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Abstract

Purpose – The purpose of this paper is to examine the direct and indirect effects of CEO transformational leadership on product innovation performance. This research investigates the mechanism between CEO transformational leadership and product innovation performance, to understand the process through which transformational CEOs exert their influence.

Design/methodology/approach – This study is a quantitative research. Data were collected from 269 manufacturing firms in Thailand through a mail survey. This research applied a two-step structural equation modeling process.

Findings – The results indicate that CEO transformational leadership indirectly affects product innovation performance through an innovation culture, organizational learning, and the new product development (NPD) process. CEO transformational leadership has a strong effect on innovation culture and organizational learning. Organizational learning is strongly associated with the NPD process, which significantly leads to product innovation performance. By integrating the knowledge of leadership and operations management fields, this study helps extend the understanding of how leaders at the top of an organization influence the NPD process and product innovation outcomes.

Practical implications – For practical implications to be more effective, CEOs focusing on product innovation should develop their skills and behaviors of transformational leadership to foster innovation culture and organizational learning, which in turn will affect product innovation performance.

Originality/value – This study makes a contribution to the literature by filling the research gaps proposed by several prior studies and offering a theoretical framework of the relationship between CEO transformational leadership and product innovation performance.

Keywords Transformational leadership, New product development, Product innovation performance

Paper type Research paper

1. Introduction

Despite there being various styles of leadership, transformational leadership has received much attention (Senior and Fleming, 2006) and has often been studied by researchers to predict innovation performance (Chen *et al.*, 2012; Gumusluoglu and Ilsev, 2009a, b). According to Di Benedetto (2013), in recent years, transformational leadership has become an emerging research topic in innovation and has increasingly received attention from scholars. Many studies support the positive effect of transformational leadership on organizational innovation (Aragón-Correa *et al.*, 2007; García-Morales *et al.*, 2008; Gumusluoglu and Ilsev, 2009a, b; Jung *et al.*, 2008; Matzler *et al.*, 2008; Noruzy *et al.*, 2013).

However, this positive relationship requires a wider analysis of the intermediate steps between transformational leadership and product innovation performance; how transformational leadership effectively influences product innovation is a complex process (Mumford and Licuanan, 2004). The mechanisms for its connection with product innovation processes and outcomes have not been explicitly studied (Crossan and Apaydin, 2010).

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Despite some advances, few studies (Chen *et al.*, 2014; Gumusluoglu and Ilsev, 2009a, b) have gone beyond a simple, direct relationship between transformational leadership and product innovation performance. However, an explanation of the process through which transformational leadership affects product innovation performance is missing. In addition, most previous studies examined transformational leadership of lower management level rather than at the CEO level (Chen *et al.*, 2014). In essence, knowledge is limited as to why CEO transformational leadership is related to product innovation performance. We aim to address this limitation.

Which theoretical mechanism explains why transformational leadership may relate to product innovation performance? We advance one theoretical explanation and propose that the link between CEO transformational leadership and product innovation performance is mediated by some organizational factors. To build our theoretical framework, we argue that transformational leading by the CEO increases a firm's ability to recognize and exploit opportunities for product innovation. Transformational CEOs can influence social interaction and social change within the organization, which promotes a culture of innovation. CEO transformational leadership also influences the innovation strategy by focusing on tactics and pushing the strategic direction toward innovation. Davila *et al.* (2006) conclude that CEOs have important roles in putting the innovation strategy in place, as well as making innovation a part of the company's culture.

The theoretical framework of this study was developed from a multidimensional framework of organizational innovation (Crossan and Apaydin, 2010) and was grounded in transformational leadership theory. A theoretical framework that links CEO transformational leadership, organizational factors (i.e. innovation strategy, organizational learning, innovation culture, and the new product development (NPD) process), and product innovation performance is proposed and depicted in Figure 1.

2. Literature review and hypotheses

2.1 The roles of CEO transformational leadership on innovation strategy, organizational learning, and innovation culture

To make a firm more competitive, it is CEO's role to plan and execute the company's strategies, including innovation strategies. CEOs have an influence on a firm's strategic innovation orientation. They decide the overall strategic direction of the firm, the composition of the project portfolio, and the allocation of resources across innovation projects (Talke *et al.*, 2011). CEOs with more personal attitudes toward change tend to place

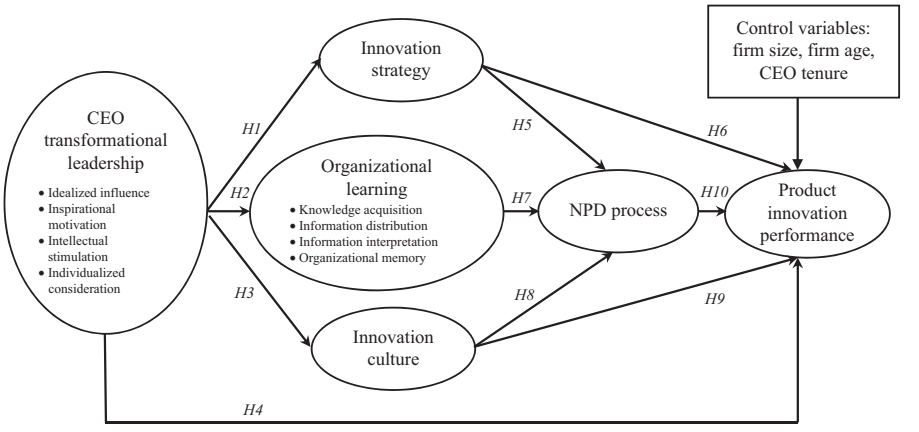


Figure 1.
Research model

more emphasis on innovation in their strategies (Musteen *et al.*, 2010). CEOs with transformational leadership tendencies are more likely to choose strategies that are change and growth oriented (Jung *et al.*, 2008). Therefore, transformational leaders who are visionary and committed to the challenging goals are more likely to emphasize an innovation strategy; they pay attention to the innovation strategy since they cannot effectively direct how the company achieves business goals if there are no goals or long-term plans for innovation. Transformational leaders who use inspirational motivation (IM) stress ambitious goals, project an idealized vision of innovation, and communicate that the vision is achievable. Transformational CEOs can influence how firms formulate and execute their innovation strategy; it is the role of the transformational CEOs to assure that the innovation strategy is aligned with the overall business strategy; resource allocation for the innovation project is planned; commitment to innovation is expressed to all staff; and the courses of action are implemented. Transformational leading behaviors are beneficial for strategy implementation because CEOs create an environment in which followers feel trust and respect toward the leaders and are motivated to go beyond leaders' expectations (Engelen *et al.*, 2012). A study by Elenkov *et al.* (2005) reveals that possessing transformational leadership skills as a part of strategic leadership behaviors is crucial to executing the innovation strategy. The reason for this is that transformational leaders articulate a compelling vision through their openness to new ideas, take a facilitative approach to innovation goals, and foster innovation activity.

CEO transformational leadership is one of the crucial sources for creating organizational learning (Hult *et al.*, 2000; Slater and Narver, 1995). Transformational CEOs can influence learning orientation by being role models, showing individualized consideration (IC), promoting intellectual stimulation (IS), and providing IM among employees (Coad and Berry, 1998). With IC, transformational leaders pay personal attention to followers and focus on individual needs, including the need for learning and development. Thus, transformational leaders provide learning opportunities for followers to raise their skills and confidence. With IS, transformational leaders stimulate their followers to be more innovative and creative by questioning assumptions, rethinking problems, and finding new solutions. A transformational leader's behavior can motivate followers to learn and apply new knowledge in order to generate new ideas and solutions. With IM, transformational CEOs envision an attractive picture of the future and challenge their followers with high expectations. This behavior encourages followers to raise their efforts to attain this vision. Thus, followers will develop themselves through learning. Aragón-Correa *et al.* (2007) argued that transformational leaders play an important role in shaping firms' potential to generate innovations by creating an environment and making decisions that promote successful idea generation and implementation of knowledge. Implementing organizational learning requires supportive leaders who have transformational characteristics: being a good designer, master, mentor, challenger, and integrator and having a clear shared vision (Lloréns Montes *et al.*, 2005). Empirical results from various studies support the positive effects of transformational leadership on organizational learning (Aragón-Correa *et al.*, 2007; García-Morales *et al.*, 2011; Hult *et al.*, 2000; Noruzy *et al.*, 2013; Thanyasunthornsakun, 2012).

There is clear evidence that senior leaders are in a strategic position to shape the organizational culture (Sarros *et al.*, 2011). Wan *et al.* (2005) argue that top managers have an important but difficult role to play in shaping an innovation culture. Transformational leaders, who intellectually stimulate workers, articulate a strong vision, and emphasize innovation, help create an organizational climate where followers feel challenged to find innovative solutions (Gumusluoglu and Ilsev, 2009a). Transformational CEOs, who are inspirational and, ideally, influential, are likely to empower their followers in the search for or creation of optimal alternatives. Thus, creativity and risk

acceptance are encouraged among employees (Bass and Avolio, 1994), and an innovation culture is developed. Transformational leadership is significantly and negatively related to uncertainty avoidance (Ergeneli *et al.*, 2007). In other words, transformational leadership should be associated with uncertainty acceptance or risk-taking, which is an important element of an innovation culture. Jung *et al.* (2003) report that transformational leaders positively create an innovative climate and culture through empowerment and providing support for innovation. A study by Moriano *et al.* (2014) shows that transformational leadership has a positive effect on innovativeness and risk-taking, which are key elements of an innovation culture. Transformational leaders had a positive influence on employees' creativity (Khalili, 2016). Further, prior studies reveal that transformational leadership has a significant and positive relationship with an innovation-supporting culture (Jung *et al.*, 2003; Jung *et al.*, 2008; Tipu *et al.*, 2012). Thus, we propose that:

H1. CEO transformational leadership is positively associated with the innovation strategy.

H2. CEO transformational leadership is positively associated with organizational learning.

H3. CEO transformational leadership is positively associated with an innovation culture.

2.2 The roles of CEO transformational leadership on product innovation performance

Transformational leadership is often viewed as a style that supports innovation projects (Judge and Bono, 2000; Bono and Judge, 2004). With IM, transformational leaders inspire followers by challenging the followers' work and displaying commitment to goals and shared visions (Bass and Avolio, 1994). With a strong vision of innovation and a sense of power and confidence, transformational CEOs strive to ensure the market success of an innovation (Gumusluoglu and Ilsev, 2009b). Thus, transformational CEOs could motivate their followers to ensure the success of an innovation (Jung *et al.*, 2003). Song and Noh (2006) conclude that leaders who are visionary and inspirational motivators positively influence product innovation performance. With IS, transformational leaders encourage their followers to be creative and innovative by approaching old situations in new ways (Bass and Avolio, 1994). The followers' ideas are not criticized if they differ from the leaders' ideas. As a result, team climate and open communication among team members are strengthened and new ideas, as well as creative solutions, are developed by team members. Sun *et al.* (2012) report that transformational leadership has a positive effect on NPD team climate and performance in terms of quality of work and initiative. Consequently, NPD team climate and NPD team performance could facilitate NPD, which results in higher product innovation performance.

Based on empirical results, transformational leadership had a positive effect on product innovativeness and firm performance (Matzler *et al.*, 2008). Transformational leadership, as a part of strategic leader behavior, had a strong positive relationship with executive influence on product-market innovations (Elenkov *et al.*, 2005). Elenkov and Manev (2009) also report that visionary-transformational leadership influences the adoption of innovation, including product innovation. In addition, previous studies have revealed that transformational leadership was significantly and positively related to the performance of product innovation (Chen *et al.*, 2012; Chen *et al.*, 2014; Gumusluoglu and Ilsev, 2009a, b; Nijstad *et al.*, 2014). Therefore, we propose that:

H4. CEO transformational leadership is positively associated with product innovation performance.

2.3 The roles of the innovation strategy on the NPD processes and product innovation performance

An innovation strategy guides a firm in planning for NPD, aligning NPD goals with business goals and strategic plans, allocating necessary resources for NPD projects, and monitoring the progress of NPD projects. The NPD process can be successfully implemented if the innovation strategy is well defined. Without an innovation strategy, it is unknown how a firm prioritizes various types of innovation projects, what the objectives for innovation are, and how many resources are allocated, which leads to delay and harm the NPD process. The innovation strategy will identify the types and risk levels of innovation. Different types and risk levels of an innovation project should have different practices in the NPD process. For example, radical innovation projects, which have a higher level of risk than incremental innovation projects, need a more complex NPD process. An incremental innovation project is usually of low risk with low investment in R&D. The project may provide little benefit to customers, and then requires little modification from existing products. Thus, incremental innovation projects do not require a sophisticated NPD process with many stages. NPD stages and decision points could be skipped or combined, depending on the nature and risk of the project (Cooper and Kleinschmidt, 1995).

The innovation strategy of the company's NPD program can ensure that NPD projects receive sufficient resources. Moreover, the criteria for prioritizing NPD projects can reduce conflicts among NPD team members and accelerate the process of product definition (Parry *et al.*, 2009). Additionally, Salomo *et al.* (2007) reveal that business planning is a crucial antecedent of project and risk planning, which supports the quality of NPD process management. Thus, an innovation strategy, which is a part of business strategy and business planning, can influence the implementation of the NPD process.

It is generally agreed that firms with formal strategies performed better than those without strategies (O'Regan *et al.*, 2006). An innovation strategy is a firm's strategic action, which can drive a firm's competitive advantage and financial performance (Wei and Wang, 2011). Oke *et al.* (2012) argue that executing an innovation strategy can ensure that a firm focuses on objectives for innovation and NPD. With an innovation strategy, a firm emphasizes developing innovation, including product innovation, through the allocation of sufficient resources. Moreover, top management has a commitment to innovation by spending time and taking a facilitative approach to supporting innovation. NPD projects will be regularly reviewed to ensure that NPD goals are achieved. Fruhling and Siau (2007) conclude that an innovation strategy can improve the management of a company's innovation capabilities. An innovation strategy also strengthens a firm's commitment to innovation and the formal setting for innovation (Nybakk and Jenssen, 2012). Therefore, an innovation strategy can enhance innovation capabilities and formalized approaches, which, in turn, contributes to product innovation performance. Crespell and Hansen (2008) concluded that having innovation as a core part of a firm's strategy could affect firm innovativeness, leading to better firm performance.

Based on empirical results, having an innovation strategy showed a positive and significant relationship with business performance (Morgan and Berthon, 2008; Nybakk and Jenssen, 2012), SME performance (including the success of new products launched and improved product innovation) (Terziovski, 2010), innovation performance (Li and Atuahene-Gima, 2001; Oke *et al.*, 2012), and new product sales and profits (Markham and Griffin, 1998). Therefore, we put forward the following hypotheses:

H5. An innovation strategy is positively associated with the NPD process.

H6. An innovation strategy is positively associated with product innovation performance.

2.4 The role of organizational learning on the NPD process

Organizational learning is a complex process that contributes to the development of new knowledge and the potential to change behavior (Huber, 1991; Slater and Narver, 1995). The literature suggests that organizational learning could enhance firms' innovative capability (Škerlavaj *et al.*, 2010), which relates to the implementation of the NPD process. Thus, organizational learning that involves team learning and the utilization of employees' knowledge could be beneficial for the NPD process. Innovation requires employees to acquire existing knowledge and share this knowledge within the firm. Innovation also requires the transformation and exploitation of existing knowledge (Jiménez-Jiménez and Sanz-Valle, 2011). The NPD process requires the NPD team to share their knowledge and experiences, which is useful in both the initiation and implementation stages. When team members are encouraged to learn, share new ideas, and influence group decisions, the NPD team is more innovative (Hurley and Hult, 1998). Thus, organizational learning would be valuable for the implementation of the NPD process.

The practice of managing learning and knowledge plays a crucial role in the innovation process (Alegre *et al.*, 2011). Saban *et al.* (2000) suggest that organizational learning can affect product innovation performance, and should be considered a critical component of the NPD process. Firms should adopt a holistic organizational learning style that enables them to be more knowledgeable about the factors that cause successful or failed products. Thus, a firm can adjust its decision and behavior to better implement the NPD process. The NPD process, which is usually a complex, innovative activity, requires firms to coordinate and exchange knowledge between firms and users, which implies effective organizational learning (Meeus *et al.*, 2001). Based on the empirical results, Mat and Razak (2011) conclude that organizational learning capability positively affects the implementation of the NPD process:

H7. Organizational learning is positively associated with the NPD process.

2.5 The roles of the innovation culture on the NPD process and product innovation performance

Organizational culture is one of the key intangible assets that can make the firm more competitive. Organizational culture plays a key role in managing innovation (Škerlavaj *et al.*, 2010). An organizational culture, which supports experimentation and allows employees to take risks without fear, might contribute to the innovation (Makri and Scandura, 2010) and NPD processes. In addition, organizational culture has a significant impact on the performance of a cross-functional team, the norms of behavior, and the innovation process (Slater *et al.*, 2014). Value supporting innovation positively affects employees' innovative behaviors (Hogan and Coote, 2014). An innovation culture encourages employees to be creative, open, and flexible. These characteristics of culture should promote the implementation of the NPD process, which emphasizes creativity, open communication, and flexibility. Creativity could support idea generation for NPD. Openness helps NPD team members from different functions to share ideas and find new solutions. An innovation culture influences employees' creative and problem-solving skills and leads to higher levels of participation in the NPD process (Tidd *et al.*, 1997). An innovation culture also values customer orientation, which is crucial for the NPD process. Customer orientation helps a firm to better understand customers' needs, and information from customers is valuable for the NPD process. Tipu *et al.* (2012) also report that an innovation-supporting culture strongly predicts innovation propensity. In other words, an innovation culture contributes to the reflection of innovation in the organizational processes.

To boost product innovation, firms should pay attention to their organizational cultures, since culture can both promote and inhibit product innovation (Valencia *et al.*, 2010).

Cooper (2011) concludes that organizational culture proves to be the strongest driver of product innovation performance. The nurture and development of an innovation culture is crucial for companies seeking better innovation (Wan *et al.*, 2005). The primary reason for this is that an organizational culture can nurture workers' innovative behaviors and can foster employees' motivation to innovate by emphasizing the importance of innovation, stimulating employees to believe in innovation as an organizational value, and specifying that employees should behave innovatively (Hartmann, 2006).

There are key elements of innovation culture that enhance product innovation. These elements, for example, are creativity (Dobni, 2008; Liao *et al.*, 2012; Panuwatwanich *et al.*, 2008; Prajogo and McDermott, 2011; Valencia *et al.*, 2010), openness (Enzing *et al.*, 2011; Valencia *et al.*, 2010), customer focus (Dobni, 2008; Prajogo and McDermott, 2011), external orientation (Büschgens *et al.*, 2013; Dombrowski *et al.*, 2007; Valencia *et al.*, 2010), and risk-taking (Herrmann *et al.*, 2007; Liao *et al.*, 2012; Uzkurt *et al.*, 2013; Valencia *et al.*, 2010; Wan *et al.*, 2005). Taken together, firms that strive for product innovation would then need an innovation culture that values creativity, openness, customer focus, external orientation, and risk-taking. Thus, we propose the following hypotheses:

H8. An innovation culture is positively associated with the NPD process.

H9. An innovation culture is positively associated with product innovation performance.

2.6 The role of the NPD process on product innovation performance

Considering the effect of the NPD process on product innovation performance, Akroush (2012) reports that the NPD process has a positive effect on a new product's competitive advantage, which influences a positive impact on product innovation performance. Buganza *et al.* (2010) reveal that the adoption of a formal development process, formal project plan, and standard project organization for the NPD process is positively related to the firm's revenue growth. Lynn *et al.* (1999) and Salomo *et al.* (2007) argue that NPD process management is an important predictor of product innovation performance. The NPD process can reduce ambiguity for team members when working together because an effective NPD process must determine criteria for evaluating NPD projects during each stage. In addition, NPD goals, budgets, and schedules are specified, and NPD projects are reviewed on a regular basis. Thus, the NPD process could positively affect product innovation. Moreover, the good practice of the NPD process should involve the collaboration of employees from different functions. McNally *et al.* (2011) found that internal integration measured by the functional diversity and information integration from team members had a positive effect on product quality and speed to market, which contribute to product profitability.

Product innovation performance is affected by several factors including NPD process characteristics (Cooper and Kleinschmidt, 1995, 2007; Henard and Szymanski, 2001; Kahn *et al.*, 2012; McNally *et al.*, 2011) and NPD process proficiency (Song and Noh, 2006). The NPD process is the firm's core capability and is shown to have a positive impact on the NPD program (Reid and Brady, 2012). The NPD process consisting of initiation and implementation processes contributes to new product performance (Im *et al.*, 2003). In other words, consistently executing initiation and implementation processes could positively affect product innovation, which contributes to higher financial performance. Thus, it was hypothesized:

H10. The NPD process is positively associated with product innovation performance.

3. Methodology

3.1 Data collection and sample

This study collected large-scale data through a self-administered mail survey of manufacturing firms in Thailand. The sources of firm databases were derived from the

National Science Technology and Innovation Policy Office of Thailand, the National Science and Technology Development Agency, and the National Innovation Agency. The cover letter requested a firm to send the questionnaire to an executive or a manager responsible for R&D, marketing, manufacturing, or other functions related to NPD. A total of 354 questionnaires were received, representing a response rate of 9.11 percent. The response rate for this survey was lower than expected, but was close to previous studies in the operations management field (e.g. Goktan and Miles, 2011; Li *et al.*, 2005; Shah and Ward, 2007). There were 85 unusable questionnaires due to their missing data or lack of information on a firm's product innovation performance. There were 269 remaining usable questionnaires.

3.2 Measurement

The measurement items used in the survey were derived from the literature and verified through a Q-sort method. The Q-sort method is an iterative process to initially evaluate reliability and construct validity of questionnaire items before they will be used in survey research (Nahm *et al.*, 2002). The concept of the Q-sort method is to have experts act as judges and sort items into several groups, with each group corresponding to a factor or dimension based on the agreement between judges (Moore and Benbasat, 1991). All items in the questionnaires were measured using a five-point Likert scale from 1 "strongly disagree" to 5 "strongly agree." A list of all measurement items is provided in Table I.

3.2.1 CEO transformational leadership. The operational definition of CEO transformational leadership derives from the concept of the "Four Is" developed by Bass and Avolio (1994, 1995): idealized influence (II), inspirational motivation (IM), intellectual stimulation (IS), and individualized consideration (IC). The CEO transformational leadership construct consists of four first-order constructs, as shown in Figures 1 and 2. The measurement items are adopted from Engelen *et al.* (2012), García-Morales *et al.* (2008), Sun *et al.* (2012), and Thanyasunthornsakun (2012) to evaluate whether their CEOs display the behavior described in each item.

3.2.2 Innovation strategy. The innovation strategy is operationalized on the degree to which a firm focuses on an innovation strategy. The measurement items for the innovation strategy were adapted from Oke *et al.* (2012), Terziovski (2010), and Wei and Wang (2011).

3.2.3 Organizational learning. The operational definition of organizational learning is based on the four processes of organizational learning by Huber (1991). These processes are knowledge acquisition (KA), information distribution (ID), information interpretation (INI), and organizational memory (OM). The organizational learning construct consists of four first-order constructs, as illustrated in Figures 1 and 2. Organizational learning is measured as to what extent a firm manages the four processes. The measurement items were adapted from Jiménez-Jimenez *et al.* (2008), Jiménez-Jiménez and Sanz-Valle (2011), and López *et al.* (2005).

3.2.4 Innovation culture. An innovation culture is operationalized as whether company values are favorable to exploring new opportunities, developing innovation, and facilitating employees' innovative behaviors. The measurement items are related to such cultural elements as risk-taking, creativity, and openness. The measures were adopted from Hammedi *et al.* (2013), Terziovski (2010), and Uzkurt *et al.* (2013).

3.2.5 The NPD process. The NPD process is measured by the extent to which a firm implements its NPD process. The measurement items were adopted from Cooper and Kleinschmidt (2007), Im *et al.* (2003), and Kahn *et al.* (2012).

3.2.6 Product innovation performance. The operational definition of product innovation performance captures both financial and non-financial performances of improved or new products introduced by a firm within the last three years. The measurements derive from the literature. Sample items for product innovation performance are "new products achieved the company's stated objectives of the percentage of sales with respect to new products,

Constructs and items	Factor loading	*t*-value	*p*-value
(1) CEO transformational leadership (CR = 0.95, AVE = 0.83)			
(1.1) CEO idealized influence (II)			
II1, CEO is admired	0.78	15.043	***
II2, CEO leads by example	0.81	15.854	***
II3, CEO demonstrates high standard of ethics and moral conduct	0.86	–	–
(1.2) CEO inspirational motivation (IM)			
IM1, CEO motivates the followers by communicating that vision is achievable	0.87	16.244	***
IM2, CEO gets the group to work together for the same goal	0.89	16.684	***
IM3, CEO clearly communicates about the expectations that the followers need to meet	0.80	–	–
(1.3) CEO intellectual stimulation (IS)			
IS1, CEO purposefully seeks different perspectives when solving problems	0.84	16.418	***
IS2, CEO challenges employees to think about old problems in new ways	0.81	15.550	***
IS3, CEO stimulates employees to rethink some things that they never have questioned before	0.77	14.351	***
IS4, CEO gets employees to look at problems from many different angles	0.83	–	–
(1.4) CEO individualized consideration (IC)			
IC1, CEO can help employees to improve their professionalism	0.88	20.822	***
IC2, CEO is capable of guiding his/her followers on their jobs	0.87	20.249	***
IC3, CEO always supports employees to continuously develop their skills, knowledge, and expertise	0.86	19.817	***
IC4, CEO treats employees as individuals rather than just as members of the group	0.85	–	–
(2) Innovation strategy (CR = 0.90, AVE = 0.65)			
INS1, The company emphasizes the need for innovation for a company growth	0.73	9.187	***
INS2, The company sets objectives for innovation	0.89	10.383	***
INS3, The company strategy has a priority on various types of innovation	0.93	10.523	***
INS4, The company has a plan to focus on different types of innovation (product, process, business models, etc.)	0.80	10.548	***
INS5, There is the strategy on collaborating with external partners to seek ideas for innovation	0.58	–	–
(3) Organizational learning (CR = 0.93, AVE = 0.77)			
(3.1) Knowledge acquisition (KA)			
KA1, Employees attend fairs and exhibitions to gain new information and knowledge regularly	0.62	8.993	***
KA2, New ideas and approaches on work performance are gathered and experimented continuously	0.80	11.504	***
KA3, The company collects and uses the information generated during organizational changes such as NPD and process improvement	0.86	12.063	***
KA4, Information from customers is regularly obtained	0.69	–	–
(3.2) Information distribution (ID)			
ID1, Information about the aims of the company is always distributed to employees	0.56	8.478	***
ID2, The company has formal mechanisms to guarantee the sharing of the best practices among the different fields of the activity	0.76	11.585	***
ID3, When something important happens to major customers, the whole company knows about it shortly	0.62	9.450	***
ID4, When one unit finds out something important about competitors, it is fast to alert other units	0.72	–	–

(*continued*)

Table I. Results of confirmatory factor analysis

Constructs and items	Factor loading	*t*-value	*p*-value
(3.3) Information interpretation (INI)			
INI1, The company tries to develop an interpretation as uniform as possible of relevant information	0.73	14.452	***
INI2, Market information is interpreted by members from various functions	0.69.	12.813	***
INI3, The company develops a shared understanding in the company of the available market information	0.88	20.003	***
INI4, Several opinions are considered to assess and interpret market situations	0.90	–	–
(3.4) Organizational memory (OM)			
OM1, The company has databases to store its experiences and knowledge so as to be able to use them later on	0.79	16.189	***
OM2, Databases are always kept up-to-date	0.88	19.197	***
OM3, The company has stored a great deal of knowledge about its market.	0.89	–	–
(4) Innovation culture (CR = 0.87, AVE = 0.59)			
INC1, The company actively seeks innovative ideas	0.78	12.418	***
INC2, The company culture encourages employees to share knowledge	0.83	13.208	***
INC3, The company encourages risk-taking efforts.	0.64	10.219	***
INC4, The company culture encourages the collaboration with external partners such as suppliers and customers	0.81	12.927	***
INC5, The company rewards behaviors that relate to creativity and innovation	0.75	–	–
(5) NPD process (CR = 0.92, AVE = 0.63)			
NPD1, NPD process consists of formal stages of development activities	0.72	11.191	***
NPD2, Go/ no-go criteria are clear and predefined for each review gate of NPD process	0.74	11.507	***
NPD3, NPD process is flexible to meet the needs, size, and risk of individual projects	0.77	11.190	***
NPD4, The company applies a systematic new idea screening procedure	0.83	12.806	***
NPD5, There is a preliminary market assessment before a project of new product moves to development phase	0.80	12.298	***
NPD6, There is a preliminary technical assessment before a project of new product moves to development phase	0.79	12.186	***
NPD7, The company makes strong marketing promotion efforts for new product launch	0.73	–	–
(6) Product innovation performance (CR = 0.91, AVE = 0.69)			
PIP1, New products achieve the company's stated objectives of the percentage of sales with respect to new products, against total sales	0.91	12.729	***
PIP2, New products achieve the company's stated objectives of sales	0.97	13.281	***
PIP3, New products achieve the company's stated objectives of market share	0.93	12.940	***
PIP4, The number of product innovations developed by my company is higher than that of major competitors.	0.59	15.432	***
PIP5, The level of newness of the company's new products is greater than that of major competitors	0.65	–	–

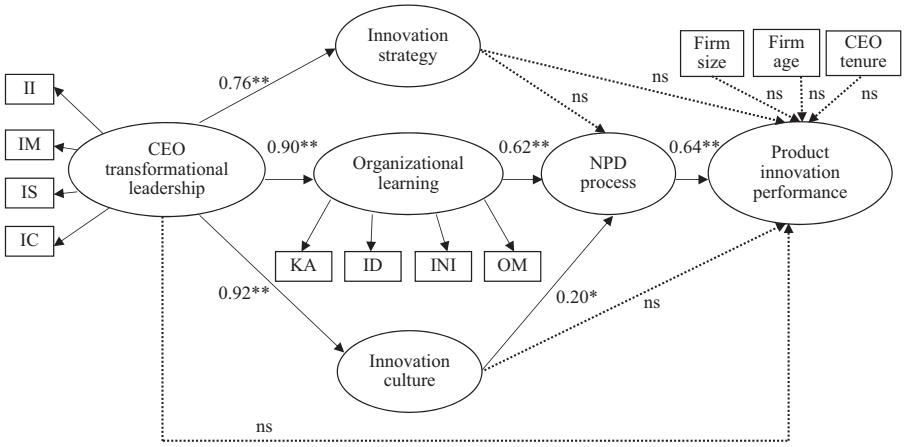
Table I.

Note: ***Significant at 0.001 level

against total sales" (Gumusluoglu and Ilsev, 2009a, b; Wei and Atuahene-Gima, 2009; Zhang *et al.*, 2009) and "the level of newness of the company's new products is greater than that of major competitors" (Hernández-Espallardo and Delgado-Ballester, 2009; Tsai *et al.*, 2011; Zhang and Duan, 2010).

3.3 Control variables

Firm size and firm age are commonly found to influence NPD activities and innovation outcomes (Chen *et al.*, 2012; Chen *et al.*, 2014; Jung *et al.*, 2003; Rhee *et al.*, 2010).



Notes: *$p<0.05$; **$p<0.001$

Figure 2.
The hypothesized structural model results

A meta-analysis of 53 studies (Camisón-Zornoza *et al.*, 2004) also confirmed the existence of a significant and positive correlation between organizational size and innovation. CEO tenure was also found to be significantly related to his/her transformational leadership (Jung *et al.*, 2008). Thus, firm size, firm age, and CEO tenure are control variables in this study.

3.4 Non-response bias

To detect non-response bias, the data were tested to discover whether there were statistical differences between early respondents and late respondents (the first and last 25 percent of the sample) (Armstrong and Overton, 1977; Hammedi *et al.*, 2013). The results from a χ^2 test showed that there were no significant differences between the first and fourth quartiles of respondents in terms of position of respondents, industry, firm age, firm size, and revenue, and CEO tenure. In addition, the *t*-test revealed that all constructs have equality of means at 0.05 significance level. Therefore, it can be concluded that this study was not affected by a non-response bias.

3.5 Common method variance

Data for all variables were obtained from the same source using a self-report questionnaire. Thus, common method variance should be considered. To test for the potential common method bias, a Harman's one-factor test was conducted (Podsakoff and Organ, 1986). An exploratory factor analysis was also conducted; all measurement items accounted for 71.2 percent of the total variance, while the first (largest) factor explained 38.4 percent of the total variance. The results indicated that no single dominant factor existed. Thus, the common method variance was not an issue for this study.

4. Results

This study applies a two-step structural equation modeling (SEM) process, as recommended by Anderson and Gerbing (1988) and Hair *et al.* (2010). In the first step, the fit and construct validity of the measurement models was tested by confirmatory factor analysis (CFA). Once a satisfactory measurement model was achieved, the second step was to test the structural model (Hair *et al.*, 2010).

4.1 The measurement model

To ensure the validity and reliability of each construct, convergent validity was evaluated using standardized factor loadings, average variance extracted (AVE) and fit indices of the measurement model from the CFA, and construct reliability was assessed using the composite reliability (CR) score. As shown in Table I, all factor loadings for each item with respect to its construct were statistically significant ($p < 0.001$) and were higher than 0.5, as recommended by Hair *et al.* (2010). Additionally, AVE scores of all constructs were above 0.5, which suggests adequate convergence (Hair *et al.*, 2010). The CR of each construct ranged from 0.87 to 0.95, which met the recommended level of CR at 0.7 (Hair *et al.*, 2010). Table II summarizes the fit indices for all six latent variables. The fit indices from the CFA of all constructs met the acceptable level, thus confirming the convergent validity.

Table III reports the descriptive statistics and correlation matrix of the first-order constructs. According to Table III, the intercorrelations between the two constructs were less than the square root of the AVE estimates of the two constructs, supporting the evidence of discriminant validity (Fornell and Larcker, 1981; Hair *et al.*, 2010).

4.2 Hypothesis testing

Analyses were conducted at the firm level to test the relationships between CEO transformational leadership, innovation strategy, organizational learning, innovation culture, NPD processes, and product innovation performance as depicted in Figure 2.

Because SEM requires a high ratio of number of observations to number of parameters estimated (the ratio should be at least 5:1) (Bentler and Chou, 1987), the hypothesized model used summated scales for the first-order constructs of CEO transformational leadership and organizational learning. By doing so, the number of parameters estimated considerably decreased, and the number of observations to number of parameters estimated increased. Using a parcel instead of several indicators results in a smaller covariance matrix, which, in turn, could improve the model fit (Williams and O'Boyle, 2008). This study adopted a total aggregation parceling approach by combining all indicators of first-order constructs into a single indicator (Škerlavaj *et al.*, 2010; Williams and O'Boyle, 2008). According to Figure 2, CEO transformational leadership and organizational learning, which are second-order constructs, consist of four parcels representing four theoretical first-order constructs.

In SEM, the estimation of the parameters of the hypothesized models and the assessment of goodness of fit are the primary goals (Hu and Bentler, 1999). This study used the AMOS application and maximum likelihood estimation technique to test the structural model. Similar to CFA, two types of indices, absolute fit and incremental fit, were used to evaluate the fitness of the structural model. These indices were χ^2/df, GFI, CFI, TLI, and RMSEA. χ^2/df should be less than or equal to 3.00 (Chau, 1997), and GFI should be greater than 0.90 (Chau, 1997); however, a value between 0.80 and 0.90 is acceptable (Joreskog and Sorbom, 1989). A CFI or TLI value greater than 0.90 indicates a good fit (Chau, 1997; Hair *et al.*, 2010). A value for RMSEA below 0.05 indicates a good fit (Joreskog and Sorbom, 1989).

Table II.
A summary of the fit indices for the constructs

Constructs	χ^2	df	χ^2/df	GFI	CFI	TLI	RMSEA
CEO transformational leadership	141.99	72	1.97	0.94	0.97	0.96	0.06
Innovation strategy	4.06	3	1.35	0.99	1.00	1.00	0.04
Organizational learning	134.90	82	1.65	0.94	0.98	0.97	0.05
Innovation culture	7.81	5	1.56	0.99	0.99	0.99	0.05
NPD process	16.36	11	1.49	0.98	1.00	0.99	< 0.01
Product innovation performance	3.76	4	0.94	0.99	1.00	1.00	< 0.01

Table III.
Descriptive statistics and correlation matrix of the first-order constructs

Constructs	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12
(1) Idealized influence (II)	4.26	0.66	0.79											
(2) Inspirational motivation (IM)	4.11	0.74	0.66	0.85										
(3) Intellectual stimulation (IS)	4.03	0.69	0.64	0.65	0.82									
(4) Individualized consideration (IC)	4.09	0.69	0.57	0.58	0.67	0.88								
(5) Innovation strategy	3.79	0.80	0.47	0.50	0.55	0.46	0.81							
(6) Knowledge acquisition (KA)	3.72	0.77	0.38	0.43	0.48	0.45	0.61	0.76						
(7) Information distribution (ID)	3.88	0.69	0.44	0.48	0.52	0.49	0.50	0.64	0.70					
(8) Information interpretation (INI)	3.55	0.80	0.44	0.45	0.50	0.45	0.57	0.62	0.69	0.82				
(9) Organizational memory (OM)	3.78	0.87	0.46	0.43	0.45	0.49	0.54	0.63	0.67	0.72	0.85			
(10) Innovation culture	3.62	0.83	0.48	0.52	0.52	0.46	0.65	0.68	0.67	0.63	0.65	0.77		
(11) NPD process	3.58	0.85	0.37	0.36	0.44	0.38	0.58	0.66	0.61	0.66	0.66	0.65	0.79	
(12) Product Innovation performance	3.12	0.91	0.24	0.21	0.31	0.23	0.45	0.50	0.40	0.48	0.49	0.46	0.62	0.83

Note: The shaded numbers in the diagonal row are the square roots of the average variance extracted (AVE) estimates

A RMSEA value up to 0.08 is considered a reasonable error of approximation in the population (Browne and Cudeck, 1993; Moore, 2005).

Figure 2 presents the hypothesis testing results from SEM. From ten hypotheses, six hypotheses (*H1*, *H2*, *H3*, *H7*, *H8*, and *H10*) were significantly supported. However, the other four hypotheses (*H4*, *H5*, *H6*, and *H9*) were not statistically supported (as shown by dotted lines). The model fit measures are $\chi^2/df = 1.77$, GFI = 0.84, CFI = 0.94, TLI = 0.94, and RMSEA = 0.05. These fit indices meet the acceptable threshold, representing that the structural model is well fitted to the proposed model and the data. The structural model explains about 74 and 39 percent of the variance of the NPD process and product innovation performance, respectively. Thus, the hypothesized structural model adequately supports the linkages between CEO transformational leadership, organizational factors, and product innovation performance.

H1 proposes that CEO transformational leadership would be positively associated with innovation strategy. As shown in Figure 2, this relationship was confirmed ($\beta = 0.76$, $p < 0.001$). Thus, *H1* is supported. *H2* predicts that CEO transformational leadership is positively associated with organizational learning. The SEM results showed that CEO transformational leadership was positively associated with organizational learning ($\beta = 0.90$, $p < 0.001$), thus supporting *H2*. *H3* proposed that CEO transformational leadership was positively associated with innovation culture. This relationship was confirmed ($\beta = 0.92$, $p < 0.001$), thus supporting *H3*.

H4 is not supported by the data. CEO transformational leadership was not positively and significantly associated with product innovation performance ($\beta = -0.26$, $p = 0.391$). *H5* is also not supported. The findings showed that the level of innovation strategy was not associated with the NPD process ($\beta = 0.09$, $p = 0.164$). Further, *H6* is not statistically supported. The level of innovation strategy had a positive but non-significant effect on product innovation performance ($\beta = 0.11$, $p = 0.262$).

H7 proposes that organizational learning is positively associated with the NPD process. The findings supported the existence of a strong and positive relationship between organizational learning and the NPD process ($\beta = 0.62$, $p < 0.001$), thus supporting *H7*. *H8* suggests a positive association between innovation culture and the NPD process. As shown in Figure 2, the results supported this hypothesis, confirming that innovation-supporting culture significantly facilitated the NPD process ($\beta = 0.20$, $p < 0.05$).

H9 predicts that an innovation culture positively affects product innovation performance. The results of this hypothesis testing indicated that innovation culture was not significantly associated with product innovation performance ($\beta = 0.15$, $p = 0.510$). Thus, *H9* is not supported.

H10 proposes that the NPD process significantly affects product innovation performance. The findings indicated that the NPD process had a strong and positive effect on product innovation performance ($\beta = 0.64$, $p < 0.001$). Therefore, *H10* is supported.

5. Discussion

The primary objective of this study was to investigate the effects of CEO transformational leadership on product innovation performance at the firm level. A theoretical framework presenting the connection between CEO transformational leadership, organizational factors, and product innovation performance is proposed and tested using the SEM.

The findings from *H1-H3* explained that CEO transformational leadership was positively associated with innovation strategy, organizational learning, and innovation culture. However, according to *H4*, CEO transformational leadership was not found to be associated with product innovation performance. There are a few ways to explain the unexpected result of *H4*. First, the direct effect of CEO transformational leadership on product innovation performance was fully mediated by intervening variables. Second, under

the limitation of a cross-sectional study, the time lag may conceal the direct effect of CEO transformational leadership on product innovation performance. CEO transformational leadership is a subjective or intangible factor, and it may not immediately influence product innovation performance, which is a tangible factor. Thus, CEO transformational leadership did not directly affect product innovation performance. Instead, CEO transformational leadership indirectly influenced product innovation performance through mediating factors.

The findings from *H5* and *H6* showed that innovation strategy did not affect the NPD process or product innovation performance. There are some explanations as to why the findings of these hypotheses were not as expected. First, an innovation strategy is a broad firm strategy aimed for various types of innovations including product, service, process, or business model innovation. It may not explain whether a firm has an effective strategy for NPD. Thus, a high level of innovation strategy is not directly related to the level of NPD process efficiency. Second, the NPD process had many stages of development activities. An innovation strategy may influence only a few stages, especially during the planning and initiation stages; an innovation strategy focuses on the plan and objectives for innovation rather than the mechanism of the NPD process. Third, an innovation strategy is executed at the top management level. Thus, an innovation strategy may not directly influence the performance of new products. The NPD strategy, rather than an innovation strategy, should influence product innovation performance. In fact, a study by Kahn *et al.* (2012) reports that NPD practitioners rank the NPD strategy as the most important factor leading to new product success.

The results from *H7* and *H8* confirmed that organizational learning and innovation culture positively influenced the NPD process. The findings from this research revealed that innovation culture, which encourages employees to seek new opportunities and share knowledge, positively influenced the NPD process. Nevertheless, the effect size of the relationship between innovation culture and the NPD process was not high. The possible explanation is that innovation culture is more related to organizational climate and employees' innovative behaviors than the organizational processes. Unlike innovation culture, organizational learning, which is the process of KA, ID, INI, and OM, is more closely related to the process of NPD. The NPD process requires information and knowledge exchange among team members in every stage of NPD. Thus, this study found a strong positive association between organizational learning and the NPD process.

Regarding the relationship between innovation culture and product innovation performance (*H9*), the results showed that innovation culture was not significantly associated with product innovation performance. There are prior studies supporting the positive relationship between innovation culture and innovation performance (Liao *et al.*, 2012; Panuwatwanich *et al.*, 2008; Uzkurt *et al.*, 2013); however, the study samples were firms in service industries such as banking and design firms. Additionally, a meta-analysis of 233 studies by Evanschitzky *et al.* (2012) reveals that the effects of an organizational climate are stronger for services than for products, and are stronger in North America and Europe than Asia. Based on the data from only manufacturing firms in Thailand, the findings of this study did not significantly show the direct association between innovation culture and product innovation performance.

H10 explored the relationship between the NPD process and product innovation performance. The findings indicated that the NPD process had a strong and positive effect on product innovation performance. The results of this research were consistent with the literature (Cooper, 1994; Cooper and Kleinschmidt, 2007; Im *et al.*, 2003; Lynn *et al.*, 1999; Reid and Brady, 2012; Song and Noh, 2006). These studies confirmed that an effective NPD process significantly contributed to product innovation and, thus, better financial performance of new products.

6. Theoretical contributions and managerial implications

The findings of this study contribute to both theory and practice. This study shed light on several unresolved issues in the leadership and innovation literature. First, the findings have filled the research gap suggested by Gumusluoglu and Ilsev (2009a, b), and Makri and Scandura (2010). They recommended that researchers investigate the processes that mediate the relationship between leadership and innovation. Crossan and Apaydin (2010) and Oke *et al.* (2009) also concluded that the linkages between leadership and the innovation process have not been explicitly studied. To be parsimonious, this study chose CEO transformational leadership as the independent variable and product innovation performance as the dependent variable. Organizational factors, including innovation strategy, innovation culture, organizational learning, and the NPD process, were mediating variables. The findings indicated that CEO transformational leadership did not directly influence product innovation performance. Rather, it indirectly affected product innovation performance through innovation culture, organizational learning, and the NPD process. Thus, this study can provide a framework that explains the mechanism between CEO transformational leadership and product innovation performance.

Second, the results highlight the critical intervening role of organizational learning in the linkage between CEO transformational leadership and product innovation performance. Organizational learning was strongly influenced by CEO transformational leadership. Additionally, organizational learning is a crucial antecedent for product innovation performance since organizational learning strongly affects the NPD process, which, in turn, influences product innovation performance. Organizational learning considerably contributes to the NPD process by acquiring, sharing, interpreting, and memorizing knowledge required for the process of product development. In fact, compared with innovation culture and innovation strategy, organizational learning had the strongest positive influence on the NPD process.

Third, the NPD process had a large direct impact on product innovation performance. This result was consistent with several prior studies from different contexts (i.e. industries and countries). For instance, a study by Cooper and Kleinschmidt (2007) confirmed that a high-quality NPD process was the strongest driver of the profitability of product innovation. Thus, we may conclude that the implementation of a systematic NPD process is a universal key factor and is necessary to ensure the high performance of product innovation.

Besides theoretical contributions, the findings of this study offer important managerial implications. First, to boost product innovation performance, a CEO should develop his/her transformational leadership skills and behaviors. Even though transformational leadership does not directly influence product innovation performance, it can help promote an innovation culture and organizational learning, which, in turn, influence the NPD process and product innovation performance. For example, when a CEO shows his/her intellectual stimulation by challenging employees to rethink an issue they never have questioned before, creativity and risk-taking behaviors will be encouraged, and an innovation culture will be developed. Moreover, to prepare for future top management, a firm that emphasizes innovation should integrate transformational leadership aspect into its executive development program.

Second, top leaders must recognize that organizational learning provides a crucial mediating link between CEO transformational leadership, the NPD process, and product innovation performance. Managers should emphasize organizational learning to better facilitate the NPD process and product innovation performance. Four processes of organizational learning (KA, ID, INI, and OM) should be developed and embedded in the NPD process. How to effectively manage and utilize information and knowledge as key intangible assets can be a firm's competitive advantage that contributes to an effective NPD process and product innovation performance.

7. Limitations and future research

While the findings of this study provide both theoretical contributions and managerial implications, the study also has limitations. First, because data were collected only from manufacturing firms in some industries in Thailand, the generalizability of the findings is limited. Thus, future research may collect data from different contexts, such as service sectors, and compare the results between manufacturing and service industries. By doing so, future research can help extend the understanding of the connection between CEO transformational leadership and product/service innovation performance.

Second, this study may not cover all factors associated with product innovation performance. Future research may expand the current theoretical framework by integrating additional mediating or moderating variables into the analysis. For instance, researchers may examine the mediating effects of the NPD strategy on the relationship between CEO transformational leadership, innovation strategy, and product innovation performance. In addition, this study used the NPD process as a single construct. Future studies may analyze the effects of different stages of the NPD process (e.g. concept evaluation, product development, launch and post launch) on the leadership and product innovation relationship. Alternatively, future research might examine the effects of the four dimensions of organizational learning on different phases of the NPD process.

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