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Breaking the Routines: Entrepreneurial Orientation, Strategic Learning, Firm Size, and Age

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Drawing upon prior research suggesting inertia prevents organizations from learning, we suggest that the relationship between entrepreneurial orientation (EO) and strategic learning (SL) is not as straightforward and linear as has been suggested. The size and age of an organization, considered indicators of inertia, are important factors affecting how EO contributes to the components of SL. Data from 182 software companies confirm the non-linear relationships between EO and the dissemination, interpretation, and implementation components of SL. The results also indicate that the U-shaped association between EO and specific components of SL is more pronounced for larger and established companies than for younger and smaller ones. These findings depart from previous work based on strategic learning from mistakes, and offer a specific understanding of the relationship between EO and the four distinct components of SL. These results suggest that companies should opt to facilitate the individual components of SL as they are affected differently depending on the level of EO, and the age and size of the organization.

Introduction

A major proposition regarding entrepreneurial orientation (EO) is that highly entrepreneurial firms are better equipped to adjust to dynamic competitive environments than their less entrepreneurial counterparts (Covin and Slevin, 1989; Lumpkin and Dess, 1996; Miller, 1988; Zahra, 1993). Despite the mounting evidence for the generally positive effects of EO on company profitability and growth (Wiklund, 1999; Wiklund and Shepherd, 2005; Zahra, 1991; Zahra and Covin, 1995), studies examining how EO actually affects the long-term adaptive capability of the firm are rare (Kreiser, 2011) and establishing this connection is not straightforward (Covin and Slevin, 1991; Wales et al., 2011). Specifically, from an organizational ecology perspective (e.g., Hannan and Freeman, 1984, 1989), it is evident that difficulties with inertia, ingrained routines, and institutionalized structures pose a significant threat to the long-term adaptation of organizations, and hence may inhibit the effect of entrepreneurial action.

Recent EO literature (Anderson et al., 2009; Covin et al., 2006; Green et al., 2008; Mueller et al., 2012) proposes strategic learning (SL) as a long-term adaptive capability that allows organizations to break away from their current strategic path and renew their core capabilities. SL consists of knowledge creation, dissemination, interpretation, and implementation (Kuwada, 1998; Thomas et al., 2001), and links directly with the key management question of how organizations change their strategies to maintain and develop a competitive advantage (Ambrosini and Bowman, 2005). Hence, the components of SL have an important role when the change initiatives originating from EO must be realized and strategy adjusted (Anderson et al., 2009; Covin et al., 2006). The components of SL are especially important in explorative settings where firms must determine where their competitive advantage lies, because it guides the variation–selection–retention process of entrepreneurial initiatives (Burgelman, 1991; Mintzberg and Waters, 1985).

Strategic learning from EO is not simple. Organizational ecology theorists argue that implementation of SL is hindered by organizational inertia (Ahuja and Lampert, 2001; Levinthal and March, 1981; Miner et al., 2001; Zahra et al., 2006) and signals generated by EO that are insufficiently strong are likely to be blocked from the variation–selection–retention process. However, increasing EO brings the organization into contact with diversity, new assumptions, and new organizational frameworks that shift a firm's focus toward fundamental strategic adjustments (Cope, 2003). Thus, highly entrepreneurial firms have been associated with overcoming learning traps (Ahuja and Lampert, 2001; Levinthal and March, 1993) thus fostering strategic adjustments in the organization. It is also well established in the organizational ecology literature that as an organization grows in terms of size and age, resistance to change increases, affecting how new entrepreneurial ideas are absorbed (Sørensen and Stuart, 2000; Wales et al., 2011). The liabilities of size, related to structures and resources, inhibit

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adaptation and renewal (e.g., Aldrich and Auster, 1986; Baker and Cullen, 1993; Wales et al., 2011). On the other hand, liabilities of age further complicate renewal. These may be traced back to organizational path dependencies such as development of organizational routines and the socialization of individual knowledge to an organizational code as well as rigid network ties. Hence, SL from EO becomes more difficult when a firm grows or matures.

Our study contributes to EO literature by proposing that the relationship between EO and SL is non-linear. We further suggest that this non-linear relationship between EO and SL takes different forms depending on the size and age of the company. Especially in larger and more established companies, SL is positively influenced only by higher levels of EO, while this relationship is more straightforward and linear in smaller and younger companies. The study contributes to an under-researched area, answering the call of Wales et al. (2011; p. 21) for studies addressing the question, "How does the pervasiveness of EO relate to temporally linked organizational factors: liabilities/viabilities of newness, inertia, and core rigidities?" The current research also adds to organizational learning and dynamic capability literature by studying how structurally constrained companies, in which the learning effect can be hampered by inertia, can promote SL (Ahuja and Lampert, 2001; Levinthal and March, 1993). Zahra et al. (2006; p. 937) noted that prior studies "provide little direct empirical evidence on differences in learning processes" in smaller versus larger but also in newly founded versus established companies. Therefore, we introduce organization size and age as indicators of structural inertia and moderators of the non-linear relationship of EO and SL. We suggest that in order to engage in SL, larger and more established companies need to cultivate a strong EO in their organizations. By going beyond the linear rationality of the EO–SL relationship, we step into "a promising avenue for future research," that is, "the examination of curvilinear relationships between antecedents and organizational knowledge transfer" (van Wijk et al., 2008; p. 848). Finally, prior research has generally applied a unidimensional representation of SL (Anderson et al., 2009; Covin et al., 2006; Green et al., 2008; Mueller et al., 2012). We find such an approach difficult because of the different natures of the four components of SL and the possibility that EO influences these components differently. Hence, we recognize the importance of separating the components of SL and clarifying the role of EO in facilitating strategic knowledge creation, dissemination, interpretation, and implementation.

Theoretical background

Conceptualizing strategic learning

The concept of strategic learning was introduced by Mintzberg and Waters (1985) and later developed by Kuwada (1998) and Thomas et al. (2001). It extends the idea of organizational learning from "something deployed in service of existing strategies" (Voronov, 2008; p. 196), where a firm learns the skills and competencies necessary to realize its intended strategy, and moves the focus to the emergence of new strategies and strategic adjustments (Mintzberg and Waters, 1985). Concentrating on a firm's ability to create and use knowledge to revise the firm's strategy (Anderson et al., 2009), the concept of SL captures aspects of a strategic-level learning where "basic assumptions underlying corporate-level knowledge are reframed and lead to a renewal of the organization's strategic capability" (Kuwada, 1998; p. 719). Building on Burgelman's (1991) intra-organizational, ecological perspective on strategy-making, an organization is viewed as an ecology where strategic initiatives are continuously created and compete for limited resources. SL's major role is to retain the most viable strategic initiatives (Burgelman, 1991), formed through active learning from entrepreneurial activity. Thus, the fundamental idea of SL is broader than just learning from mistakes as indicated in some prior studies (Anderson et al., 2009; Covin et al., 2006; Green et al., 2008; Mueller et al., 2012). Building on existing SL models (Crossan et al., 1999; Kuwada, 1998; Thomas et al., 2001), we suggest that SL is based on four sets of capabilities supporting a firm by way of strategic adjustments: knowledge creation, dissemination, interpretation, and implementation of strategic knowledge.

Strategic knowledge creation is an exploratory knowledge acquisition process enabling individuals in an organization to gather strategic information from their environment to extend their current knowledge (Atuahene-Gima and Murray, 2007; March, 1991). The process conducted by individuals and groups provides a company with new market knowledge to fuel its knowledge-creation processes (Jones and Macpherson, 2006) and bolster its existing stock of knowledge (Crossan and Berdrow, 2003). Knowledge creation drives a firm's ability to perceive and anticipate external change and to develop the knowledge base necessary to advance strategic changes (Ben-Menahem et al., 2013).

Strategic knowledge dissemination is a social exchange process that refers to the sharing of strategic knowledge through interactions within and between organizational units (Jerez-Gómez et al., 2005) in order to ensure new ideas permeate the whole organization (De Clercq et al., 2010). Knowledge dissemination can occur both formally and informally and both horizontally (i.e., interdepartmentally) and vertically (cross-functionally) within the firm (Van der Bij et al., 2003). For entrepreneurial firms it is important that the various functional areas are guided by a cross-functional knowledge dissemination process. This process encourages and facilitates knowledge transfer across and within subunits to retain a diversity of views and to foster cooperative beliefs and understandings among all functional areas to direct them toward coordinated innovation efforts (Siguaw et al., 2006).

In the process of *strategic knowledge interpretation* organizational members interpret new information about potential opportunities through a mutual process of interaction including open dialogue with people of diverse backgrounds and perspectives (Daft and Weick, 1984; Kuwada, 1998; Slater and Narver, 1995). In this sense-making process, conflicting assumptions and alternative interpretations are considered and, if necessary, acted upon to change behaviors and the way the organization interprets information. Knowledge interpretation allows a firm to identify meaningful fragments of information and

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act to alter its strategy, and thereby its performance (Daft and Weick, 1984; Tippins and Sohi, 2003). According to Kuwada (1998), when strategic learning occurs, some of a firm's basic assumptions change and it acquires a new frame of reference, and thus a different mode of interpreting created and disseminated knowledge.

Strategic knowledge implementation is a formal process that institutionalizes new strategic knowledge on the non-human facets of organizations, such as organizational systems, structures, procedures, and routines (Alegre et al., 2013; Huber, 1991). These are collectively referred to as organizational memory or knowledge storage systems (Walsh and Ungson, 1991). In the knowledge implementation process, various departments, groups, and teams within the organization test the applicability of the strategic initiative. The most viable initiatives eventually become formal strategies and generate new products, services, and processes (Nonaka and Takeuchi, 1995).

The four components noted above represent capabilities that support a firm's ability to derive knowledge from strategic actions and to leverage that knowledge to adjust its strategy (Anderson et al., 2009). The organizational learning model devised by Crossan et al. (1999) suggests that in order to strategically change the organization, several learning capabilities must work simultaneously to ensure learning is implemented into the organization's strategy. The new knowledge needs to be disseminated, interpreted, and implemented while working in a setting where institutionalized learning affects these processes. However, SL dimensions do not necessarily follow a sequential order (Crossan et al., 1999; Flores et al., 2012). It is important to recognize that because the four components of SL are distinct but work interdependently, they all contribute to strategic changes. Accordingly, we propose that paying attention to individual SL components and their relationships with EO provides a finer grained picture of the phenomena than the previous unidimensional representations.

From the dynamic capability perspective, the components of SL constitute dynamic capabilities in a firm because SL enables the firm to create, extend, and modify its knowledge base to respond to shifts in the business environment (Collis, 1994; Eisenhardt and Martin, 2000; Helfat and Peteraf, 2003; Zollo and Winter, 2002). SL provides benefits such as an enhanced ability to recognize and utilize new product and market opportunities, to capitalize on innovations, and to adapt to changes in the marketplace (Anderson et al., 2009; Berghman et al., 2013; Kuwada, 1998; Thomas et al., 2001). SL also plays a particularly important role as an agent for changing direction without losing the speed and efficiencies generated by established operational routines (Kuwada, 1998) when organizational change and radically new competencies are required. SL is related to double-loop and second-order learning because it is transformational (Ambrosini et al., 2009), and therefore distinct from operational capabilities (Helfat and Winter, 2011) and single-loop learning processes (Argyris and Schön, 1978, 1996). SL could be juxtaposed with concepts like knowledge management (Alegre et al., 2013; Hedlund, 1994; Tanriverdi, 2005) and absorptive capacity (Cohen and Levinthal, 1990; Zahra and George, 2002). However, SL research focuses on the learning process and hence is different from the main body of knowledge management research that seeks to understand the content of learning or the nature of knowledge as an asset (Vera et al., 2011). Absorptive capacity refers to a firm's ability to recognize, assimilate, and apply new external R&D-related knowledge (Cohen and Levinthal, 1990). It is often seen as a dyad-level construct of limited application at the firm level, and is typically used to measure interorganizational knowledge transfer (Lane et al., 2001; Mowery et al., 1996; Wang and Ahmed, 2007), rather than the firm-level strategic knowledge processes that are central to the components of SL.

Entrepreneurial orientation and strategic learning

The relationship between EO and different types of learning has intrigued scholars (e.g., Hughes et al., 2007; Keh et al., 2007; Kreiser, 2011; Real et al., 2014; Wang, 2008). However, prior EO studies have mainly focused on single-loop learning (e.g., De Clercq et al., 2010; Keh et al., 2007; Wang, 2008) where new knowledge created is related to existing knowledge and is not likely to conflict with the firm's established models (Atuahene-Gima and Murray, 2007). Recently, the EO literature (Anderson et al., 2009; Covin et al., 2006; Green et al., 2008; Mueller et al., 2012) has included discussions on the concept of *strategic learning* in terms of it being one of the main ways to understand the learning that activates strategic change in organizations. Although EO has been linked to SL in previous studies, there is limited understanding of the shape and form of the relationship. Only a handful of empirical studies (Anderson et al., 2009; Covin et al., 2006; Mueller et al., 2012) have touched upon how EO and SL might intersect. Anderson et al. (2009) found that EO had a positive impact on SL but that the effect was weaker than expected. Covin et al. (2006) hypothesized that SL would positively moderate EO and sales growth but, unexpectedly, found that the moderation was negative. Mueller et al. (2012) also surprisingly found SL negatively moderated the relationship between a pioneering orientation and performance. All these prior studies that anticipated a linear relationship between EO and SL derived their data from the manufacturing industry in the USA, and focused only on one specific conception of SL; learning from mistakes. Although learning from mistakes is very important, SL can also take other forms (Covin et al., 2006; Crossan and Berdrow, 2003) and includes several distinct components (Kuwada, 1998; Thomas et al., 2001).

The strategic learning components of knowledge creation, dissemination, interpretation, and implementation encompass double-loop learning, through which the organization analyzes and modifies its existing norms, procedures, strategies, and objectives (Argyris and Schön, 1978; Thomas et al., 2001). Scholars claim that it is significantly more difficult to achieve strategic learning than the operational, single-loop learning discussed in previous research (e.g., Zhao et al., 2011). Organizational ecology theorists argue that compared to single-loop learning processes, the implementation of SL is hindered by organizational inertia, since the fear of wasting limited resources and undertaking unsuccessful experimentation may cause firms to rely on existing competences and limit activity within established boundaries (Ahuja and Lampert, 2001;

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Levinthal and March, 1981; Miner et al., 2001; Zahra et al., 2006). Thus, while lower levels of EO are easily rejected in the variation–selection–retention process, increasing levels of EO provide enough impetus to overcome the inertial forces, and thus the effect on the components of SL is strong only in the presence of higher levels of EO.

EO is an orientation that ties up considerable resources (Covin and Slevin, 1991; Wiklund, 1999; Wiklund and Shepherd, 2005) and introduces ideas that challenge accepted assumptions and cognitive structures (Lei et al., 1996). EO can provoke organizational resistance because of the risks associated with entrepreneurial behaviors (Miller and Chen, 1994; Wales et al., 2011). For example, new knowledge creation and implementation based on EO are very risky as they involve substantial effort and expenditure and the outcome of the activity is uncertain (Keh et al., 2007). Furthermore, the components of SL are constrained because of path dependencies; that is, learning is inherently linked to a firm's history and previous activities (Fiol and Lyles, 1985; Leonard-Barton, 1992). For instance, while the tacitness, specificity, and complexity of strategic knowledge protect knowledge from imitation by rivals, those same characteristics make it hard to disseminate within and across organizational functions (Li et al., 2009; van Wijk et al., 2008). The components of SL are also constrained due to the complementary nature of established resources, knowledge, and networks (e.g., Ahuja and Lampert, 2001; Argyris and Schön, 1978; Deeds et al., 2000; Tripsas and Gavetti, 2000). When facing problems, firms generally look to their prior knowledge and experience for solutions (Liao et al., 2008). This leads to a focus on acquiring complementary knowledge instead of creating the novel insights that are a fundamental prerequisite for the components of SL to exist (Hughes et al., 2007; Levinthal and March, 1993). Knowledge creation is greatly affected by the accessibility of sources of information, which favors the adoption of tried and tested sources (O'Reilly, 1982). Accordingly, Huber (1991, p. 98) suggests that a "search-justifying threshold" must be exceeded before knowledge creation can spread into new arenas. Together, these arguments signal that in non-entrepreneurial firms, the organization has not built specialized competences around entrepreneurship and therefore entrepreneurial initiatives will often be overlooked because the organization has little experience of them and weak entrepreneurial signals are insufficiently disruptive to attract notice (Weick and Bougon, 1986). Against this background, we argue that lower levels of EO may exert little influence on attaining higher levels of knowledge creation, dissemination, interpretation, and implementation. While lower levels of EO may support simple process improvements and adjustments to current operations, the influence of lower levels of EO on the components of SL is likely to be weak at best.

Keh et al., (2007 p. 597) suggest that only firms "with high levels of entrepreneurial orientation are likely to be active in information acquisition and utilization". Increasing EO levels have been associated with overcoming learning traps such as the tendency to favor the familiar over the unfamiliar, a tendency to prefer the mature over the nascent, and a tendency to search for solutions that are close to existing knowledge rather than investigate completely new solutions (Ahuja and Lampert, 2001; Levinthal and March, 1993; March, 1991). This is because strong EO brings the organization into contact with significant diversity, new assumptions, and new organizational frameworks. The focus shifts beyond the near future or historical conditions toward fundamental strategic adjustments and opportunities (Cope, 2003). For example, higher levels of EO frequently expose the organization to novel technologies, an exposure that enables the organization to increase heterogeneity in its knowledge base. This effect arises because exposure to these different approaches challenges an organization to test existing cognitive structures and cause-and-effect relationships, adding new problem-solving capabilities to the organization's armory (Ahuja and Lampert, 2001). Highly entrepreneurial firms are more open to diverse information that exists outside of their boundaries, which facilitates the creation of technical knowledge from new sources (Kreiser, 2011; Liu et al., 2002; Slater and Narver, 1995). Further, due to their open-minded attitudes, highly entrepreneurial firms are more likely to interact with key constituents in their operating environment (Kreiser, 2011), thus enabling knowledge creation. In other words, increasing EO enables the firm to choose from a broader array of responses appropriate to the prevailing environmental conditions. Entrepreneurial firms are also more likely to prompt effective knowledge dissemination within and between organizational functions than are non-entrepreneurial ones, because the proactive utilization of knowledge resources is necessary to capitalize on emerging market opportunities (Li et al., 2009). Thus, an organization maintaining EO at higher levels is more likely to have developed specialized competences and processes in the area of knowledge dissemination, facilitating a coordinated innovation effort and learning throughout the organization (Ahuja and Lampert, 2001; Siguaw et al., 2006). In terms of knowledge interpretation, while conservative firms (as judged on their lower EO levels) are often overconfident in the validity of their past assumptions, higher EO levels fuel that might be termed an *unfreezing process* involving a re-evaluation of existing ways of perceiving information, and which makes room for new forms of interpretation (Louis and Sutton, 1991; Sitkin, 1992). In terms of knowledge implementation, firms committed to higher EO are willing to utilize new information to change their strategies, processes, and procedures in the hope of developing and maintaining a competitive edge over rival firms (Kreiser, 2011). In general, when the signal to be entrepreneurial is very strong, firms tend to pay closer attention to processing new information because the motivation to adapt is clear (Sitkin, 1992). Thus, increasing levels of EO enable the organization to overcome the restrictions to learning capabilities and improve its ability to successfully acquire, interpret, distribute, and incorporate strategically important new knowledge to facilitate and continuously re-create its capabilities.

The arguments above suggest only the highest levels of EO can provide enough material from outside the current domain of a firm for the creation, dissemination, interpretation, and implementation of SL to take place. The inertia present in any organization trying to change its strategic direction is likely to reduce the effectiveness of new information and incentives generated by entrepreneurial activities (Huff et al., 1992). Therefore, to have a significant positive effect, the stimulus from EO has to be strong enough to breach the resistance established by other influences such as structures, resource rigidity, and the bounded rationality of managers. Eventually however, the established structures must give way, which permits the components of SL to flourish, and that leads us to hypothesize:

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Hypothesis 1. The relationship between EO and the components of strategic learning is non-linear: The effect of EO on the components of SL is limited at lower EO levels but increases exponentially with higher levels of EO.

Wales et al. (2011) suggest that the effectiveness of EO may alter as a function of the firm's level of development. Particularly liabilities linked with age and size constitute major organizational contingencies affecting the EO outcome (Wales et al., 2011). For example, research has shown that as organizations age and grow, the liabilities stemming from internal inertia, core rigidities, and external dependencies severely limit the capability of the organizations to change (Aldrich and Auster, 1986; Leonard-Barton, 1992; Thornhill and Amit, 2003). Next, we discuss how the non-linear relationship between EO and the components of SL is moderated by the liabilities of the size and age of the firm.

Moderating effects arising from liabilities of firm size

In terms of the EO–SL component relationship, two important aspects associated with liabilities of size are structures and resources (e.g., Aldrich and Auster, 1986; Baker and Cullen, 1993; Wales et al., 2011).

First, in larger organizations, organizational size and complexity demand a structured approach (i.e., higher levels of specialization and formalization, and a more rigid hierarchy) to regulate organizational activities (Ahuja and Lampert, 2001; Burgelman, 1983). Although established organizational structures increase efficiency, the complexity associated with size makes large organizations more reluctant to change because it complicates communication and decision making (Aldrich and Auster, 1986; Baker and Cullen, 1993). In large organizations, knowledge needs to be transferred across horizontal and vertical structures, making not only information dissemination but also knowledge interpretation more difficult (Child and Kieser, 1981). Forming cooperative beliefs and fostering a shared understanding of entrepreneurial initiatives through knowledge interpretation is a demanding task in large organizations with specialized functions because of differing functional mandates, processes, and objectives (Argote et al., 2000; Song et al., 1997; Tsai, 2002). Indicating where a particular type of information can be found and with whom new information should be shared is also challenging in the presence of specialization and departmentalization (Huber, 1991; Moreland, 1999; Tsai, 2002). More cumbersome structures may also hamper information sharing due to the increased likelihood of their fostering tunnel-vision among employees who focus on their own narrow responsibilities without concerning themselves with the issues faced by others (Bunderson and Boumgarden, 2010). Centralized structures can also cause inefficiency because the dissemination of knowledge from individual unit to corporate headquarters is prone to error and delays (Poppo, 1995; Tsai, 2002). In addition, institutionalized structures often necessitate a strong emphasis on administration. In terms of knowledge implementation, increased decision-making complexity can slow and complicate reactions to entrepreneurial initiatives because the implementation of strategic change has to be agreed by several decision makers and because political factions are common (Hannan and Freeman, 1977, 1984). Owing to these challenges brought by institutionalized structures and complexities, large organizations require more external stimuli and more evidence before they will implement required changes. This creates a more pronounced non-linear relationship between EO and the components of SL than would be evident in small organizations.

Small organizations also have to deal with liabilities hampering their adaptation to change, but face different issues to larger organizations (Aldrich and Auster, 1986; Kelly and Amburgey, 1991). Because small firms enjoy the benefits of flexibility and less bureaucracy (Hitt et al., 1990; Whetten, 1987), that permit them to swiftly take advantage of new learning opportunities arising from EO, the creation, dissemination, interpretation, and implementation of SL in small firms tend to be less restricted (Real et al., 2014). The simple and informal structures and decision-making processes often found in such firms counter inertia, enabling them to more easily extract SL from EO (Hanks et al., 1993; Wales et al., 2011). For example, small firms may disseminate EO initiatives more easily because their small size means fewer knowledge transactions between hierarchical levels (Wong and Aspinwall, 2004). In addition, in small organizations, it is more likely that the whole organization engages in knowledge creation through day-to-day interactions with customers, suppliers, and other business associates (Keh et al., 2007). The effect is to make the knowledge creation process inherently organizational, and potentially to deliver a broad range of new knowledge to key staff. Further, because in small organizations achieving consensus requires involving fewer decision makers and thus less bureaucracy, strategic changes can be implemented quicker and in a more straightforward manner. It is also likely that the interest in sharing and interpreting new strategic information would also be stronger in small firms because each organizational member has more autonomy regarding implementation decisions (Kim and Lee, 2006). Consequently, the relationship between EO and the components of SL should be more linear and straightforward in small firms than in larger organizations.

Second, while large firms may have the advantage in terms of access to the resources and capabilities required for EO, radically new ideas are likely to encounter organizational resistance because they challenge the established resource base of the organization (Ahuja and Lampert, 2001; Miller and Chen, 1994; Wales et al., 2011). Large firms are less likely to improvise with resources (Brinckmann et al., 2010) because they have built a specialized resource base that guarantees economies of scale (Hitt et al., 1996). Projects built on clearly specified predecessors are more easily justifiable than entrepreneurial projects that rely on completely new principles (Ahuja and Lampert, 2001). Therefore, in large firms where entrepreneurial activities occur only rarely (i.e., there are lower levels of EO), resources, including time allocation, may not be easily redirected to the creation, dissemination, interpretation, and implementation of new entrepreneurial initiatives. However, when entrepreneurial action is frequent (i.e., there are increasing levels of EO), there is likely to be an internal pressure in the

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organization to allocate resources to learn from these events, enabling the effect flowing from EO to the components of SL to materialize.

Furthermore, large firms often have highly developed value networks with partners, suppliers, and customers that complicate the effect of EO on the components of SL (Aldrich and Auster, 1986; Rosenbloom and Christensen, 1994). Changing the strategy may mean changes in the co-specialized assets the network has developed, and consequently strategic changes in large organizations often require the approval of a broad group of stakeholders (i.e., customers, distributors, and suppliers) before they can be implemented (Deephouse, 1999). Kim et al. (2006) highlight that as organizational size increases, networks become more complicated, and that complex networks within an organization exert a considerable influence on any changes in interorganizational ties. The resistance to strategic changes that necessitate changes in the co-specialized assets of the network is likely to suppress the influence of EO on the components of SL. However, strong EO assists in building new networks and partnerships (Kreiser, 2011), overcoming the resistance from the current network, and thus permitting the effect from EO on the components of SL to materialize.

Small firms, on the other hand, while resource poorer, are suggested to be more capable of directing resources to emerging opportunities in a timely manner. For example, small firms are often led by owner-managers with great discretion to shape and change resource allocations, and accordingly those organizations are better positioned to facilitate SL from EO (Finkelstein and Hambrick, 1990). Consequently, small firms are capable of "rallying resources together, orchestrating an immediate offering, and hustling for a first customer" (Brinckmann et al., 2010; p. 25), making creation, dissemination, interpretation, and implementation of strategic knowledge from EO faster and more linearly related to the amount of EO within the firm.

The arguments above lead us to propose that the inertia brought about by size and therefore present especially in large, institutionalized firms trying to change their strategic direction, effectively serves to mitigate the effect from EO on the components of SL. Consequently, in large organizations, stimulus from EO has to be strong enough to overcome the inertia arising from established structures and resource rigidity if it is to be effectively transferred to the resource modifications and structural changes that SL entails (Huff et al., 1992). That leads us to hypothesize:

Hypothesis 2. The curvilinearity of the U-shaped relationship between EO and the components of SL will be greater for larger than for smaller companies.

Moderation effects arising from liabilities of age

Previous research has considered an organization's age an important singular determinant of how organizations can capture value from entrepreneurial strategies (e.g., Sørensen and Stuart, 2000). In general, strategic change becomes less likely as organizations age (e.g., Amburgey et al., 1993; Delacroix and Swaminathan, 1991; Miller and Chen, 1994). The advantages of youth or liabilities of age may be traced back to organizational path dependencies such as the development of organizational routines and the socialization of individual knowledge into an organizational code, and also to the rigidity of network ties.

First, the liabilities of age link with intra-organizational path dependencies related to the development of the organizational routines that are repeated patterns of behavior bound by stable customs and rules (Baker and Cullen, 1993; Feldman, 2000). Because organizational routines and knowledge search strategies develop as a consequence of past actions, routines favor projects that look for solutions similar to previously implemented solutions (Nelson and Winter, 1982). Long-established routines mean organizations become heavily anchored in past experiences (Sørensen and Stuart, 2000) that are likely to stand in the way of the creation, dissemination, interpretation, and implementation of strategic knowledge from EO. For example, older firms tend to become increasingly rigid in terms of their internal communication methods (Barnett, 1990; Rabbiosi and Santangelo, 2013; Ranger-Moore, 1997). That rigidity can cause such firms to routinely continue knowledge sharing activities in domains where knowledge has become obsolete. Lyles and Schwenk (1992) propose that organizational knowledge structures are likely to become more complex over time (as manifested in a large amount of information and elements constituting the knowledge structure) making storing new knowledge difficult. Huber (1991) emphasizes that organizations that have become constrained by inertia benefit from significant unlearning activity to move themselves away from outdated ways of doing things. Thus, to break old routines and action paths, the impetus from EO needs to be strong enough to convince the organization that change is essential. In comparison, Autio et al. (2000) argue that younger firms have learning advantages because their short history provides them with fewer organizational routines to unlearn, and because organizational assimilation and subsequent retrieval of the knowledge occur in an intense and repetitive fashion. It follows that the established routines in established companies would complicate the relationship between EO and the components of SL more than they would in younger firms.

Second, organizational path dependencies also play a role in the development of homogeneous thinking within organizations. It is well established that over time organizations tend to focus on issues that maximize consensus and minimize internal conflict (Van de Ven, 1986). While socialization to a shared organizational frame often supports efficiency in the organization, it also strengthens the homogeneity of thinking and problem solving (Granovetter, 1973; Van de Ven, 1986). Huber (1991, p. 102) emphasizes that "more learning has occurred when more and more varied interpretations have been developed", because variety in interpretations change the range of the organization's potential behaviors. Thus, organizations that have accumulated experience can fail to extract important insights from EO because their staffs become increasingly

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trapped in prevailing ways of thinking and thus of interpreting new knowledge. A manifestation of such a situation would be when an accumulation of experience fosters the use of mental shortcuts such as overgeneralization, and decreases engagement in counterfactual thinking (e.g., imagining alternative outcomes for past events) that assist in formulating more effective strategies to deliver better outcomes (Baron, 1998, 2000; Shepherd et al., 2003). Hence, a lack of heterogeneity means the older organization can easily fail to observe the need for the components of SL, creating learning traps (March, 1991). In contrast, the routines and action paths have not yet solidified within younger firms, and are not yet subject to an organizational code, accordingly problem solving is apt to be more varied (March, 1991).

Finally, older firms also become institutionalized in their long standing relations, creating resistance to the components of SL through established network ties (Kim and Lee, 2006; Kim et al., 2006). Strategic change often involves changes in existing interorganizational ties. Dissolving old relationships and forming new network ties becomes more difficult with age because of the established bonds, experiences, and routines with partners, and therefore it is unlikely that an established firm will replace its partners solely on economic grounds (Kim and Lee, 2006; Kim et al., 2006). From the knowledge creation perspective, long-lasting relationships may generate knowledge useful only in the context of the current network tie, causing the firm to remain specialized in niches in which its previous experience with the partner yields advantages (Kim and Lee, 2006; Kim et al., 2006). Consequently, the firm becomes increasingly removed from other potentially rewarding experience and knowledge (David, 1985; Kim and Lee, 2006; Kim et al., 2006). From the knowledge dissemination perspective, in a long-lived network tie, highly partner-specific procedures for knowledge dissemination create high fixed costs to establish specialized knowledge sharing systems (e.g., a shared intranet for new product development and accounting systems), potentially leading to inertia (Ebers, 1999; Kim and Lee, 2006; Kim et al., 2006). Due to cognitive integration (i.e., cultural values and goals being shared by partners in long interorganizational ties), knowledge interpretation becomes increasingly constrained by inertia (Kim and Lee, 2006; Kim et al., 2006). Accordingly, in older organizations, the stimulus flowing from EO needs to be stronger before strategic change takes place. In contrast, young firms often lack strong network ties, simply because developing trust and working relationships with partner organizations takes time. The study by Grichnik et al. (2014) showed that young firms are more likely to acquire resources from weak ties formed by more distant business contacts. New ties required by a changing strategic focus are thus more easily formed and current networks are more easily restructured, as the potential for the deterioration of interpersonal relationships is low (e.g., Grichnik et al., 2014; Kim and Lee, 2006; Kim et al., 2006). It follows that from a structural inertia perspective, younger organizations should be less affected by network inertia and thus the effect from EO to the components of SL should be more linear than in older organizations that are affected by the rigidity associated with long-term relationships.

Overall, network ties along with organizational and individual level routines all intertwine to constrain the effect of EO on the components of SL when organizations age. Against this background, it appears that age-related inertia may impede the influence of lower levels of EO on attaining higher levels of the creation, dissemination, interpretation, and implementation of strategic knowledge in more established firms (Reinganum, 1983; Wolfe and Shepherd, 2015). However, a strongly entrepreneurial mindset focuses on opportunity, and a highly developed ability to perceive opportunities reduces the rigidity of routines (Gilbert, 2005), allowing firms to overcome the inertia that hampers the components of SL. For these reasons, we hypothesize that:

Hypothesis 3. The curvilinearity of the U-shaped relationship between EO and the components of SL will be greater for older than for younger companies.

Methods

Research design and sample

We conducted a survey among software companies in Finland with at least five employees registered for value-added tax in 2009. The Statistics Finland database offered 1161 firms meeting the criteria. Following software industry reports (e.g., Rönkkö et al., 2010), companies were defined as software businesses if they belonged to the Standard Industrial Classification 2008 class 62 (*Computer programming, consultancy and related activities)*. Researchers confirmed the correct business sector and the CEO's email address by consulting websites prior to distributing the web-based survey. After two reminders and a follow-up telephone call to all non-responding CEOs, we had received 206 responses; a response rate of 18%. After discarding responses lacking essential data, the final sample comprised 182 firms, a response rate of 16%, which is acceptable for this type of survey (Baruch, 1999). In the data collection year, a typical respondent firm (in median value terms) had an annual turnover of €1.4 m, generated an annual profit of €55,000, employed 14 staff, served 50 customers, and was 11.7 years old. Of the firms, 82.7% had their own software products, 38.9% offered subcontracting, and almost all of them (94.5 %) also provided consulting and training services.

The Finnish software sector offered an attractive context for the study due to the growing importance of software companies for the Finnish economy (Rönkkö et al., 2010) and the high rate of change within the industry, which suggests that learning is indispensable (Bingham and Davis, 2012; Davis and Eisenhardt, 2011). The dynamic setting also increases the opportunities to learn, suggesting that strategic learning would be a practice more common in the Finnish software sector than in more stable industries. In addition, the very nature of the business means that software firms actively seek to

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capitalize on learning opportunities and are conscious of knowledge-sharing benefits available from different sources (Autio et al., 2000).

To check for non-response bias, we compared respondents to non-respondents in terms of revenue, profit, and age. There was no statistically significant difference between non-respondents and respondents in terms of revenue and profit, but there was a small difference in terms of age ($p < 0.05$). We observed no statistically significant difference between the groups of early and late respondents in terms of key study variables (Armstrong and Overton, 1977; Werner et al., 2007), suggesting that the data were sufficiently free from non-response bias.

Measures

Entrepreneurial orientation

To measure EO, we relied on the measure utilized most often (Rauch et al., 2009), that of Covin and Slevin (1989). The scale consists of nine items: three designed to measure innovativeness, three to assess market proactiveness, and three to measure risk taking. An examination of the modification indices suggested that some individual items' error terms should be allowed to correlate. After adding two correlations, the CFA indicated an adequate model fit ($\chi^2 = 28.33$, $df = 22$, $p = 0.165$; $\chi 2/df = 1.29$; RMSEA = 0.04; SRMR = 0.04; CFI = 0.99; and TLI = 0.98). All items significantly were loaded on their latent construct ($p < 0.001$, with z-values greater than 9.0). Cronbach's alpha values for the different dimensions were 0.71, 0.73, and 0.63 respectively and 0.83 for the whole construct, suggesting the measure had internal consistency and reliability. As did its predecessors, the current research proposes three underlying dimensions (i.e., innovativeness, proactiveness, and risk taking) for EO. Furthermore, because the three subscales are manifestations of EO, we follow previous studies in using the average score of the dimensions instead of the individual subscales (for a detailed discussion informing this choice, see Covin et al., 2006; Covin and Wales, 2012; Keh et al., 2007; Slevin and Terjesen, 2011).

Strategic learning

The SL instrument utilized in this study captures the theoretical dimensions of creation (four items), dissemination (five items), interpretation (four items), and implementation (three items) of strategic knowledge (Crossan and Berdrow, 2003; Huber, 1991; Kuwada, 1998; Pietersen, 2002; Sirén et al., 2012; Thomas et al., 2001). As this comprehensive SL instrument is new (see Appendix 1), we followed the accepted scale development process suggested by Hinkin (1995).

All the SL dimensions exhibited satisfactory Cronbach's alpha values (0.76, 0.85, 0.76, and 0.73, respectively). Furthermore, after adding one correlation between two dissemination items, CFA showed adequate fit for the four-factor model ($\chi^2 = 110.11$, $df = 97$, $p = 0.171$; $\chi 2/df = 1.14$; RMSEA = 0.03, SRMR = 0.05, CFI = 0.99, and TLI = 0.98), underlining that all dimensions are empirically separable from each other. All items loaded significantly on their respective latent construct ($p < 0.001$, with z values greater than 7.83). We also tested whether a second-order SL model would provide a better fit to the data than the four-factor model, but it did not ($\Delta\chi 2(5) = 3.43$, p = n.s.). The highest intercorrelation between SL dimensions is 0.44, indicating discriminant validity between the dimensions (Tabachnick and Fidell, 1996). Contrary to previous unidimensional representations of SL (e.g. Anderson et al., 2009; Covin et al., 2006; Green et al., 2008; Mueller et al., 2012), these results suggest that the components of SL should be considered to be treated separately.

Firm age and size

Firm age was measured as the number of years the firm had been in business, and firm size by the number of employees. Both measures were obtained from the Orbis secondary database. Firm size is treated in the subsequent analysis as a natural scale. Using the cut-off point of six years suggested by Zahra et al. (2000), firms were divided into two age categories: young and established.

Control variables

The study controlled for an organization's readily available but unused resources or slack (Bourgeois, 1981), because previous research suggests that organizational slack can provide resources for creative behaviors (Bourgeois, 1981; Cyert and March, 1963). Available slack was measured using the firm's current ratio (Bourgeois, 1981). We controlled for the number of patents a company held to encompass a firm's unique proprietary assets that indicate the technological capabilities directly affecting its ability to strategically adapt (Lee et al., 2001). We also controlled for firm structural differentiation with a dichotomous variable on whether the firm had branches (coded as 1 if the firm had branches and 0 if not) because large-sized firms' with distributed branches (or units) might benefit more easily from EO than a medium-sized company without structural differentiation. These variables were obtained from the Orbis database. We also controlled for environmental hostility and dynamism (indicators adapted from Green et al., 2008) because prior studies suggest that the importance of SL (Mintzberg and Lampel, 1999; Teece, 2007; Volberda, 1996) and EO (Covin and Slevin, 1989; Green et al., 2008; Wiklund and Shepherd, 2005) is affected by the type of environment a firm operates in.

Tests of measures

In following Gerbing and Hamilton (1996), this study estimates the quality of the measurement model using CFA to complement the measurement of individual constructs. For subsequent analysis we parceled the items for EO and environmental

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factors as appropriate on both empirical and theoretical grounds (Acock, 2013; Little et al., 2002). The measurement model provided an adequate fit to the data ($\chi^2 = 195.78$, df = 171, p = 0.094; $\chi 2/df = 1.14$; RMSEA = 0.03, SRMR = 0.05, CFI = 0.98, and TLI = 0. 97). We also tested the extent to which the survey items EO, the components of SL, environmental dynamism, and hostility might have been prone to common method bias by performing Harman's (1976) one-factor test to determine whether any single-factor accounts for more than 50% of the total variance (Podsakoff and Organ, 1986). The analysis revealed nine factors with eigenvalues >1; in total, these factors explained 65% of the variance among the tested items. The most influential factor only accounted for 20% of the variance, suggesting that common method bias did not materially influence the results of this investigation. In addition, we analyzed whether the model fit improved as the complexity of the research model increased (Iverson and Maguire, 2000; Korsgaard and Roberson, 1995; McFarlin and Sweeney, 1992; Podsakoff et al., 2003). We compared the single-factor model to the more complicated research model and found that the research model provided better goodness-of-fit indices than the single-factor model ($\chi^2 = 660.87$, $df = 186$, $p < 0.001$, $\chi 2/df = 3.55$; RMSEA = 0.12, SRMR = 0.11, CFI = 0.58, and TLI = 0.53), indicating that common method variance was not a problem in this dataset.

Statistical analysis

Given the limitations of testing non-linear relationships with structural equation modeling (Gefen et al., 2000), we opted to test our hypotheses by ordinary-least-squares regression using *Stata 13* software. We used clustered robust standard errors in all regressions to mitigate concerns about heteroscedasticity and to control for the possibility that error variances differ for different sub-industries in the IT-sector (the errors are clustered by the four digit NACE codes. For a more detailed discussion on clustered standard errors see Dunkelberg et al. (2013). This specification provides for a more conservative test of our hypotheses. Estimation with robust standard errors does not change the regression coefficients but produces estimates of the standard errors that are less sensitive to deviations from the standard assumptions of normality and homoscedasticity (Rogers, 1993; Williams, 2000; Wooldridge, 2002). We calculated variance inflation factors for each regression model in Table 2 and found each to be substantially below the established threshold of 5.0 (model VIFs <2; O'Brien, 2007), indicating that multicollinearity did not influence the model results. Table 1 presents the descriptive statistics and the correlation matrix for the variables used in the study.

Results

Table 2 presents the results of the hierarchical regression analyses. Models 1, 6, 11, and 16 report the influence of the controls on the SL components. Models 2, 7, 12, and 17, which controlled for the linear influence of EO on the SL components, reported EO was positively related to knowledge creation (model 2: $\beta = 0.43$, $p < 0.001$), knowledge dissemination (model 7: $\beta = 0.15$, $p < 0.001$), knowledge interpretation (model 12: $\beta = 0.19$, $p < 0.001$), and knowledge implementation (model 17: $\beta = 0.29$, $p < 0.001$). Wald linear restriction tests showed that all of these models differed statistically significantly from the control models.

Next, in models 3, 8, 13, and 18, we evaluated the non-linear effect of EO on the SL components, before age and size were introduced as moderators. The results showed that EO does not have a non-linear relationship with knowledge creation (model 3: $\beta = 0.11$, $p = ns$), but that it was nonlinearly associated with knowledge dissemination (model 8: $\beta = 0.16$, $p < 0.01$), knowledge interpretation (model 13: $\beta = 0.13$, $p < 0.05$), and implementation (model 18: $\beta = 0.14$, $p < 0.05$). Wald linear restriction tests showed that these three models differed statistically significantly from their linear models (knowledge dissemination: $\Delta R^2 = 0.02$, $F = 8.46$, $p < 0.01$; knowledge interpretation: $\Delta R^2 = 0.01$, $F = 5.03$, $p < 0.05$; knowledge implementation: $\Delta R^2 = 0.02$, $F = 6.68$, $p < 0.05$), providing prima facie evidence of non-linear effects.

In accordance with recommendations to discern the non-linear specification of EO and its marginal effect on the SL components, we plotted the significant relationships in Figure 1 and computed the marginal effect of EO at the full range of values that EO takes at 0.2 intervals (Brambor et al., 2006). The marginal effects, including the 90% confidence interval (Preacher et al., 2010), suggest that EO's non-linear effect on knowledge dissemination, interpretation, and implementation is statistically significant at different levels of EO, confirming the non-linear relationship. Thus, these results support Hypothesis 1 in terms of knowledge dissemination, interpretation, and implementation.

Models 9, 14, and 19, serve as baseline models for testing the non-linear interaction models by including age and size as moderators of the linear relationship between the EO and SL components. Models 10, 15, and 20 test our Hypotheses 2 and 3, which predicted that size and age would moderate the non-linear relationship between EO and the SL components. The results from models 10, 15, and 20 suggest that size moderates EO's non-linear effect on both knowledge dissemination (model 10: $\beta = 0.003$, $p < 0.001$) and implementation (model 20: $\beta = 0.001$, $p < 0.05$) and that age moderates EO's non-linear effect on both knowledge interpretation (model 15: $\beta = 0.28$, $p < 0.01$) and implementation (model 20: $\beta = 0.26$, $p < 0.01$). Wald linear restriction tests showed that including size and age as moderators of the non-linear EO – knowledge dissemination, interpretation and implementation relationships significantly improved these models (knowledge dissemination: $\Delta R^2 = 0.06$, $F = 11.24$, $p < 0.00$; knowledge interpretation: $\Delta R^2 = 0.05$, $F = 8.09$, $p < 0.01$; knowledge implementation: $\Delta R^2 = 0.04$, $F = 35.01$, $p < 0.001$). Nevertheless, size did not moderate the relationship between EO's non-linear effect on interpretation (model 15: $\beta = 0.00$, $p = ns$), and age did not moderate the relationship between EO's non-linear effect on knowledge dissemination (model 10: $\beta = 0.08$, $p = ns$). Accordingly, these results provide partial support for Hypotheses 2 and 3.

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Table 1
Descriptive statistics and correlations[a]

	Variable	Mean	SD	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1)	Firm size	40.04	74.73	1.00											
(2)	Firm age[b]	0.75	0.43	0.07	1.00										
(3)	Slack resources	2.06	1.82	–0.10	0.08	1.00									
(4)	Number of patents	2.06	6.75	0.13	–0.02	0.03	1.00								
(5)	Firm structure[c]	0.30	0.46	0.24**	0.04	–0.06	0.03	1.00							
(6)	Environmental dynamism	2.73	0.84	–0.09	–0.09	–0.08	0.06	–0.25**	1.00						
(7)	Environmental hostility	3.02	0.72	0.08	–0.02	–0.12	–0.10	0.06	0.30***	1.00					
(8)	Entrepreneurial orientation	3.41	0.68	–0.01	0.03	–0.06	0.16*	0.06	–0.13	–0.19*	1.00				
(9)	Strategic learning: knowledge creation	3.66	0.69	–0.07	0.12	0.07	0.09	0.04	0.07	0.03	0.39***	1.00			
(10)	Strategic learning: knowledge dissemination	3.91	0.70	–0.21**	0.14	0.07	0.11	–0.13	–0.05	–0.12	0.16*	0.28***	1.00		
(11)	Strategic learning: knowledge interpretation	3.95	0.58	–0.11	–0.03	0.09	0.05	0.03	0.07	0.08	0.19*	0.35***	0.44***	1.00	
(12)	Strategic learning: knowledge implementation	3.88	0.58	–0.12	–0.05	0.06	0.12	–0.03	–0.12	–0.10	0.35***	0.31***	0.39***	0.42***	1.00

[a] Pearson correlations.
[b] Firm age is coded as 0, “Young firms” and 1, “Established firms”.
[c] Firm structure is coded as 0, “Firms with no branches” and 1, “Firms with branches”.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$ (two-tailed tests).

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Table 2
Results of hierarchical regression analyses

	Knowledge creation					Knowledge dissemination				
Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Controls										
Slack resources	0.03*	0.04**	0.05***	0.04**	0.04**	0.02	0.02	0.02†	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)
Number of patents	0.01†	0.00	0.00	0.00	0.00	0.01†	0.01†	0.01	0.01*	0.01*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Firm structure	0.08	0.06	0.07	0.10†	0.11†	–0.21	–0.22	–0.20	–0.16	–0.13
	(0.05)	(0.06)	(0.05)	(0.06)	(0.06)	(0.13)	(0.13)	(0.14)	(0.11)	(0.12)
Environmental dynamism	0.06		0.11*	0.11*	0.12*	–0.05	–0.04	–0.03	–0.04	–0.03
	(0.05)		(0.05)	(0.04)	(0.05)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)
Environmental hostility	0.02	0.09†	0.09†	0.09†	0.09*	–0.08†	–0.06	–0.05	–0.04	–0.03
	(0.04)	(0.05)	(0.05)	(0.05)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Main effects										
EO		0.43***	–0.30	0.54**	2.28		0.15***	–0.94*	0.19*	–0.02
		(0.05)	(0.77)	(0.16)	(2.14)		(0.03)	(0.39)	(0.08)	(1.64)
EO squared			0.11		–0.27			0.16**		0.03
			(0.11)		(0.35)			(0.06)		(0.25)
Firm size				0.00	0.00				–0.01†	0.02**
				(0.00)	(0.00)				(0.00)	(0.01)
Firm age				0.53	5.31*				0.72***	1.74
				(0.70)	(1.98)				(0.18)	(2.30)
Interactions										
EO * Firm size				–0.00	–0.00				0.00	–0.02**
				(0.00)	(0.00)				(0.00)	(0.00)
EO * Firm age				–0.10	–3.09†				–0.14*	–0.74
				(0.22)	(1.51)				(0.07)	(1.47)
EO squared * Firm size					0.00					0.003***
					(0.00)					(0.001)
EO squared * Firm age					0.45					0.08
					(0.26)					(0.22)
ΔR2		0.17	0.01	0.02	0.03		0.02	0.02	0.07	0.06
R2	0.02	0.19	0.20	0.21	0.24	0.04	0.06	0.08	0.13	0.19
F	2.03	18.81	26.76	42.94	139.54	9.55	22.48	19.83	46.67	59.71

	Knowledge interpretation					Knowledge implementation				
Variables	Model 11	Model 12	Model 13	Model 14	Model 15	Model 16	Model 17	Model 18	Model 19	Model 20
Controls										
Slack resources	0.03*	0.04**	0.04**	0.04*	0.04**	0.01	0.02	0.02†	0.02	0.02*
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Number of patents	0.00	0.00	0.00	0.00	0.00	0.01*	0.01	0.01	0.01†	0.01*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)
Firm structure	0.07	0.06	0.07	0.11†	0.13**	–0.08	–0.10*	–0.08†	–0.04	–0.02
	(0.06)	(0.05)	(0.05)	(0.06)	(0.04)	(0.05)	(0.05)	(0.04)	(0.05)	(0.04)
Environmental dynamism	0.05	0.06	0.07*	0.06	0.08*	–0.09	–0.07	–0.06	–0.06	–0.05
	(0.03)	(0.04)	(0.03)	(0.04)	(0.04)	(0.05)	(0.05)	(0.04)	(0.05)	(0.04)
Environmental hostility	0.06	0.09†	0.09†	0.09	0.10†	–0.03	0.01	0.01	0.02	0.02
	(0.05)	(0.05)	(0.04)	(0.06)	(0.05)	(0.08)	(0.07)	(0.07)	(0.08)	(0.08)
Main effects										
EO		0.19***	–0.66	0.35***	1.44*		0.29***	–0.63†	0.43***	1.24***
		(0.04)	(0.40)	(0.07)	(0.68)		(0.03)	(0.36)	(0.06)	(0.17)
EO squared			0.13*		–0.17			0.14*		–0.12***
			(0.06)		(0.10)			(0.05)		(0.02)
Firm size				0.00	0.02				0.00	0.01**
				(0.00)	(0.01)				(0.00)	(0.00)
Firm age				0.62*	3.69**				0.47	3.32**
				(0.24)	(1.03)				(0.41)	(1.15)
Interactions										
EO * Firm size				–0.00	–0.01				–0.001*	–0.009**
				(0.00)	(0.01)				(0.000)	(0.003)
EO * Firm age				–0.20**	–2.10**				–0.16	–1.93**
				(0.07)	(0.64)				(0.11)	(0.61)
EO squared * Firm size					0.00					0.001*
					(0.00)					(0.001)
EO squared * Firm age					0.28**					0.26**
					(0.10)					(0.08)
ΔR2		0.05	0.01	0.02	0.05		0.10	0.02	0.03	0.04
R2	0.02	0.07	0.08	0.10	0.15	0.04	0.14	0.16	0.17	0.21
F	2.83	12.59	17.58	17.05	130.39	6.14	40.52	100.38	171.28	939.18

Notes: Huber–White sandwich robust standard errors clustered by four digit NACE codes in parentheses; model 4 R2 was compared to model 2 R2 and model 5 R2 was compared to model 4 R2 (same logic applies to other models). Standardized coefficients are reported; Huber–White sandwich robust standard errors clustered by four digit NACE codes in parentheses.

† $p < 0.10$.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$ (two-tailed tests).

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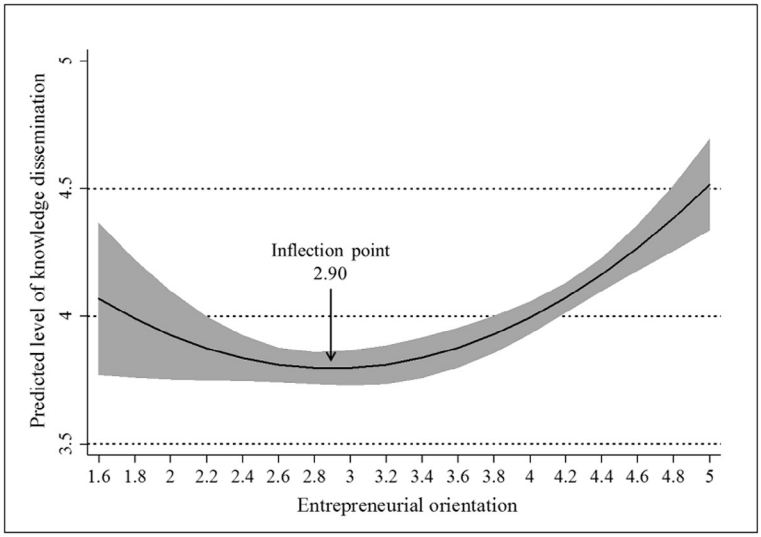

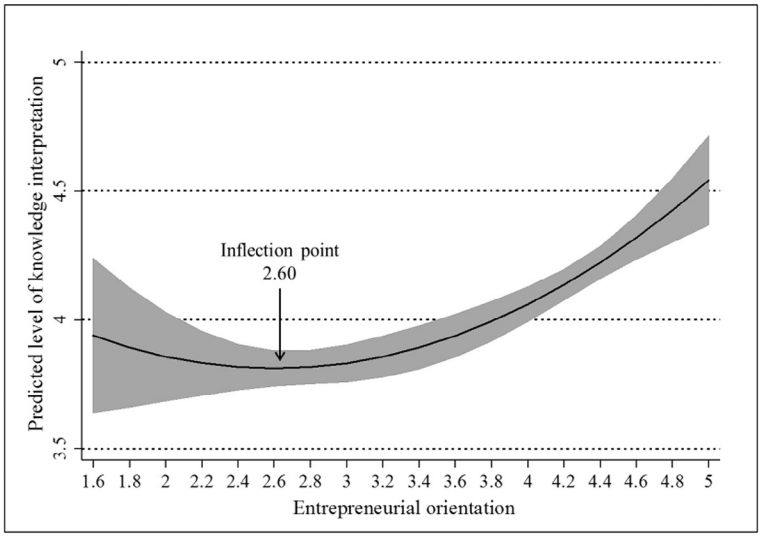

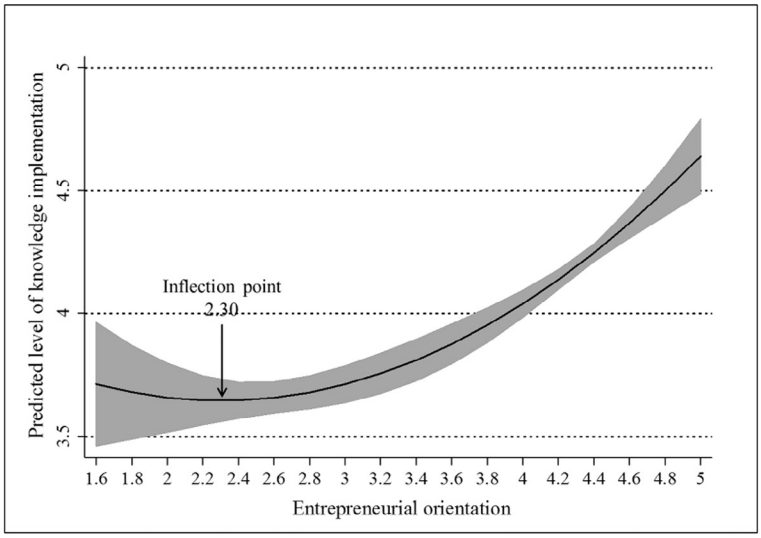

Figure 1. Non-linear relationship between EO and knowledge dissemination, interpretation, and implementation. Note: The marginal effects of the non-linear EO on dissemination, interpretation and implementation are significant at least at the 10% level (two-tailed) for different levels of EO. Gray area around the curve represents 90% confidence intervals

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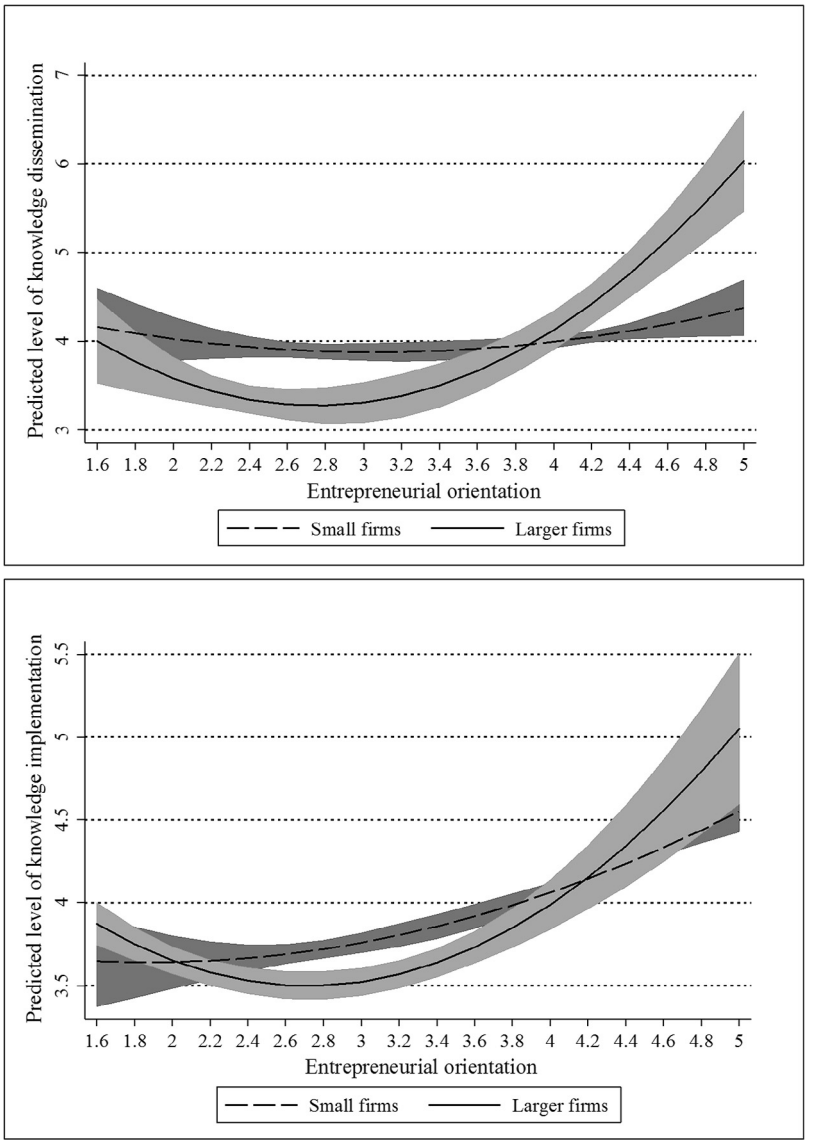

Figure 2. Interaction of non-linear EO and size on knowledge dissemination and implementation. Note: The marginal effect of the interaction between non-linear EO and size on knowledge dissemination and implementation is significant at least at the 10% level (two-tailed) for all of the curves. Gray area around the curve represents 90% confidence intervals. Small firms = employees mean 15.34 (calculated as employees mean of firms employing less than 50 persons) (82% of the firms), larger firms = employees mean 158.42 (calculated as employees mean of firms employing more than 50 persons) (18% of the firms)

Consistent with the recommendations to direct attention to the marginal effect of non-linear EO on the components of SL at different meaningful levels of the moderating variables (Brambor et al., 2006), we plotted the significant interactions in Figures 2 and 3 and analyzed the confidence intervals. The plots in Figure 2 with different levels of firm size suggest that the relationship between EO and knowledge dissemination is more non-linear for larger firms than for small firms. For knowledge implementation, confidence intervals overlap in lower and higher levels of EO for small and larger firms, meaning that the difference is significant at intermediate levels of EO, but not at the extreme ends of the EO continuum. Furthermore, the plots in Figure 3 with different levels of firm age suggest that EO's effect on knowledge interpretation and implementation is non-linear, especially for established firms. Finally, for knowledge interpretation, only at lower EO levels do the confidence intervals not overlap, which signals that as levels of EO increase, its positive effects on knowledge interpretation in young and established firms become indistinct.

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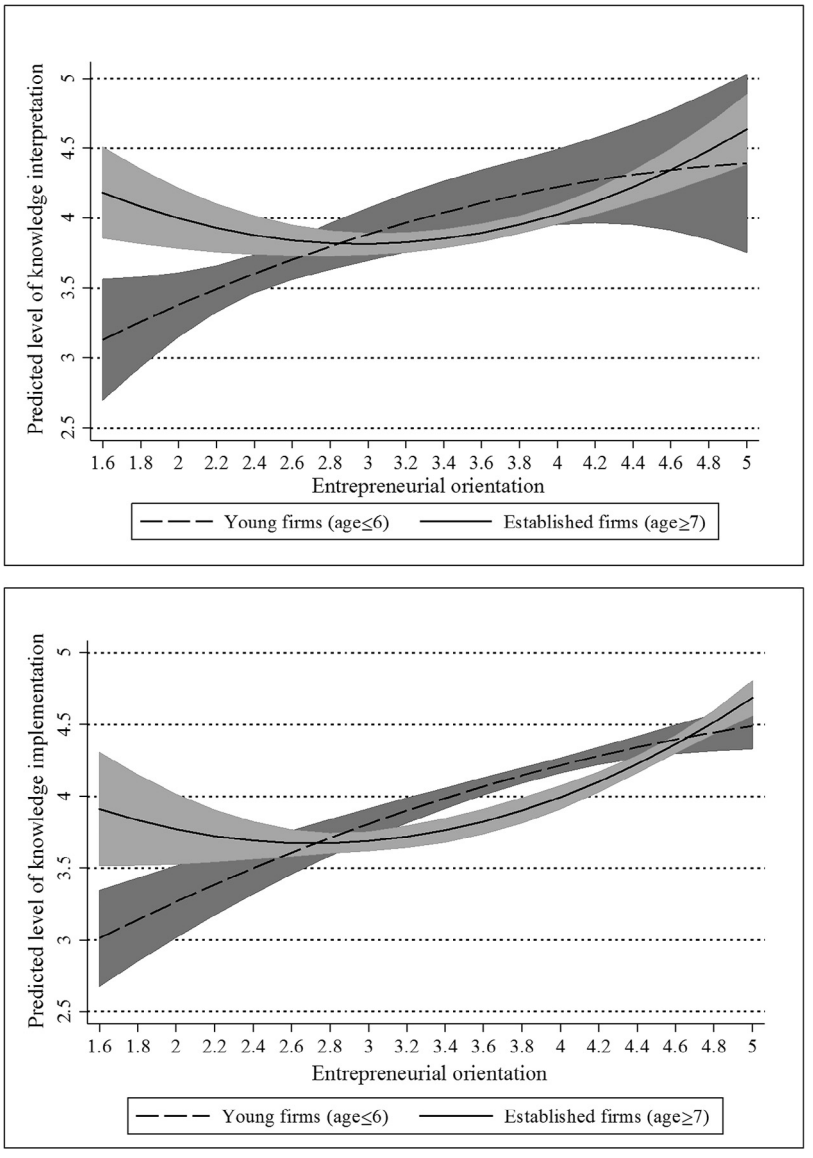

Figure 3. Interaction of non-linear EO and age on knowledge interpretation and implementation.
Note: Both in young (25% of the firms) and established firms (75% of the firms), the marginal effect of EO on knowledge interpretation and implementation is significant at least at the 10% level (two-tailed). Gray area around the curve represents 90% confidence intervals

Endogeneity analysis

To check whether endogeneity issues such as omitted variables or potential simultaneous feedback loops between dependent and independent variables might bias our results (March and Sutton, 1997; Vagnani, 2015), we replicated our results with instrumental variable regression and the generalized methods of moments (GMM) estimator technique (Blundell and Bond, 1998) that is widely used in strategic management (e.g., Cassar, 2010; Keil et al., 2008; Uotila et al., 2009; Vagnani, 2015). We used three instruments that can be taken as correlates of EO: *customer dependency* that measures the share of the total revenue deriving from the most important customer (coded as 1 when less than 10%, 2 when between 10 and 29%, 3 for 30–49%, and 4 for 50% or more); whether the company had its *own products* (coded as 0 if the firm had its own products and 1 if not); and *entrepreneurial entry* rate in the period 2008–2010 (new companies established in the region divided by total labor force in the region) (Armington and Acs, 2002; Audretsch and Fritsch, 1994; Kibler, 2013). The first two instruments were collected via the survey and the third instrument was based on publicly available data. The rationale behind using the first two instruments is that the dependency stemming from a large share of revenue from a single customer, and a firm not having its own products constrain innovation, and hence negatively affect EO (Yli-Renko and Janakiraman,

Table 3
Post-hoc analysis: results of instrumental variables regression

Variables	Instrumenting EO				
	First stage (dependent = EO)	Second stage (dependent = knowledge creation)	Second stage (dependent = knowledge dissemination)	Second stage (dependent = knowledge interpretation)	Second stage (dependent = knowledge implementation)
Additional instruments					
Customer dependency	–0.10**				
	(0.03)				
Own products	–0.34***				
	(0.08)				
Entrepreneurial entry rate	23.82†				
	(13.10)				
Controls					
Slack resources	–0.03*	0.04**	0.02	0.05***	0.03*
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Number of patents	0.02**	0.01	0.01*	–0.00	0.00
	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)
Firm structure	0.04	0.07	–0.26**	0.04	–0.09*
	(0.06)	(0.05)	(0.08)	(0.05)	(0.04)
Environmental dynamism	–0.04	0.07†	–0.02	0.08*	–0.04
	(0.04)	(0.04)	(0.03)	(0.04)	(0.04)
Environmental hostility	–0.11†	0.04	–0.04	0.09*	0.07
	(0.06)	(0.04)	(0.04)	(0.04)	(0.05)
Main effect					
EO		0.17	0.27**	0.36**	0.53***
		(0.14)	(0.08)	(0.14)	(0.11)
R2	0.14	0.13	0.05	0.03	0.07
Model F	53.48				
F-test on joint sign. of instruments	23.82***				
Wald χ^2		12.68	127.35	39.48	42.52

Notes: Instrumental variable regression using GMM estimation; Huber–White sandwich robust standard errors clustered by four digit NACE codes in parentheses; own products is coded as 0, "Firms with own products" and 1, "Firms with no own products".
† $p < 0.10$.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$ (two-tailed tests).

2008). The use of the third instrument is based on the notion that higher regional start-up rates in the past serve as an on-going conduit for greater entrepreneurial activity, for example, by increasing innovation activity, knowledge spillovers, competition, and firm diversity (e.g., Audretsch and Keilbach, 2004; Kibler, 2013) and thus affect EO.

Because researchers dealing with endogeneity in non-linear relationships risk spurring a particular form of *forbidden regression* that leads to inconsistent estimations (Haans et al., 2015; Wooldridge, 2002), we concentrated on the direct relationship between EO and the components of SL. A good instrumental variable must be uncorrelated with the error term in the base regression, but must be highly correlated with the possibly problematic predictor (here EO) (Wooldridge, 2002). A Hansen *J* statistic overidentification test indicated that the instruments were uncorrelated with the error term (Hansen's *J* chi-squared test: knowledge creation 0.36, $p = 0.83$; knowledge dissemination 0.80, $p = 0.67$; knowledge interpretation 1.11, $p = 0.58$; knowledge implementation 0.70, $p = 0.71$), supporting the conclusion that those variables were appropriate instrumental variables. The results for the first stage instrumental variable regression in Table 3 show that the instrumental variables are statistically significant predictors of EO. In addition, the *C* (difference-in-Sargan) statistic indicated that endogeneity was not a concern in knowledge dissemination, interpretation, and implantation models (*C* chi-squared test: knowledge dissemination 0.58, $p = 0.45$; knowledge interpretation 0.63, $p = 0.43$; knowledge implementation 2.14, $p = 0.14$). However, the *C* chi-squared test for knowledge creation was marginally significant (2.82, $p = 0.09$). In line with the unclear findings available on the relationship between EO and knowledge creation, the results of the instrumental variable analyses in Table 3 show that the relationship in this test was non-significant, signaling that endogeneity might be a concern for knowledge creation. The relationship between EO and knowledge dissemination, interpretation, and implementation retained their significance and expected direction, thus suggesting that omitted variables or endogeneity issues did not create any undue bias in our findings.

Discussion

Although research has made significant advances in understanding the importance of EO to adjust in competitive and dynamic situations, it is not yet quite clear how it facilitates the long-term adaptive learning capability of a company (Covin and Slevin, 1991; Kreiser, 2011; Wales et al., 2011). Departing from the findings of prior studies that have mainly focused

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on SL from mistakes (e.g., Anderson et al., 2009) and suggested that the relationship between EO and SL is linear, we predicted that the relationship between EO and the different components of SL would not prove so straightforward. The inertial forces present in all organizations complicate strategic change, and hence we expected and found overall support for U-shaped, non-linear relationships between EO and the components of SL. In addition to the non-linear relationships, we followed the line of thinking of Wales et al. (2011) that the stage of a firm's development alters the effectiveness of EO and hypothesized that the size and age of the organization would be important factors affecting how and why EO contributes to strengthening the components of SL. Our results on firm size highlighted that firm size moderated the non-linear relationships between EO and knowledge dissemination and EO and knowledge implementation. Our results with regard to firm age revealed that firm age moderated the non-linear relationships between EO and knowledge interpretation and implementation. As such, the overall message from our findings is that the components of SL are affected differently by the EO, age, and size of the organization, highlighting the need to comprehend SL as consisting of distinct components of knowledge creation, dissemination, interpretation, and implementation leading to "a renewal of the organization's strategic capability" (Kuwada, 1998, p. 719; Thomas et al., 2001). Our study provides several contributions and interesting insights to advance our understanding of the relationship between EO and the components of SL, which are worth emphasizing and discussing.

The relationship between EO and the different components of SL is non-linear except in the case of knowledge creation, which appears to be linearly and positively linked with EO. Our results show that at lower EO levels, its effect on knowledge dissemination, interpretation, and implementation is only moderate, while at higher levels of EO the effect increases exponentially. This convincing support for non-linearity provides empirical insights into why some highly entrepreneurial firms are able to strategically learn and renew their current strategies, while firms with lower levels of EO may not benefit from EO in terms of SL. More broadly, these findings help extend the important concept of learning traps discussed in the organizational ecology and organizational learning literature (e.g., Ahuja and Lampert, 2001; Levinthal and March, 1993). Following on from organizational ecology theory, the implementation of SL is hindered by organizational inertia, and therefore companies may find it challenging to activate the components of SL if the signals from EO are weak and thus easily blocked in the variation–selection–retention process. By highlighting how higher levels of EO are relevant to overcoming such learning traps, our work raises the intriguing notion that when strategic change is considered, the level of EO clearly matters more than previously theorized.

Our results suggest that while higher levels of EO always have positive effects on the components of SL, the U-shaped curves suggest that moderate levels of EO may at times actually be less effective for some specific components of SL than lower EO levels. Theoretically, conservative, low-EO firms are likely to rely upon existing systems to process strategic knowledge, albeit change is actioned infrequently and only when deemed absolutely necessary (Miller and Friesen, 1982). From such a perspective, occasional or underdeveloped EO that confronts these existing learning systems might actually cause disagreement, ambiguity, and uncertainty in the organization (Atuahene-Gima and Murray, 2007), leaving employees puzzled by the strategic direction of the company and the core competencies necessary to its survival, a situation likely to inhibit effective SL. However, the confidence intervals of the curves are visibly increased in the presence of lower EO levels, and hence, such assertions could only be made with caution. What we can conclude with certainty is that management should not be halfheartedly entrepreneurial, but commit fully in order to promote the SL necessary for strategic change and adaptation, since higher EO levels are always better for SL than lower EO levels.

Contrary to our hypothesis and the expectations that "some sort of threshold must be exceeded before search will take place" (Huber, 1991, p. 98), the relationship between EO and the knowledge creation component of SL is linear; higher EO means more knowledge created. This un-hypothesized relationship might be understood by comparing the nature of the different components of SL. Each of the other SL components concentrate on intra-organizational knowledge development, and is thus vulnerable to organizational inertia, but knowledge creation has a strong external focus and accordingly the forces of structural inertia do not reach it, meaning entrepreneurial behaviors linearly increase the amount of knowledge created. This logic is supported by Barr et al. (1992, p. 15) who argue that "renewal hinges not so much on noticing new conditions, but on being able to link environmental change to corporate strategy and to modify that linkage over time."

With regard to liabilities of firm size (Aldrich and Auster, 1986; Baker and Cullen, 1993; Wales et al., 2011), our moderation plots show how the non-linear relationship between EO and the components of SL changes depending on the size of the company. A more detailed investigation of the confidence intervals confirms that in larger companies, the U-shaped relationship between EO and knowledge dissemination is more pronounced than in small firms. Although overlapping confidence intervals suggest that size does not matter to knowledge dissemination at lower EO levels, at intermediate levels of EO small firms appear more competent in disseminating strategic knowledge than larger firms. This effect is probably due to the more fragmented knowledge structures of larger firms (Flores et al., 2012) and the difficulty of identifying with whom new information should be shared (Huber, 1991; Moreland, 1999; Tsai, 2002). In small companies, "the communication line is often shorter and direct", thus allowing quicker knowledge dissemination (Wong and Aspinwall, 2004, p. 50). Many larger firms do not support entrepreneurial behavior, or they have structural devices in place that stifle it (Ireland et al., 2006), causing the more pronounced U-shape for larger firms. However, an increase in EO quickly shifts the level of knowledge dissemination above that found in small firms, indicating that smaller firms may not have developed sufficiently efficient knowledge dissemination mechanisms to process high levels of EO initiatives (McAdam and Reid, 2001; Wong and Aspinwall, 2004). Large firms in contrast could have developed effective integrative mechanisms such as electronic knowledge management systems (Hansen, 2002), enabling EO initiatives to be effectively disseminated once they get through to the variation–selection–retention process. Similar effects of size are evident in the relationship between EO and knowledge implementation,

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yet the highest and lowest levels of EO represent what might be termed an indifference zone as confidence intervals overlap. At the highest levels, EO can overcome size related inertia and act as an equally effective driver of knowledge implementation for both smaller and larger firms. In large firms, medium levels of EO can signal fragmented attempts at strategic change. Abrahamson (2000) calls this type of firm permafrost organizations and warns that failure to implement strategies is often caused by middle managers fatigued by the demands of change and by the absence of a culture supporting change. In line with our findings, Keh et al. (2007, p. 609) advise that knowledge implementation "should not be a one-time event; rather it should be an on-going process through day-to-day interactions with customers, suppliers, and other business associates." Medium EO levels may also lead to "superstitious learning" (March and Olsen, 1975, p. 139) where firms create, disseminate, and interpret new knowledge and modify behaviors, but the behaviors do not significantly affect the consequences (see also Lyles and Schwenk, 1992). Prior research has also suggested that failures of implementation can often be attributable to inertia (Floyd and Lane, 2000; Guth and MacMillan, 1986). Our findings suggest that EO promotes a state of dynamic stability (Abrahamson, 2000), a reconfiguration of existing practices and therefore can overcome forces of inertia.

It is also interesting that strategic knowledge interpretation does not appear to be contingent on organizational size. The marginal effects of size on knowledge interpretation follow a similar pattern as that for knowledge dissemination, the U-shape is deeper for larger firms. However, for knowledge interpretation the confidence intervals overlap and hence suggest that the difference between small and large firms is not significant. This can be explained by the fact that knowledge interpretation is a process that is not so much dependent on organizational size as on the power structures, credibility of, and shared views among the management team (Lyles and Schwenk, 1992). Interpretation can be seen as an alternative process to knowledge dissemination, but here, the processing of knowledge to produce actionable insights is limited to a smaller group of people and hence is not affected by the size of the firm. This kind of transformation of knowledge structures may require changes deep in the individual cognitive models or involve power struggles among the management teams – issues that should be investigated in further research.

Focusing on liabilities of age (Sørensen and Stuart, 2000), a factor equal in importance to that of liabilities of size, the inspection of significant marginal effects illustrates that although the starting level of the effect of lower EO on knowledge interpretation and implementation is higher in established organizations, an increase from lower EO levels increases knowledge interpretation and implementation in young firms, while in established firms it has a decreasing effect. This finding demonstrates that young but conservative firms may have learning advantages over older ones, and the latter might need to undertake significant unlearning actives (Autio et al., 2000; Hedberg, 1981; Huber, 1991). On the other hand, the downward interaction curve in established firms suggests that intermediate levels of EO could disrupt the functioning of the institutionalized knowledge interpretation and implementation processes (Beckert, 1999). However, as EO increases, these variations quickly become indistinct in terms of knowledge interpretation. In terms of strategic knowledge implementation, there is also an evident difference between young and established firms at medium to medium–high levels of EO. Although the effect flowing from EO to implementation is greater in young firms, a unit increase in EO in established firms increases the effect flowing to knowledge implementation more strongly. Wong and Aspinwall (2004), provide one potential explanation for this finding. In the case of young firms, the knowledge assets are yet to develop in terms of magnitude and specialization and therefore the process of implementing new knowledge may be easier. However, in established firms, once the EO signals are strong enough and the organization is ready to change its knowledge stock, the existing knowledge may facilitate implementing EO (Cohen and Levinthal, 1990). This finding indicates that the level of EO needs to be very high to overcome age-related inertia. Nevertheless, the age of the firm does not appear to have a significant effect on the non-linear relationship between EO and knowledge dissemination, which may be due to knowledge dissemination being a more operational routine process (Zollo and Winter, 2002) in firms that have established communication structures. Here the age of the firm is not so much an issue, but the institutionalized routines constructed to communicate strategic knowledge in established firms substitute for the virtue of flexibility and learning benefits of young firms. At this point, it is worth remembering that an increase in EO to above average levels will confer learning benefits irrespective of firm age or size, as in all cases the slope is positive.

Finally, our results showed that neither size nor age moderated the linear or the non-linear relationship between EO and knowledge creation. This finding aligns with that of Autio et al. (2000) who argue that organizational age affects how knowledge is spread and interpreted within the firm, not with knowledge creation as such. It may also be that creation of strategic information as such is more of an individual level intuiting process (Crossan et al., 1999) that is assisted by soft components such as the culture of EO, but is not overly contingent on established processes and systems that are captured by the age or size of the organization. However, as we know, individual level processes link with organizational SL, highlighting the need for further research to extend the investigation of SL as a multi-level process.

Managerial implications

From an inertia perspective, we believe our research has important implications for when management should – and when it must – cultivate higher levels of EO in the organization. Scrutiny of the effects of EO on individual SL components makes it apparent that although EO is a universal positive catalyst of all SL components, it has a non-linear relationship with knowledge dissemination, interpretation, and implementation, but not with knowledge creation. This means that firms should opt to govern the aspects of SL individually. In order to benefit from EO in terms of knowledge dissemination, interpretation, and implementation, firms need to fully commit to pursuing EO, because weak intentions can easily lead an

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EO initiative to fail to survive the variation–selection–retention process. On the other hand, to avoid missing valuable opportunities, managers in companies with lower levels of EO should pay close attention to weak entrepreneurial signals and promote knowledge dissemination, interpretation and implementation based on them.

This research also highlights some consequences of size and age for companies. Although SL capabilities have a key role to play in supporting competitive advantage in larger and established companies, it is more difficult for them to strategically learn from EO than it is for smaller and younger firms. The individual links between EO and the components of SL reveal that larger companies should consider that increasing EO levels would improve their SL capabilities to cultivate dissemination and implementation, while established firms benefit from improved knowledge interpretation and implementation. Interestingly, our study also outlines a potential unintended consequence of intermediate levels of EO. Although the effect is evident in general, it is notable that intermediate levels of EO are a problem for the three components of SL in larger and established companies. The lowest levels of EO, while not conducive to strategic knowledge creation, might facilitate knowledge interpretation, dissemination and implementation more efficiently than intermediate, fragmented EO can. Large established firms have established structures and the absorptive capacity to disseminate and interpret strategic knowledge and established ways to implement changes (Cohen and Levinthal, 1990). Intermediate levels of EO (as a representation of the entrepreneurial disposition of top management) may disrupt the functioning of these established processes and make it more difficult for organizational actors to make decisions on strategic change. This finding offers a challenge for managing entrepreneurial initiatives in that those initiating changes need to work with the inertial forces that limit large and established companies to their current strategic paths. Key works on change management (e.g., Lewin, 1947) and later re-appraisals (e.g., Burnes, 2004) suggest that in order to change the course of a firm, it is necessary to reduce the obstacles to change and be aware of how to work with the outlined strategic paths and practices to ensure SL occurs. As such, management needs to be aware that SL problems are not erased merely by facilitating higher levels of EO. EO is executed in an organizational context and our amalgamation of EO and learning would suggest that while SL capabilities counter obstacles to change, EO promotes the change itself. Such a view is consistent with both learning and behavioral theories of organizational change indicating that decisions to change are dependent on the willingness to change, the awareness of the need to change, and the perceived capacity to change effectively (Katona, 1951; Zahra et al., 2006).

Study limitations and future research

The current research has several limitations that offer interesting opportunities for future research. While focusing on the software industry helps to understand the knowledge-intensive context studied, it also limits the generalizability of the results. Therefore, the research model should be tested in other industries with different lifecycles, technological intensities, and institutional contexts. The generalizability of this research is also limited by its focus on Finnish software companies, and the results might differ in other nations and cultures (Bontis et al., 2002; Lee et al., 2011). In spite of its advantages in terms of richness of information, our sample is relatively small. Future research should consider analyzing larger datasets to prove our predictions, especially on the effects of lowest EO levels.

Because organizations can also vary their learning processes over their lifetimes (Bingham and Davis, 2012), future studies might pay closer attention to the interplay of the components of SL over time. Examining how organizational antecedents and contextual factors are associated with the creation, dissemination, interpretation, and implementation components of SL would also enhance our understanding of how these learning processes work. Further research might consider specific devices that assist and potentially mediate the influences of EO on SL. For example, to facilitate SL, an organization might review how it provides individuals with access to organizational knowledge located in different places in the organization, and how it might encourage staff to contribute to that store of knowledge. Potential routes to ease access include cross-functional teams, face-to-face interactions, and discussion forums. In addition, an organization with higher levels of EO aiming to improve SL may benefit from its management mastering what Argyris and Schön (1978, 1996) call deutero-learning: reflective routines aimed at improving the learning system itself.

Conclusions

Prior research has used a unidimensional representation of strategic learning to develop a view of a linear relationship between EO and SL, which implies that any increase in EO assists in securing the adaptive capability of a company to thrive over time. In this article, we drew upon theory suggesting that inertia hampers strategic change, argued for a non-linear effect between EO and SL, and provided a detailed investigation of this effect by concentrating on individual components of SL. The results of our study confirm that the relationship between EO and SL is complex and non-linear with regard to most components of SL. Overall, lower levels of EO in a firm threaten the progress of SL from entrepreneurial initiatives through the firm's variation–selection–retention process. We find support for higher levels of EO providing enough impetus to overcome the inertial forces, structural hurdles, and path dependencies that face all companies as they grow. The current research suggests that management seeking change through SL should take the size and age of the company into account when considering what level of EO should be cultivated.

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Appendix. 1 Measurement scales

Constructs and items
Entrepreneurial orientation (Covin and Slevin, 1989)
Innovativeness
Our firm places a very strong emphasis on R&D, technological leadership, and innovations, instead of trusting only in tried-and-tested products and services
In the past 5 years, we have marketed a number of new lines of products or services
In the past 5 years, changes to our product or service lines have usually been quite dramatic
Proactiveness
In dealing with competitors, my firm typically initiates actions which competitors then respond to
In dealing with competitors, my firm is very often the first business to introduce new products/services, administrative techniques, operating technologies, etc.
In dealing with competitors, my firm typically adopts a very competitive 'undo-the-competitors' posture
Risk taking
In general, the top managers of my firm have a strong proclivity for high-risk projects (with chances of very high returns)
In general, the top managers of my firm believe that owing to the nature of the environment, bold, wide-ranging acts are necessary to achieve the firm's objectives
When confronted with decisions involving uncertainty, my firm typically adopts a bold posture in order to maximize the probability of exploiting opportunities
Strategic learning
Strategic knowledge creation (Atuahene-Gima and Murray, 2007)
We prefer to collect market information before determining strategic needs to ensure experimentation
Our aim is to acquire knowledge to develop projects that lead us into new areas of learning such as new markets and technological areas
We collect novel information and ideas that go beyond our current market and technological experiences
Our aim is to collect new information that forces us to learn new things during product development
Strategic knowledge dissemination (Bontis et al., 2002; Tippins and Sohi, 2003)
Within our firm, sharing strategic information is the norm
Within our firm, strategically important information is easily accessible for those who need it most
Representatives from different departments meet regularly to discuss new strategically important issues
Within our firm, strategically important information is actively shared between different departments
When one department obtains strategically important information, it is circulated to other departments
Strategic knowledge interpretation (Bontis et al., 2002; Sinkula et al., 1997; Tippins and Sohi, 2003)
When faced with new strategically important information, our managers usually agree on how the information will impact our firm
In meetings, we seek to understand everyone's point of view on new strategic information
Groups are prepared to re-think decisions when presented with new strategic information
When confronting new strategic information, we are not afraid to critically reflect on the shared assumptions we have about our organization
Strategic knowledge implementation (Bontis et al., 2002)
Strategic knowledge gained by working groups is used to improve products, services, and processes
The decisions we make according to any new strategic knowledge are reflected in changes to our organizational systems and procedures
Strategic knowledge gained by individuals has an effect on the organization's strategy
Environmental dynamism (Green et al., 2008)
How would you assess your firm's business environment with the following statements?
Product demand is hard to forecast
Customer requirements and preferences are hard to forecast
My industry is very unstable and subject to huge changes resulting from major economic, technological, social, or political forces
Environmental hostility (Green et al., 2008)
How would you assess your firm's business environment with the following statements?
Competitive intensity is high in my industry
Customer loyalty is low in my industry
Severe price wars are a characteristic of my industry
Low profit margins are a characteristic of my industry

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Biographies

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Henri Hakala is a Research Fellow and Project Director at the University of Vaasa, Department of Management. His current research focuses on entrepreneurship and small business strategies, opportunity and value creation as well as entrepreneurial ecosystems. His work has been published in journals such as International Journal of Management Reviews, Industrial Marketing Management and Journal of Small Business Management.

Joakim Wincent is Professor of Entrepreneurship at Hanken School of Economics and at Luleå University of Technology. His current research focuses largely on strategic inter-firm relations, corporate entrepreneurship and influences of psychological constructs such as passion and stress on innovative processes. He is also interested in measurement developments. His work is published in journals such as Academy of Management Review, Strategic Management Journal, Journal of Management Studies and Organizational Research Methods.

Dietmar Grichnik is Chaired Professor for Entrepreneurship and Technology Management at University of St. Gallen, in the Global Center for Entrepreneurship & Innovation. His research interests among others include strategic entrepreneurship, technology entrepreneurship, and start-up management. His work is published in journals such as Entrepreneurship Theory and Practice, Journal of Business Venturing, and Research Policy.

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