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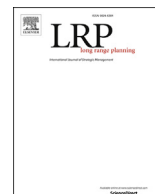
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Productive organizational energy mediates the impact of organizational structure on absorptive capacity

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ABSTRACT

The ability of an organization to cope with radical technological change is regarded to be heavily dependent on its ability to absorb and apply knowledge from its environment. This study investigates the role of organizational structure in driving absorptive capacity and uncovers the role of the emergent phenomenon of organizational energy as the enabler of this relationship. A field study was conducted among firms that are challenged by the disruptive nature of Cloud computing. Our results show that organizational design affects the degree of mobilization of an organization's affective, cognitive and behavioral resources, which in turn influence the effectiveness of learning processes related to the absorption and exchange of knowledge within the organization. Furthermore, they reveal the positive relationship between the enactment of absorptive capacity and the successful adoption of Cloud technology for incumbent firms. The findings contribute to our understanding of the micro-foundations of absorptive capacity and how positive organizational phenomena facilitate effective adoption and implementation of emerging technologies.

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Introduction

Rapid technological change constitutes a powerful competitive force that bears significant strategic implications for organizations (Adner, 2002; Day et al., 2004; Hamilton, 1985). Schumpeter (1934) famously described such technological change as a force of “creative destruction” which can erode or reinforce the competitive advantage of all firms involved in the affected industries. Firms and organizations operating in such environments, however, are not completely at the mercy of said forces. Predicting and managing the implications of such change has been found to be related to the ability of organizations to absorb and utilize knowledge from their environment, i.e. their *absorptive capacity* (Grant, 1996; Lane et al., 2006; Zander and Kogut, 1995).

Recent empirical research has shed light on the antecedents of absorptive capacity by constructively synthesizing theories of learning, managerial cognition, the knowledge-based view of the firm and dynamic capabilities (for a review see Volberda et al., 2010). Consequently, extant studies have revealed a breadth of contributing factors, traced at different levels of analysis, such as managerial, inter-organizational, intra-organizational or environmental. At the intra-organizational level, organizational design has been identified as a key factor that has a major influence on absorptive capacity (Van den Bosch et al., 1999).

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By organizational design, we refer to the “formal allocation of work roles and the administrative mechanisms to control and integrate work activities including those who cross formal organizational boundaries” (Child, 1972: p.2). Unfortunately, despite the theoretical weight put on organizational design in relation to supporting absorptive capacity, empirical evidence remains limited and agreement on the nature of the relationship between structural attributes and organizational capabilities is lacking (Volberda et al., 2010). Moreover, empirical research is yet to enquire the underlying mechanisms that drive this relationship.

By adopting a positive organizational scholarship (POS) lens (Cameron and Caza, 2004; Cameron et al., 2003; Luthans and Youssef, 2007; Luthans and Church, 2002), the current study aims to reveal the collective psychological underpinnings of absorptive capacity and how they are influenced by organizational characteristics such as organizational design (i.e. degree of centralization and formalization). POS is concerned with both personal fulfillment and the “long-term sustainability of people, organizations, society, and the environment” (Spreitzer and Cameron, 2012: 1037). As such, it puts emphasis on the generative dynamics that lead to sought-after positive organizational outcomes (Meyers et al., 2013) by looking at the role of employee strengths and positive states on shaping important individual- and organizational-level outcomes (Steele et al., 2012).

Prior research has shown the emotional, cognitive and behavioral underpinnings of organizational learning (Chadwick and Raver, 2012; Fineman, 1997; Leroy and Ramanantsoa, 1997; Osterloh and Frey, 2000; Scherer and Tran, 2003). Building on these insights, we investigate how the positive emotional, cognitive and behavioral resources of organizational members jointly manifest as a higher-level resource (i.e. productive organizational energy) that can enhance the learning capabilities of organizations. Productive organizational energy (POE) captures the “shared experience and demonstration of positive affect, cognitive arousal, and agentic behavior among unit members” (Cole et al., 2012: p.447). Most importantly, it is malleable as it can be influenced by organizational factors such as degrees of autonomy and participation in the decision-making process, something that has implications for organizations. Organizational energy has been associated with knowledge creation and exchange (Cross et al., 2007). Energized individuals have a significant impact on what units and networks as a whole learn over time, while energizing relationships were found to be a consistent determinant of knowledge exchange (Cross et al., 2003). In fact, the energy network is an important predictor of information-seeking relationships, as people are more likely to seek out information and learn from individuals that are considered highly and positively energized (Cross et al., 2007). In this sense, POE is a very useful construct that helps us ground the development of organizational capabilities on micro-psychological phenomena that manifest collectively through micro and interactional processes.

Our theoretical model predicts that organizational design influences the intensity of POE, which in turn enhances the learning capabilities of organizations. The two aspects of organizational structure that have been included in this study are centralization and formalization since they have been shown to influence organizational behaviors that relate to learning, innovation and knowledge management (Hirst et al., 2011; Jarvenpaa and Staples, 2000; Lubit, 2001; Zmud, 1982). To investigate the above issues, we conducted a survey study among SMEs that are challenged by the Cloud computing technology. Finally, we conducted a post hoc analysis based on interview data generated by a field study that was conducted concurrently to the survey data collection to gain better insight in the interpretation of our results and into the ambiguous relationship between organizational structure and ACAP.

The current study makes several important contributions to the literature. By combining the literature on absorptive capacity with insights from organizational behavior and particularly the construct of POE, we add to existing knowledge on the effects of structural characteristics of firms on learning capabilities and particularly knowledge absorption and application. At the same time, this study is one of the first to empirically investigate the role of the emergent phenomenon of POE as an enabler of learning capabilities, such as absorptive capacity. Moreover, contrary to the majority of studies investigating absorptive capacity in the context of large organizations, we focus on small and medium-sized firms that depend heavily on external sources for new knowledge acquisition and typically lack formal R&D departments due to limited internal resources. While the survival of such firms is heavily dependent on their ability to recognize and utilize external knowledge, relevant literature has remained relatively limited in this area (Zahra et al., 2006). Additionally, the nature of organizational energy as an emergent collective phenomenon rooted in interpersonal employee interactions renders it difficult to be monitored and measured in a way that takes into consideration the divisional and multilayered organizational structure of large firms. To this regard, smaller organizations provide a more fertile ground to measure the collective energetic activation of organizational members.

Theoretical background and hypotheses

Our theoretical model is built around the premise that key characteristics of the work environment influence the level of energetic activation of unit members, i.e. their level of positive affect, constructive thinking regarding work-related problems and investment of physical resources to benefit the organization (Cole et al., 2012). In particular, we focus on the degree to which individuals participate in the decision-making process and the degree of job standardization. In the rich literature on absorptive capacity a multitude of inter- and intra-organizational variables are discussed that can act as antecedents and enablers of absorptive capacity (Jansen et al., 2005; Volberda et al., 2010). In this study, we are concerned with the intra-organizational domain where organizational design has been identified as an important, yet under-researched antecedent, particularly when considering the psychological and behavioral underpinnings of this relationship. Since our objective is neither to delineate all the relationships underlying organizational structure and absorptive capacity nor to identify new ones

we focus on two major structural characteristics of firms that are considered central in the literature: centralization and formalization.

We posit that the collective manifestation of productive energy facilitates the indirect relationship between organizational design and absorptive capacity. Absorptive capacity, in its turn, is a key capability for successfully adopting emerging technologies. Following the above, the theoretical model developed and tested in this study involves 4 sets of factors: (1) the organizational design (as captured via the constructs of centralization and formalization), (2) POE (encompassing the affective, cognitive and behavioral activation of work members), (3) absorptive capacity (comprised of the three processes of recognition, assimilation and application of knowledge), and (4) the enactment of absorptive capacity as an important organizational outcome (see Fig. 1).

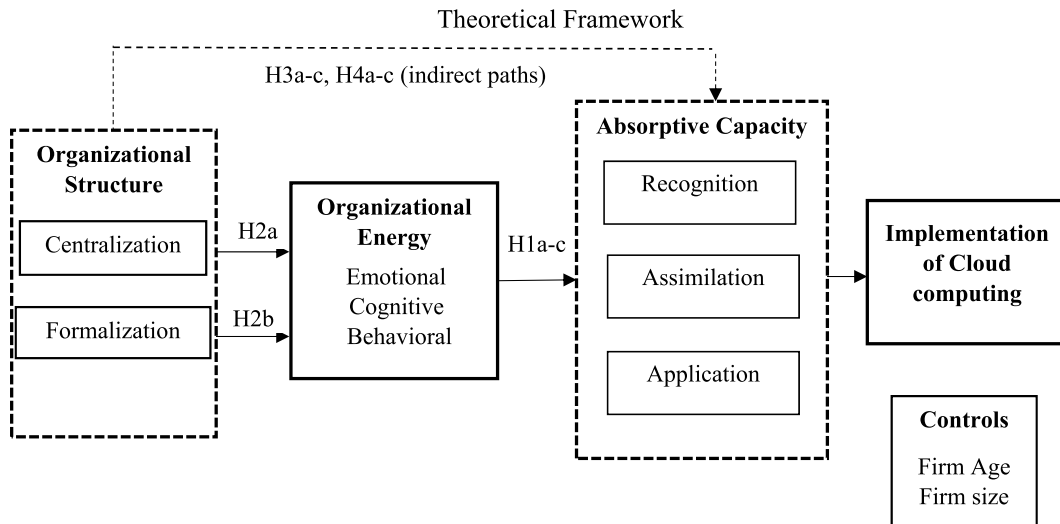


Fig. 1. Theoretical framework.

Existing literature has shown that the standardization of jobs and centralization of decision making has psychological and behavioral implications for work members (Berger and Cummings, 1979; Kohn and Schooler, 1973; Oldham and Hackman, 1981; Porter and Lawler, 1965). Moreover, organizational design choices could be responsible for altering the composition of the working force, as different structures tend to attract individuals with different dispositions (Schaubroeck et al., 1998). As a result, overarching affective, cognitive or behavioral norms tend to be reinforced (e.g. Knight et al., in press).

POE captures the interplay between the emotional, cognitive and behavioral resources of work members as it emerges in the collective level in the form of an organizational resource. In other words, while its three constituents are distinct and can be influenced by different conditions, the interplay of all three gives rise to an organizational quality that can be uniquely perceived and measured. As such, it represents an invisible but powerful force that can be observed mainly by its effect (Bruch and Ghoshal, 2003). It represents an emergent construct that manifests at the organizational level through the mechanisms of emotional and cognitive contagion (Barsade, 2002; Gibson, 2001; Hatfield et al., 1994; Park et al., 2013) social interaction (Klein et al., 1994; Morgeson and Hofmann, 1999) and behavioral integration (Bandura, 2001). Positive emotions influence cognition, attitudes and behaviors (Avey et al., 2008; Fredrickson and Branigan, 2005; Isen, 1984). Furthermore, the broaden-and-build theory of positive emotions, poses that this interaction results in upward self-reinforcing spirals (Fredrickson and Joiner, 2002). As moods and feelings spread among organizational members through interaction, so do attitudes, motivation and behaviors. Following the modeling principle of isomorphism, collective energy emerges in upward spirals too, the difference being that the interaction between its constituents relies on social mechanisms instead of biological or psychological processes. The result of the positive interaction between the emotional, cognitive and behavioral resources of unit members is a social experience which can be perceived by observers as POE. Drawing on the original conceptualization by Bruch and Ghoshal (2003) we treat POE as a second order construct that captures the interplay between the organization's cognitive, emotional and physical states. As such, it helps us evaluate the psychological and behavioral impact of organizational design on work members. Such characteristics can have a potentially beneficial or detrimental effect on the motivation of individuals as well as on the quality of interpersonal social interaction (i.e. communication, coordination and trust) which is vital for supporting learning and knowledge management behaviors within the organization (Bartol and Srivastava, 2002; Hoegl et al., 2003; Janz et al., 1997; Nahapiet and Ghoshal, 1998).

POE has similarities but is theoretically distinct from constructs such as collective motivation (Chen and Kanfer, 2006; Pinder, 2008), collective efficacy (Bandura, 2001), group cohesion (Carron and Brawley, 2000), organizational affective climate (Knight et al., in press.) or collective exhaustion (Shirom, 2003). Some of these constructs are expected to correlate

with one of the dimensions of POE but none captures the amplification quality that energized organizational entities possess as a result of the interaction between their positive emotional, cognitive and behavioral resources. Table 1 sums up the key differences between POE and other related constructs.

Table 1
POE and related constructs.

Construct	Key differences	Illustrative studies
Collective motivation	Focuses primarily on cognitive processes (Judge and Ilies, 2002; Latham and Pinder, 2005) while POE captures also the affective and behavioral resources of work members	Chen and Kanfer (2006); Pinder (2008)
Collective efficacy	Captures a group's <i>belief</i> that its members are capable of pursuing and achieving certain goals while POE captures its member's actual affect, cognitions and behavior instead.	Bandura (2001)
Group cohesion	Reflects tendencies of group members to stick together in the pursuit of shared objectives. Likely positively correlated with POE, but POE captures more than the cohesive (e.g., affective) bonds among a work unit's members. Additionally, group cohesion has been found to have both positive and detrimental effects for performance, while POE is considered to be a desirable emergent state.	Carron and Brawley (2000)
Collective exhaustion	Collective exhaustion focuses on the emotional fatigue and depletion of coping resources of unit members therefore it is expected to be correlated (albeit negatively) with the affective dimension of POE only.	Shirom (2003)
Collective empowerment climate	Empowerment at the individual level is rooted in the psychological domain and relates to intrinsic motivation. At the collective level, however, it captures the organizational conditions that stimulate empowerment and potentially energy but not the shared psychological state itself.	Seibert et al. (2016)
Organizational affective tone	Affective tone captures the descriptive norms that concern consistent, similar, and converging affect among organizational members. As such it is expected to correlate positively with the affective dimension of POE. POE, however, by considering affect, cognition, and behavior as complementary energy components it captures the amplification quality of energized organizational entities -instead of just consuming resources, energized unit members also produce resources.	Knight et al. (in press)

Building on the original definition provided by Cohen and Levinthal (1990), we define absorptive capacity as the ability of a firm to recognize the value of new knowledge, assimilate it and apply it. We consider these processes as inherent to the cycle of knowledge absorption. Therefore, we employ a process model of absorptive capacity and expect its dimensions to be highly correlated. Moreover following the example of Schleimer and Pedersen (2013), we distinguish between a firm's ability to absorb knowledge and the enactment on this ability. In our case, the *enactment* on absorptive capacity refers to whether a firm managed to utilize the newly acquired knowledge in order to adopt the Cloud computing technology in their processes.

Hypotheses

The role of POE in the development of absorptive capacity

Etzioni (1968) expressed energy as a form of a psychic and social resource. Under this view, human beings are members of a social system and can be activated through reflected-upon experiences in order to commit themselves to a transcendental mission of bringing about societal change (De, 1979). Ingalls (1976), in a similar vein, defines energy as “the level of psychic and physical force that we have available to bring to bear on accomplishing any task or on developing any relationship we choose”. Ingalls's theory was that any deviation from a behavior that is based on effective interpersonal relations and tolerance of ambiguity, results in a non-optimal energy solution. In other words, when an individual faces a lack of task objectivity and certainty in his or her work, the resulted conflict, interpersonal misunderstanding, generation of mistrust or organizational power struggle, requires energy expenditure for the system to be rebalanced.

More recently, organizational psychology, has contributed significantly towards linking human energy to important organizational outcomes through an array of theories with implicit or explicit energetic implications, such as the theories of employee burnout, engagement, emotional dissonance, thriving, and human flourishing (for a review see Quinn et al., 2012; Schippers and Hogenes, 2011). At the same time, the collective phenomenon of organizational energy has recently attracted scholarly interest and was found to have a substantial and predictable effect on organizational performance (Bruch and Ghoshal, 2003, 2004) and innovation through learning (Cross et al., 2007). Organizational learning, in particular, has been implicitly linked to the energetic activation of work members (e.g Cross et al., 2003) due to its rooting in the affective and cognitive domain. Unfortunately, there has been very limited research on explicitly revealing the nature of this relationship.

The link between energy and learning becomes clearer when we consider the combined role of emotions, cognition and behavior in the process of learning (More, 1974; Shipton and Sillince, 2012). Emotions influence important phases of learning such as readiness to learn, search for and processing of new information and disposition to reproduce information and knowledge (Scherer and Tran, 2003). Negative emotions such as anxiety, inadequacy or dependency can hinder learning while the opposite holds true for hope, excitement or curiosity (Antonacopoulou and Gabriel, 2006). Similarly, the activation of intellectual processes such as the acquisition, distribution and interpretation of information is at the base of both individual and organizational learning (Huber, 1991). Finally, the directive and stimulating properties of motivation generate arousal and instigative behaviors characterized by persistence and purpose (Brophy, 1983; Dweck, 1986). It is obvious from the above that energized individuals characterized by positive emotions, cognitive engagement and agentic behavior share qualities that are conducive to learning.

As Cohen and Levinthal (1990) discuss in their seminal paper, intensity of effort is critical for developing an absorptive capacity at the individual level. While the authors focus more on the cognitive effort and behavioral attitudes that are linked to the development of absorptive capacity, our previous discussion highlights the additional emotional component that is also central to the learning process. Extending these insights from the individual to the organizational level we argue that the collectively manifested intensity of the positive emotional, cognitive and behavioral resources (i.e. the observed collective energy) that a work unit exhibits directly influences the processes of organizational absorptive capacity.

Productive energy performs the same theoretical function across different levels of analysis with the difference being that it emerges at the higher level via mutual dependence and interindividual interaction instead of psychological or biological processes (Cole et al., 2012). Absorptive capacity, in a similar fashion, can also manifest at a collective level with the difference being that the process of acquisition and assimilation of information that occurs at the individual level, is complemented by the organization's ability to exploit it (Cohen and Levinthal, 1990). This step involves the transfer of knowledge across and within sub-units and is heavily dependent on the structure of communication as well as the character and distribution of expertise in the organization (Cohen and Levinthal, 1990). Energized individuals have been found to act as hubs for information exchange due to their open, committed and positive stance (Cross et al., 2003). Such individuals can therefore assume what Cohen and Levinthal (1990) call "gatekeeping" or "boundary-spanning" roles. As a result, we can expect improved internal communication, stronger informal networks and relational contracts, and an enhanced culture of trust, all of which contribute towards the absorptive capacity of the organization (Argote et al., 2003; Swift and Hwang, 2013; Volberda et al., 2010). Overall, we expect, POE to be positively associated with every step in the absorptive capacity process, although every step has potentially different requirements in terms of emotional, cognitive or behavioral investments. In line with the arguments above, it follows that:

H1a–c. There is a positive relationship between productive organizational energy and the firm's ability to recognize, assimilate and exploit knowledge from its environment.

The relationship between organizational design and POE

As we previously discussed, POE can constitute an important organizational resource that can be measured, is malleable and can be utilized towards attaining key organizational goals. According to Bruch and Ghoshal's research (2003), organizations differ significantly in both the intensity and quality of their energy. More specifically, they differ in "the level of activity, the amount of interaction, the extent of alertness and the extent of emotional excitement" (p.46). We can trace some of this variance on contextual factors like organizational structure and climate (Cross et al., 2007; Fritz et al., 2011; Quinn et al., 2012). For example, organizational culture and management style (i.e. lack of participation and effective consultation, poor communication, politics, a major restructuring, ambiguous work environments and individual cultural incongruence) are related to negative emotional states and stress, directly influencing the energy levels of individuals (Cooper and Cartwright, 1994; Danna and Griffin, 1999). On the other hand, higher autonomy, delegation of authority and involvement in the decision making process have been linked with higher levels of performance (Liden et al., 2000; Spreitzer, 1997), organizational commitment (Avolio et al., 2004; Spector, 1986) and informal learning (Kukenberger et al., 2012). Moreover, such empowerment satisfies the need of individuals to enhance their self-esteem and self-worth as well as retain and increase their sense of self-consistency and self-expression, concepts that begin to enrich traditional motivational theories (Shamir, 1991) and are expected to have a positive influence on the energy levels of individuals. Furthermore, especially in highly volatile environments, formalization can act as a protective factor against ambiguity that is typically accompanied by negative emotions (Meyerson, 1990), high stress levels (Cooper and Cartwright, 1994; Glowinkowski and Cooper, 1986), work alienation (Michaels and Cron, 1988) and energy depletion (Maslach and Jackson, 1981). We thus propose:

H2a. There is a negative relationship between centralization and a firm's productive organizational energy.

H2b. There is a positive relationship between formalization and a firm's productive organizational energy.

The indirect relationship between organizational design and absorptive capacity

The knowledge based view of the firm and the theory of dynamic capabilities suggest that organizational structure plays a catalytic role in the capacity of firms to create and absorb knowledge from their environment as it influences the structure of communication, cross-function interfaces, the transfer of knowledge among and within units and the development of networks of internal and external relationships (Van den Bosch et al., 1999). An organization's structure is in essence responsible for how multiple knowledge-related tasks such as assimilating, integrating and utilizing knowledge, are effectively carried out (Loasby, 1976). The same structures, however, influence organizational members at an affective, cognitive and behavioral level, indirectly shaping the effectiveness of absorptive capacity.

Centralization reflects the locus of authority and the extent to which decision-making is dispersed in an organization (Damanpour, 1991). A less centralized structure can reduce knowledge disparities between managers and subordinates (Adler and Borys, 1996) and inspire employee motivation, loyalty, and creativity (Manz and Sims, 1995; Parker et al., 2010). Allowing individuals the freedom to combine thought and action and group members to interact and create new perspectives, enhances the ability of organizations to generate as well as retrieve and apply existing knowledge (Nonaka, 1988; Nonaka et al., 2000). At the same time, a decentralized structure typically results in broader communication channels, improving therefore

the accurate and timely flow of information as well as the quality and quantity of ideas and knowledge that may be shared (Sheremata, 2000). Including a greater number of individuals in the process of decision-making and strategic reflection, can consequently enable the organization to harvest on a wider variety of ideas, enhancing knowledge creation and utilization.

Centralized, mechanistic structures, tend to increase the information demands and cognitive load of the individuals and hinder the assimilation of new patterns, reflective action-taking and learning (Galbraith, 1973; Morgan and Ramirez, 1983). The limited autonomy and feeling of control has also implications for individuals at an emotional level (Sheldon et al., 1996). We therefore expect that centralization has cognitive, affective and behavioral implications for individuals that in turn influence the three absorptive capacity processes. In other words, while centralization is expected to have a negative effect on absorptive capacity, this is an indirect effect that can be explained partially by the detrimental effect of centralization on the intensity with which the cognitive, emotional and behavioral resources of organizational members are invested and utilized in the learning process. We expect that the degree of centralization would influence absorptive capacity at all steps of the process. In particular, a decentralized structure can enhance the ability of the organization to tap into and synthesize new sources of knowledge, for instance, by accessing improved environmental information from employees who know that this would be valued by their employers (Baum and Wally, 2003). Similarly, it can enhance the flow of existing information and knowledge within the organization, facilitating the application of this knowledge towards beneficial outcomes (Pertusa-Ortega et al., 2010; Tsai and Ghoshal, 1998). We therefore propose:

H3a–c. There is a negative indirect relationship between centralization and the firms' abilities to recognize, assimilate and exploit knowledge through POE.

Formalization refers to the degree to which working relationships are prescribed by formal rules, procedures and policies (Fredrickson, 1986). Formalization has been previously theorized to have both a negative and a positive relationship to absorptive capacity (Vega-Jurado et al., 2008). Traditionally, formalization has been argued to have a negative impact on learning in organizations (Goh and Richards, 1997; March and Simon, 1958; Weick, 1979). At the same time however, there is evidence that formalization can also facilitate knowledge creation and utilization (Organ and Greene, 1981; Podsakoff et al., 1986; Sine et al., 2006). The perception of formalization as the antithesis of flexibility has deep roots in social theory and writings on bureaucracy (Feldman and Pentland, 2003). In this sense, formalization is perceived as a tool for organizing expertise and exercising control that inevitably kills tacit knowledge (Lam, 2000) and creates a closed environment that reduces creative input and reciprocal knowledge interaction, limiting therefore the capacity for acquiring and assimilating external knowledge.

Yet, formalization can also have a redeeming side. Under certain circumstances, formalization mechanisms can facilitate creativity, innovation or information exchange (Fiedler and Welpel, 2010). More specifically, it can facilitate the codifying of best practices and enhance the inter-functional transfer of explicit and codified knowledge, reduce role ambiguity, and improve cooperation and collaboration among organizational staff as a whole (Pertusa-Ortega et al., 2010; Vega-Jurado et al., 2008). At the same time, formalization can ease access to existing information, improve coordination, provide with efficient communication paths as well as better causal understanding of sets of tasks within units (Adler and Borys, 1996; J.E. Mathieu, Heffner, Goodwin, Salas and Cannon-Bowers, 2000). All the above can facilitate the ability of organizational members to efficiently absorb and exploit knowledge, offsetting the negative implications of formalization in the learning process.

The above discussion reveals the ambiguous role of formalization with regards to organizational learning. Our theory, however, predicts that the positive implications of formalization will offset the negative ones for mainly two reasons. First of all, the redeeming effects of formalization tend to be more pronounced in environments characterized by uncertainty, complexity and interdependence (Juillerat, 2010). Such is the context of our study, since we are investigating firms challenged by an emerging technology. Second, the typical lack of formalization and standardization in the work of SMEs (Ghobadian and Gallea, 1997; Spence, 1999) tends to inhibit their knowledge management practices and learning performance (Yew Wong and Aspinwall, 2004) therefore in the context of this study the positive effects of formalization might further outweigh the negative ones. Given the above, we would expect a positive direct effect of formalization on the processes of ACAP.

Yet, as we discussed before, reasonable amounts of formalization can alleviate the negative feelings associated with ambiguity and uncertainty and can enhance the motivation and commitment of work members towards knowledge management practices (Schindler and Eppler, 2003). In other words, formalization can have an energizing effect for work members which translates in higher involvement and commitment in the processes of knowledge absorption, codification and utilization. We advance the second hypothesis:

H4a–c. There is a positive indirect relationship between formalization and the firms' abilities to recognize, assimilate and exploit new knowledge through POE.

While not included in our original hypotheses, our model will investigate the relationship between absorptive capacity and its enactment, as captured by the degree of success in implementing a new technology in their operations. The reason behind this extra step is that even though a firm might have in place the mechanisms that allows it to recognize the value, assimilate, and apply the captured knowledge, it doesn't necessarily mean that they will be enacted and contribute to the implementation process. While this relationship does not have a central role in our conceptual framework, we deem that it is useful to explore. Finally, true to our process view of absorptive capacity we have included paths from the recognition component to the assimilation components and from the assimilation component to the application component of absorptive capacity.

Method

Setting & data collection

The hypotheses were tested in a sample of 110 firms in five industries (Automotive, Telecommunications, Hospital & Healthcare, Insurance and Banking, and Retail) that, according to industry analysts, are most heavily affected by disruptive consequences of Cloud computing. Cloud computing is primarily viewed by incumbents as a form of low cost IT outsourcing, however the technology has shown its potential to re-shape the technology industry but also the institutional architectures and management practices across an array of industries. As a game changing emerging technology, prior research has examined Cloud as an important force requiring strategic response by established organization (e.g. [Ahmadi et al., 2017](#); [Khanagha et al., 2017](#)). While this stream of research has been focused on the disruptive effects of Cloud on organizations' core technology, our focus is on a population of firms that utilize Cloud to reconstruct their IT infrastructure and enable the corresponding opportunities for efficiency and innovation in internal processes.

Since organizations across industries have recognized the strategic value of the technology, many have already incorporated Cloud computing in their operations. As a result, we have already evidence of early and late adopters of the technology as well as of successful and failed implementations, providing with the necessary variation in the phenomenon of technology adoption which is the context of this study. A summary of the disruptive effects of Cloud computing for the aforementioned industries can be found in the Appendix. We defined our sample carefully in order to ensure a high level of validity and reliability from the data. First, we chose to focus on small and medium sized companies since for large organizations several of our key independent variables would tend to be heterogeneous. For example, the level of centralization in a large organization can differ between units due to, for instance, the leadership style of the middle manager responsible for that unit. Second, we pursued the involvement of senior managers (CEO or member of the top management team) in the survey. This ensured a reliable evaluation of the absorptive capacity of the involved firms as well as of other variables in this study.

Our population was identified through collaboration with a major professional community of Cloud computing in the Netherlands and it involves the largest world-wide community of firms that were challenged by the disruptive effect of Cloud computing. The community numbers thousands of members, but our industry and size requirements resulted in a total of 1194 candidate organizations. Among this group, a total of 201 firms were open to participate in an external research project out of which 111 completed the survey after one reminder. One case was deleted due to missing values in more than 5 percent of the total questions. The percentage of respondents who finished the survey in relation to all of the respondents who started the survey was 55.2%. All companies were contacted by e-mail, and follow-up phone calls were done after one week to ensure a reasonable response rate. Participants included only members of the top-management teams or manager/directors who are directly responsible for the Cloud services.

In order to increase the reliability of our measurement, we asked the participants to introduce a second respondent. In response to our request, 65 respondents agreed to introduce a second respondent. We considered a time-lag of six-months with the original measurement, and contacted second respondents via email in order to answer the questions concerning absorptive capacity and successful adoption of the Cloud computing. After a reminder, 61 responses (54.9% of the population) were collected and this second measurement did not show any significant difference ($p > 0.05$) when compared with the original responses.

Prior to its distribution, the survey was pre-tested by several Cloud computing experts to ensure the validity and clarity of the questions. To encourage participation and provide some benefits to the respondents, an executive summary of the survey results was offered to all the participants. We compared the company attributes (number of employees, sales revenue, and years in business) for respondents and non-respondents and found no significant differences ($p > 0.05$).

Measures

Unless indicated otherwise, we used a five-point Likert scale ranging from 1 = "totally disagree" to 5 = "totally agree" for our measures.

Absorptive capacity

In order to measure absorptive capacity, we used a nine item adapted scale from [Schleimer and Pedersen \(2013\)](#). In their study, they conceptualize absorptive capacity as having three dimensions: value recognition, assimilation, and application. Example items for the three dimensions include "We recognized the potential of Cloud technology to create value for the organization", "We understood how the components of the Cloud system fitted together to make it work in our market", "We were able to monitor the performance of Cloud solutions and corrected problems as they surfaced". These three dimensions form the ability of a firm to recognize, assimilate and apply knowledge successfully, something that the authors distinguish from the enactment of this ability. In other words, instead of a 'potential' versus 'realized' absorptive capacity, our model includes the ability to absorb, which is what [Cohen and Levinthal \(1990\)](#) originally defined as absorptive capacity and measures the enactment on this ability separately by evaluating the implementation result. Furthermore, in line with the [Lane et al. \(2006\)](#) model of ACAP, we opted for a process model of ACAP in order better refine the nature of the relationship between POE and ACAP. The Cronbach's alpha for all scales included in the analysis can be found in the diagonal of [Table 2](#).

Organizational structure

Centralization in the context of our study reflects the concentration of authority and power in a firm (Baum and Wally, 2003) which would work against higher employee autonomy and informal communication channels (Finlay et al., 1995). Formalization, on the other hand reflects the “the extent to which rules, procedures, instructions, and communications are written” within an organization (Pugh et al., 1968, p.75). In order to capture the opposite effects of the centralized hierarchical structure and job standardization on the development of the absorptive capacity capability, we adopted the three item scales used in the study of Jansen et al. (2006). Example items include: “There can be little action taken in the organization until senior management approves a decision” and “Whatever situation arises, written procedures are available for dealing with it”.

Productive organizational energy

POE was measured by using a ten item adapted version of Cole et al. (2012) “productive energy at work” questionnaire. The three-dimensional construct captures the emergent phenomenon of energy at work. The affective dimension of the scale captures the positive feelings and emotional arousal that work members experience in their work environment. The cognitive dimension refers to the shared intellectual processes that result in persistent and constructive thinking when it comes to solving work related challenges. Finally, the behavioral dimension reflects the enactment of joined efforts by the work members to benefit the organization. Example items are: “people in the organization are mentally alert”, “people in the organization often work extremely long hours without complaining” and “people in the organization feel enthusiastic in their job”.

Enactment of absorptive capacity

Following the example of Schleimer and Pedersen (2013), we distinguish between possessing the ability to absorb knowledge from the environment and enacting this ability in order to implement the cloud computing project. We measured the degree of successful implementation of cloud computing by adapting the three item scale originally developed by Schleimer and Pedersen (2013) to measure the degree of success in implementing a marketing strategy in subsidiary firms of multinational corporations to the context of our study. Example items are: “We have integrated Cloud successfully into our organizational routines”, “The process of implementing Cloud has been a success for our organization”.

Control variables

We controlled for the size of the firm, as it may have an impact on the available resources and its flexibility on acquiring and assimilating external knowledge. Size was measured following the EU specifications for SMEs, meaning that the companies in our sample were either defined as micro (1–10), small (11–50) or medium-sized (51–250). The variable could thus take the values of 1, 2 or 3. In the same way, a unit’s age could play a role in its ability to acquire and exploit knowledge (Jansen et al., 2005). Therefore, age was also controlled for and measured by the number of years since its founding.

Table 2

Means, standard deviations, alpha coefficients, and intercorrelations among constructs.

	M	SD	Correlations								
			1	2	3	4	5	6	7	8	
1. Centralization	2.8	0.8	.75								
2. Formalization	3.0	0.9	.35**	.83							
3. POE	4.1	0.7	-.31**	.10	.90						
4. AC_Recognition	4.4	0.7	-.10	.15	.54**	.86					
5. AC_Assimilation	4.3	0.7	-.20*	.26**	.69**	.64**	.92				
6. AC_Application	4.1	0.7	-.18 [†]	.18 [†]	.62**	.66**	.85**	.88			
7. Enactment	4.3	0.7	-.22*	.17 [†]	.63**	.54**	.84**	.85**	.94		
8. Firm age	14.1	21	.14	.15	-.06	.07	-.05	.03	-.04		
9. Firm size	1.9	0.8	.16	.24*	-.04	.05	-.09	.03	-.07	.42**	

Note. Values on the diagonal represent estimates of internal consistency.

[†]p < 0.05 level., **p < 0.01 level., [†]p < 0.10.

The diagonal in bold represents the Cronbach's alpha.

Results

Results presented in Table 2 include descriptive statistics, scale reliabilities, and zero-order correlations among organizational design, absorptive capacity, POE, the enactment of ACAP and the control variables. All of the reliability estimates for the applicable variables were above .75. As expected the correlations between the three components of absorptive capacity are high. POE was found to correlate with all three dimensions of ACAP. However, the two organizational design variables are only correlated with the assimilation dimension of AC. They do, however, correlate with the application dimension at a .10 level. When it comes to the enactment of ACAP, all three dimensions of ACAP, POE and centralizations were significantly correlated with it, while the correlation with formalization was marginally insignificant. Finally, only centralization correlates significantly with the construct of organizational energy.

We deployed structural equation modeling as our analytical approach since the technique allows us to simultaneously link latent variables associated with concepts of theory to indicators used to present these concepts and at the same time estimate the relationships among these latent variables as proposed by the theory (Williams et al., 2009). It is recommended that, when using SEM, the measurement model is assessed independently prior to the assessment of the structural model (Anderson and Gerbing, 1988; Hancock and Mueller, 2001). In relation to the measurement model, we conducted a confirmatory factor analysis and we evaluated the convergent validity (i.e. the degree of association between measures of a construct) and discriminant validity (i.e. the degree to which measures of constructs are distinct) of all constructs included in our analysis. Several fit criteria were used to assess the measurement model, including the comparative fit index (CFI; Bentler, 1990), the Tucker-Lewis coefficient (also known as NNFI; Bentler and Bonett, 1980) and the root mean square error of approximation (RMSEA; Browne and Cudeck, 1993). The measurement model showed a relatively good fit; CFI = .94, NNFI = .93, RMSEA = .06.

Table 3 displays the average variance extracted by each construct and correlations between constructs, which provide estimates for convergent and discriminant validity, respectively. Composite scale reliabilities are also provided and as shown in Table 3, all of the constructs demonstrated sufficiently high composite scale reliabilities. To evaluate convergent validity (CV), the average variance extracted (AVE) of every construct was compared against its correlation with the other constructs. Convergent validity was confirmed for all cases as their AVE scores were consistently lower than each construct's correlation with other constructs (Gefen et al., 2000). Discriminant validity was also established since the maximum shared variance (MSV) was consistently lower than AVE for all the constructs (Hair et al., 2010).

Table 3
Convergent and discriminant validity assessment.

	CR	AVE	MSV	1	2	3	4	5	6	7
1. Centralization	.75	.51	.09	.71						
2. Formalization	.84	.63	.09	.30	.79					
3. POE	.88	.72	.39	-.26	.09	.85				
4. AC_Recognition	.87	.69	.35	-.08	.13	.48	.83			
5. AC_Assimilation	.92	.79	.63	-.17	.24	.63	.59	.89		
6. AC_Application	.84	.64	.60	-.15	.16	.54	.59	.77	.80	
7. Enactment	.93	.81	.63	-.19	.15	.57	.49	.80	.78	.90

Note. Values on the diagonal represent the square root of average variance extracted; AVE = Average Variance Extracted; MSV = Maximum Variance Extracted; CR = Composite Reliability.

Values on the diagonal represent the square root of average variance extracted.

Organizational energy construct

Following the original conceptualization of Organizational Energy (Cole et al., 2012) we inserted it in our structural model as a second order variable comprised of its cognitive, emotional and behavioral dimensions. However, we decided to first explore the relationships between the 10 items of POE using SEM with different relationship specifications. As a result, we used three alternate models of POE in order to test its dimensionality. Table 4 provides with multiple measures that assess the overall fit of the different models in order to provide with a more robust and valid assessment of the differences between the models. The indices used are the chi-square, the goodness-of-fit index (GFI), the non-normed fit index (NNFI), the comparative fit index (CFI), and the root mean square error of approximation (RMSEA). Typically, GFI and NNFI values ranging from 0.9 to 1 indicate good fit, while RMSEA should be below 0.08. The CFI index is the main source of comparison between models.

Model 1 treats POE as a uni-dimensional first-order factor accounting for the variance among all 10 items. Model 2, tests the possibility that POE is in fact better captured as three independent, uncorrelated, first-order constructs. Finally, Model 3 posits a second-order construct that is reflected in three first-order constructs. As evident in Table 4, Models 1 and 2 show rather poor fit. On the contrary Model 3, which highlights the multidimensionality of the POE construct indicates satisfactory fit in terms of GFI and NNFI scores which are higher than 0.90. Also, Model 3 has a much lower chi-square than the rest ($\chi^2 [32] = 57$), lower RMSEA and higher results for CFI. Collectively, these results support the case of a second-order POE construct that is formed at the intersection of the three first-order dimensions of affective, cognitive and behavioral energy.

Table 4
Goodness-of-fit statistics for alternative models of POE

	Model 1 <i>Uni-dimensional first-order factor</i>	Model 2 <i>Uncorrelated first-order constructs</i>	Model 3 <i>Second-order construct</i>
Chi-square (d.f.)	172.56 (35)	177.6 (35)	56.7 (32)
GFI	0.70	0.77	0.91
NNFI (TLI)	0.74	0.73	0.95
RMSEA	0.19	0.19	0.08
PCLOSE	0.00	0.00	0.07
CFI	0.80	0.79	0.96

Absorptive capacity construct

As this study adopts a process view of absorptive capacity (Berghman et al., 2013; P. Lane et al., 2006; Patterson and Ambrosini, 2015; Todorova and Durisin, 2007; Zahra and George, 2002), we decided to include its three dimensions (i.e. recognition, assimilation, application) as separate first order constructs connected with path lines. This way we can better explore how organizational structure relates to the different processes involved in knowledge absorption and application as well study the role of POE in this process in more detail.

Structural model

The next step in the analytical process was to form the structural model by specifying the causal relationships as suggested by the hypotheses. The structural model including the variables centralization, formalization, POE, absorptive capacity, enactment of ACAP, firm age and firm size fit well to the data (CMIN/DF = 1.6, CFI = .98, NFI = .95, GFI = .94, PCLOSE = .17 and RMSEA = .07).

Hypotheses 1a–b that link POE to the processes of knowledge recognition and assimilation were supported. Hypothesis 1c which predicted a positive relationship between POE and knowledge application was not supported. POE was found to have a positive effect on knowledge recognition ($\beta = .51$, $p < .001$) and a positive effect on knowledge assimilation ($\beta = .38$, $p < .001$). In contrast, the relationship between POE and knowledge application was found positive but not significant ($\beta = .11$, $p = .13$). Given the process view of ACAP we further explored the relationship between POE and application. A bootstrapping analysis revealed an indirect effect of POE on application through recognition and assimilation ($\beta = .20$, 95% CI: .11–.35, $p < .001$).

Hypothesis 2a proposes that centralization has a negative effect on POE. Consistent with our prediction, centralization was found to have a moderate negative effect on POE ($\beta = -.36$, $p < .001$). Hypothesis 2b which predicted a positive effect of formalization on organizational energy was also supported ($\beta = .23$, $p < .05$). As expected, the realized component of absorptive capacity (assimilation – application) proved an important predictor of implementation success ($\beta = .45$, $p < .001$ and $\beta = .53$, $p < .001$ respectively). Finally, consistent with the theory of absorptive capacity, knowledge recognition was found to be positively associated to knowledge assimilation ($\beta = .41$, $p < .001$) and knowledge assimilation positively associated to knowledge application ($\beta = .75$, $p < .001$).

While formalization and organizational energy were not found to be initially correlated, the analysis yielded a positive significant effect of formalization on POE. This lead us to consider the possibility of formalization acting as a suppressor variable (Hinkle et al., 1994; Pedhazur, 1982) and potentially indicating a moderation effect on centralization. Our moderation analysis showed that formalization indeed moderates the negative effect of centralization on POE, so that the negative effect is less when formalization is high. In other words, formalization dampens the negative relationship between centralization and POE (see Fig. 2).

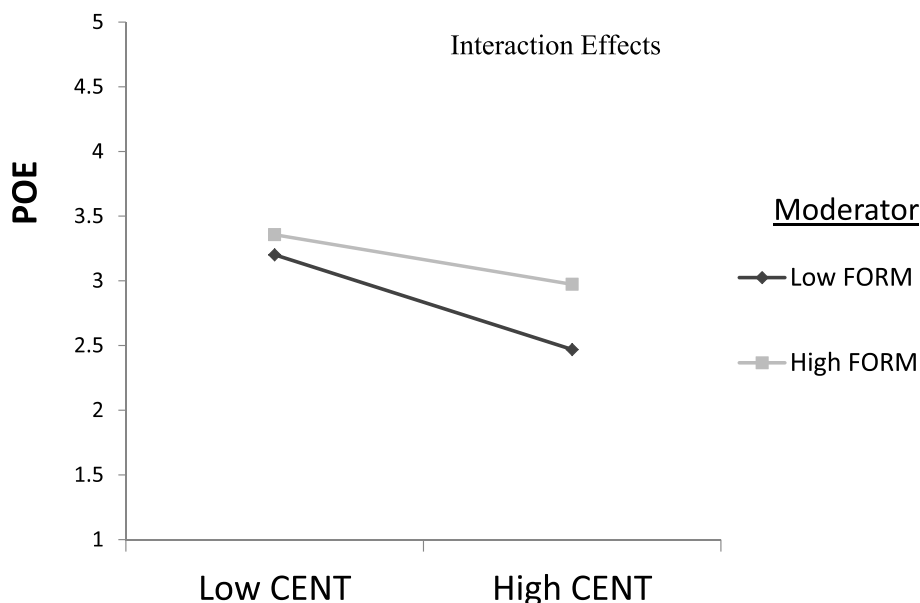


Fig. 2. Interaction effects.

A quick look at the direct relationships between formalization, centralization and ACAP at the absence of POE reveals a negative relationship of centralization with recognition ($\beta = -.18, p = .07$), assimilation ($\beta = -.32, p < .001$) and application ($\beta = -.28, p < .05$). On the contrary formalization has a positive relationship with recognition ($\beta = .20, p = .051$), assimilation ($\beta = .41, p < .001$) and application ($\beta = .27, p < .05$). Noteworthy in the above results are the marginally insignificant effects of both design variables with regards to recognition. However, according to Hayes (2009), even relationships where X and Y are not significantly related can support indirect effects via a variable M. Following the suggestions of Hayes (2009) and Mathieu and Taylor (2006) we avoid the use of the term mediator when referring to POE in these cases and instead we use the phrase “indirect effect through POE”. Due to the inherent problems related to the causal steps approach (Baron and Kenny, 1986) and the Sobel test (Sobel, 1982, 1986) approach (Hayes, 2009), we applied bootstrapping in order to investigate the indirect effects formulated in our hypotheses (Hayes, 2009; Mackinnon et al., 2012).

Hypotheses 3 and 4, predict that the relationships between centralization and formalization and the components of ACAP are indirect through POE. Using AMOS 22 we resampled 2000 times (bias-corrected) and obtained the estimates and the confidence intervals for the indirect effects. Analysis resulted in a significant, negative indirect effect of centralization on recognition ($\beta = -.17, 95\% \text{ CI: } -.33 \sim -.07, p < .01$), a significant, negative, indirect effect on knowledge assimilation. ($\beta = -.15, 95\% \text{ CI: } -.29 \sim -.05, p < .01$) and a marginally insignificant, negative indirect effect on knowledge application. ($\beta = -.04, 95\% \text{ CI: } -.12 \sim .001, p = .051$). Formalization was found to have a significant, positive indirect effect of centralization on recognition ($\beta = .09, 95\% \text{ CI: } .02 \sim .21, p < .05$), a significant positive indirect effect on knowledge assimilation. ($\beta = .08, 95\% \text{ CI: } .01 \sim .18, p < .05$) and a marginally insignificant, positive indirect effect on knowledge application. ($\beta = .02, 95\% \text{ CI: } -.001 \sim .08, p = .055$). The interesting result with regards to the insignificant indirect effects on application by both organizational design variables urged us to investigate the scenario of a three-step indirect effect through POE and assimilation on application. Indeed, the bootstrapping results showed a negative indirect effect of centralization on application through POE and assimilation ($\beta = -.11, 95\% \text{ CI: } -.23 \sim -.04, p < .01$) and a positive indirect effect of formalization on application through POE and assimilation ($\beta = .06, 95\% \text{ CI: } .01 \sim .14, p < .05$). Based on the above Hypotheses 3 and 4 were partially supported.

Finally, assimilation and application had a significant direct effect on the successful implementation of Cloud computing ($\beta = .45, p < .001$ and $\beta = .53, p < .001$ respectively), while the direct effect of recognition and ACAP enactment was not significant. Further investigating for a potential indirect effect revealed the indirect relationship of recognition on ACAP enactment through assimilation and application ($\beta = .21, 95\% \text{ CI: } .10 \sim .38, p < .001$).

Post-hoc analysis

Qualitative data is useful for corroboration and illumination of the results of complex quantitative models (Creswell et al., 2003). Hence, we attempt to enrich the findings of our quantitative study and further explicate the mechanisms through which organizational structure influences organizational energy and, thereby, the absorptive capacity of firms, through a single case study of a SME with 57 employees in the Health care sector. In case selection, we considered the value of increased transparency in observation of theoretical issues through “extreme cases” (Eisenhardt, 1989). Therefore, we searched for a highly centralized and highly formalized firm and identified company Alpha (pseudonym) that fulfilled the criteria, as several interviewees mentioned “hierarchy”, “centralized decision making”, and presence of formal routines and process as key aspects of Alpha’s structure (Table 5, rows 1 and 2).

Through field observations (3 months participatory field study), formal interviews (14 interviews ranging between 30 and 75 min) and several informal conversations, we attempted to identify the implications of structural characteristics on different dimensions of organizational energy and absorptive capacity. We transcribed the data and following a selective coding procedure (Strauss and Corbin, 1990), we identified structural influences on POE, and thereby ACAP. The summary of the results is presented in the following paragraphs. It was evident that there are important emotional implications, as people seemed to lack excitement and enthusiasm in their work. Such implications for the emotional dimension of organizational energy were referred to as “lack of the feeling of doing things together” and “lack of motivation”. Moreover, we observed a lack of mental alertness and desire for collective actions, that is reflected in the cognitive and behavioral dimensions POE. (Table 5, row 3). We see from the above that centralization has a particularly detrimental effect of energy. What is interesting is that formalization doesn’t seem to have the positive effect that our theoretical argumentation suggested. In contrast, we observed that the rules and procedures severely slow down the organization from acting when it is needed (Table 5, row 4).

The above-mentioned observations about the effect of structure on energy have performance implications, particularly in connection with the absorptive capacity of the organization. Low levels of energy results in less willingness and ability to look for potentially valuable information, as people have not motivated to “do their best” to acquire knowledge and to assimilate it (Table 5, row 5). Centralization, in turn, constrains the energetic activation of individuals and, through that, negatively influences knowledge assimilation in the organization (Table 5, row 7). People typically found it difficult to exchange information with others who were not in the same teams or units. It is noteworthy that formalization was apparently found to have mixed implications on the assimilation of knowledge (Table 5, row 6).

Finally, observations confirmed that rules and procedures cripple the energetic activation of employees at Alpha which resulted in a reduced ability to utilize the knowledge available to the organization’s members. Overall, our qualitative analysis

provides additional evidence that supports the role of productive organizational energy as a mediator between organizational design and ACAP. The above quotations are non-exhaustive but illuminating examples of our conceptual model.

Table 5
Coding scheme and representative quotations.

	Relationship	Effect	Representative quotation
1	Centralization		"There is too much hierarchy in the organization[A]. Most of the decision are being made by the CEO[A]." "Decisions are made at the top[A] and subordinates have little influence on decisions[A] about their work and about the execution of their work."
2	Formalization		"We have a manual of 100 pages for new employees[B]. We call it the Bible; in this manual its written down exactly how employees should do[B]."
3	Centralization → POE	+	"I think we have increasingly gone to a very top-down structure[A], swallowing or choking. If you do not like it then you just go. There is no feeling of 'we must do it together'. [C]" "The level of influence of the people in my team is minimal and this is partly due to the fact that the management is not always willing and open to listen to their people[A]. This leads to less motivated people. [C]" "If I have criticism on certain decisions, the CEO of Alpha will get mad[A]. This is absolutely ridiculous and this lead to behavior of running away, kind of hiding from him. This lead to less motivation from my side to invest lots of time.[C]"
4	Formalization → POE	-	"All the rules and procedures[B]; it's irritating. If something requires some changes, we should be able to change it faster. If you consider a possible improvement today - I mean we are not so big looking at the number of employees - you should be able to act quickly and change it tomorrow for example. It should not take weeks or even months. [C]"
5	POE → AC	+	"I don't know where the organization is going to. I don't know anything about the organizational goals for example. How should I know what external knowledge is interesting for the organization?[D] If they don't involve me, why should I do my best?[C]" "The organization never asks my opinion or what I think of something[A]. This certainly has an influence on my motivation to look for new knowledge" [D]. "Why should I search for new knowledge? I'm doing my job and that's it[A]. I'm more concerned now about keeping my job than searching for new knowledge to improve my work.[D]"
6	Formalization → POE → AC	+/-	"I think it would be less common here to just open a door and briefly discuss something with a colleague or manager. Here it is more within certain forms of meetings before you can discuss it[B]. And the formal presentations that are held here give the impression of a larger, more professional firm. But I think it is good, I like it as I like having more professionals around me.[C]" "Due to all formal rules and procedures in the organization[B], the speed of action is removed[D]. People are slowed down in their process. So the ability of people to act quickly and alert[C] is decreased due to the rules and procedures."
7	Centralization → POE → AC	+	"There is a low degree of influence on changes People can't influence decisions that are made[A]. This lead to less eagerness[C] to lookout for opportunities[D] as they cannot influence decisions." "I realize how difficult it is to get someone[D], if I need someone quickly. It hampers me sometimes in my work because I can't continue without the help of my supervisor[A] for example."

Coding scheme: [A]: Centralization; [B]: Formalization; [C]: POE; [D]: Absorptive capacity(AC).

Discussion

The construct of absorptive capacity has received extensive attention from strategy scholars during the past two decades, following the establishment of knowledge as a key resource for developing and sustaining competitive advantage through innovation (Geroski et al., 1993; Grant, 1996; Hall, 2000; McEvily and Chakravarthy, 2002). Still to this day, however, absorptive capacity remains an elusive construct when it comes to various dimensions of its nature (Volberda et al., 2010), as well as to factors that enable and shape it (P. Lane et al., 2006; Matusik and Heeley, 2005; Zahra and George, 2002). Our study contributes to our understanding of this organizational phenomenon by illuminating some of its enablers, notably organizational structure and POE.

Theoretical contributions

First, our study contributes to the limited volume of work that explores the role of organizational structure on absorptive capacity (Volberda et al., 2010). While some previous studies provided mixed results regarding the role of centralization and formalization in facilitating absorptive capacity, our quantitative study revealed some noteworthy effects of the two variables. Formalization, contrary to many studies that have previously suggested a detrimental effect on learning related organizational processes, was found to positively related to absorptive capacity. This interesting result, highlights the beneficial effects of formalization in contexts that are defined by ambiguity and uncertainty as the one that was the focus of this study. In contrast, our qualitative data, collected at an extremely centralized and formalized organization highlighted the detrimental effects of formalization on the energy of the employees and ACAP. This suggests that there might be a sweet spot for formalization in order to be beneficial and that too much or too little might work

negatively. Centralization, on the other hand, consistent with previous studies was found to have a negative relationship to absorptive capacity which highlights the variable effect of decision making structures on the learning processes involved (Fiol and Lyles, 1985).

Second, this study introduces a unique lens in exploring the affective, cognitive and behavioral dynamics that emerge within a firm as a result of oftentimes endogenous characteristics. Such dynamics, influence not only the individual capacity of work members to learn but most importantly enable a more effective flow of information and knowledge exchange at an organizational level by reinforcing relational ties and stimulating creative or innovative behaviors. Simultaneously, our findings suggest that the relationship between organizational design and ACAP is indirect and passes through POE, emphasizing further the anthropocentric foundations of dynamic capabilities, such as absorptive capacity. Psychological phenomena like human emotions are rarely integrated into strategy research (Huy, 2012), however they are invaluable if we are to explain the psychological or social mechanisms underlying the mental processes that affect organizational outcomes (Powell et al., 2011). Such phenomena act as enablers of many organizational capabilities linking them to internal or external conditions. Particularly interesting was also the fact that the effect of formalization on POE was significant only at the presence of centralization. Further exploring this result in terms of a potential interaction reveals that formalization dampens the negative effect of centralization on POE.

Third, our study contributes to the emerging field of positive organizational scholarship. Grounded in the field of positive psychology, POS provides macro-level scholars with a conceptual framework for organizing and integrating their research on elevating organizational processes and outcomes and the factors that shape them in the organizational context in which they take place (Cameron and Caza, 2004; Luthans and Youssef, 2007). As Pfeffer (2016) stresses in a recent essay, there is a need to reinstate in organizational studies employee well-being and happiness as important outcomes and gradually reduce our fixation on performance and profit as our dependent variables. This study takes this idea one step further to explore how positive employee states are not only important in their own right but are also tied to desirable organizational outcomes. The role of POE as a facilitator of absorptive capacity provides us with encouraging evidence towards this direction.

Fourth, while most studies on absorptive capacity so far have focused primarily on large R&D intensive companies (Spithoven et al., 2010), our study was conducted among small and medium firms which oftentimes lack formal R&D departments and due to limited internal resources (Gupta et al., 2006) tend to depend heavily on external sources for new knowledge acquisition. While absorptive capacity and dynamic capabilities in general are critical for the survival of new ventures and SMEs, there is a surprisingly limited volume of existing work done in this context (Zahra et al., 2006). This study contributes to this limited existing body of literature by highlighting the implications of absorptive capacity for the success of small and medium firms to integrate and reap the benefits of emerging technologies.

Managerial implications

The introduction and management of disruptive technologies is a challenging process, characterized by high uncertainty and complexity (Bucher et al., 2003; Day and Schoemaker, 2000). Supporting existing claims (Brown et al., 2007; Gomez and Vargas, 2009) our findings suggest that absorptive capacity influences the integration of a new technology in the firm, provided that the three processes of absorptive capacity are realized i.e. recognizing the technology's value, perceiving the relatedness of the technology to the internal body of knowledge and processes in the firm, and adapting the technology to the needs of the firm. It is also important for managers to consider that having the capacity to explore and exploit technology related knowledge from their environment does not necessarily mean that the consequent implementation of the technology will be successful. Assessing separately the existence of the capability and the enactment of the capability allows managers to better understand possible causes of successes or failures of technology integration.

Additionally, this study provides managers with new insights on how to use organizational mechanisms to successfully facilitate knowledge processes. Expanding decision making rights while reducing ambiguity through a layer of formal rules and procedures frees important cognitive and emotional resources and strengthens the relational ties among organization members, further contributing towards a climate conducive of synergy, knowledge exchange, and trust. This in turn enhances the absorptive capacity of the firm since it reinforces the processes of learning and knowledge management that are inherent to its core. Balancing the effects of decentralization and formalization might prove challenging, especially when taking into consideration that different cultures might perceive such conditions differently (Kirca and Hult, 2009). However, detecting changes in the energetic activation of work members could be a viable way to monitor the effect of policy or process changes on work members.

Limitations and directions for future research

The current research is not without limitations. First, we focused on small and medium firms operating within industries that were challenged by the technology of Cloud computing. While absorptive capacity is arguably a critical capability for firms operating under such conditions, it might be reasonable to expect variations in the manifestation of absorptive capacity across industries, an effect that our model does not capture. Second, cultural and leadership dimensions across firms are expected to play a significant role in shaping organizational energy, and consequently absorptive capacity. Third, we focused

on two out of the four main structural characteristics of firms oftentimes encountered in the literature. Existing studies have identified *integration* and *complexity* as fundamental elements in control and coordination with important implications for organizational outcomes (Lee and Grover, 1999; Liao et al., 2011). Forth, POE belongs to a family of constructs that display similar but not identical properties to positive affect. This means that constructs such as positive affective tone (Knight et al., n.d.), empowerment climate (Seibert et al., 2016), or collective engagement (Barrick et al., 2015) most likely also explain part for the relationship between organizational design and ACAP. In this sense, POE, as a more holistic construct might be acting as a proxy for such similar constructs but does not fully capture the indirect effects suggested in our model or does not explain it with the highest possible fidelity.

Finally, our study used the method of a key informant in order to collect data for testing our model. This is not uncommon in the management literature, however for emergent constructs, such as POE, the state of multilevel theorizing in the OB field suggests that those emergent states are more accurately measured using the perceptions of multiple involved people (Kozlowski and Klein, 2000). However emergence processes vary along a continuum that ranges from composition to compilation (Kozlowski and Klein, 2000). Constructs in the compilation end of the spectrum benefit from multiple respondents while constructs on the composition end of the spectrum can very well be assessed by a single key informant. POE theoretically has certain shared properties, however its conceptualization and measurement is based on the composition modeling principle of isomorphism (Cole et al., 2012). Isomorphism across levels, however, indicated that the model is closer to a compositional emergence (Sacramento et al., 2008). Additionally, provided that our sample did not involve organizations with thousands of employees but rather SMEs, we believe that the heads of these small firms are in a good position to evaluate the collective energy of their organizations. Provided that we were interested in the construct of POE as a unit level property, we believe that the key informant approach, despite its limitations, suffices for our needs.

Future studies can look into the mechanisms that enable the emergence of productive organizational energy, explore its volatility overtime and discover strategies for nurturing it, for instance in the realms of organizational culture, support, leadership or organizational work load (Schippers and Hogenes, 2011; cf. Schippers et al., 2015). At the same time it would be interesting for future studies to investigate whether design characteristics do not necessarily enhance or decrease positive energy but potentially generate “corrosive energy” (Bruch and Ghoshal, 2003), and further explore the relationship and co-existence of the two types of energy. Furthermore, the Knight et al. (in press) study on the relationship between positive and negative collective effect captures a part of these tensions and can act as an exemplar for further exploring the positive-negative energy manifestation and relationship in an organizational setting. Similarly, there is room to investigate additional mediators grounded in the affect circumplex, that could be explaining the effect of organizational design on ACAP. Social network theory can help map out the energy network in terms of information and knowledge flows as well as the contagious nature of emotions and beliefs among unit members. Additionally, future research can further explore the complex relationship of formalization and organizational learning and uncover the conditions under which it can have a positive influence. A research design that distinguishes between “coercive” and “enabling” formalization (Fiedler and Welppe, 2010) might be better able to shed some light on the ambiguous relationship between formalization and ACAP. Environments that allow for higher autonomy in self-regulation might be more conducive of an enabling perception of formalization, and further support the rudiments of absorptive capacity (Juillerat, 2010). The self-determination theory (Deci and Ryan, 1985; Ryan and Deci, 2000) can be a useful framework for exploring the interdependence between intrinsic motivation and perceptions of formalization in the context of organizational learning (Juillerat, 2010). Also, the fact that our quantitative data highlighted the positive effects of formalization but our qualitative data showed that extreme formalization kills energy, might indicate a curvilinear relationship where too much or too little formalization negatively influences the energetic activation of work members. Additionally, longitudinal studies can uncover how different conditions, incidents and managerial decisions shape organizational energy overtime. Finally, our study although it has implied it, it hasn't explicitly discussed the social aspect of organizational learning. Given that POE is a social experience at its core, a more fitting research design, such as social network analysis, would be better able to explore social interaction and information exchange are dependent on the positive emotional, cognitive and behavioral activation of work members (e.g. Cross et al., 2007).

Conclusion

In conclusion, our study offers a number of novel empirical findings regarding the drivers and enablers of absorptive capacity in the context of managing emerging technologies. It also provides a new angle to explore organizational phenomena that relate to dynamic capabilities by bringing forward the role of emergent psychological phenomena grounded in the cognitive and emotional evaluations of organizational members. Specifically, we find that the degree of centralization and formalization shapes the energetic activation of unit members which is a solid predictor of the ability of an organization to absorb and exploit information from its environment. The revealed indirect effects between organization design and ACAP through POE open up a window for the exploration of positive organizational phenomena as facilitators of dynamic capabilities. It is our hope that this study's findings will stimulate further exploration of the linkages between positive individual and organizational phenomena and key strategic outcomes for organizations.

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Appendix

The following table provides examples of disruptive effects in different industries.

Industry	Implications of Cloud computing
Automotive	<ul style="list-style-type: none"> • Design: Cloud enabled global product development, Integrated product data collection, Cloud based project management. • Supply: integrated, secure, and visible order management and shipping of parts. • Assembly: enhanced analytical and reporting capabilities for plant operations and plant product performance, integrated monitoring of product quality, synchronization between manufacturing and business systems, by making them more interoperable. • Retail: Cloud-based social media analytics and real-time monitoring of consumer behavior, advanced dealer management systems (DMS), automated vehicle servicing, faster and more effective management of parts ordering, and enhanced dealer training. • Aftermarket services: advanced connected vehicle solutions and next-generation infotainment products and services, vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication services; and mobility-related services such as car sharing, parking services and electric vehicle charging (Accenture, 2014a).
Telecommunication	<ul style="list-style-type: none"> • Enabling Internet of Things (IoT) services, such as smart home and smart city, are the scene of less certainty. • Cloud infrastructure services for a wide range of enterprises and industries (EY, 2015)
Hospital & healthcare	<ul style="list-style-type: none"> • On-demand access to computing and large storage facilities which are not provided in traditional IT environments. • Support for big data sets for electronic health records (EHR), radiology images and genomic data offloading, a burdensome task, from hospital IT departments. • Possibility for sharing of EHRs among authorized physicians and hospitals in various geographic areas, providing more timely access to life-saving information and reducing the need for duplicate testing. • Enhanced ability to analyse and track information (with the proper information governance) so that data on treatments, costs, performance, and effectiveness studies can be analysed and acted upon (Cloud Standards Customer Council, 2012).
Banking	<ul style="list-style-type: none"> • A unified customer experience across channels • Increased data transparency to clients will reduce the need for intermediation, enable additional self-service, and further squeeze pricing and profit margins • Stakeholders will receive information far more quickly, to the point where it supports real-time management decision-making and compliance monitoring • More demand for on-the-go services that will drive a departure from the traditional 'within the walls' environment of the investment bank (Accenture, 2014b)
Retail	<ul style="list-style-type: none"> • Personal information management (PIM), master data management (MDM), enterprise content management. • Customer MDM; customer relationship management (CRM), customer order management. • Analytics and reporting/real-time access to retail foundational data and customer data. • Unified commerce/service platforms • Customer order management/unified commercial/service platform to provide a single view of orders across all channels and enable fulfilment and returns across channels. • Enterprise architecture, processes and organization that enable more rapid development, configuration and deployment of new and enhanced capabilities (Accenture, 2013)
Insurance	<ul style="list-style-type: none"> • Possibility to provide a personalized experience and build a client-centric approach without having to worry about continuous IT availability and maintenance upgrades. • Scalability that allows insurance companies to spread the risk of this complex digital transformation. • Possibility to access the right information anywhere, anytime. • Faster deployment and realization of ROI • Reduction of transformation risk (Deloitte, 2015)

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