



CEO experience as micro-level origin of dynamic capabilities

CEO experience
as micro-level
origin

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Abstract

Purpose – The aim of this paper is to corroborate with empirical validations the theoretical considerations about the influence of chief executive officers (CEOs) and their experience as micro-level origin of dynamic capabilities in organisations.

Design/methodology/approach – The paper empirically analyses the impact of CEO experience (CEO firm experience, CEO age, CEO international experience, CEO functional experience) as a micro-level origin of dynamic marketing and research and development (R&D) capabilities.

Findings – The results show that CEO experience influences dynamic capabilities and corroborate the theoretical considerations about the influence of micro-level origins, i.e. CEO firm experience and CEO age influence the development of dynamic capabilities, dependent on environmental conditions.

Research limitations/implications – The findings encourage more research on the important role of micro-level origins of dynamic capabilities. With a view to the theoretical background, it would be useful to know whether CEO experience at the individual level and its impact on dynamic capabilities can be transferred to the organisational level.

Practical implications – CEO experience can significantly improve or downgrade dynamic marketing and R&D capabilities, e.g. organisations in turbulent environments have an advantage when their CEO is young, whereas organisations in less turbulent environments benefit from an older CEO.

Originality/value – The paper helps build a better understanding of the role of CEOs and their experience as a micro-level origin of dynamic capabilities in organisations. It extends the suggestion that micro-level origins are important in the development of dynamic capabilities.

Keywords Chief executives, Experience, Individual behaviour, Organisational behaviour, Dynamic capabilities, Micro-level origins

Paper type Research paper

Introduction

Continuity in the development of new technologies and new markets is fundamental in order to foster organisational growth and renewal, which ensure a firm's long-term survival (O'Connor, 2008). An emerging body of literature has examined the strategic renewal of organisations through the evolution of dynamic capabilities by which managers alter, expand, and reconfigure a firm's strategic assets (Eisenhardt and Martin, 2000; Teece *et al.*, 1997). Conceptual work has shown that dynamic capabilities are influenced by antecedents, or micro-level origins, which are drivers of firm behaviour, organisational change, and firm heterogeneity in general (Abell *et al.*, 2008; Felin and Foss, 2005; Gavetti, 2005). Scholars agree that managerial routines and experience are critical determinants of a firm's strategic decision concerning the use of dynamic capabilities (Ambrosini and Bowman, 2009; King and Tucci, 2002). Managerial beliefs and judgements play an essential role in identifying and capturing new strategic opportunities and affect how resources are to be allocated (Augier and Teece, 2009; Chadwick and Dabu, 2009). Managerial experience, which can act as



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micro-level origin of dynamic capabilities, plays a crucial role in their evolution (Adner and Helfat, 2006).

Most of the studies in the field of dynamic capabilities consist of conceptual and theoretical discussions (Helfat and Peteraf, 2009; Macher and Mowery, 2009). Empirical studies on dynamic capabilities, however, are rare (Danneels, 2008; Helfat and Peteraf, 2009; Narayanan *et al.*, 2009; Wang and Ahmed, 2007), and many of those rely on small samples (Arend and Bromiley, 2009). Empirical studies on micro-macro linkages in the development of dynamic capabilities are particularly uncommon (Easterby-Smith *et al.*, 2009; Felin and Foss, 2005; Gavetti, 2005; Pablo *et al.*, 2007). Few works have described in detail how managerial characteristics, such as experience, affect the ability to develop or leverage dynamic capabilities (Adner and Helfat, 2006; MacCormack and Iansiti, 2009), although interest in how managers influence the development of dynamic capabilities through their motivation, skills, and experience is increasing (Ambrosini and Bowman, 2009; Augier and Teece, 2009; Rothaermel and Hess, 2007).

These research gaps should be closed for several reasons. Globalisation and technological change place significant pressure on organisations to adapt, and this adaptation results in new issues and challenges for strategic management (Agarwal and Helfat, 2009; Mellahi and Sminia, 2009). Organisations need to renew their capabilities continuously in order to generate growth and to survive in changing environments. Continuity in the development of new capabilities underpins a firm's ability to survive changing environmental conditions (Agarwal and Helfat, 2009; Gavetti, 2005; Teece *et al.*, 1997). Micro-level origins at the individual, firm, or network level drive a firm's ability to develop new capabilities that lead to competitive advantage. Thus, there is increasing interest in how micro-level origins influence the development of dynamic capabilities in organisations (Easterby-Smith *et al.*, 2009; Gavetti, 2005; Pablo *et al.*, 2007).

This paper extends the understanding of the role of micro-level origins in the development of dynamic capabilities in organisations by determining how the experience of a chief executive officer (CEO) – more concretely CEO firm experience, CEO age, CEO international experience, and CEO functional experience – influences dynamic marketing and R&D capabilities, which are key resources in organisations (Krasnikov and Jayachandran, 2008). We formulate two research questions:

- RQ1.* How does CEO experience influence dynamic marketing and R&D capabilities, and does this influence entail implications for the impact of human capital as a micro-level origin of dynamic capabilities in general?
- RQ2.* To what extent do environmental conditions (market turbulence, technological turbulence, and competitive intensity) moderate the influences of CEO firm experience and CEO age on dynamic marketing and R&D capabilities?

This article is structured as follows: First, we describe the theoretical premises underlying the influence of CEO experience as a micro-level origin of dynamic marketing and R&D capabilities. We then develop our research model and derive hypotheses. Next, we present the methodology, elaborating on the survey data and the measures used in the present study. After a discussion of our findings and suggestions for academics and practitioners, we conclude with the limitations of this study and provide proposals for future research.

Theory and hypotheses

Dynamic capabilities

Dynamic capabilities involve adaptation and change, so they provide organisations with the ability to react to changing environments. Dynamic capabilities help explain the performance heterogeneity of firms in different environments (Helfat, 2000; Zott, 2003). In general, dynamic capabilities describe a firm's ability to configure and reconfigure its portfolio of strategic competencies in turbulent environments (Eisenhardt and Martin, 2000; Teece *et al.*, 1997). A continuous flow of dynamic capabilities enables organisations to react to new environmental conditions with new strategic opportunities (López, 2005). Dynamic capabilities can exist in several functional areas of firms (Morgan *et al.*, 2009), but those in marketing and R&D tend to be key; they shape markets, and markets shape these capabilities, so the firm and its markets evolve together (Augier and Teece, 2009; Augier and Teece, 2008). Several studies have verified the influence of these key capabilities on performance and their role in explaining differences in firms' performance outcomes (Jayachandran *et al.*, 2004; Morgan *et al.*, 2009; Vorhies and Morgan, 2005). Both marketing and R&D capabilities are important in developing and commercialising new technologies and innovations. Therefore, we focus on dynamic capabilities in these two domains.

Dynamic marketing capabilities support firms that are moving away from a stationary process in order to evolve (Bruni and Verona, 2009). Continuous interaction with the markets leads to new capabilities, which in turn shape markets; thus, the firm and its markets co-evolve (Augier and Teece, 2009; Lin *et al.*, 2010). Firms with dynamic marketing capabilities are able to detect market changes and provide value to their customers; this is especially true in turbulent environments (Danneels, 2008). Dynamic R&D capabilities help firms develop new technical knowledge, which they combine with existing technology in order to design superior products and services (Dollinger, 1995). Dynamic R&D capabilities foster the development of innovations and new technologies and enable the firm to respond to changing technological environments (Wind and Mahajan, 1997). Since dynamic capabilities are built and leveraged through micro-level origins and since dynamic marketing and R&D capabilities are highly relevant to firm performance, we analyse the impact of CEO experience as a micro-level origin of dynamic marketing and R&D capabilities.

CEO experience as micro-level origin

Managers play a central role when it comes to converting resources into dynamic capabilities (Augier and Teece, 2009; Kor and Mahoney, 2005). Their ability to detect the need to develop dynamic capabilities depends on their motivation, skills, and experiences (Ambrosini and Bowman, 2009). Several studies have examined the impact of executives' experiences on their strategic choices and on how they perceive their environments (Herrmann and Datta, 2006). Studies have revealed a correlation between CEOs' functional background experiences and firms' diversification strategies (Smith and White, 1987) or their competitive strategies (Chaganti and Sambharya, 1987). CEOs often act as central decision-makers in their organisations, so they have the power to influence the development of strategic assets and dynamic capabilities (Barker and Mueller, 2002). Therefore, CEO experience can play an important role as a micro-level origin of dynamic marketing and R&D capabilities. Micro-level origins of dynamic capabilities can be found at the individual, organisational, and network level

of a firm (Rothaermel and Hess, 2007). CEO experience serves as micro-level origin at the individual level and can influence the strategic and operational decisions regarding the organisation's use of dynamic marketing and R&D capabilities. Herrmann and Datta (2006) identified CEO firm experience, CEO age, CEO international experience, and CEO functional experience as indicators of CEO experience. We have used this framework to develop our hypotheses.

CEO firm experience

Research that examines CEO experience in the firm has found that CEOs with more firm experience make fewer changes in strategy than do CEOs with less firm experience (Grimm and Smith, 1991; Hambrick *et al.*, 1999). CEOs with more firm experience show greater commitment to the status quo (Hambrick *et al.*, 1993) and have lower risk-taking propensity (Finkelstein and Hambrick, 1990; Wiersema and Bantel, 1992). CEOs with longer firm tenure are associated with a "defender" strategy, resulting in a more internal orientation that focuses on existing markets and the improvement of internal processes (Thomas *et al.*, 1991). The defender strategy involves a narrow view with a limited mix of products and customers as well as a tendency to protect the firm's position from competitors (Miles and Snow, 1978). Longer-tenured CEOs are inclined to lose touch with their organisations' environments and, thus, with the ability to make important decisions for changes and investments that are required in order to keep their firms evolving over time (Miller, 1991).

CEOs with less firm experience tend to follow a "prospector" strategy, which is associated with an open mind and far-seeing strategic options. Shorter-tenured CEOs expand activities that foster new technologies, innovations, and markets (Thomas *et al.*, 1991). CEOs with short tenures tend to be better at allocating new information on their environment and to be more willing to take risks (Miller, 1991). These characteristics should enable them to manage environmental conditions such as market turbulence, technological turbulence, and competitive intensity (Jaworski and Kohli, 1993) more effectively, whereas longer-tenured CEOs are less qualified to react on these conditions. Therefore, we postulate:

- H1a/b.* CEO firm experience does not have a positive influence on the use of dynamic (a) marketing and (b) R&D capabilities in organisations.
- H1c/d.* CEOs with a high level of firm experience do not tend to foster more use of dynamic (c) marketing and (d) R&D capabilities when there is a highly turbulent market.
- H1e/f.* CEOs with a high level of firm experience do not tend to foster more use of dynamic (e) marketing and (f) R&D capabilities when there is a high level of technological turbulence.
- H1g/h.* CEOs with a high level of firm experience do not tend to foster more use of dynamic (g) marketing and (h) R&D capabilities when there is high competitive intensity.

CEO age

Research has indicated that executive age is an indicator of the CEO's level of experience and propensity for risk-taking and change (Guthrie and Datta, 1997). Older

executives tend to be more conservative and risk-averse and may have difficulty in recognising new opportunities and in learning new behaviours (Hambrick and Mason, 1984). They are likely to be reluctant to employ practices that entail higher levels of risk and they prefer financial and career security. In contrast, young executives tend to show greater risk-taking propensity (Child, 1974).

Older executives may have less physical and mental stamina and less of the information-processing ability needed to implement organisational change than younger executives do. Younger executives tend to have a greater capacity for information processing and analysis and, as a consequence, have a better understanding of the respective situation, enabling them to range different environmental conditions (Child, 1974). Due to their greater propensity to take risks, younger executives tend to be more liberal with regard to the development of new technologies and markets, and they are more inclined to foster dynamic capabilities in the marketing and R&D area. Their capacity for information processing and analysis is more pronounced, helping them respond to changing environments such as those characterised by market turbulence, technological turbulence, and competitive intensity. Older executives may have difficulty responding to new situations because of their limited capacity to process information, which is essential in order to be able to address changing environments through the use of new capabilities. Thus, we hypothesise the following:

- H2a/b.* CEO age does not have a positive influence on the use of dynamic (a) marketing and (b) R&D capabilities in organisations.
- H2c/d.* Older CEOs do not tend to foster more use of dynamic (c) marketing and (d) R&D capabilities when there is a highly turbulent market.
- H2e/f.* Older CEOs do not tend to foster more use of dynamic (e) marketing and (f) R&D capabilities when there is a high level of technological turbulence.
- H2g/h.* Older CEOs do not tend to foster more use of dynamic (g) marketing and (h) R&D capabilities when there is high competitive intensity.

CEO international experience

Executives with international experience possess more knowledge about foreign markets and culture, more foreign business practice experience, a broader worldview, and more professional ties that help them manage international operations than do executives without international experience (Daily *et al.*, 2000). Executives with international experience are more comfortable making significant resource commitments in international markets because they are more capable of dealing with the uncertainty associated with international operations – primarily because they are less uncertain about it (Carpenter *et al.*, 2003) – and because they have more confidence in their ability to manage operations in complex foreign business environments (Black, 1997). Researchers have argued that a firm's effectiveness in international and new markets is linked with the international experience of its executives (Athanassiou and Nigh, 2000; Daily *et al.*, 2000). Executives with international experience show a higher awareness of international market opportunities and are more able to identify new strategic and operational potentials in new markets and distribution channels as well as in new technologies and

innovations. Executives with international experience tend to understand the need for dynamic activities. Therefore, we postulate that:

H3a/b. CEO international experience has a positive influence on the use of dynamic (a) marketing and (b) R&D capabilities in organisations.

CEO functional experience

The functional experience of executives has important implications for their knowledge base, skills, and cognitive orientation. This personal experience influences executives' strategic decisions because executives tend to identify and define business problems and solutions in terms of their functional backgrounds (Dearborn and Simon, 1958). Executives often spend a significant part of their careers in one functional area (e.g. marketing, finance), and this experience affects and shapes how they visualise and associate with business problems and solutions (Hambrick and Mason, 1984). Hambrick and Mason (1984) differentiated between throughput functional experience and output functional experience: throughput experience incorporates production/operations, finance/accounting, administration, and legal career experience, so CEOs with career experience in these areas are inclined to improve the efficiency of the organisation. They foster existing processes and tend toward exploitative actions rather than toward exploring new and undiscovered possibilities (Barker and Mueller, 2002). Output experience incorporates marketing and R&D career experience. CEOs with output experience favour innovation strategies in order to strike new paths and emphasise growth by discovering and implementing new products and markets (Finkelstein and Hambrick, 1996). In short, CEOs with output functional experience foster dynamic capabilities, whereas CEOs with throughput functional experience tend to avoid dynamic capabilities. Therefore, we hypothesise the following:

H4a/b. CEO output functional experience has a positive influence on the use of dynamic (a) marketing and (b) R&D capabilities.

H4c/d. CEO throughput functional experience has no influence on the use of dynamic (c) marketing and (d) R&D capabilities.

Figure 1 shows an overview of the conceptual research model with all hypotheses.

Methods

Sample and data collection

We conducted a survey with a sample of 2,190 German companies from diverse settings to validate the theoretical model empirically. Following the key informant approach, which states that top managers represent the best source of information for this type of study, we directed our questionnaires to the chief executive officer (CEO) or founder of the firm (Van der Werf and Bush, 1989). Using a three-wave mailing approach (Dillman, 1978) via e-mail, we received 267 responses, corresponding to a response rate of 12.19 percent. According to Klassen and Jacobs (2001), the response rate for online surveys should exceed 9 percent. Table I provides descriptive information about our sample composition.

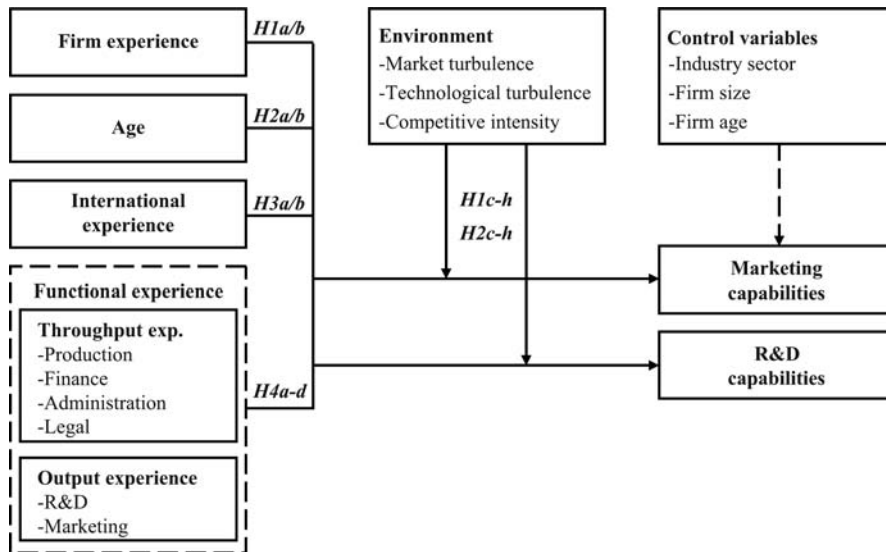


Figure 1.
The conceptual model of the study

Measures

Following Churchill (1979), all measures used in this analysis are established measures from prior studies. We developed the questionnaire in German using the conventional back-translation process to ensure translation equivalence. To ensure the face validity and clarity of the measures, we performed a pre-test with a group of fourteen experts (managers and academics) (Churchill, 1979) and, based on their feedback, made some minor changes in wording. For all measurement items except CEO firm experience, CEO age, CEO international experience, CEO functional experience and controls for firm age, firm size and industry sector, we used seven-point Likert scales. All items for the main constructs are presented in the Appendix.

Dependent variables. Marketing and R&D capabilities are the dependent variables in our study. An eight-item measurement scale was used to measure marketing capabilities ($\alpha = 0.95$). For R&D ($\alpha = 0.94$), we used a six-item measurement scale. Both measurement scales were adopted from Danneels (2008).

Independent variables. All measurement scales for the CEO experiences were adopted from Herrmann and Datta (2006). We measured CEO firm experience, defined as the number of years the executive has been in the firm, with a single-item construct across seven categories. CEO age resulted in a single-item construct with seven categories. CEO international experience was measured with a dummy variable; CEOs without international experience were coded 0, and those with international experience were coded 1. To measure CEO functional experience, we established six categories: finance/accounting, production/operations, administration, and legal as throughput experience; and marketing and R&D as output experience. Because the six functional experience categories were not mutually exclusive, we created a single dummy variable for each of the six categories (coded 1 if the CEO had experience, and 0 otherwise).

| MD | | % |
|------------------------|----------------------------------|----|
| 50,4 | | |
| 618 | <i>Industry</i> | |
| | Engineering | 13 |
| | Automotive | 3 |
| | Electronic | 3 |
| | Chemicals/health care | 4 |
| | Building | 19 |
| | IT/media | 5 |
| | Energy and resource | 3 |
| | Professional and finance service | 7 |
| | Consumer | 19 |
| | Logistics | 3 |
| | Other | 21 |
| | <i>Firm age (years)</i> | |
| | < 6 | 5 |
| | 6-10 | 9 |
| | 11-20 | 21 |
| | 21-40 | 27 |
| | 41-60 | 20 |
| | 61-90 | 9 |
| | > 90 | 9 |
| | <i>Firm size (employee no.)</i> | |
| | < 6 | 6 |
| | 6-10 | 7 |
| | 11-20 | 13 |
| | 21-50 | 35 |
| | 51-100 | 20 |
| | 101-250 | 12 |
| | > 250 | 7 |
| | <i>Industry sector</i> | |
| | Manufacturing | 40 |
| | Service | 60 |
| | <i>CEO firm exp. (years)</i> | |
| < 4 | 14 | |
| 5-9 | 19 | |
| 10-16 | 20 | |
| 17-24 | 28 | |
| 25-30 | 11 | |
| 31-35 | 6 | |
| > 36 | 2 | |
| <i>CEO age (years)</i> | | |
| < 30 | 3 | |
| 31-40 | 16 | |
| 41-47 | 29 | |
| 48-53 | 24 | |
| 54-60 | 17 | |
| 61-70 | 10 | |
| > 70 | 1 | |

Table I.
Composition of the
sample

(continued)

| | % | CEO experience as micro-level origin |
|----------------------------------|----|--|
| <i>CEO throughput experience</i> | | |
| Finance/accounting exp. | 66 | |
| Production/operations exp. | 61 | |
| Administration experience | 54 | |
| Legal experience | 22 | 619 |
| <i>CEO output experience</i> | | |
| Marketing experience | 75 | |
| R&D experience | 30 | |
| <i>CEO int. exp.</i> | | |
| No experience | 69 | |
| Experience | 31 | |
| Note: $n = 267$ | | Table I. |

Moderator variables. The moderator variables of this study are market turbulence ($\alpha = 0.90$), technological turbulence ($\alpha = 0.91$), and competitive intensity ($\alpha = 0.80$), all measured with four items. We adopted these three measures from Jaworski and Kohli (1993).

Control variables. In testing our hypotheses, we included several control variables that could influence marketing and R&D capabilities. In line with Danneels (2008), we controlled for industry sector, firm size, and firm age. First, the industry sector was differentiated with a dummy variable; firms in the manufacturing sector were coded 0, and those in the service sector were coded 1. Firm size was included as the number of full-time-equivalent employees across seven categories. Firm age was measured as the natural logarithm of the firm age in years since its foundation.

Reliability and validity of measurement instruments

To ensure the validity of the data provided, our questionnaire assured all respondents of confidentiality. We also explained the relevance of the study and offered a standard report of our findings as a benefit for participants.

First, we tested our sample for potential biases in the respondents' answering behaviour by analysing the sample for non-response bias through a comparison of early and late respondents. As recommended by Armstrong and Overton (1977), we applied the Kolmogorov-Smirnov test and the Mann-Whitney test and found no significant differences ($p < 0.05$) between early and late respondents, so there was no evidence of non-response bias. Since the data were obtained from a single informant by using a single survey instrument, there are several typical options (Podsakoff and Organ, 1986) to test for a common method bias in general (Crompton and Wagner, 1994; Lindell and Whitney, 2001). The measurements of the independent variables (CEO firm experience, CEO age, CEO international experience, CEO functional experience) are fixed parameters and are not subjective estimations by the single informant, so there is no risk of common method bias.

We also analysed the model fit with confirmatory factor analysis using AMOS 17.0 software (Arbuckle, 2007). The results (see Table II) indicated that the measurement

model fits the data well (SRMR = 0.05; NFI = 0.98; RFI = 0.98; GFI = 0.98; AGFI = 0.98) and confirmed the unidimensionality of each construct in the model (Anderson and Gerbing, 1988)[1]. Convergent validity is observed when the path coefficients from latent constructs to their respective indicators are statistically significant (Anderson and Gerbing, 1988). All items loaded significantly and positively ($p \leq 0.001$) on their respective latent constructs, with loadings of higher than 0.40 (Hulland, 1999). All constructs had high reliability, with Cronbach's alphas over 0.70, and the cut-off level of 0.60 for composite reliability (CR) was exceeded by all constructs (Bagozzi and Yi, 1988). Furthermore, the average variance extracted (AVE) threshold of 0.50 was met in all cases (Hair *et al.*, 2006). These findings supported both indicator and construct reliability of the proposed measures.

We also tested the Fornell-Larcker criterion for assessing discriminant validity. If a construct shares more variance with its measures than with any other construct in the model, sufficient discriminant validity is assured (Fornell and Larcker, 1981). The square roots of the average variance extracted, which are shown on the diagonal in Table III, indicate satisfactory discriminant validity for all constructs.

Results

We used moderated multiple regression analyses to test our hypotheses. In order to reduce multicollinearity, we applied standardised variables. Therefore, the interaction terms were also built with these standardised variables (Aiken and West, 1991), and only one interaction term was considered per model (Cohen *et al.*, 2003). We calculated the variance inflation factors (VIF) for all models to check for potential multicollinearity; all factors ranged well below 2, so the regression results were not distorted by multicollinearity (Hair *et al.*, 2006). The results of the regression analyses are denoted in Table IV (dynamic marketing capabilities as dependent variable) and Table V (dynamic R&D capabilities as dependent variable).

The first block in Tables IV and V contains the control variables and the predictors of market turbulence, technological turbulence, and competitive intensity, of which the interaction terms are composed (Tables IV and V, model 1). The results for the first model show that the control variables firm size and firm age have a significant influence only on dynamic R&D capabilities. Further, the predictors in the first model for market turbulence and competitive intensity exert significant influence on both dynamic marketing and R&D capabilities, whereas technological turbulence has a significant influence only on R&D capabilities (Tables IV and V, model 1).

| Factor | Number of items | Range of loadings | Cronbach's Alpha | Composite reliability | Average variance extracted |
|--------------------------|-----------------|-------------------|------------------|-----------------------|----------------------------|
| Marketing capabilities | 8 | 0.78-0.87 | 0.95 | 0.95 | 0.70 |
| R&D capabilities | 6 | 0.64-0.95 | 0.94 | 0.95 | 0.74 |
| Market turbulence | 4 | 0.76-0.89 | 0.90 | 0.90 | 0.70 |
| Technological turbulence | 4 | 0.82-0.90 | 0.91 | 0.91 | 0.72 |
| Competitive intensity | 4 | 0.60-0.85 | 0.80 | 0.81 | 0.52 |

Notes: Model fit indexes: SRMR = 0.05; NFI = 0.98; RFI = 0.98; GFI = 0.98; AGFI = 0.98

Table II.
Measurement
information of the
confirmatory factor
analysis

| Variables | Mean | SD | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|------------------------------------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1. Marketing capabilities | 4.52 | 0.99 | 0.84* | | | | | | | | | | | | | | | | |
| 2. R&D capabilities | 4.63 | 1.11 | 0.58 | 0.86* | | | | | | | | | | | | | | | |
| 3. Firm size | 4.17 | 1.49 | 0.08 | 0.15 | n.a.* | | | | | | | | | | | | | | |
| 4. Firm age | 3.31 | 0.94 | -0.04 | -0.07 | 0.26 | n.a.* | | | | | | | | | | | | | |
| 5. Industry sector | 0.60 | 0.49 | 0.13 | -0.06 | -0.26 | -0.20 | n.a.* | | | | | | | | | | | | |
| 6. CEO firm experience | 3.31 | 1.50 | 0.10 | 0.02 | -0.03 | 0.22 | -0.15 | n.a.* | | | | | | | | | | | |
| 7. CEO age | 3.70 | 1.32 | 0.05 | 0.01 | -0.01 | 0.06 | -0.63 | 0.45 | n.a.* | | | | | | | | | | |
| 8. CEO international experience | 0.31 | 0.47 | 0.10 | 0.09 | 0.01 | 0.05 | -0.04 | -0.13 | -0.07 | n.a.* | | | | | | | | | |
| 9. CEO finance/accounting exp. | 0.66 | 0.47 | 0.05 | 0.02 | 0.02 | 0.07 | 0.07 | 0.16 | 0.10 | 0.01 | n.a.* | | | | | | | | |
| 10. CEO production/operations exp. | 0.61 | 0.49 | 0.07 | 0.10 | 0.11 | 0.08 | -0.18 | 0.18 | -0.04 | 0.03 | 0.14 | n.a.* | | | | | | | |
| 11. CEO administration experience | 0.54 | 0.50 | 0.08 | 0.13 | -0.05 | 0.07 | -0.02 | 0.18 | 0.05 | -0.14 | 0.25 | 0.20 | n.a.* | | | | | | |
| 12. CEO legal experience | 0.22 | 0.42 | 0.05 | 0.10 | -0.09 | 0.06 | 0.02 | 0.11 | 0.10 | -0.08 | 0.18 | 0.12 | 0.28 | n.a.* | | | | | |
| 13. CEO marketing experience | 0.75 | 0.43 | 0.18 | 0.03 | -0.14 | -0.10 | -0.01 | 0.10 | 0.05 | 0.06 | 0.06 | 0.19 | 0.11 | 0.08 | n.a.* | | | | |
| 14. CEO R&D experience | 0.30 | 0.46 | 0.03 | 0.14 | -0.03 | -0.14 | -0.15 | 0.15 | 0.03 | 0.07 | 0.11 | 0.30 | 0.08 | 0.20 | 0.13 | n.a.* | | | |
| 15. Market turbulence | 3.74 | 1.10 | 0.27 | 0.33 | 0.07 | -0.01 | -0.14 | -0.02 | -0.01 | 0.08 | -0.05 | -0.03 | -0.05 | -0.02 | 0.03 | 0.04 | 0.83* | | |
| 16. Technological turbulence | 3.45 | 1.29 | 0.15 | 0.29 | 0.03 | -0.07 | -0.06 | 0.14 | 0.02 | -0.04 | 0.00 | -0.04 | -0.03 | 0.00 | 0.07 | 0.20 | 0.49 | 0.85* | |
| 17. Competitive intensity | 4.05 | 0.84 | 0.27 | 0.27 | 0.01 | 0.14 | 0.04 | 0.13 | 0.09 | 0.03 | 0.04 | 0.07 | 0.03 | 0.05 | 0.04 | 0.01 | 0.18 | 0.09 | 0.72* |

Notes: *Numbers on the diagonal show the square root of AVE, numbers below the correlations; Correlations > 0.17 are significant at 0.01 level, > 0.12 at level 0.05

Table IV.
Multiple regression
analysis with dynamic
marketing capabilities as
dependent variable

| Variables | Mod. 1 | Mod. 2 | Mod. 3 | Mod. 4 | Mod. 5 | Mod. 6 | Mod. 7 | Mod. 8 |
|----------------------------------|-------------------|--------------------|--------------------|-------------------|-------------------|--------------------|--------------------|--------------------|
| Firm size | 0.09 | 0.13 ^b | 0.12 ^a | 0.13 ^b | 0.13 ^b | 0.11 ^a | 0.12 ^a | 0.13 ^b |
| Firm age | -0.08 | -0.11 ^a | -0.09 | -0.10 | -0.10 | -0.10 | -0.11 ^a | -0.11 ^a |
| Industry sector | 0.04 | 0.06 | 0.07 | 0.06 | 0.07 | 0.07 | 0.05 | 0.08 |
| Market turbulence | 0.22 ^c | 0.22 ^c | 0.22 ^c | 0.22 ^d | 0.23 ^c | 0.20 ^c | 0.22 ^c | 0.24 ^d |
| Technological turbulence | 0.02 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 | -0.03 |
| Competitive intensity | 0.24 ^d | 0.22 ^d | 0.22 ^d | 0.22 ^d | 0.21 ^c | 0.24 ^d | 0.23 ^d | 0.20 ^c |
| CEO firm experience | | 0.09 | 0.08 | 0.08 | 0.09 | 0.09 | 0.09 | 0.10 |
| CEO age | | -0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.01 | -0.01 |
| CEO international experience | | 0.10 ^a | 0.10 ^a | 0.09 | 0.10 ^a | 0.10 | 0.10 | 0.09 |
| CEO throughput experience: | | | | | | | | |
| Finance/accounting experience | | 0.01 | 0.03 | 0.01 | 0.02 | 0.02 | 0.01 | 0.01 |
| Production/operations experience | | 0.01 | 0.03 | 0.02 | 0.01 | 0.02 | 0.01 | 0.02 |
| Administration experience | | 0.07 | 0.05 | 0.07 | 0.07 | 0.05 | 0.06 | 0.08 |
| Legal experience | | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.04 | 0.01 |
| CEO output experience: | | | | | | | | |
| Marketing experience | | 0.15 ^b | 0.14 ^b | 0.14 ^b | 0.15 ^b | 0.14 ^b | 0.14 ^b | 0.15 ^b |
| R&D experience | | -0.04 | -0.03 | -0.05 | -0.04 | -0.03 | -0.04 | -0.03 |
| <i>Two-way interactions</i> | | | | | | | | |
| CEO firm exp. × market turb. | | | -0.11 ^a | -0.09 | -0.04 | -0.15 ^b | -0.11 ^a | -0.11 ^a |
| CEO firm exp. × techn. turb. | | | | | | | | |
| CEO firm exp. × comp. int. | | | | | | | | |
| CEO age × market turb. | | | | | | | | |
| CEO age × techn. turb. | | | | | | | | |
| CEO age × comp. int. | | | | | | | | |
| R^2 | 0.14 | 0.19 | 0.20 | 0.20 | 0.19 | 0.21 | 0.20 | 0.20 |
| Adjusted R^2 | 0.12 | 0.14 | 0.15 | 0.14 | 0.14 | 0.16 | 0.15 | 0.15 |
| F | 6.91 ^d | 3.89 ^d | 3.88 ^d | 3.79 ^d | 3.66 ^d | 4.10 ^d | 3.88 ^d | 3.88 ^d |

Notes: Standard regression coefficients are shown; $n = 267$; ^a $p < 0.10$; ^b $p < 0.05$; ^c $p < 0.01$; ^d $p < 0.001$

| Variables | Mod. 1 | Mod. 2 | Mod. 3 | Mod. 4 | Mod. 5 | Mod. 6 | Mod. 7 | Mod. 8 |
|----------------------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| Firm size | 0.15 ^c | 0.17 ^c | 0.16 ^c | 0.17 ^c | 0.17 ^c | 0.15 ^b | 0.15 ^b | 0.16 ^c |
| Firm age | -0.13 ^b | -0.15 ^b | -0.14 ^b | -0.15 ^b | -0.16 ^b | -0.14 ^b | -0.15 ^b | -0.15 ^b |
| Industry sector | -0.02 | 0.00 | 0.01 | 0.00 | -0.01 | 0.00 | -0.01 | 0.03 |
| Market turbulence | 0.18 ^b | 0.18 ^c | 0.18 ^c | 0.18 ^c | 0.17 ^c | 0.16 ^b | 0.18 ^c | 0.21 ^c |
| Technological turbulence | 0.17 ^c | 0.18 ^c | 0.18 ^c | 0.18 ^c | 0.18 ^c | 0.18 ^c | 0.18 ^c | 0.19 ^c |
| Competitive intensity | 0.24 ^d | 0.23 ^d | 0.23 ^d | 0.23 ^d | 0.24 ^d | 0.25 ^d | 0.24 ^d | 0.20 ^c |
| CEO firm experience | | -0.02 | -0.03 | -0.02 | -0.02 | -0.02 | -0.03 | -0.01 |
| CEO age | | 0.01 | 0.01 | 0.01 | 0.00 | 0.01 | 0.01 | 0.00 |
| CEO international experience | | 0.11 ^a | 0.11 ^a | 0.11 ^a | 0.11 ^a | 0.10 ^a | 0.10 ^a | 0.09 |
| CEO throughput experience: | | | | | | | | |
| Finance/accounting experience | | -0.03 | -0.02 | -0.03 | -0.04 | -0.02 | -0.04 | -0.04 |
| Production/operations experience | | 0.05 | 0.06 | 0.05 | 0.05 | 0.06 | 0.05 | 0.06 |
| Administration experience | | 0.15 ^b | 0.13 ^b | 0.15 ^b | 0.15 ^b | 0.13 ^b | 0.15 ^b | 0.16 ^c |
| Legal experience | | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.09 | 0.05 |
| CEO output experience: | | | | | | | | |
| Marketing experience | | -0.03 | -0.04 | -0.04 | -0.04 | -0.05 | -0.04 | -0.03 |
| R&D experience | | 0.03 | 0.04 | 0.03 | 0.04 | 0.04 | 0.03 | 0.04 |
| <i>Two-way interactions</i> | | | | | | | | |
| CEO firm exp. × market turb. | | | -0.09 | | | | | |
| CEO firm exp. × techn. turb. | | | | -0.01 | | | | |
| CEO firm exp. × comp. int. | | | | | -0.05 | | | |
| CEO age × market turb. | | | | | | -0.13 ^b | | |
| CEO age × techn. turb. | | | | | | | | |
| CEO age × comp. int. | | | | | | | | |
| R^2 | 0.21 | 0.25 | 0.26 | 0.25 | 0.26 | 0.27 | -0.09 ^a | -0.16 ^c |
| Adjusted R^2 | 0.19 | 0.21 | 0.21 | 0.21 | 0.21 | 0.22 | 0.22 | 0.28 |
| F | 11.27 ^d | 5.71 ^d | 5.52 ^d | 5.33 ^d | 5.39 ^d | 5.77 ^d | 5.57 ^d | 6.00 ^d |

Notes: Standard regression coefficients are shown; $n=267$; ^a $p < 0.10$; ^b $p < 0.05$; ^c $p < 0.01$; ^d $p < 0.001$

Table V. Multiple regression analysis with dynamic R&D capabilities as dependent variable

The second block in Tables IV and V contains the independent variables of our model design to test *H1a-H4a* and *H4c* (Table IV, model 2) and *H1b-H4b* and *H4d* (Table V, model 2). The two-way interaction terms are included in block 3 to test *H1c/e/g* and *H2c/e/g* (Table IV, models 3-8) and *H1d/f/h* and *H2d/f/h* (Table V, models 3-8).

The effect of CEO firm experience on dynamic marketing (Table IV, model 2) and R&D capabilities (Table V, model 2) is not significant, confirming *H1a* and *H1b*. In addition, CEO age has no significant influence on marketing (Table IV, model 2) or R&D (Table V, model 3) capabilities, confirming *H2a* and *H2b*. The results in model 2 also confirm *H3a* and *H3b* because the effect of CEO international experience on marketing and R&D capabilities is significant (Table IV, model 2: $\beta = 0.10, p < 0.10$; Table V, model 2: $\beta = 0.11, p < 0.10$). CEO output functional experience has a partial influence on dynamic marketing capabilities because the effect of CEO functional experience in marketing (Table IV, model 2: $\beta = 0.15, p < 0.05$) is significant, whereas the effect of CEO functional experience in R&D is not significant for dynamic marketing capabilities. Therefore, *H4a* is confirmed for CEO output experience in marketing, but not for experience in R&D. Regarding dynamic R&D capabilities, the influence of CEO output experience is not significant for either functional marketing experience or functional R&D experience, so *H4b* is not confirmed. CEO throughput functional experience is not significant for dynamic marketing capabilities, so *H4c* is confirmed. For dynamic R&D capabilities, only CEO throughput experience in administration has a significant effect (Table V, model 2: $\beta = 0.15, p < 0.05$), whereas all other throughput experiences have no influence on dynamic R&D capabilities. *H4d* is therefore confirmed for CEO throughput experience in finance/accounting, production/operations and legal, but not for experience in administration.

To ensure that the interactions were illustrated clearly, we plotted the significant interactions (Figures 2 and 3) by splitting the independent variables into high and low categories, one standard deviation above and below the mean, respectively (Aiken and West, 1991).

The interaction term of CEO firm experience and market turbulence is significant for dynamic marketing capabilities (Table IV, model 3: $\beta = -0.11; p < 0.10$), so *H1c* is confirmed. The value for the explained variance for this model (Table IV, model 3, 15 percent) added one percent to the explained variance obtained in model 2 (Table IV, 14 percent). The illustration of this effect (Figure 2a) shows that firms in highly turbulent markets that have a CEO with low firm experience use more dynamic marketing capabilities than do firms where the CEO has a high level of firm experience. In highly turbulent markets, the use of dynamic marketing capabilities decreases when the CEO's firm experience increases, whereas more CEO firm experience increases the use of dynamic marketing capabilities in markets with low turbulence. The interaction terms of CEO firm experience and technological turbulence as well as those of CEO firm experience and competitive intensity are not significant, so *H1e* and *H1g* are not confirmed.

The interaction terms of CEO age and market turbulence, CEO age and technological turbulence, and CEO age and competitive intensity are significant (Table IV, model 6: $\beta = -0.15; p < 0.05$; model 7: $\beta = -0.11; p < 0.10$; model 8: $\beta = -0.11; p < 0.10$) for dynamic marketing capabilities, confirming *H2c*, *H2e*, and *H2g* (Figures 2b, c, and d). In highly turbulent environments, the use of dynamic marketing is high when the CEO is young. This result is obtained for high market

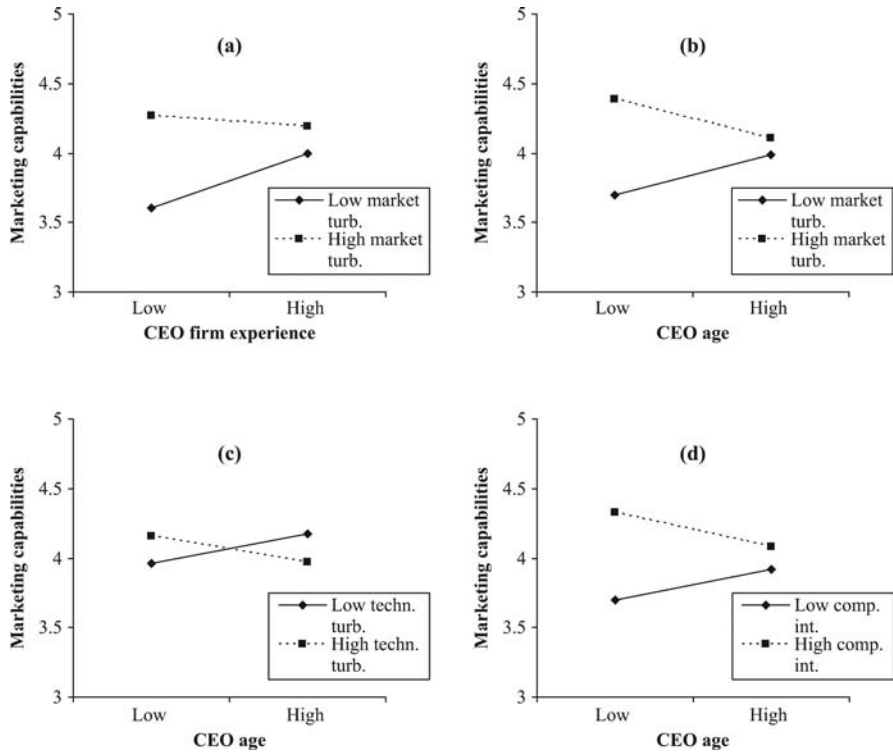


Figure 2.
Illustrations of the
two-way interactions

turbulence, high technological turbulence, and high competitive intensity. The use of dynamic marketing capabilities in these environmental situations decreases as the CEO's age increases, whereas in environments with low market turbulence, low technological turbulence, and low competitive intensity, the use of dynamic marketing capabilities increases with the age of the CEO. Therefore, the older the CEO is, the more the firm uses dynamic marketing capabilities.

None of the interaction terms of CEO firm experience and market turbulence, CEO firm experience and technological turbulence, and CEO firm experience and competitive intensity are significant for dynamic R&D capabilities, so *H1d*, *H1f*, and *H1h* are not confirmed.

The interaction terms of CEO age and market turbulence, CEO age and technological turbulence, and CEO age and competitive intensity are significant (Table V, model 6: $\beta = -0.13$; $p < 0.05$; model 7: $\beta = -0.09$; $p < 0.10$; model 8: $\beta = -0.16$; $p < 0.01$) for dynamic R&D capabilities, confirming *H2d*, *H2f*, and *H2h* (Figure 3a, b, c). The effect is the same as for marketing capabilities. When market turbulence, technological turbulence, and competitive intensity are high, the use of dynamic R&D capabilities is high when the CEO is young. However, when market turbulence, technological turbulence, and competitive intensity are low, the use of dynamic R&D capabilities increases with the age of the CEO.

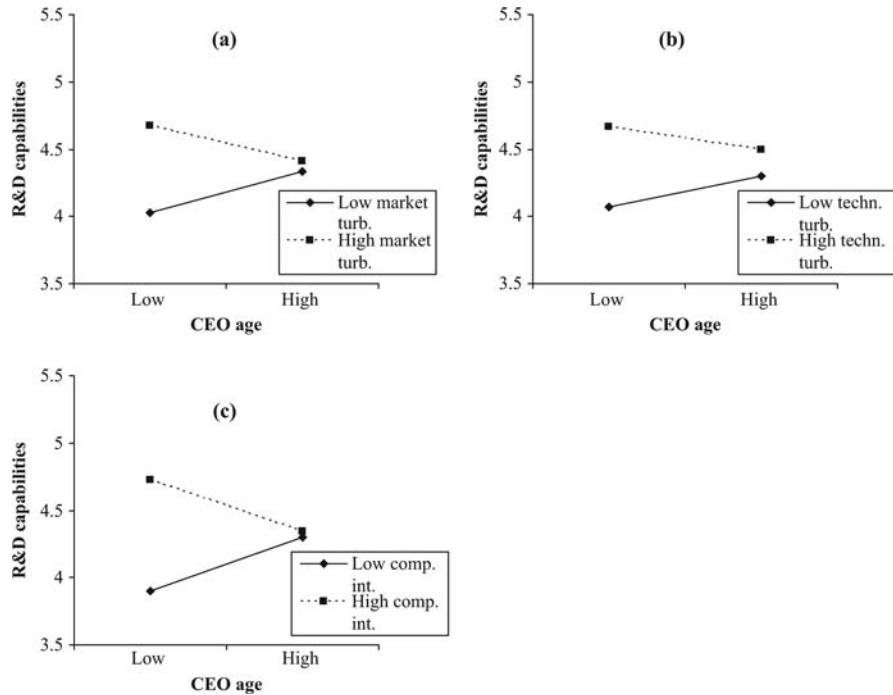


Figure 3. Illustrations of the two-way interactions

Discussion

Implications for theory

The dynamic capabilities approach is an established approach used in the strategic management literature to explain the increased performance of some firms in turbulent environments, and the emergence of dynamic capabilities has been of increasing interest. Several scholars have spoken about the micro-level origins that are responsible for the emergence of dynamic capabilities (Gavetti, 2005; Abell *et al.*, 2008; Felin and Foss, 2005), but the discussion of the influence of micro-level origins on dynamic capabilities has not yet been examined empirically. The primary purpose of our study is to address this gap by analysing the influence of CEO experience as a micro-level origin of dynamic marketing and R&D capabilities because CEOs play a central role in the conversion of resources into dynamic capabilities (Augier and Teece, 2009; Kor and Mahoney, 2005).

The major finding of this study is that there is a link between CEO experience and dynamic marketing and R&D capabilities. This finding corroborates the theoretical considerations about the influence of micro-level origins of dynamic capabilities in organisations. The results underscore the fact that the constellation of CEO experience is important for the evolution of dynamic capabilities in organisations, partly dependent on the environmental situation of the firm.

With a view to the theoretical background, it would be useful to know whether CEO experience at the individual level and its impact on dynamic capabilities can be transferred to the organisational level. Are employee experiences, such as firm experience, international experience, and prior work experience, or age relevant to the

development of dynamic capabilities? Further research should address this question by analysing employee experiences in departments such as marketing, R&D, and operations areas. The questionnaire should be addressed to the chief marketing officer (CMO) for the marketing area and the chief research officer (CRO) or the chief technical officer (CTO) for the R&D area. These managers know the employees in their departments best. A detailed analysis of employee experiences would be fruitful for deepening the understanding of how organisations can systematically control the development of dynamic capabilities through their employees. With these findings, organisations could select their employees in such a way as to improve their dynamic capabilities. In addition, organisations would have the opportunity to advance the human capital of their employees systematically through specially tailored job trainings. It would also be useful to determine whether other employees' human capital skills, whether generic, industry-specific, or firm-specific, influence the evolution of dynamic capabilities (Castanias and Helfat, 1991). Are these skills relevant to the development of dynamic capabilities? Employee skills may differ in their mix and in the level of ability in each type of skill, resulting in heterogeneous dynamic capabilities in organisations.

Another finding of this study is that environmental conditions such as market turbulence, technological turbulence, and competitive intensity influence the link between CEO firm experience and CEO age on the one hand and between dynamic marketing and R&D capabilities on the other. Future studies on employee experience or human capital as a micro-level origin of dynamic capabilities should consider the moderating role of environmental conditions. Turbulent environments can influence the individual's cognition, his or her allocation of new information, and the willingness to take risks (Miller, 1991).

The findings of our study answer our research questions and encourage more research on the important role of micro-level origins of dynamic capabilities. Our results show that CEO experience as a micro-level origin at the individual level influences dynamic capabilities. With a view to the theoretical background, the focus of future research should be on understanding employee experience, as addressed in this study, and their human capital (e.g. generic, industry-specific, or firm-specific skills) in general as micro-level origins of dynamic capabilities at the organisational level. It is important to know how firms can influence the development of dynamic capabilities through their human capital because human capital is one of the main resources of a firm. Furthermore, the environmental conditions of the firm should be included as moderators in future research about human capital as a micro-level origin of dynamic capabilities.

Implications for practice

Our research provides several implications for practice, most notably the observation of the role CEO experience plays in the development of dynamic marketing and R&D capabilities. CEO experience can significantly improve or downgrade dynamic marketing and R&D capabilities. CEO age has a particularly significant influence on the development of dynamic marketing and R&D capabilities in organisations, dependent on the environmental situation. Organisations in turbulent environments have an advantage when their CEO is young. Young CEOs tend to foster more use of dynamic marketing and R&D capabilities in organisations, whereas older CEOs tend more to foster existing strategies with less risk and are less inclined to develop

dynamic capabilities. By contrast, organisations in less turbulent environments have an advantage when their CEO is older. The use of dynamic marketing and R&D capabilities in organisations in less turbulent environments increases with increasing CEO age. CEO firm experience has no influence on the development of dynamic marketing and R&D capabilities except in turbulent markets, where CEOs with less firm experience foster the use of dynamic marketing capabilities more than older CEOs do. Further, CEO international experience has a significant influence on the use of dynamic marketing and R&D capabilities in organisations, while CEO functional experience exerts a minor influence on the use of dynamic marketing and R&D capabilities.

Organisations in turbulent environments have an advantage when the CEO is young and has less firm experience, a high level of international experience, and functional marketing experience. This combination of CEO experiences would be fruitful for the evolution of dynamic marketing and R&D capabilities in turbulent environments.

For organisations in less turbulent environments, an older CEO with firm experience, a high level of international experience, and functional marketing experience would enhance the development of dynamic marketing and R&D capabilities.

In practice, knowing more about the influence of CEO experience on dynamic capabilities in other functional areas of organisations would be useful. For example, does the CEO experience addressed in this study influence the dynamic capabilities in the operations area of an organisation? Are the findings of our study concerning the impact of CEO experience on dynamic capabilities of a general nature, and are they transferable to the capabilities of other functional areas and departments?

Limitations and further research

Although our study takes another step towards understanding the micro-level origins of dynamic capabilities, its conceptual focus and empirical setting impose limitations, some of which present valuable opportunities for future research.

First, there are CEO experiences other than those addressed in the CEO experience framework of Herrmann and Datta (2006), and these other experiences may as well play a role as micro-level origins of dynamic marketing and R&D capabilities. For example, the CEO's educational and entrepreneurial background may have an influence. In addition, there are also other capabilities that could have an effect as micro-level origins, especially at the organisational level.

Second, since we tested our theoretical model with a sample consisting exclusively of German companies, it would be useful and interesting to conduct a similar study in countries with other cultural influences, such as Asian countries, in order to test the hypotheses. Cultural norms and rules govern how individuals and organisations behave (North, 1991; Scott, 1995). Do the CEO experiences addressed in this study have the same impacts on dynamic capabilities in countries with other cultural influences? A survey in a different cultural context could lead to new theoretical and practical implications.

Finally, as mentioned in the practical implications, other types of dynamic capabilities may offer possibilities for future research. For example, Krasnikov and Jayachandran (2008) identified capabilities in the operations area as another core capability. Such a study could provide new insights, especially for the manufacturing industries.

Conclusion

This work explores CEO experiences as micro-level origins that leverage dynamic capabilities and extends the low number of studies on micro-level origins of dynamic capabilities in organisations. The results of our study show that CEO experience – in the form of CEO age (depending on the environmental conditions) and CEO international experience – influences the development of dynamic capabilities, thus leading us to assume that employee experiences at the organisational level could also act as micro-level origins of dynamic capabilities. However, this assumption needs to be confirmed by future research. Our findings and their implications contribute to the literature on the dynamic capabilities approach of a firm and help build a better understanding of how micro-level origins provide a source of dynamic capabilities in general. In sum, our study deepens the understanding of the roots of dynamic capabilities.

Note

1. Good fit is achieved if the normed fit index (NFI) (Bentler and Bonnet, 1990), the relative fit index (RFI) (Bollen, 1986), the goodness-of-fit index (GFI), and the adjusted goodness-of-fit index (AGFI) exceed 0.90, whereas the standardised root mean square residual (SRMR) should not exceed 0.10 (Byrne, 2010).

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Appendix. Survey items

Dynamic marketing capabilities (adapted from Danneels, 2008)

(Reflective, seven-point Likert scale, (1) strongly disagree-(7) strongly agree). Relative to our competitors, my company is good at ...

- (1) ... assessing the potential of new markets.
- (2) ... building relationships in new markets.
- (3) ... setting up new distribution channels.
- (4) ... setting up new sales force.
- (5) ... leveraging its brand reputation or company image to new markets.
- (6) ... researching new competitors and new customers.
- (7) ... developing new advertising or promotion strategies.
- (8) ... developing new pricing strategies.

Dynamic R&D capabilities (adapted from Danneels, 2008)

(Reflective, seven-point Likert scale, (1) strongly disagree-(7) strongly agree). Relative to our competitors, my company is good at ...

- (1) ... setting up new types of manufacturing facilities and operations.
- (2) ... learning about technology it has not used before.
- (3) ... recruiting engineers in technical areas it is not familiar with.
- (4) ... assessing the feasibility of new technologies.
- (5) ... identifying promising new technologies.
- (6) ... implementing new types of production processes.

Market turbulence (adapted from Jaworski and Kohli, 1993)

(Reflective, seven-point Likert scale, (1) strongly disagree-(7) strongly agree). To what extent do you agree with the following statements?

- (1) In our kind of business, customers' product preferences change quite a bit over time.
- (2) Our customers tend to look for new products all the time.
- (3) We are witnessing demand for our products and services from customers who never bought them before.
- (4) New customers tend to have product-related needs that are different from those of our existing customers.

Technological turbulence (adapted from Jaworski and Kohli, 1993)

(Reflective, seven-point Likert scale, (1) strongly disagree – (7) strongly agree). To what extent do you agree with the following statements?

- (1) The technology in our industry is changing rapidly.
- (2) Technological changes provide big opportunities in our industry.
- (3) Important technological developments are again and again in our industry.
- (4) A large number of new product ideas have been made possible through technological breakthroughs in our industry.

Competitive intensity (adapted from Jaworski and Kohli, 1993)

(Reflective, seven-point Likert scale, (1) strongly disagree – (7) strongly agree). To what extent do you agree with the following statements?

- (1) Competition in our industry is cutthroat.
- (2) There are many "promotion wars" in our industry.
- (3) Anything that one competitor can offer, others can match readily.
- (4) Price competition is a hallmark of our industry.

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