





on MLQ scales, Avolio, Bass, and Jung (1999) proposed a six-factor model using a reduced set of items producing the best fit to the data when compared to a series of nested models.

In a recent study, Rafferty and Griffin (2004) re-examined the theoretical model developed by Bass (1985) and identified five sub-dimensions of transformational leadership including vision, inspirational communication, intellectual stimulation, supportive leadership, and personal recognition. Confirmatory factor analysis provided support for the five factor structure of transformational leadership measures. The definitions of the five sub-dimensions and definitions are described in Table 1.

2.2. Organizational culture

The concept of culture has been the subject of considerable academic debate in the last 25 years and there are various approaches to define and study culture. Schein (2004) defined organizational culture as “the tacit, unwritten rules for getting along in the organization; the ropes that a newcomer must learn in order to become an accepted member; the way we do things around here”. While Deal and Kennedy (1999) focused on espoused values and defined culture as the articulated, publicly announced principles and values that the group claims to achieve, such as “product quality” or “price leadership”. From linguistic paradigms perspective, Hofstede and Hofstede (2005) defined culture as the shared cognitive frames that guide the perceptions, thought, and language used by the members of a group and taught to new members in the early socialization process.

By synthesizing and analyzing previous definitions, Schein (2004) proposed a three-level framework of organizational culture that ranges from the very tangible overt manifestations that one can see and feel to the deeply embedded, unconscious, basic assumptions, in between the two levels are various espoused beliefs, values, norms, and rules of behavior, as depicted in Fig. 1.

The level of underlying assumptions represents the belief systems that individuals have towards human behavior, relationships, reality, and truth. The middle level of espoused beliefs and values represents a manifestation of culture that signify espoused beliefs identifying what is important to a particular cultural group, and these values answer the question as to why people behave the way they do. While the third level of artifacts represents the most visible manifestations and creations of culture (Schein, 2004).

Within the three levels of organizational culture, artifacts are easy to observe but difficult to decipher, and basic assumptions are invisible and preconscious thus are not easily studied. To understand the culture characteristics of an organization, one must attempt to get at its shared basic assumptions, and the middle level of espoused beliefs and values may be particularly useful in explaining how top leadership transforms the beliefs and values that get a group move in dealing with its internal and external problems (Schein, 2004).

The three-level framework has provided a qualitative description of organizational culture. Majority studies conceptualized organizational culture from level of values and quantitatively divided organizational culture into different typologies. Drawing on Competing Values Framework (CVF), Quinn and Spreitzer (1991)

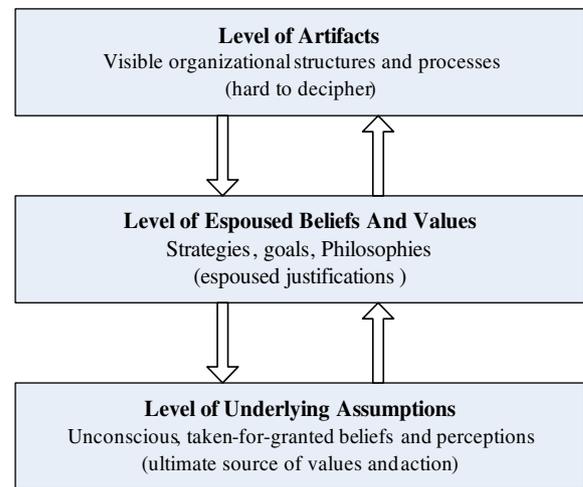


Fig. 1. Three levels of organizational culture.

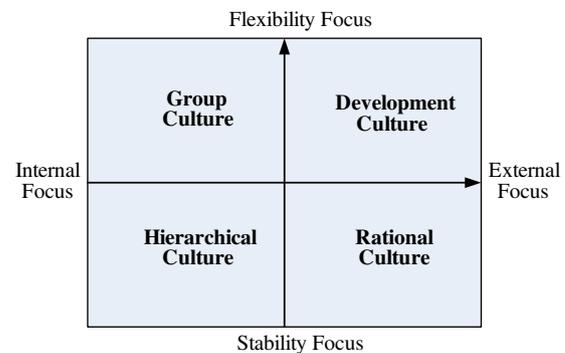


Fig. 2. Organizational culture typology based on competing values model.

divided organizational culture into four typologies—development culture, group culture, hierarchical culture and rational culture from internal vs. external value orientation as well as stability vs. flexibility value orientation, as depicted in Fig. 2.

The four types of organizational culture vary in the values and concerns that they address. The development culture in the upper right quadrant emphasizes flexibility and change, and maintains a primary focus on the external environment. Core values in development culture include growth, stimulation, creativity and resource acquisition; the group culture in the upper left quadrant emphasizes flexibility and maintains a primary focus on the internal organization. Core values in group culture focus on belonging, attachment, cohesiveness, trust and participation; the hierarchical culture in the lower left quadrant focuses on the logic of the internal organization and emphasizes on stability. Core values in hierarchical culture include uniformity, security, order, rules, control, coordination, regulations and efficiency; while rational culture in the lower right quadrant focuses on internal stability and external environment. Core values in rational culture include planning,

Table 1  
Five dimensions of transformational leadership (Rafferty & Griffin, 2004).

Sub-dimensions	Definitions
Vision	Expressing an idealized picture of the future based around organizational values
Inspirational communication	Expressing positive and encouraging messages about the organization, and statements that build motivation and confidence
Supportive leadership	Expressing concern for followers and taking account of their individual needs
Intellectual stimulation	Enhancing employees' interest in, and awareness of problems, and increasing their ability to think about problems in new ways
Personal recognition	Providing rewards such as praise and acknowledgement of effort for achievement of specified goals

**Table 2**  
Comparison between culture typologies.

Quinn and Spreitzer (1991)	Denison and Mishra (1995)	Ogbonna and Harris (2000)	Xenikou and Simosi (2006)	Cameron and Quinn (2011)
Development culture	Adaptability	Innovative culture	Adaptive culture	Adhocracy culture
Group culture	Involvement	Community culture	Humanistic culture	Clan culture
Hierarchical culture	Consistency	Bureaucratic culture	Not defined	Hierarchy culture
Rational culture	Mission	Competitive culture	Achievement culture	Market culture

productivity, efficiency and the successful achievement of pre-determined goals (Denison & Mishra, 1995; Quinn & Spreitzer, 1991).

Although different cultural typologies are proposed, Quinn and Spreitzer (1991)'s cultural typology is widely used in empirical studies, since it has a strong theoretical foundation of CVF and has fairly short, validated measurement instruments for organizational culture. Table 2 lists a comparison between Quinn and Spreitzer (1991)'s cultural typology and other cultural typologies proposed in extant literature.

From Table 2 we can see all of the cultural typologies proposed in extant literature correspond with development culture, group culture, hierarchical culture and rational culture proposed in Quinn and Spreitzer (1991)'s study. Thus in this study, we use Quinn and Spreitzer (1991)'s typology to measure organizational culture quantitatively.

### 2.3. Knowledge sharing

Knowledge sharing has become a popular topic since the last decades. Knowledge-based view argues that knowledge is the foundation of a firm's competitive advantage, and, ultimately, the primary driver of a firm's value (Kearns & Sabherwal, 2006; Kraaijenbrink, Spender, & Groen, 2010). Since organizational knowledge largely resides within individuals, the willingness of individuals in an organization to share with others the knowledge they have acquired or created is critical in utilizing and realizing the potential value of knowledge (Gibbert & Krause, 2002).

By distinguishing knowledge traits, Bock, Zmud, Kim, and Lee (2005) further classified knowledge sharing into explicit knowledge sharing and tacit knowledge sharing. Drawing from literature in knowledge management, explicit knowledge is formal and systematic, and can be achieved through readings of project manuals and team discussions, while tacit knowledge is highly personal, context-specific, subjective, and can be represented in the form of metaphors, drawings, non-verbal communications and practical expertise. It is usually difficult to articulate tacit knowledge through a formal use of language since it is expressed in the form of human actions such as evaluations, attitudes, points of view, commitments and motivation (Koskinen, Pihlanto, & Vanharanta, 2003).

### 2.4. Transformational leadership and organizational culture

The topics of leadership and organizational culture have attracted considerable interest from both academics and practitioners in the past decades. Earlier studies have posited the relationship between leadership style and organizational culture. Culture arises when individual assumptions lead to shared experiences that solve organizational problems of external survival and internal integration, and it is the leader that initiates this process by imposing his or her beliefs, values, and assumptions at the outset. Leaders begin the culture creation process and play a significant role in managing and changing organizational culture (Schein, 2004).

Specifically, transformational leaders are more likely to be needed to unfreeze the organization and launch the change pro-

grams, and a significant function that distinguishes transformational leadership from transactional leadership is its concern for culture. Transactional leadership tends to operate within the existing culture, while transformational leaders frequently work towards changing the organizational culture in line with their vision. Thus excellent leaders are more likely to exhibit transformational leadership traits that enable them to alter aspects of their culture in order to improve their organizational performance (Bass et al., 2003).

Empirical studies also indicated a positive relationship between transformational leadership and organizational performance. In one study, Ogbonna and Harris (2000) validated the mediating effect of organizational culture on transformational leadership and organizational performance. In another study, Xenikou and Simosi (2006) reported that the achievement and adaptive cultural orientations had a direct effect on performance, while transformational leadership and humanistic cultural orientation had an indirect positive impact on performance through achievement cultural orientation. Most recently, Sarros et al. (2008) found that transformational leadership is indirectly related with organizational climate for innovation, mediated by a competitive, performance-oriented organizational culture.

### 2.5. Organizational culture and knowledge sharing

Organizational culture is considered as a critical factor fostering knowledge sharing. Bock et al. (2005) posited that changing people's behaviors is generally considered to be the most severe challenge facing firms that desire to increase their members' knowledge-sharing behaviors, and three types of organizational climate were identified as being particularly conducive to knowledge sharing. The first type of organizational climate is fairness that focuses on building trust between members and serving to overcome the public good dilemma associated with knowledge sharing. The second type of organizational climate is innovativeness that emphasizes learning, open information flows, and reasoned risk-taking. While the third type of organizational climate is affiliation that reflects the caring and pro-social behavior critical to inducing an organization's members to help one another.

In the context of ERP implementation, Jones et al. (2006) examined the impact of organizational culture on knowledge sharing during ERP implementation, and indicated that ERP requires firms to reengineer business processes as well as adjust organizational structures, and organizations need to enact initiatives to overcome cultural barriers and bring about changes in the underlying organizational culture to support the integrated, cross-functional nature of ERP systems.

Jones et al. (2006) further suggested that the requirements for knowledge sharing do not stop with the implementation, but is also necessary in ERP assimilation phase to achieve ERP success. Thus researchers also need to investigate knowledge sharing from a tacit and explicit knowledge perspective so as to yield additional insight on the way organizational culture affects the sharing of these specific types of knowledge.

## 2.6. ERP success

Drawing from innovation diffusion theory (IDT) perspective, a typical ERP systems lifecycle is usually described in terms of three phases: ERP adoption, ERP implementation and ERP assimilation (Swanson & Ramiller, 2004; Wu & Chuang, 2010), and the focus of ERP research so far has been on the adoption and implementation phase (Nah, Zuckweiler, & Lau, 2003; Umble et al., 2003). Most of extant studies assess ERP success by whether the system is implemented on-time and/or within budget, but ignore that the ultimate goal of using ERP systems is to create business value and enhance business performance. It is until recently that research on ERP assimilation has emerged as a second wave (Liang, Saraf, Hu, & Xue, 2007; Liu, Feng, Hu, & Huang, 2010a, 2010b; Zhang, Lee, Huang, Zhang, & Huang, 2005; Zhu, Li, Wang, & Chen, 2010). This is primarily because the potential business value of ERP systems cannot be fully realized until they are extensively assimilated in various business processes and the effective application of ERP systems in support of organizational business processes and value-chain activities is more relevant to benefit realization (Purvis et al., 2001; Liang et al., 2007).

By emphasizing the significance of post-implementation success of ERP systems, Shang and Seddon (2002) measured ERP success from dimensions of operational, managerial, strategic, IT infrastructure and organizational benefits. Zhu et al. (2010) argued that the ERP systems directly affect the operational and managerial processes, thus benefits resulting from amelioration in those processes can better characterize the direct advantages that ERP systems bring to the organization, whereas the strategic and organizational benefits reflect the long-term gains of the organization and it is hard to differentiate them from other factors such as market environment and business strategy in achieving competitive advantages for an organization. IT infrastructure was also excluded from the measures since the benefits from IT are not representative of the post-implementation success of ERP (Zhu et al., 2010).

Based on Zhu et al. (2010) and Shang and Seddon (2002)'s studies, we focus on ERP assimilation phase and measure ERP success from the improvement of operational and managerial benefits.

## 2.7. The missing link in the literature

Although extant literature has explored the relationship between transformational leadership and organizational culture, the relationship between organizational culture and knowledge sharing, and their impact on ERP success, few studies have been conducted in the context of ERP assimilation, and there is still a missing link between the four factors. Ke and Wei (2008) have theoretically analyzed how transformational leadership affects ERP implementation by fostering the desired organizational culture along the dimensions of learning and development, participative decision making, power sharing, support and collaboration, and tolerance for risk and conflicts. However, their study ignored the role knowledge sharing plays between organizational culture and ERP success. Besides, the proposed theoretical model has not been validated with empirical data.

Drawing on the extant literature, in this study, we propose a theoretical model to examine the mediating effect of organizational culture and knowledge sharing between transformational leadership and ERP success, as described in the following section.

## 3. Theoretical model and hypotheses

In ERP assimilation phase, most of the radical customizations and business process reengineering are complete (Luo & Strong,

2004), and the system is considered officially “rolled out” for routine usage. However, having the system up and running does not automatically produce the expected benefits to both business operations and the financial performance. Organizations are faced with a new set of challenges in the assimilation phase.

Continuous learning by individuals has been identified as one of the important activities in ERP assimilation phase (Liu et al., 2010a, 2010b). Since ERP systems integrate multiple business functions, individuals must not only be familiar with their own task and responsibility, but also collaborate closely with employees up and downstream along organizational integral business process. They need to undergo an intensive learning process to bridge the gap between what they have known and what the system requires them to know (Ke & Wei, 2008; Ravichandran, 2005). Extant literature indicates that skills and knowledge acquisition are supported by the interaction and encouragement of organizational members, and an organizational culture of support and collaboration can reduce employees' fear and increase their openness to share their knowledge with others (Ke & Wei, 2008).

In an empirical study, Bock et al. (2005) posited that in trust-oriented culture, employees are more likely to share knowledge with their colleagues, thus to form a shared belief that emphasizes knowledge acquisition and application within the organization, which are critical drivers of ERP implementation success (Vandaie, 2008). In multi-site case studies, Jones et al. (2006) found that organizational culture that focuses on coordination, collaboration and trust can facilitate knowledge sharing in ERP implementation, specifically, a collaboration oriented culture is more likely to facilitate tacit knowledge sharing within the organization (Jones, 2005).

Transformational leadership was identified as a critical facilitator of organizational culture and exploitative learning (Bass et al., 2003; Schein, 2004). Nemanich and Vera (2009) indicated that transformational leadership has indirect impact on organizational learning, mediated by organizational learning culture that emphasizes psychological safety, openness and decision making participation. Jansen, Vera, and Crossan (2009) empirically found that leadership behaviors that facilitate improving and extending are significantly associated with exploitative learning of existing knowledge. While Tsai, Chen, and Cheng (2009) also reported a positive relationship exists between transformational leadership, employees' positive moods and their task performance.

Drawing on the extant literature, we argue that in order to stimulate employees' intrinsic motivation to learn systems functionalities and facilitate organizational sharing of ERP knowledge, the top executive needs to promote a trust-oriented group culture that focuses on belonging and participation by expressing concern for followers and taking account of their individual needs, and these leadership traits are largely exhibited in sub-dimension of supportiveness of transformational leadership (Rafferty & Griffin, 2004). This leads to the following hypotheses:

**H1.** Organizational group culture mediates the relationship between transformational leadership and ERP knowledge sharing.

**H1a.** Transformational leadership is positively related with organizational group culture.

**H1b.** Organizational group culture is positively related with ERP knowledge sharing.

ERP assimilation also requires users to develop an exploratory learning of system's capabilities and potentials (Ke & Wei, 2008; Liu et al., 2010a; Purvis et al., 2001), to think innovatively for

new possibilities and applications of ERP systems (Jasperson, Carter, & Zmud, 2005; Liu et al., 2010a). Since its complexity, an exploratory learning of ERP systems may need a climate in which the organization accepts conflicts and risk. Ke and Wei (2008) posited that tolerance for risk culture allows the innovative ideas to be tested for their feasibility and effectiveness, thus to encourage the empowered employees to make ad hoc decisions in response to market changes and be responsible for their behaviors (Markus & Tanis, 2000). This is in correspondence with previous views. Amabile, Barsade, Mueller, and Staw (2005) posited that in innovativeness oriented culture, there is a shared belief that innovative ideas are a valuable aspect of staying competitive in the market place, and employees are provided with opportunities for personal development. These behaviors are beneficial to enhance individuals' motivation to explore new system functions.

Transformational leadership was identified as a critical promoter of organizational exploratory learning. Jansen et al. (2009) argued that transformational leadership that challenges assumptions, takes risks and inspires others is ideally suited to exploratory innovations. Through inspirational communication and intellectual stimulation, transformational leadership provides ideological explanations that link individuals' identities to the collective identity, and can increase followers' intrinsic motivation to engage in exploratory innovation (Jung, Chow, & Wu, 2003), to think "out of the box" and come up with creative observations (Bass et al., 2003). Based on a survey of 1158 managers, Sarros et al. (2008) indicated that transformational leadership indirectly influence organizational climate for innovation through a competitive, performance-oriented organizational culture. Most recently, Song, Kolb, Lee, and Kim (2012) found that transformational leadership was positively related with employees' work engagement and organizational knowledge creation practices.

Thus we argue that in order to improve competitive advantage with ERP systems and achieve ERP success, the top executive needs to facilitate a development culture that focuses on innovativeness, creativity, and adaptation to the external environment, thus to offer the users a vision of organizational strategic directions and inspire the users to think innovatively about how the system might enable the business to accomplish its goals and achieve business performance, and these traits are largely exhibited in sub-dimensions of vision, inspirational communication and intellectual motivation of transformational leadership. This leads to the following hypotheses:

**H2.** Organizational development culture mediates the relationship between transformational leadership and ERP success.

**H2a.** Transformational leadership is positively related with organizational development culture.

**H2b.** Organizational development culture is positively related with ERP success.

During ERP assimilation phase, new system processes and functionalities need to be designed and upgraded in support of organizational new business requirements, and individuals need to master the new systems processes and functionalities to manage daily business process efficiently and effectively. For the majority of ERP users in organizations, the prior related knowledge of ERP systems is rare, thus user training is also identified as a critical factor fostering the assimilation of ERP systems (Liu et al., 2011), and how to encourage the individuals to participate in the training process actively is another critical challenge in ERP assimilation phase.

Drawing from the research of work behavior, extrinsic motivation (rewards) is proved to be significantly related with worker participation. Lin (2007) posited that certain forms of extrinsic motivation such as monetary incentives or praise and public recognition may stimulate individual extrinsic motivation and foster their knowledge sharing intention.

In order to promote individuals' active participation in ERP systems training, the top executives need to set up appropriate evaluation mechanisms and orchestrate a system of reward mechanisms to foster a hierarchical culture that emphasizes efficiency, uniformity and coordination, thus to accommodate the new system functions and processes and resolve any misfit that might arise (Podsakoff, Bommer, Podsakoff, & MacKenzie, 2006; Sharma & Yetton, 2003; Umble et al., 2003). The required leadership traits are largely exhibited in sub-dimension of personal recognition of transformational leadership (Rafferty & Griffin, 2004). This leads to the following hypothesis:

**H3.** Organizational hierarchical culture mediates the relationship between transformational leadership and ERP knowledge sharing.

**H3a.** Transformational leadership is positively related with organizational hierarchical culture.

**H3b.** Organizational hierarchical culture is positively related with ERP knowledge sharing.

Transformational leadership is also indispensable for the top executive to promote a rational culture that focuses on accomplishment and achievement, so as to drive ERP knowledge sharing and achieve ERP success. On the one hand, Ogbonna and Harris (2000) reported that supportive leadership has positive impact on competitive culture that focuses on goal setting and accomplishment. This is consistent with Xenikou and Simosi (2006)'s finding that transformational leadership is significantly related with achievement culture that emphasizes accomplishment of objectives. On the other hand, Jones et al. (2006) posited that organizational rationality oriented culture is positively related with organizational knowledge sharing.

According to the above analysis, we posit that in ERP assimilation phase, the top executives also need to promote a rational culture, and the required leadership traits of clear goal setting and articulation are largely exhibited in sub-dimensions of vision and inspirational communication of transformational leadership (Rafferty & Griffin, 2004). This leads to the following hypotheses:

**H4.** Organizational rational culture mediates the relationship between transformational leadership and ERP knowledge sharing.

**H4a.** Transformational leadership is positively related with organizational rational culture.

**H4b.** Organizational rational culture is positively related with ERP knowledge sharing.

In knowledge management research fields, knowledge sharing has been considered as a critical factor driving knowledge creation, application and developing competitive advantages in the organization. From a resource based view, Kearns and Sabherwal (2006) have discussed how knowledge sharing between IT and business executives create competitive advantage. Liao, Fei, and

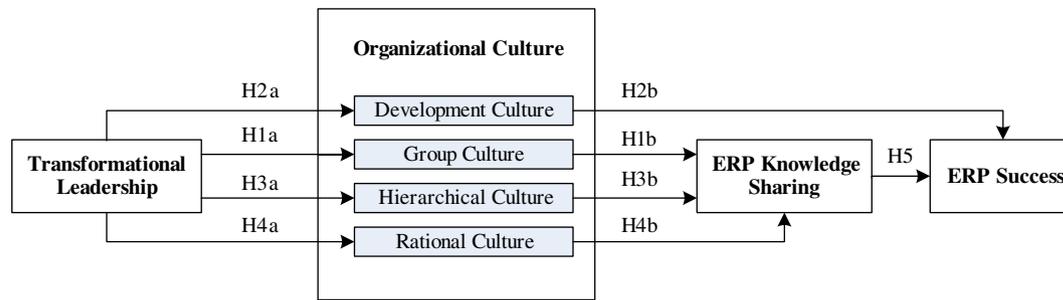


Fig. 3. Research model.

Chen (2007) investigated the relationships between knowledge sharing, absorptive capacity, and innovation capability and found that knowledge sharing is positively related with absorptive capacity and innovation capability. Using survey data, Wang, Lin, Jiang, and Klein (2007) found that effective knowledge transfer and sharing can lead to a better fit between ERP systems and organizational processes, further, to enhance business performance and achieve competitive advantage.

Drawing from the existing literature, we argue that in assimilation phase, knowledge sharing is important for organizational members to assimilate ERP knowledge, thus to have a deeper understanding of system functionalities and capabilities. This leads to the following hypothesis:

**H5.** ERP knowledge sharing is positively related with ERP success in assimilation phase.

Based on the above theoretical analysis and five hypotheses, we develop a research model that integrates transformational leadership, organizational culture, knowledge sharing and ERP success, as described in Fig. 3.

## 4. Research methodology

### 4.1. Measures

The survey instrument was developed based on a comprehensive review of the existing literature. The questionnaire was then translated into Chinese, and a few revisions were made to adapt to ERP assimilation context. All the items were measured on a five-point likert scale, anchored from 1 (strongly disagree) to 5 (strongly agree). The specific items of each construct are provided in the Appendix.

#### 4.1.1. Transformational leadership

Drawing from Rafferty and Griffin (2004)'s study, transformational leadership was measured from five dimensions including vision, inspirational communication, intellectual stimulation, supportive leadership, and personal recognition, and three reflective items are used to measure each construct. Empirical studies suggest that the five dimensions of transformational leadership are highly correlated with each other (Bass & Avolio, 1995; Rafferty & Griffin, 2004). Thus following Bono and Judge (2003)'s study, the items for each sub-dimension of transformational leadership were first averaged to form a synthesized score, then the five synthesized score in correspondence with the five leadership dimensions were used to measure transformational leadership as reflective items.

#### 4.1.2. Organizational culture

We refer to Quinn and Spreitzer (1991)'s study to measure four typologies of organizational culture including development culture, group culture, hierarchical culture and rational culture. An

important assumption of CVF is that each type of culture is an ideal one. The culture in an organization is a combination of different culture orientations, although usually one type is more dominant than the others. A high rating on one dimension does not exclude high rating at the other end (Iivari & Huisman, 2007). Following Quinn and Spreitzer (1991)'s study, three reflective items are designed for each culture typology.

#### 4.1.3. Knowledge sharing

Bock et al. (2005) defined knowledge sharing as a second-order construct composed of explicit knowledge sharing and tacit knowledge sharing. Two and three reflective items were designed to measure the two constructs separately. To guarantee that each construct will have at least 2–3 items after deleting the item with low factor efficient, we added an item to measure explicit knowledge sharing, and further adjusted their scale to accommodate to the context of ERP assimilation.

#### 4.1.4. ERP success

Scales of ERP success were adapted from Shang and Seddon (2002)'s study. Zhu et al. (2010) have pinpointed the importance of ERP post-implementation phase (assimilation phase), and applied Shang and Seddon (2002)'s scale to measure ERP post-implementation success. Thus in this study, we focus on ERP assimilation phase, and measure ERP success with reflective items of operational costing saving, sales income increase, decision efficacy improvement and customer satisfaction enhancement. The respondents were asked to evaluate the improvement of business benefits from the five dimensions after using ERP systems for at least 1 year.

### 4.2. Data collection

We used field survey to test the proposed research model. A pretest was initially conducted to examine the content validity of the questionnaire, and experts from industry and academics were invited to evaluate the specific items of the questionnaire and find if the items are clear and easy to understand. Several items of transformational leadership are adjusted since they are too long to read, while three items of organizational culture are also revised in case of their obscurity. 45 firms in Harbin, China were invited to participate in the pilot study to statistically examine the construct validity of the variables. A top executive in charge of ERP systems and his/her direct subordinate were asked to complete two questionnaires in each firm, and 72 valid questionnaires from 36 firms were received. PLS analysis results suggest that most of the items load high on corresponding construct, and one item of hierarchical culture with factor loading lower than 0.7 was deleted from the questionnaire.

A field study was conducted once all the amendments were made to the final questionnaire. Initial contact was made with a large and established ERP software corporation in Zhengzhou of

Henan province using personal contacts. We contacted with the top executive of the software company to search for 200–400 client organizations. The objective sampling organizations need to have used ERP software for at least 1 year, also, have a professional IS executive responsible for the ERP systems. Based on the requirements, 300 firms from diverse locations of Henan province were selected. We contacted these organizations using e-mail facilities or mobile phones, and approximately 120 organizations agreed to participate in this research. The survey was disseminated to the organizations and a research team consisting of four doctoral students and eight employees visited the 115 organizations separately to explain the purpose of the research and to provide directions for completing the questionnaire. Data collection was conducted from August 19th, 2010 to August 25th, 2010.

Common method bias has been considered as a potential problem in behavioral research. Podsakoff, MacKenzie, Lee, and Podsakoff (2003) argued that one way of controlling for common method bias is to collect the measures of these variables from different sources. Thus we collect data of transformational leadership and ERP success from IS executives while data of organizational culture and knowledge sharing from ERP end users. Participants were 115 IS executives and 413 ERP end users from the 115 organizations. In each investigated organization, the IS executive was asked to evaluate the leadership style of his or her direct superior leader, also, to evaluate ERP success from operational cost, sales income, productivity, user satisfaction and competitive advantage at the organizational level. Averagely two to four employees were asked to evaluate organizational culture and knowledge sharing at the individual level. Totally 88 and 343 valid questionnaires were collected from IS executives and ERP end users in 88 organizations, with one questionnaire at organizational level and four questionnaires at individual level for each organization. This amounts to a valid response rate of 76.5% at organizational level and 83% at individual level separately.

Since our analysis is at organizational level, 343 data from individual respondents was then averaged to match with the 88 data from IS executives. After removing the data that has only one valid individual respondent, we finally obtained 75 data for analysis at organizational level. Demographics of organizational samples is described in Table 3.

**Table 3**  
Demographics of samples.

	Category	Percentage
Firm ownership	State owned	10.23
	Joint venture	4.55
	Private	67.05
	Foreign invested	4.55
	Others	13.62
Firm type	Manufacturing	26.4
	Retail	54
	Others	19.5
Revenues (million dollars)	<10	36.36
	10–100	35.23
	101–500	12.5
	501–1000	4.55
	>1000	5.68
	Missing	5.68
Number of employees	<100	62.5
	100–500	25
	501–1000	4.55
	1001–5000	1.14
	>5000	3.40
	Missing	3.41
Demographics of ERP end users	Employees	61.52
	Business managers	20.41
	Top executives	2.91
	Missing	15.16

From Table 3 we can see that most of the sample organizations are small and middle sized enterprises (SMEs) from retail industry. This is consistent with the previous findings. In developing countries such as China, the government has launched the policy of using IT technologies to speed up industrialization and SMEs are encouraged to implement ERP systems to support their business operations and achieve market competitive advantage. With the variety of products increases and the retailer size expands, ERP systems have become indispensable for supporting retailers to sell the right product to the right customers at the right time and price. As an emerging market entity, SMEs from retailing industry play a major role in the national economy. The enterprise needs to manage a growing variety of products, and a powerful IT such as ERP system was required to satisfy diversification of customer requirements (Chien, Hu, Reimers, & Lin, 2007; Zhu & Kraemer, 2005; Zhu, Li, Qian, Chen, & Chen, 2008; Zhu et al., 2010).

## 5. Data analysis and hypothesis testing

### 5.1. Statistical analysis technique

For analyzing both the measurement and structural models of this study, the structural equation modeling (SEM) method was employed as it was capable of allowing the incorporation of both unobserved (i.e. latent) and observed variables in the same model, and being able to handle errors of measurement within exogenous variables in a better manner. Additionally, SEM is able to process multiple dependent variables, which is not feasible in a traditional regression analysis method (Chin, Marcolin, & Newsted, 2003; Gefen, Straub, & Boudreau, 2000).

Two diverse methodological approaches are proposed to calculate SEM. The first one is the covariance structure analysis technique using programs such as, AMOS or LISREL. The other is Partial Least Squares (PLS) technique employing programs; for instance, PLS-Graph and SmartPLS (Temme, Kreis, & Hildebrandt, 2006; Ringle, Wende, & Will, 2005). PLS is appropriate for both reflective and formative construct analysis, and is able to accommodate smaller data sample models without requirements of normality distribution of the data (Chin et al., 2003). As the sample size collected in this study is relatively small, we chose the PLS approach for data analysis.

### 5.2. Measurement model

The measurement model was assessed to analyze internal consistency reliability, convergent validity and discriminant validity. Internal consistencies are considered as acceptable if each construct's composite reliability, Cronbachs alpha score and item loadings has exceeded 0.7, implying that all the measures consistently represent the same latent construct (Chin et al., 2003).

Convergent validity was examined by checking the average variance extracted (AVE). AVE was calculated by averaging the percentage of variance extracted of each construct from its indicators, and it was reported that AVE should be 0.5 or greater to suggest adequate convergent validity (Pavlou & Fygenon, 2006).

Table 4 describes the item loadings, composite reliability, Cronbachs alpha and AVE of each construct.

As Table 4 illustrates, except for one item of hierarchical culture, item loadings of all the other constructs are greater than 0.8, with most of the loadings exceeding 0.9, and the *t*-test results are all significant at the 0.01 level, indicating that all the measures consistently represent the same latent construct. The composite reliability and Cronbachs alpha of each construct is greater than 0.85, while the average variance extracted (AVE) of each construct





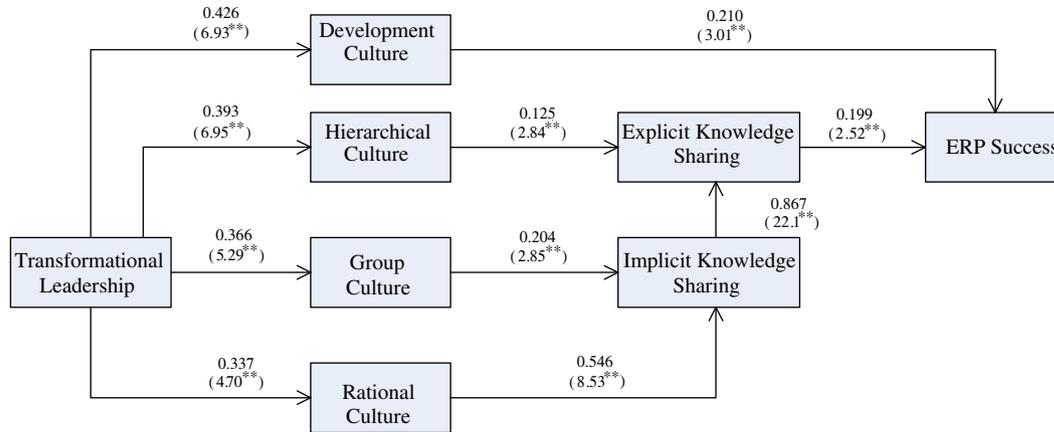


Fig. 5. Structural equation model analysis results II (\*\* represents  $p < 0.01$ , \* represents  $p < 0.05$ , ns represents not significant).

## 6. Discussions

### 6.1. Theoretical implications

The theoretical contributions of this study are mainly three folds. Firstly, this study is among the first to examine the joint effect mechanism of transformational leadership, organizational culture and knowledge sharing on ERP success. Previous studies have signified the role senior leadership plays in fostering ERP success. However, what specific leadership traits the top executive needs to exhibit and how does senior leadership impact ERP success are still largely unknown. We proposed a theoretical model to examine the impact mechanism of transformational leadership on ERP success, mediated by organizational culture and knowledge sharing. The proposed model can extend the existing studies of senior leadership in ERP assimilation phase.

Secondly, this study fills in the research gap between organizational culture and ERP success. Although culture theory has been used to explain an extensive range of social behaviors and outcomes such as firm effectiveness and firm performance, few studies have been conducted in ERP context, and what is the specific relationship between organizational culture and ERP success is still unexplored. ERP systems require firms to reengineer business processes and adjust organizational structures, and this may contradict existing organizational culture. Since employees have adapted to their traditional business process and formed a fixed schema, they would not like to think outside the fixed schema and accept the new business processes. And the top executives need to enact initiatives to overcome cultural barriers and bring about changes in the underlying organizational culture to increase their members' knowledge-sharing behaviors, so as to support the integrated, cross-functional nature of ERP systems and enhance business efficacy and effectiveness with ERP systems.

Thirdly, this study contributes to the research of knowledge sharing in ERP context by considering knowledge characteristics and exploring the impact of organizational culture on tacit and explicit knowledge sharing. Previous studies have signified the positive relationship between organizational culture and knowledge sharing, however, none studies have investigated knowledge sharing from a tacit and explicit knowledge perspective. Based on Competing Values Framework and knowledge based view, we found that group culture and rational culture have direct impact on tacit knowledge sharing, while hierarchical culture indirectly impacts explicit knowledge sharing.

Finally, this study emphasizes the importance of ERP assimilation phase since "the success of ERP systems cannot be achieved

after it is assimilated within the organization (Liang et al., 2007)". Data was collected in firms that have used ERP software for at least 1 year and statistical analysis can support most of our hypotheses. The research findings can provide a comprehensive understanding of the interface between three types of human behaviors (transformational leadership, organizational culture as well as knowledge sharing) and ERP systems.

### 6.2. Practical implications

From a practical perspective, this study provides insights for the top management team to pay attention to ERP knowledge sharing even after the implementation has completed and the system has been devoted into daily use. Top executives should realize that knowledge sharing is also important in ERP assimilation phase after the system is devoted into daily use, and changing people's beliefs and behaviors is one of the most severe challenges facing firms that desire to increase their members' knowledge-sharing behaviors.

In order to promote appropriate organizational culture, a top executive who exhibit strong transformational leadership traits is needed to take charge of ERP assimilation. The top executive needs to be able to conduct strategic and tactical actions, thus to facilitate the organizational culture changes in support of both ERP explicit knowledge sharing and tacit knowledge sharing.

Explicit knowledge is formal and can be achieved through readings of project manuals. Thus in order to promote explicit knowledge sharing, the top executive needs to set up new policies, to clarify individuals' new roles and responsibilities with regards to ERP systems, also, to set up appropriate evaluation mechanisms and provide rewards for employees' achievement. These leader traits are beneficial to promote a type of order-oriented hierarchical culture and facilitate explicit knowledge sharing.

Tacit knowledge is highly personal and could be represented in the form of non-verbal communications, and group culture and rational culture is positively related with ERP tacit knowledge. This requires the top executives to set up clear missions and organizational objective, thus to promote an organizational culture that focuses on accomplishment and achievement. In addition, the top executives also need to take account of employees' individual needs by expressing concern and providing personal coach, so as to promote a trust and belonging oriented organizational culture. This is beneficial to achieve ERP success since followers are more likely to equate their own success with the organizations' success and pursue the achievement of organi-

zational long-term goals under rational and group organizational culture.

Instead of group and rational culture, a development culture that focuses on innovation and creativity is also needed to foster an exploratory learning of ERP systems' capabilities. This requires the top executives to articulate an idealized picture of the future with regards to ERP systems, thus to encourage the followers to think innovatively for new systems applications and use ERP systems flexibly and efficiently, finally, to improve operational and managerial benefits with ERP systems.

## 7. Conclusions

Drawing from leadership theory, organizational culture theory and knowledge based view, this study developed a theoretical model to examine the joint impact mechanism of transformational leadership, organizational culture and knowledge sharing on ERP success. Field survey method was used to test the proposed research model and totally 431 valid questionnaires were collected from IS executives and ERP end users in 88 organizations, with one questionnaire at organizational level and four questionnaires at individual level for each organization. PLS analysis indicates that development culture has direct positive impact on ERP success. While hierarchical culture, group culture and rational culture is indirectly related with ERP success, mediated by knowledge sharing. Specifically, trust-oriented group culture and achievement-oriented rational culture is directly related with tacit knowledge sharing while control-oriented hierarchical culture is directly related with explicit knowledge sharing. Further, tacit knowledge sharing is indirectly related with ERP success, mediated by explicit knowledge sharing. The empirical results highlight the significance of transformational leadership in promoting desired organizational culture and facilitating individuals' tacit and explicit knowledge sharing intention, thus to achieve business benefits through the assimilation of ERP systems.

There are some limitations in this study. First of all, this study averaged the items for each sub-dimension of transformational leadership to form a synthesized score, and used the five synthesized score to measure transformational leadership as reflective items. Future studies can use the five sub-dimensions of transformational leadership as independent latent variables and examine their specific impact mechanism on ERP success, to further explore which specific sub-dimension of transformational leadership is more likely to promote the four types of organizational culture and foster the two types of knowledge sharing. Secondly, data collection was mostly conducted in Henan province of China, and the generality of the research findings may be restricted by the locations. Future studies need to extend the sample size and collect data from other locations in China to further validate our research results. In addition, since our study was conducted in China, future studies need also consider some national context factors such as Chinese specific "guanxi" culture into the model.

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## Appendix A. Scales and items

### Transformational leadership

Sub-dimension	Items
Vision	<ol style="list-style-type: none"> <li>1. The top executive has a clear understanding of where we are going</li> <li>2. The top executive has a clear sense of where he/she wants our unit to be in 5 years</li> <li>3. The top executive can clearly articulate the strategic vision and objectives</li> </ol>
Inspirational communication	<ol style="list-style-type: none"> <li>1. The top executive says things that make employees proud to be a part of this organization</li> <li>2. The top executive says positive things about the work unit</li> <li>3. The top executive encourages people to see changing environments as situations full of opportunities</li> </ol>
Intellectual stimulation	<ol style="list-style-type: none"> <li>1. The top executive challenges me to think about old problems in new ways</li> <li>2. The top executive has ideas that have forced me to rethink some things that I have never questioned before</li> <li>3. The top executive has challenged me to rethink some of my basic assumptions about my work</li> </ol>
Supportive leadership	<ol style="list-style-type: none"> <li>1. The top executive considers my personal feelings before acting</li> <li>2. The top executive behaves in a manner which is thoughtful of my personal needs</li> <li>3. The top executive sees that the interests of employees are given due consideration</li> </ol>
Personal recognition	<ol style="list-style-type: none"> <li>1. The top executive commends me when I do a better than average job</li> <li>2. The top executive acknowledges improvement in my quality of work</li> <li>3. The top executive personally compliments me when I do outstanding work</li> </ol>

### ERP post-implementation success

- PS1: Operational cost in our firm is reduced after the ERP system was devoted into daily use
- PS2: Sales income in our firm is increased after the ERP system became operational
- PS3: Managerial decision efficiency in our firm is improved after the ERP system was devoted into daily use
- PS4: Customer satisfaction in our firm is enhanced after the ERP system became operational

### Organizational culture

Sub-dimension	Items
Development	1. Our firm is a very dynamic and

(continued on next page)



