communication among individuals and groups brings about knowledge assimilation that enables firms to obtain new knowledge that are externally generated (Fletcher and Prashantham, 2011).

Third, knowledge transformation is defined as the firm's capability to integrate newly acquired knowledge with prior knowledge through a specific procedure that expedites the use of integrated knowledge (Andersén and Kask, 2012; Flatten, Greve and Brettel, 2011; Flatten, Engelen, Zahra and Brettel, 2011). According to Martins (2012), knowledge transfer is a process that includes dual ties between the knowledge source and the knowledge recipient and represents a firm' s attempt to acquire tacit as well as explicit knowledge (Fletcher and Prashantham, 2011). These forms are invaluable in creating new knowledge and are complementary to each other (Kamasak and Bulutlar, 2010). Moreover, transforming knowledge from tacit to explicit or vice versa is reflected in the individuals'/groups' interactions that can encapsulate the release of each individual's tacit knowledge into the shared documents explicit textual knowledge can be reflected upon (Feghali and El-Den, 2008). Nevertheless, not all knowledge transfer has successful and assured outcomes (Martinkenaite, 2012) because knowledge that fall beyond a firm's search area are disregarded and not easily graspable (Han and Erming, 2012). Finally, knowledge exploitation basically means the capability of the firm to apply the transformed knowledge into its products and processes for the maintenance of ongoing growth (Kamal and Flanagan, 2012;

Liao *et al.*, 2003). Exploitation represents the final consequence of ACAP and is mostly measured in tangible outputs such as new products (Andersén, 2015; Martinkenaite, 2012). Nevertheless, some firms may be capable of transferring knowledge but are not so skillful in knowledge exploitation (Andersén, 2012) owing to several obstacles. These may include organizational resistance to change, deficiency of effective knowledge sharing methods and the gap between the new external knowledge and the firm's prior knowledge (Iii *et al.*, 2009; Srivastava and Gnyawali, 2011).

Additionally, the existence of external knowledge is not enough to achieve successful absorption (Wang and Han, 2011). In this regard, Hurmelinna-Laukkanen (2012) stated that innovation does not hinge on knowledge alone but also depends on its application. Therefore, the acquisition, retention, transference and application of knowledge shift the researchers' attention from knowledge analysis as a source to analyzing an organization's capabilities that produce new knowledge internally toward integrating this with other resources for innovation enhancement (formally through coordination, formalization with partners or informally through socialization process) (Martinkenaite, 2012). This process is based on the dual role of ACAP to produce knowledge internally in order to facilitate an organization's identification, absorption and assimilation of knowledge from external sources (Andersén, 2015; Michailova and Jormanainen, 2011).

Hypotheses development and research framework

Firms can survive in a business environment due to the demand for their products and as a result of possessing certain resources to compete with others. Within this context, many reasons may explain why EO should be beneficial for supporting innovation capabilities. The most prominent one is represented in providing unexploited opportunities to commercialize the innovation (Aljanabi and Noor, 2015b; Boso *et al.*, 2012a). Moreover, the relation between innovativeness as a dimension of EO and innovation has been studied extensively in prior research (e.g. Aljanabi and Noor, 2015b; Kocak *et al.*, 2017; Laforet, 2011; Otero-Neira *et al.*, 2013; Pérez-Luño *et al.*, 2011). Huang and Wang (2011), in their study that focused on promoting innovation capabilities' levels within SMEs, have considered innovation to be an EO outcome. In addition, proactive firms expend effort on observation and monitoring of the environment in an attempt to find new trends and to stay ahead of the competition (Pérez-Luño *et al.*, 2011; Zahra and Hayton, 2008), which is dynamically linked to market signal responsiveness (Culkin, 2016; Hughes *et al.*, 2007). Proactiveness can generate capabilities, allowing firms to come up with unique products/new markets far ahead of their rivals and the customer's expectations (Li *et al.*, 2008). Moreover, innovation is primarily risky owing to the potential failure of the new offerings (Ko and Lu, 2010; Messersmith and Wales, 2011; Zahra, 2008), particularly in the case of SMEs (Jones and Rowley, 2011). Unless the firm is prepared to face such failure, it will steer clear of them and refrain from such activities. Hence, innovation capabilities generation is linked with steep learning curves that involve the ability of the firm to obtain new operational knowledge resulting from entrepreneurial attitudes (Pérez-Luño *et al.*, 2011; Saleh *et al.*, 2016; Zahra and Hayton, 2008).

Despite these arguments, Messersmith and Wales (2011) elucidated a non-significant relationship between EO and small firms' innovation. However, researchers like Boso *et al.* (2012a) gave an accurate depiction of the relationship that links EO with product innovation. They argued that the main reason implied in this relationship is found in one of the EO dimensions, which is a high level of innovativeness. Engelen *et al.* (2015) and Baker and Sinkula (2007) also reported that product innovation is strongly related to innovativeness. Other researchers have highlighted the role of other dimensions of EO. For instance, risk-taking can foster a firm's ability to produce new products and processes (Chen, 2012; Cheng *et al.*, 2012; Morgan *et al.*, 2015) because risk-taking nature could promote firms toward

dedicating the necessary resources that can help in producing new innovations (Ko and Lu, 2010). Based on the discussion above, this study proposed the following hypothesis:

H1. EO is positively related with TIC.

Scholars proved that EO reflect firms' practices like decision-making styles, working methods and other managerial practices (Lumpkin and Dess, 1996; Ren and Yu, 2016). As such, EO could affect knowledge commercialization and crucial utilization of ACAP through determining the attitudes, threats, and opportunities to get full advantage from knowledge resources (Qian and Jung, 2017; Wales *et al.*, 2013). Determining such threats and opportunities should lead to creating other new knowledge about current and potential products and the markets' attitudes (Javalgi *et al.*, 2014). As reported by Dada and Fogg (2014), entrepreneurial firms observe their external environment precisely in their endeavor to innovate new products and that requires a capability to learn and absorb the related knowledge. Thus, poor relationship between EO and ACAP limits firm' capabilities to identify the most promising opportunities, interpret problems correctly, and meet the current trends in the market (Engelen *et al.*, 2014; Wales *et al.*, 2013). Further support for this notion can be found in Javalgi *et al.* (2014), who discussed that merely determining promising opportunities is not enough; firms must capitalize on these opportunities. This means that entrepreneurs must be able to effectively disseminate information about these opportunities to ensure successful transformation and exploitation of this information. On the other hand, the high level of EO augments the willingness of other partner to create a cooperative relationships with the entrepreneurial firms and such effective cooperation tends to increase firms' ACAP (Tsai, 2001; Wu, 2007).

Consequently, as EO increases, adherence to absorb relevant knowledge will increase rapidly in order to develop new products and manufacturing processes (Kreiser, 2011; Tseng, 2013) as well as enhance a firm's dynamic capabilities to adapt to environmental changes (Ren and Yu, 2016). In a similar vein, Wales *et al.* (2013) argue that EO may enable firms to increase performance successfully within their ACAP, Cohen and Levinthal (1990) suggested that previous knowledge of entrepreneurs influences the ACAP of their firms to gain new knowledge, and Gellynck *et al.* (2015) study confirmed that possessing higher level of EO results in greater firm's ACAP. Thus, the study advanced the following hypothesis:

H2. EO is positively related with ACAP.

Many of the previous studies supported the notion that ACAP plays a direct role in boosting innovation (Gebauer *et al.*, 2012; Laforet, 2011; Laukkanen, 2012; Tsai, 2001). Nevertheless, some researchers find a non-significant relationship between knowledge acquisition and technological innovation among industrial firms (Lee *et al.*, 2013). However, and according to Caccia-Bava *et al.* (2006), ACAP can help in fostering technological innovation facilely, and it can also determine the extent to which value can be created (Laukkanen, 2012) by identifying the rapidity, frequency, and volume of innovation (Tseng *et al.*, 2011). Within this context, researchers (e.g. Huang and Wang, 2011; Liao *et al.*, 2010) reported that innovation capabilities depend on the organizational ability to turn both internal and external knowledge into action and outcomes and do not depend on the knowledge itself. Hung *et al.* (2010) noted that firms attempt to merge knowledge by providing facilitative conditions to knowledge sharing between individuals and groups in order to achieve the highest level of innovation capabilities. Thus, building ACAP and disseminating new knowledge is a precondition for sourcing innovation from external sources (Mason-Jones and Towill, 2016). Accordingly, continuous innovation hinges on a firm's ACAP that enhance a firm's integration, building and reconfiguration of internal competencies to tackle an ever-changing market environment. This is only possible through the activation, transference, synthesis, reconfiguration, and redeployment of various skills and resources

(Gray, 2006; Tuominen and Hyvönen, 2004). Consequently, a firm with high ACAP can augment externally generated knowledge benefits and improve their innovation capabilities (Lee and Song, 2015). Hence, ACAP of the firm possesses an active role in fostering innovation in its technological form, and it can also border on the extent of value creation (Aljanabi and Noor, 2015b). This leads to the following hypothesis:

H3. ACAP is positively related with TIC.

Knowledgeable firms know where to seek new opportunity and how to exploit it (Cohen and Levinthal, 1990), but unless they willing to take advantage of these opportunities, the knowledge resources are possibly worthless (Pérez-Luño *et al.*, 2011). This could explain why some firms can acquire and assimilate externally generated knowledge, but not be able to exploit it in successfully achieving innovation (Caccia-Bava *et al.*, 2006). In addition, Tsai (2001) argued that ACAP could soften complicated problems and boosts firms' abilities to determine and respond to new opportunities. In furtherance of these arguments, Sciascia *et al.* (2014) stated that ACAP could enhance the different aspects of EO. Moreover, EO as a firm-level process could be promoted based on a firm's capabilities to acquire external knowledge (Flatten, Greve and Brettel, 2011; Muscio, 2007; Tseng, 2013). This is especially true with the greater uncertainty of a dynamic environment when it is more difficult to detect what rivals are doing, to acquire their knowledge, and to apply it to new products and processes (Pérez-Luño *et al.*, 2011). Belderbos *et al.* (2015) also found that ACAP dimensions had more indirect influences than direct ones on innovation. Therefore, EO could be more effective only with the availability of mechanisms for knowledge acquisition and exploitation to enhance innovation capabilities of the firm (Sciascia *et al.*, 2014). The above debates may ensure that ACAP would enhance the effectiveness of EO in maximizing TIC. In this sense, the following hypothesis is suggested:

H4. ACAP mediates the relationship between EO and TIC.

Based on the developed theoretical debates above, the theoretical framework (as depicted in Figure 1) illustrates how EO influences the TIC directly and indirectly through the firm's ACAP.

Methodology

Data collection and sample

A self-administered questionnaire was conducted to gather data from the industrial SMEs' owners operating in the Kurdistan region in Iraq, namely, the provinces of Erbil, Sulaimany, and Duhok. The survey was conducted from early May 2016 to the end of September 2016. The data were collected from the industrial SMEs owners within these three provinces

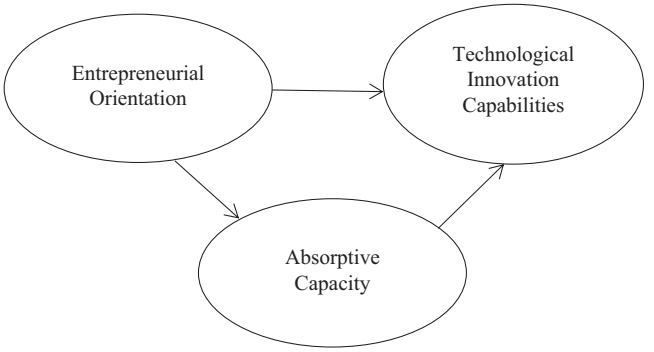

Figure 1.
Research framework

during the same period of time, while, the data collected from every industry one after the other. The targeted population of this study includes eight groups of industrial SMEs. They are: machinery and equipment, construction materials, food industry, electric industry, non-metal industry, metal industry, textiles industry, and paper industry. The total number of industrial SMEs is 2,607. SMEs in the Kurdistan region are defined according to the World Bank, as published in the International Finance Corporation report, whereby enterprises with 1-19 employees are considered to be small enterprises. Enterprises with 20-99 employees are considered as medium enterprises. Large enterprises are those that hire 100 employees or more (IFC, 2011).

Stratified sampling used in this study given to its accuracy, lack of bias, and the ability to obtain generalizable results. Since the respondents are of the Kurdish origin, the questionnaire was translated into the Kurdish language based on Brislin's (1970) method, then sent to two bilingual experts (English/Kurdish) to ensure that the texts of these two versions were consistent. Then, another bilingual expert translated it back from the final Kurdish version to the English language to eliminate the differences. Based on Krejcie and Morgan (1970) and given the population size, it is adequate methodologically to select a minimum sample of 338 industrial SMEs from the whole research population. In addition, the response rate for previous studies related to SMEs innovation ranged from 21 to 67 percent (Liao *et al.*, 2010; Morris *et al.*, 2007; Zahra, 2008). Therefore, the sample in the current study has been doubled to 676 to get more appropriate sample size in the light of targeted population. Finally, the total number of collected and usable questionnaires was 432 usable questionnaires, which comprised a 63.9 percent response rate.

The assessment of non-response bias was conducted by the *t*-test technique as recommended by Armstrong and Overton (1977). Testing of non-response bias was performed by comparing the early and the late respondents' answers regarding investigated variables, the results show no significant differences between the two groups. Therefore, it can be inferred that the respondents' answers from these two groups are free from data bias.

Descriptive statistics

In order to obtain the data summary, descriptive statistics used to provide a general overview of the study's variables, as shown in Table I. All the constructs' means are above the average; the mean of TIC is 4.24, with a standard deviation of 1.14. For EO, the mean is 4.02, with a standard deviation of 0.81. ACAP obtained a mean of 4.31 with a standard deviation of 0.82.

Measures

Each investigated construct was measured in the questionnaire using a seven-point Likert scale, where 1 was determined for "strongly disagree" ranging to 7 for "strongly agree." Content validity was performed by reviewing the related literature extensively in addition to interviewing the experts in the academic field. TIC was measured using a 16-item scale adapted from Camisón and Villar-López (2012) and Tuominen and Hyvönen (2004). Whereas, EO was measured via a 20-item scale adapted from Miller and Friesen (1982) and Boso *et al.* (2012a). Finally, the ACAP scale includes 16 items adapted from Cohen and Levinthal (1990), Flatten, Engelen, Zahra and Brettel (2011) and Flatten, Greve and Brettel (2011).

Variables	Mean	SD	Minimum	Maximum
Technological innovation capabilities	4.24	1.14	1	7
Entrepreneurial orientation	4.02	0.81	1	7
Absorptive capacity	4.31	0.82	1	7

Table I. Descriptive statistics of the constructs

Statistical analysis and results

Partial least squares (PLS) method (Hair, Ringle and Sarstedt, 2011; Hair, Sarstedt, Ringle and Mena, 2011) was employed for the confirmation of developed model in its two aspects; the outer model (the relationships between the investigated constructs and their own indicators) and the inner model (the relationships between investigated constructs themselves). Following Hair *et al.* (2014), the bootstrapping method utilized to determine significance levels for loadings and path coefficients, to analyze the data Smart-PLS version 3.2.0 used.

Testing the measurement model "outer model" using PLS approach

Convergent validity. Convergent validity pertains to the level to which a measure of specific indicators positively measures the same determined construct (Hair, Ringle and Sarstedt, 2011). Convergent validity entails the testing of several criteria: factor loadings, composite reliability (CR) with recommended values > 0.7 and average variance extracted (AVE) with recommended values > 0.5, as indicated by Hair *et al.* (2011). Accordingly, the items' loadings were assessed and revealed that some items have low factor loadings and therefore were excluded from the analysis, namely, innovativeness (Innovati8) and process innovation capabilities (ProcInn3, ProcInn5, ProcInn8). All other items' loadings were higher than 0.60 (as depicted in Figure 2), which are considered acceptable loading levels as explained in the literature of multivariate analysis.

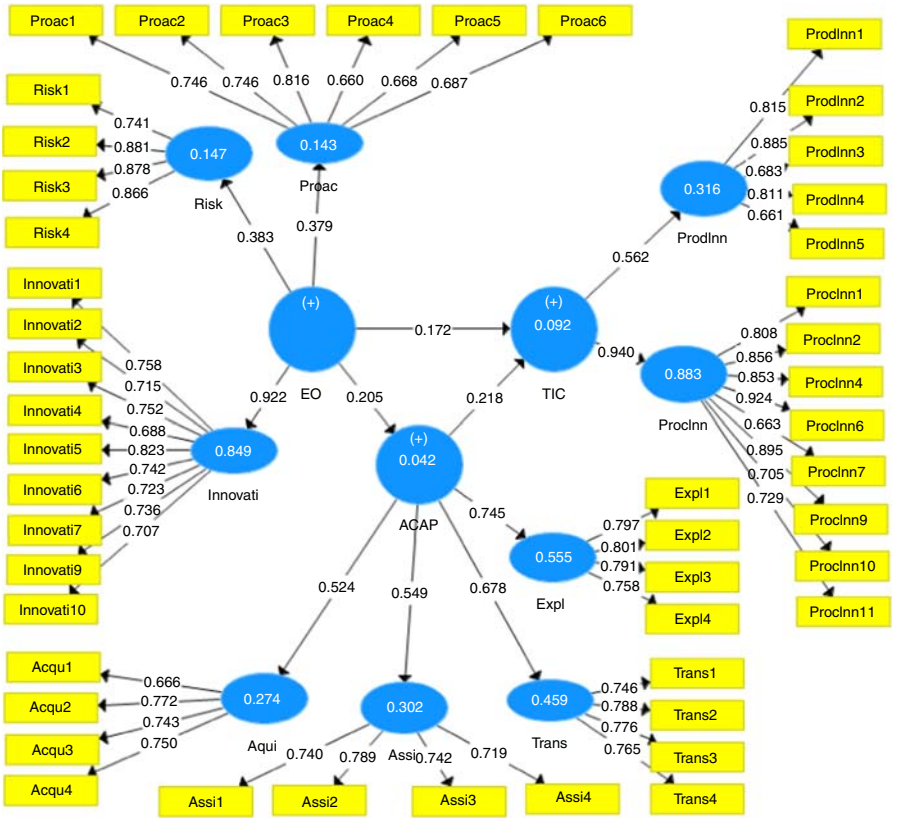

Figure 2.
Measurement model

Table II illustrates that the obtained results of the outer model are greater than the recommended values for CR and AVE, thus elucidating sufficient convergent validity.

Discriminant validity. After proving the convergent validity, discriminant validity was assessed following Fornell and Larcker's (1981) method. The discriminant validity measures

Constructs	Items	Factor loadings	Cronbach's α	Convergent validity: Composite reliability[a]	Convergent validity: Average variance extracted[b]
Technological innovation capabilities	ProdInn1	0.815	0.830	0.882	0.602
	ProdInn2	0.885			
	ProdInn3	0.683			
	ProdInn4	0.811			
	ProdInn5	0.661			
	ProcInn1	0.808	0.922	0.937	0.654
	ProcInn2	0.856			
	ProcInn4	0.853			
	ProcInn6	0.924			
	ProcInn7	0.663			
	ProcInn9	0.895			
	ProcInn10	0.705			
	ProcInn11	0.729			
Entrepreneurial orientation	Proac1	0.746	0.817	0.867	0.522
	Proac2	0.746			
	Proac3	0.816			
	Proac4	0.660			
	Proac5	0.667			
	Proac6	0.687			
	Risk1	0.741	0.863	0.907	0.711
	Risk2	0.881			
	Risk3	0.878			
	Risk4	0.866			
	Innovati1	0.758	0.896	0.915	0.546
	Innovati2	0.715			
	Innovati3	0.752			
	Innovati4	0.688			
	Innovati5	0.823			
	Innovati6	0.742			
	Innovati7	0.723			
	Innovati9	0.736			
	Innovati10	0.707			
Absorptive capacity	Acqu1	0.666	0.715	0.823	0.538
	Acqu2	0.772			
	Acqu3	0.743			
	Acqu4	0.750			
	Assi1	0.740	0.737	0.835	0.559
	Assi2	0.789			
	Assi3	0.742			
	Assi4	0.719			
	Trans1	0.746	0.769	0.852	0.591
	Trans2	0.788			
	Trans3	0.776			
	Trans4	0.765			
	Expl1	0.797	0.795	0.867	0.619
	Expl2	0.801			
	Expl3	0.791			
	Expl4	0.758			

Notes: [a]CR = (Σ factor loading)2/{(Σ factor loading)2)+Σ (variance of error)}; [b]AVE = Σ (factor loading)2/(Σ (factor loading)2+Σ (variance of error)}

Table II. Convergent validity analysis

show the level to which the items are differentiated among the constructs; it ensures that the items belong to different and non-overlapping constructs. Therefore, despite the correlation among the constructs, they are evaluated through distinct concepts as stated by Hair *et al.* (2011), who reached the conclusion that if the measures' discriminant validity is confirmed, the shared variance between each construct and its measures have to be greater compared to the variance shared among other constructs. The norm is that if the square root of the AVE values that appear in the diagonal line in the matrix exceeded the values in the rows and columns for a specific construct, then we can confirm the discriminant validity of the measure. Table III illustrates that the diagonal values exceeded the values in their own rows and columns, which give ample evidence to establish the discriminant validity of the measure.

Despite the frequent use of the Fornell-Larcker method for more than three decades, it is still characterized by weak sensitivity in terms of discriminant validity evaluation which calls for an alternative approach to face such problems (Henseler *et al.*, 2015). The major drawback of the Fornell-Larcker method is the lack of further theoretical explanations regardless of the strong correlation of specific items that should be achieved with its own construct and weak correlations with other constructs. Also, this method does not offer any empirical evidence that may cause an obvious false correlation through theoretically unconnected indicators and constructs. In addition, this approach provides a criterion value and not a statistical test (Henseler *et al.*, 2015). Thus, heterotrait-monotrait (HTMT) ratio has been developed to estimate the correlation between constructs (Henseler *et al.*, 2015).

Practically, there are two steps involved when applying the HTMT ratio to evaluate discriminant validity: first, it is used as a criterion by comparing it with a predetermined threshold. If the HTMT value is higher than the predetermined threshold, one can deduce that there is paucity of discriminant validity for the compared latent variables. The exact predetermined threshold is a debatable matter, where some researchers have proposed a value of 0.85 (Clark and Watson, 1995; Henseler *et al.*, 2015). It has also been suggested to be 0.90 (Henseler *et al.*, 2015). However, Table IV shows that all obtained correlation values are less than the lowest predefined threshold of 0.85, reflecting an acceptable level of HTMT as a criterion to assess discriminant validity.

Second, the HTMT ratio can be used as a statistical test to assess discriminant validity by testing the null hypothesis (H_0: HTMT $\geqslant 1$) vs the alternative hypothesis ($H1$: HTMT < 1). In other words, if the confidence interval of HTMT contains the value "1," (i.e. H_0 accepted), it denotes lack of discriminant validity. To the contrary, if the value "1" falls outside the confidence interval of HTMT, this denotes that the two evaluated constructs are practically discrete (Henseler *et al.*, 2015). Table V illustrates that all investigated variables have acceptable level of HTMT confidence interval, since all acquired values are less than 1, which leads to accepting $H1$ and rejecting H_0 as discussed above.

Table III. Correlations and discriminant validity

Items	1	2	3	4	5	6	7	8	9
1. Acquisition	*0.734*								
2. Assimilation	0.085	*0.748*							
3. Exploitation	0.246	0.198	*0.787*						
4. Innovativeness	0.033	0.096	0.162	*0.739*					
5. Proactiveness	0.058	0.069	0.120	0.090	*0.722*				
6. Process innovation capabilities	0.128	0.178	0.214	0.186	0.143	*0.809*			
7. Product innovation capabilities	0.032	0.057	0.011	0.147	0.013	0.245	*0.776*		
8. Risk-taking	0.062	0.019	0.025	0.121	0.092	−0.018	0.024	*0.843*	
9. Transformation	0.158	0.210	0.267	0.125	0.031	0.124	0.137	0.112	*0.769*

Establishing second-order constructs. This study made use of second-order latent constructs for all investigated variables. Hence, there was a necessity to verify whether the first-order constructs were competent to be conceptually revealed by their second-order constructs before testing the research model. Therefore, they have to be represented well by their hypothesized first-order constructs where these first-order constructs have to be discriminant and convergent (Byrne, 2010). The repeated indicator approach for modeling the second-order factors in the PLS analysis was followed as suggested in related literature. Table VI illustrates that these constructs are confirmed to be distinct according to Hair *et al.* (2014).

The assessment of the structural "inner" model and hypotheses testing procedures. The path coefficients' significance was confirmed through the bootstrapping method in Smart-PLS 3.2.0, where the *t*-values of each path coefficient were produced and are presented with their *p*-values in Figure 3 and Table VII. The present study's findings gave interesting outcomes for discussion, which are an extension of previous studies that focused on the concept of TIC.

Table VII shows four hypotheses related to the study's objectives. The results reveal that EO positively and significantly influences TIC at the 0.01 significance level ($\beta = 0.172$, $t = 3.138$, $p < 0.01$). This result supports *H1*. The relationship between EO and ACAP shows significant influence at the 0.001 significance level ($\beta = 0.205$, $t = 3.716$, $p < 0.001$) and thus *H2* is supported. Likewise, the results show that ACAP significantly influences TIC ($\beta = 0.218$, $t = 4.469$, $p < 0.001$) indicating that *H3* is supported. In addition, the study tested the mediating effect of ACAP in the relationship between EO and TIC. The bootstrapping method used to evaluate the indirect effect and the result illustrates a significant indirect effect ($\beta = 0.045$, $t = 2.450$, $p < 0.01$), proving the mediating effect of ACAP. To determine the size of indirect effect, the variance accounted for (VAF) formula was used as suggested by Hair *et al.* (2014). This formula helps to determine the extent to which the variance of dependent variable is directly explained by independent variables and how much of that variance is explained by the indirect relationship via the mediator variable. The following formula depicts how to calculate the VAF:

$$\text{VAF} = \frac{(\text{path a} \times \text{path b})}{(\text{path a} \times \text{path b} + \text{path c}')} \quad (1)$$

The result shows that the VAF for this study is 0.21, which is ranked as a partial mediation (Hair *et al.*, 2014).

Discussion and implications

Drawing on the RBV of the firm, this study developed an argument according to which the results of this study confirm the essential role of EO, especially for SMEs that have high

Items	1	2	3	4	5	6	7	8	9
1. Acquisition									
2. Assimilation	0.131								
3. Exploitation	0.318	0.255							
4. Innovativeness	0.083	0.120	0.193						
5. Proactiveness	0.099	0.112	0.147	0.110					
6. Process innovation capabilities	0.154	0.219	0.251	0.205	0.166				
7. Product innovation capabilities	0.088	0.104	0.077	0.172	0.057	0.285			
8. Risk-taking	0.089	0.079	0.060	0.138	0.113	0.046	0.063		
9. Transformation	0.209	0.279	0.340	0.153	0.081	0.147	0.173	0.135	

Table IV. Heterotrait-monotrait (HTMT) criterion values

Items	SE (STERR)	*t*-statistics (IO/STERRI)	*p*-values
Assimilation → acquisition	0.030	2.815	0.005
Exploitation → acquisition	0.066	3.562	0.000
Exploitation → assimilation	0.036	2.874	0.004
Innovativeness → acquisition	0.023	3.267	0.001
Innovativeness → assimilation	0.020	4.201	0.000
Innovativeness → exploitation	0.037	2.593	0.010
Process innovation capabilities → acquisition	0.040	2.940	0.003
Process innovation capabilities → assimilation	0.042	3.226	0.001
Process innovation capabilities → exploitation	0.053	3.432	0.001
Process innovation capabilities → innovativeness	0.053	3.767	0.000
Product innovation capabilities → acquisition	0.030	3.090	0.002
Product innovation capabilities → assimilation	0.040	3.247	0.001
Product innovation capabilities → exploitation	0.023	2.983	0.003
Product innovation capabilities → innovativeness	0.049	3.491	0.001
Product innovation capabilities → process innovation capabilities	0.060	4.873	0.000
Proactiveness → acquisition	0.031	2.487	0.013
Proactiveness → assimilation	0.025	3.903	0.000
Proactiveness → exploitation	0.037	3.400	0.001
Proactiveness → innovativeness	0.031	3.046	0.002
Proactiveness → process innovation capabilities	0.046	3.149	0.002
Proactiveness → product innovation capabilities	0.020	2.743	0.006
Risk-taking → acquisition	0.032	2.251	0.025
Risk-taking → assimilation	0.026	3.597	0.000
Risk-taking → exploitation	0.021	2.540	0.011
Risk-taking → innovativeness	0.035	3.719	0.000
Risk-taking → process innovation capabilities	0.023	2.311	0.021
Risk-taking → product innovation capabilities	0.023	2.797	0.005
Risk-taking → proactiveness	0.035	3.124	0.002
Transformation → acquisition	0.050	3.508	0.000
Transformation → assimilation	0.042	2.643	0.008
Transformation → exploitation	0.056	3.678	0.000
Transformation → innovativeness	0.033	2.364	0.018
Transformation → process innovation capabilities	0.033	2.788	0.006
Transformation → product innovation capabilities	0.052	3.121	0.002
Transformation → proactiveness	0.021	3.212	0.001
Transformation → risk-taking	0.029	2.156	0.032

Table V.
Heterotrait-monotrait (HTMT) statistical test

Second-order construct	First-order construct	Path coefficient	SE	*t*-value	*p*-value	R^2
Technological innovation capabilities	Product innovation capabilities	0.562***	0.066	8.656	0.000	0.316
	Process innovation capabilities	0.940***	0.01	98.470	0.000	0.883
Entrepreneurial orientation	Proactiveness	0.379***	0.093	3.642	0.000	0.143
	Risk-taking	0.383***	0.092	3.912	0.000	0.147
	Innovativeness	0.922***	0.027	31.132	0.000	0.849
Absorptive capacity	Knowledge acquisition	0.524***	0.068	7.911	0.000	0.274
	Knowledge assimilation	0.549***	0.067	7.923	0.000	0.302
	Knowledge transformation	0.678***	0.044	14.536	0.000	0.459
	Knowledge exploitation	0.745***	0.034	20.546	0.000	0.555

Note: ***$p < 0.001$

Table VI.
Establishment of second-order constructs

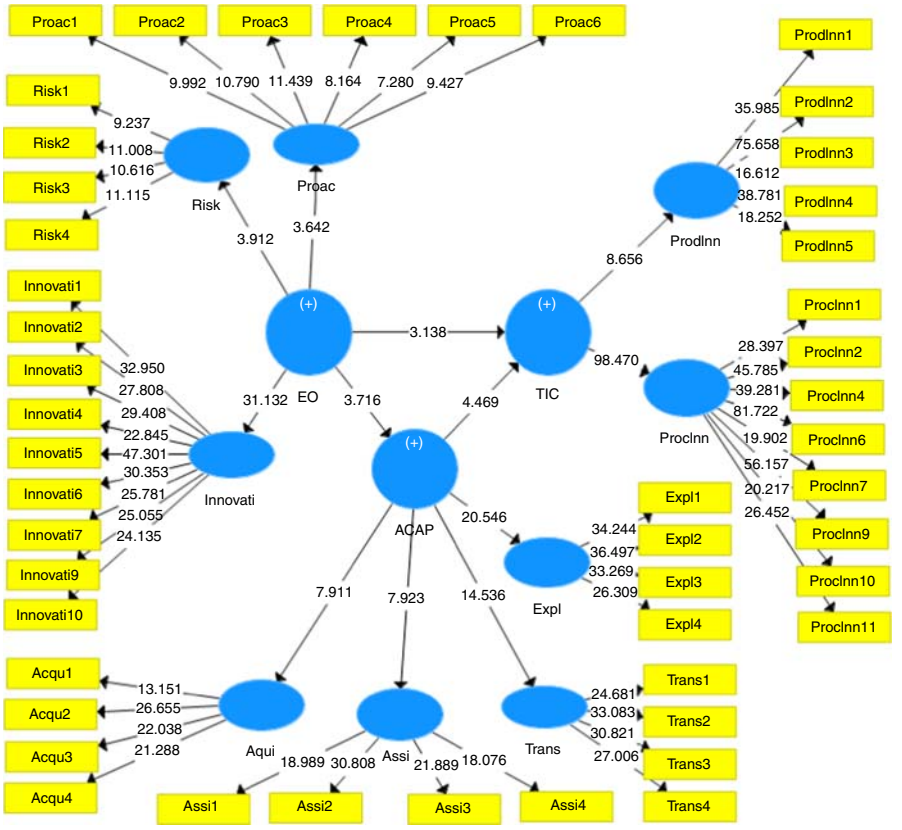

Figure 3.
Structural "inner" model

Hyp. no.	Hypothesis statement	Path coefficient	SE	*t*-value	*p*-value	Decision
H1	EO → TIC	0.172**	0.052	3.138	0.001	Supported
H2	EO → ACAP	0.205***	0.058	3.716	0.000	Supported
H3	ACAP → TIC	0.218***	0.050	4.469	0.000	Supported
H4	EO → ACAP → TIC	0.045**	0.018	2.450	0.007	Supported

Notes: **$p < 0.01$; ***$p < 0.001$

Table VII.
Results of the structural "inner" model

levels of ACAP to enhance TIC. Thereby answering Engelen *et al.* (2014) calls for more researches on the importance of ACAP in the context of EO field. Although the literature (Ferraresi *et al.*, 2012; Messersmith and Wales, 2011) continually elucidated a non-significant relationship between EO and innovation, this study revealed the opposite. The first finding deduces that firms with EO attitudes could enhance their TIC and utilize externally generated knowledge. This finding gives a significant insight into the debate in the literature regarding the role of a firm's EO itself and adopted knowledge in enhancing SMEs' innovation capabilities, especially in making decisions that are related to technological innovation, enterprises are likely to consider whether or not they receive entrepreneurial opportunities. This indicates that the nature of EO and its components urge the firms to consider new ideas and take part in creative ventures, tolerate risks and

be proactive. Therefore, enterprises have several opportunities for developing their TIC within EO, although it is important for them to take technological changes, industry changes, shifts in demography and changes in the macro-economy into consideration. With respect to the Kurdistan region, it appears that EO of industrial SMEs is a sturdy tool for achieving TIC and this may be attributed to the instability, especially in light of political and security unrest which is troubling the country from time to time.

Contrary to much argumentation in the literature on ACAP, some researchers (Lee *et al.*, 2013) claim a non-significant relationship between knowledge acquisition and technological innovation among the industrial firms. However, the second finding of this study confirms the significant relationship between ACAP and TIC. This could provide insight related to possessing access to external knowledge that enables firms to take advantage of important learning opportunities. Namely, have access to a various bundles of new knowledge and skills, which enhance internal abilities to comprehend this knowledge and then translate that to new and innovative products. This could explain why SMEs rely on external knowledge to develop their innovation capabilities. In addition, the measurement of industrial SMEs' TIC can help enterprises to realize and achieve a high degree of innovation by dealing with factors affecting ACAP (i.e. EO) because it plays a significant role in the innovation level. This finding also explains that SMEs owners in the Kurdistan region realize that, in the light of limited training opportunities for their workers, concentrating only on existing knowledge cannot develop their innovations due to the scarcity of available knowledge for them (RDSKR, 2011). Thus, acquiring externally generated knowledge could successfully enhance TIC beyond that of the firm's rivals among industrial SMEs in the Kurdistan region of Iraq.

In accordance with the theoretical arguments of this study, the third finding revealed that the firm's ability to absorb and exploit external knowledge could serve as a mechanism to enhance entrepreneurial attitudes to develop innovation capabilities. This is contrary to the findings of previous study of Chang *et al.* (2013). That is, the valuable knowledge helps SMEs to evaluate their opportunities and determine the most beneficial option, thereby reducing the size of uncertainty. In the same vein, the mere existence of knowledge outside the firm's boundaries does not mean that there is ease in acquiring and exploiting this knowledge. Therefore, to achieve competitive advantage, SMEs should seek out the appropriate knowledge to exploit for their activities. This finding also shows the importance of externally generated knowledge in improving EO attitudes to enhance the enterprise's innovation capabilities, owing the change-oriented nature of ACAP enterprises tend to evolve and restructure their resource base in order to adapt to the ever-changing and competitive market. These capabilities are manifested in the observable corporate structures and processes and are ingrained in the enterprise culture and employees' relationships and cannot be confined or attributed to a single employee.

Elucidated from a practitioner's standpoint, the results of this study demonstrate that some capabilities can help firms to carry out a strategic attitude reinforcing their relationship with innovation. In particular, ACAP to acquire new externally generated knowledge qualifies a firm to perform an entrepreneurially oriented activities more effectively especially in turbulent environments. In addition to its practical implications, the empirical result concluded in this study could be utilized by policy-makers in the Kurdistan region of Iraq to enhance the mechanisms that provide industrial SMEs with pertinent training programs to develop their entrepreneurial capabilities in producing new competitive and innovative products. Thus, the results of this study will be a resource for the reforms required by the bodies concerned with the development of the private sector like CIPE and the government of the Kurdistan region in developing their regional development strategy, and facilitate the efforts of both practitioners and decision makers to reach the desired level of development in the industrial privet sector.

Conclusions

Current study on TIC has a number of conclusions about how EO could be beneficial for supporting innovation capabilities (Hughes *et al.*, 2007; Otero-Neira *et al.*, 2013). Research framework concludes that the EO is contributed by promoting innovation capabilities and that leads to providing unexploited opportunities to commercialize the innovation (Aljanabi and Noor, 2015b; Boso *et al.*, 2012a). Therefore, continuous efforts to develop a suitable level of EO are the essence of developing TIC (Aljanabi and Noor, 2015b). Furthermore, entrepreneurial firms monitor their external environment precisely in their endeavor to innovate new products and this offers a potential explanation for rationalizing the relation of EO as it participates to creating a capability to learn and absorb the related knowledge and enhancing a firm's dynamic capabilities to adapt to environmental changes (Kreiser, 2011; Ren and Yu, 2016). This study also concludes that mere possession of knowledge cannot support TIC. However, innovation capabilities depend on the firm's ACAP to turn both internal and external knowledge into action and outcomes (Huang and Wang, 2011; Liao *et al.*, 2010). Therefore, TIC could be more effective with the availability of mechanisms for knowledge acquisition and exploitation that elevate the effect of EO on innovation capabilities.

Limitations and directions for future researches

Like the rest of empirical studies, the present study has its restrictions and the findings should be discussed in light of such limitations to give opportunity for future research. First, of the empirical research available, only a few investigate the relation between EO and ACAP and their cumulative effect on innovation capabilities. This gives an incomplete perception about the results in different contexts and restricts the generalization of such findings. Thus, future research should extensively focus on this relation. Second, this study employed a survey design with a cross-sectional technique, where data were gathered at one single point in time. In a survey design, information obtained only indicates the level of variables' association and while the causal relationships are inferred on the basis of the results obtained, it is difficult to accurately ascertain them. Thus, the study's conclusions could be different if the adopted research design had been longitudinal rather than cross-sectional. Third, the sample covers only industrial SMEs with no data obtained from large enterprises. Future studies may investigate the role of other firm attributes such as size, age, and production variety. It could be an important contribution to reinvestigate the proposed model and finding whether the present relations are confirmed in other contexts, i.e., technologically turbulent markets, different sectors, mature economy. Finally, to obtain more precise finding with the mediating role of ACAP, managerial level of industrial SMEs should be examined as a control variable and enterprises size should be considered as moderating variable.

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