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The influence of centrifugal and centripetal forces on ERP project success in small and medium-sized enterprises in China and Taiwan

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Abstract

Successful implementation of Enterprise Resource Planning (ERP) systems has become a critical facilitator for efficient operations management in both developed and developing economies. The study presented in this paper uses a novel "Centripetal and Centrifugal Forces" (CCF) model developed in the context of global new product development projects, to examine the way that the interaction of factors relevant to project management contributes to successful ERP implementation processes. Based on regression analysis of responses from 244 small and medium-sized manufacturing firms in Taiwan and China collected in May 2006, we find that the balance of centrifugal and centripetal forces fosters ERP project success, a result which has significant impacts on ERP project management practice. The study also opens up a new direction for future research on ERP implementation processes in that it suggests a novel way to model the interaction of project management factors. In addition, the new measures regarding project success and project management developed and validated in this study should prove to be useful for researchers studying ERP implementation processes.

Keywords: Enterprise Resource Planning (ERP); Small and medium-sized enterprises (SMEs); Implementation; China; Taiwan

1. Introduction

Mainland China has successfully encouraged foreign investment with an open-door policy. This has resulted in larger and more complex networks of R&D, manufacturing and service operations, and supply chains, all of which address the increasing desire for investment in China (Martinsons, 2000). At the firm level, these developments have increased the

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requirements for a sophisticated IT infrastructure. Today, China is the third largest market for information technology (IT), after the United States and Japan. Within the Asia-Pacific region, China's IT-services revenue is expected to top $43.9 billion in 2008, as China surpasses South Korea to become one of the three largest IT-services markets in the region along with Japan and Australia (Quan et al., 2005).

These developments have placed tremendous pressure on firms in China to improve their operational performance based on new IT-systems. One class of such systems is Enterprise Resource Planning (ERP) that seeks to synchronize the planning of processes across all functions within an organization. Many organizations in China have invested billions of dollars in ERP systems (Martinsons, 2004). However, previous studies on ERP implementations focused mainly on large companies in Europe or the United States, and very few focused on enterprises in developing nations such as China and Taiwan (He, 2004; Tsai et al., 2005; Reimers, 2003). As developing countries may face different challenges from those faced by developed countries, there is a gap in the ERP literature that needs more research attention.

The present study aims to narrow the above gap in the ERP literature by presenting results of an empirical study of ERP implementation in China and Taiwan. The context of these two regions offers the potential for new insights for several reasons. First, the results should complement findings from developed economies in North America and Europe. Second, as firms in China and Taiwan are usually much smaller than those in Europe and North America, the present study identifies the characteristics of ERP implementation projects in small and medium-sized enterprises (SMEs). Third, the comparison between China and Taiwan offers an interesting contrast since while both economies share the same culture (Hofstede, 2001) they differ in their stage of economic development.

2. ERP implementation as team effort

As indicated by prior research, many ERP implementation cases in China fail to meet their project deadline because of poor schedule estimates and uncertainty about the ERP implementation timeframe (Martin, 1998). In addition to the above weakness in implementing ERP systems, two major ERP challenges to SMEs in China contain weaknesses in both IT infrastructure and IT human resources (Liu and Zhou, 2001). However, SEMs in Taiwan face different obstacles in ERP implementation. According to Tsai et al. (2005), the three most important obstacles were: difficulties in transition to new systems, unavailability of skilled people, and high turnover of key project persons.

Because of the increasingly important role that of ERP plays in organizations, a substantial amount of the IS literature has focused on issues related to ERP implementation. Extant research has addressed both the software engineering and the user acceptance dimension. The *software engineering* dimension addresses the challenges of creating a cost-effective ERP code basis that is reliable, easy to modify, and easy to upgrade to new hardware platforms (e.g. Sprott, 2000). The *user-acceptance* dimension is based on system users' evaluations regarding, for example, relevance, usefulness, ease of use, satisfaction with outcomes, and ability to exchange information with other participants (e.g. Boudreau, 2003).

However, ERP system implementations that take into account only the principles from consider the above two dimensions do not always guarantee successful organizational outcomes. Although ERP systems may be perceived as well-built systems from a software-engineering perspective, ERP systems do not, in themselves, lead to a satisfactory organizational outcome without effective teamwork in ERP project teams. For example, when no incentives are available to encourage team members to input their individual knowledge into the implementation process, errors related to business processes may be presented in the ERP system. In other words, successful ERP implementations require good teamwork. Today, more than ever, work is performed in groups and teams. Organizations increasingly rely on team-based arrangements, such as project teams, task forces, quality circles, autonomous work groups, and cross-functional teams to gain competitive advantage and to improve employees' experience of work (Guzzo and Shea, 1992). The general characterization of work teams also applies to ERP project teams which—in an analogy to definitions of teams in the teamwork literature (Janicik and Bartel, 2003, p.125)—can be defined as an interdependent collection of individuals whose primary function is to perform a complex task requiring a specific output (a functioning and useful ERP system) by some deadline after which they disband. Clearly, the importance of teamwork in ERP implementation has not been addressed by the above two research dimensions in the ERP literature. The neglect of the roles that teamwork plays in ERP implementation may overlook the complex dynamics of ERP success and therefore teamwork in ERP implementation deserves more research attention.

Much work in organizations is carried out in teams because the synergy of team members often leads to greater and faster achievements. Moreover, the complexity of tasks often requires that individuals with different knowledge, skills, and expertise work together to accomplish tasks. Although teamwork may provide many benefits, such as increased flexibility and creativity, it is also known to be associated with problems of coordination and motivation (Steiner, 1972). For example, differences in members' knowledge and work routines may lead to conflict about how to perform a task or about which procedures to use. In addition, the fact that others are present to do a job may encourage free-riding behavior. Given the fact that individual team members often work on multiple projects (Wang et al., 2005), members may abandon plans owing to conflicting demands on their time use; this abandonment may, in turn, lead to delays in the flow of work. Because of these problems, teams that fail to integrate their members may perform below their potential and display deficiencies in outcomes.

We therefore suggest that ERP research needs to incorporate the teamwork dimension and thus propose the *Centripetal and Centrifugal Forces (CCF)* model for this purpose (Sheremata, 2000). The CCF model proposes that forces exist in teams can be characterized as either centripetal or as centrifugal. Carmel (1999) describes *centripetal forces* as those forces that pull the team together, making the team more effective. Some of the centripetal forces may also be considered useful outside the context of project teams, for example in the context of cross-functional interaction (Kraut and Streeter, 1995; Crowston and Kammerer, 1998; McChesney and Gallagher, 2004). Centripetal force is the opposite of *centrifugal force*, which Carmel defines as a "force that propels things outwards from the center as it disperses developers to the far corners of the world." Although Carmel (1999) suggested that centrifugal forces are the problems that pull a team apart and therefore inhibit its performance, the author also argued that centrifugal forces can have positive effects on project results. It appears that not only the force itself, but the relationship between two forces may affect team effectiveness of ERP implementation project teams. Specifically, we propose that both centrifugal and centripetal forces can have positive effects on project outcomes if the right balance between the two can be achieved. However, what the right balance is may depend contextual on factors such as the country.

Focusing on the project management of ERP implementation, this study endeavors to examine the roles that centrifugal and centripetal forces and their interaction play in the success of ERP implementation projects initiated by manufacturers in China and Taiwan. In an effort to identify viable equilibrium between opposing forces in ERP implementation, this study is geared primarily to answering the following question: How does the relationship (balance) between centrifugal and centripetal forces affect project success in SMEs operating in the context of a developing economy?

3. Theoretical development and hypotheses

3.1. Centrifugal and Centripetal Forces Model (CCF model)

To explain how the coexistence of opposing and contradictory elements of structures and processes can increase the probability of successful ERP system implementation, we draw an analogy between that a successful cycle of ERP implementation and the earth's orbit around the sun. Centripetal forces prevent the earth from flying off into space while centrifugal forces prevent it from colliding with the sun. Dynamic equilibrium between a pair of forces with equal magnitude but directions keeps the earth stay in the orbit (Sheremata, 2000). To encourage innovation within a team, the team needs to have enough freedom and a positive climate (centrifugal force) so that team members feel they can freely express their ideas. However, if team members do not have similar perceptions of the goals of their information sharing (centripetal force), the communication between team members may be too divergent to lead to any productive conclusions. In other words, a balance of centrifugal and centripetal forces is critical to the synergy and effectiveness of teamwork.

Centrifugal forces, in the organizational context, are structural elements and processes that increase the quantity and quality of ideas, knowledge, and information for an organization (Sheremata, 2000).

These forces push project team members outward, enabling them to have access to new ideas and information freely (Brown and Eisenhardt, 1995). Because centrifugal forces tend to abolish the structure and norms within a work team, teams high in centrifugal forces may take more time and effort to integrate team members' ideas and to make decisions. This may inhibit successful ERP implementation when an ERP project has a tight schedule. In contrast, centripetal forces serve as structural elements and processes that integrate dispersed ideas, knowledge, and information into collective action (Sheremata, 2000). Centripetal forces pull a project team together to ensure unified effort among team members (Brown and Eisenhardt, 1995). Because centripetal forces tend to impose a structure and norms, teams high in centripetal forces may be more time-effective and focused in the execution of the project and with regard to their decision-making. With good ERP planning, centripetal forces may lead to timely completion of the ERP project. However, the team sacrifices its creativity and synergy for effective execution and this may inhibit successful ERP implementation when ERP project requires ongoing modification (see Fig. 1).

3.2. Centrifugal forces

Organizations seek for ways to create centripetal forces that assist their employees to identify with the organization. While centripetal forces refer to the extent to which employees focus their effort on, and devote themselves to, the company's goals, centrifugal forces are becoming more important as the business environment changes rapidly. These forces, external to the organization external to the organization such as networking with employees of other companies, shift employees' attention from inside the organization to outside the organization. Whether or not these forces are work-related is not a criterion of centrifugal forces. These forces can provide employees with information and materials that promote innovation in the company. Therefore, centrifugal forces may actually benefit organizations (Sheremata, 2000). For example, a sales representative who often skips internal meetings but spends a lot of time chatting with customers may actually generate more sales revenue. This is because through the conversations, the sales representative develops a good understanding of business trends by noticing the valuable information regarding the needs of the customers, the demands of the industry and current status of the competitors. In a competitive business environment, talented staffs that utilize and channel centrifugal forces into useful information and resources are critical to a company's survival. However, when talented employees are only interested in information outside the company and fail to integrate such information into their work, centrifugal forces will result in low in commitment to the company and lead to lack of cohesion in work teams. As a result, staffs may leave and even become competitors. Clearly, a delicate balance between centrifugal and centripetal forces is required to bring a company a competitive edge through the retention of loyal employees knowledgeable about business trends. With the advances in information management systems and a flat organization structure, employees who bring valuable information from outside the organization are increasingly able to share their thoughts through various communication media.

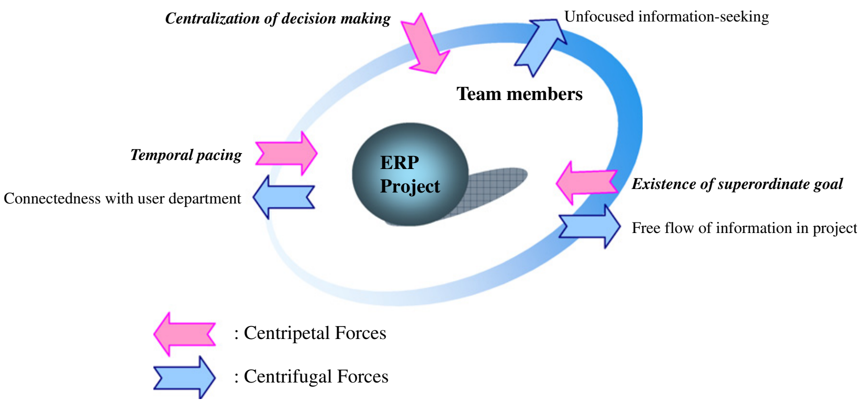

Fig. 1. The Centrifugal and Centripetal Forces model.

In the current study, we conceptualize centrifugal forces by the following three constructs:

- free flow of information in the project team;
- connectedness with user departments;
- unfocused information-seeking.

The term *free flow of information* refers to the extent to which large quantities of rich informa tion can be transferred across individuals and organizational boundaries without encountering resistance (Sheremata, 2000). Our study focuses on free flow of information in project teams with regard to both project team individuals' access to information and project team individuals' transfer of information among one another. An ERP project requires a cross-functional, multi-skilled implementation team because of its enterprise-wide scope (Davenport, 2000). To be effective, the team needs cooperation and free information sharing among its individual members. However, such free-flowing information may also lead to unanticipated changes to the project scope when opportunities for streamlining business processes or automating tasks are discovered during project implementation which may threaten on-time, on-budget implementation.

The term *connectedness with user departments* refers to team members making efforts to frequently connect with end users. Thus, *connectedness* goes beyond communication within the project team. Rather, it comprises frequent discussions between project team members and individuals from various functional departments. Moreover, interaction should include feedback from the end users as this can increase user acceptance. As a way to avoid various interaction failures, an open information policy has to be maintained for the project. However, connectedness with user departments may also endanger project goals or indeed threaten project completion, as connectedness may open the floodgates for unreasonable or idiosyncratic change requests which may bloat project scope.

The term *unfocused information-seeking* refers to information collection activities of project team members on information unrelated to the immediate project goals (Mahaney and Lederer, 2003). Employees today demonstrate an increasing awareness of issues beyond the confines of the enterprise itself. They show greater interest in collecting information not directly related to their job responsibilities and in building their personal connections. Vigorous and frequent contacts with new information have the benefit of stimulating the employees' development of creative ideas and innovative solutions for application to the employees' work, and therein lay the major advantage of unfocussed information-seeking to the enterprise. For example, in every visit to end users, a member of the ERP project team may enjoy chatting on topics unrelated to work. This seemingly idle conversation may bring out new understandings and valuable information that help refine the ERP system to better fit the needs of the organization. Similarly, unfocused surfing on the Internet can serendipitously generate valuable information for the project. However, such behavior may also threaten project goals because scarce company resources are wasted.

3.3. Centripetal forces

Top management should note that centripetal forces do not imply conservativeness or fustiness. Furthermore, top management should prevent nearsighted middle mangers uses centripetal power to suppress employee creativity. Without an appropriate level of centrifugal forces, an organization will lose its competitive edge quickly.

We conceptualize centripetal forces through the following three constructs:

- centralization of decision making;
- temporal pacing;
- existence of superordinate goals.

The construct *centralization of decision making* refers to the extent to which project decisions are controlled by project management or their superiors (e.g. members of the steering committee). Tight control over project decisions can ensure that system implementation is consistent with overarching company goals. Furthermore, conflicts among project team members or between the project team and functional departments can be quickly and efficiently resolved. However, centralization of control also restrains innovative energies of project team members and may negatively affect their motivation to contribute time and ideas to the implementation process.

The term *temporal pacing* refers to the use of a formal procedure with clear guidelines, rules, and schedules for orchestrating a project team's activities (Gersick, 1994; Griffin, 1997). In such circumstances, an ERP team is motivated to implement its project on the scheduled date, even if this would negatively affect other project goals. For example, a quick implementation approach may not provide the time necessary for team members to learn about the system and appreciate its potential value. Hence, *temporal pacing* enhances the likelihood of meeting deadlines by infusing ERP project teams with a sense of urgency and an awareness of the need to solve implementation failure early. It also helps facilitate effective senior management monitoring of a project (Brown and Eisenhardt, 1995). However, this comes at the cost of neglecting or ignoring important problems faced during project implementation.

The term *existence of superordinate goals* refers to the degree to which a project team accepts and identifies with the project goals. (Pinto et al., 1993). A *superordinate goal* enhances the likelihood of finding good-quality solutions in a timely manner because team members with a common goal become more open to the diverse perspectives of each other and more effective in integrating a larger pool of quality ideas and information (Hyatt and Rudy, 1997). In addition, structuring *superordinate goals* involves organizing them in a manner that enables the project team to describe in detail what the company strives to achieve and to incorporate these *superordinate goals* appropriately into the decision model. On the flip-side, the existence of a superordinate goal may prevent innovative ideas from being incorporated into the project because they are outside the officially sanctioned goal. Therefore, consideration of such ideas would require to extend the scope of the superordinate goal first; an effort which may not be undertaken because the results are uncertain and the effort may not be appreciated.

3.4. Dependent variables and controls

Successful project management is the main dependent variable in the study. Differing from the typical way of measuring information system success through the perspective of users, this study measured successful project management through the lens of project team members. ERP implementation project success is frequently defined in terms of the achievement of some predetermined goals, which normally include multiple parameters such as time, cost, and function (Markus et al., 2000). In this study, *successful project management* is measured in terms of the perceived deviation from the expected project goals such as meeting deadlines, staying within the budget approved at the outset, matching the ERP system with specific business objectives and achieving a specified system performance level (Hong and Kim, 2002; Zhang et al., 2003).

On the basis of previous studies on IS success, we also separate out the potential influence of the following control variables:

- size of project team;
- firm size;
- project leader expertise;
- characteristics of organizational incentive structure;
- location (China vs. Taiwan).

Size of the project team is a proxy for project scope; the larger the scope, the more people will usually be involved in the effort. Naturally, project management difficulties increases as the size of the project team becomes larger. In addition, it has been shown that project team size affects the implementation success of large software projects (Tsai et al., 2005).

Project team size may be correlated with *firm size* but larger project teams do not necessarily indicate larger firm sizes. Yet, firm size may have an independent effect on project management difficulties since larger firms usually display more complex organizational structures which should negatively affect ERP implementation processes.

Project leader expertise refers to the degree to which a project's manager possesses skills, knowledge, and experiences that are relevant to both the technical and the management aspects of the project (Nord and Tucker, 1987; Sheremata, 2000). A project manager should be an integrator who is able to motivate a team for collective action (Atuahene-Gima, 2003). He or she is responsible for reducing ERP implementation failure and, in this regard, should be able to coordinate cooperation and solve conflicts among and between team members and other functional groups. While project leader expertise has been shown to have a significant and strong effect on software implementation projects (Tsai et al., 2005), it is not of primary interest in this study. We therefore include it as a control variable.

The organizations within which ERP projects are set may have addressed the general principal-agent problems implied in delegating tasks to paid agents more or less effectively (Harrison and Harrell, 1993). The degree to which principal-agent problems differ across organizations should also have a significant and strong impact on implementation results. However, because principal-agent problems characteristic of a whole organization are not attributable to project management measures and thus not of primary interest in our study while potentially having a strong impact on ERP implementation success, we also include a measure of the extent to which an organization is plagued by general agency problems as a control variable in our study.

Finally, the economic and social environment of firms within which ERP projects are under way may have an impact on ERP project success, e.g. because of differential availability of required resources and services. We therefore include country as a control variable. While Taiwan and China share a similar cultural heritage (Hofstede, 2001), they are different in their stages of economic development. Therefore, the comparison between ERP implementations in Taiwan and China should surface differences related to the stage of economic development but not to national culture.

Since we administered our questionnaire to a population of firms which had implemented ERP software from the same vendor (see below, Section 4), we do not control for type of ERP software as another possible variable influencing project success (especially given the possibility that ERP software from different vendors is adapted to the Chinese environment to different degrees which may have a significant impact on implementation success, cf. Soh et al. (2000) and Marble (in press).

3.5. Hypotheses

Adapting the CCF model to ERP implementation processes, we suggest that successful implementation of ERP systems requires a balance between centrifugal and centripetal forces. Moreover, we conceptualize the notion of "balance" as the mutual constraining and enabling of centripetal and centrifugal forces. Specifically, on the one hand, the constraining effect of a "counter-force" limits the force under consideration but, at the same time, also allows for this force to unfold its beneficial effects. Without this countervailing or balancing effect, the force would become destructive.

In order to specify this notion, we created pairs of centrifugal and centripetal forces which argua bly display a mutual constraining and enabling relationship. These pairs are:

- Existence of superordinate goals—free flow of information in project team
- Temporal pacing—connectedness with user departments
- Centralized decision making—unfocussed information-seeking

While a free flow of information in the project team may stimulate new ideas regarding business process redesign or automation of tasks, it can also bloat project scope and thus endanger project goals. A commitment to a common, superordinate goal limits this risk while also increasing confidence in exploring unanticipated possibilities as they arise. We therefore propose:

H1. Simultaneous existence of superordinate project goals and free flow of information in project teams has a positive impact on ERP project success.

In a similar vein, a high degree of connectedness with user departments will increase the willingness of project team members to listen to user requirements. However, this may also imply more extensive software changes and thus threaten set deadlines. A tight management of deadlines may limit the risk of this outcome while also increasing confidence in the positive effects of a high degree of connectedness with user departments. We therefore propose:

H2. Tight management of deadlines (strict temporal pacing) in combination with a high degree of connectedness with user departments has a positive impact on ERP project success.

Finally, unfocused information-seeking may waste scarce company resources without brining in substantial organizational outcomes but it may also yield serendipitous results if constrained by tight management oversight. Such oversight normally comes as a byproduct of centralized decision making (Fig. 2). We therefore propose:

H3. A high degree of centralization of managerial decision making in combination with unfocused information-seeking will have a positive impact on ERP project success.

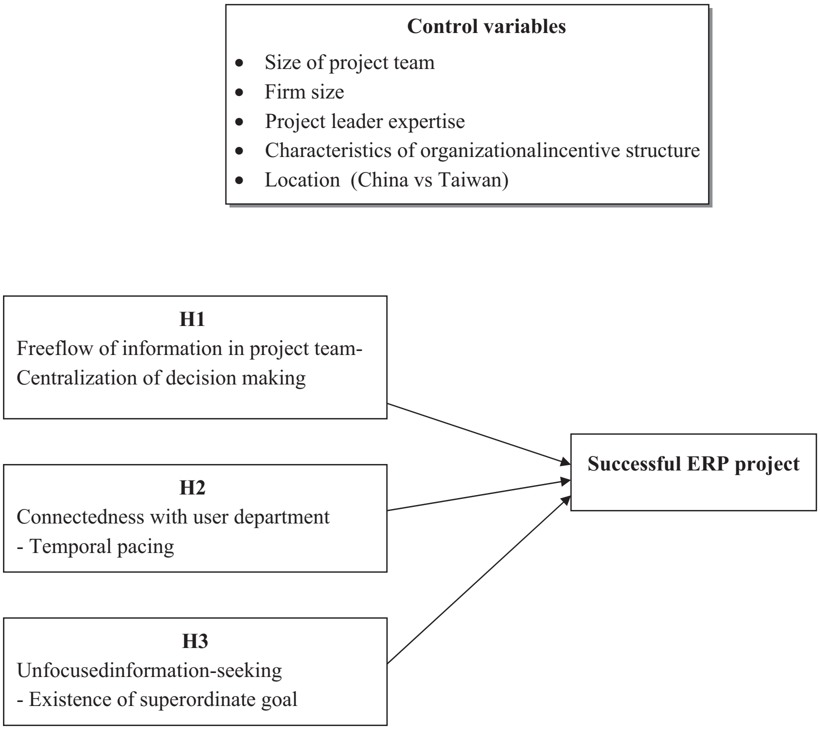

Fig. 2. Hypotheses of the study.

4. Methodology

4.1. Sample and procedure

A questionnaire survey regarding the implementation of ERP systems in China and Taiwan was conducted in May 2006. The questionnaire asked respondents about ERP project management issues through an online survey. An email invitation to participate in the survey was first sent to SME users of a particular ERP software package. The email explained the purpose of the survey, the benefit of the study, how the confidentiality of the SEMs would be ensured, and that partici pation was voluntarily. The questionnaire was administered to a sample of SME users of a Chinese language-only ERP software supplied by Data Systems Consulting (DSC). DSC is a company that has offered IT services and products in Taiwan for 25 years. In 2002, it set up a joint venture with Digital China, a Chinese IT firm, to help market its products in China. The majority of DSC's customers are SMEs in China and Taiwan. DSC has a market share of 36% of the ERP market in Taiwan (Tsai et al., 2005). In China, DSC also has the largest market share in the ERP market among medium-sized companies. All surveyed organizations were privately- owned companies in the manufacturing industry. Their products include laptops passive parts and mobile phone parts.

4.1.1. Taiwan sample

The Taiwan sample consists of organizations that had implemented ERP systems in Taiwan. The study surveyed 465 SMEs that used DSC systems and received 311 responses, resulting in a response rate of 67%. Among the returned questionnaires, 139 were complete and usable for data analysis. We emailed the questionnaires to the ERP project managers and senior project team members of each firm and asked them to forward the questionnaires to their project team members in charge of coordinating team members' effort. Data collection involved interaction with 112 project managers, 25 key project members, and 2 MIS staff members in different organizations in Taiwan (Table 1).

4.1.2. China sample

The data for project teams in China were obtained from 105 SME organizations that had successfully implemented DSC systems. The sample surveyed by the present study concerns organizations that had implemented ERP systems in Kun-Shan, Jiangsu province, the city with the greatest intensity of Taiwanese-funded companies in China. The study surveyed 290 electronics companies that had adopted the DSC system, and received 117 responses, i.e., a response rate of 40%. Among the returned questionnaires, 105 were complete and usable for data analysis. Data collection involved interaction with 60 project managers, 34 key project members, and 11 MIS staff members in different organizations in China.

4.2. Descriptive statistics

Respondents provided demographic information about areas of responsibility, job title, company type, company annual revenue, location/market, and technologies used for business purposes. Profiles for each sample are outlined in Table 1. As can be seen in Table 1, most of the respon dents from each sample were male (64%). Most of the respondents from each sample held a graduate degree (75%), and for the entire sample, 97% of the respondents had at least an undergraduate degree.

We assessed structural and demographic differences between the two sub-samples by compa ring the percentage of complete responses for each of the three categories in our survey. As shown in Table 2, there is a significant difference ($p<0.001$) in the number of employees between the two groups. That is, companies with DSC systems in Taiwan had more employees than did their Chinese counterparts. Regarding "tenure in the current organization" (measured by the number of years respondents have worked for their company) and annual revenues, we found no difference between the two sub-samples. Our findings suggest that firms in China and Taiwan are similar in their annual revenues and staff tenure while they differ in the number of employees. One possible explanation is that China is a labor intensive country with lower labor costs.

Table 1
Descriptive statistics

	China	Taiwan	Total	%
Sample size	105	139	244	100
Gender				
Males	76	81	157	64
Females	29	58	87	36
Education				
Graduate degree	69	113	182	75
College degree	29	25	54	22
No college degree	7	1	8	3
Role in project				
Project managers	60	112	172	70
Key project members	34	25	59	24
MIS staff members	11	2	13	6
Annual revenue (billion NT$)				
<1	65	58	123	50
1~<1.49	14	38	52	21
1.5~<4.99	17	16	33	16
> = 5	9	27	36	13
Number of employees				
<200	20	46	66	27
200~<499	22	41	63	26
500~<999	51	25	76	31
1000~<1999	7	18	25	10
> = 2000	5	9	14	6

Table 2
Independent samples test for China vs. Taiwan

	China		Taiwan		*t*-test for difference of means	Sig.
	Mean	SD	Mean	SD	*t*	*p*
Tenure in the current organization[a]	2.82	1.54	3.02	1.30	−.20	.293
Number of employees[b]	3.17	1.47	1.98	1.18	1.19	.000
Annual revenue[c]	1.77	0.65	2.07	0.32	−0.33	.135

[a]Tenure in the current organization : How many years are you in your company? (Please write number).

[b]Number of employees: How many regular full-time employees are in your company? (Please select only one): 1 = < 200 employees (TERMINATE); 2 = 200 to 499; 3 = 500 to 999; 4 = 1000 to 1999; 5 = 2,000 or more.

[c]Annual revenue: How much annual revenue is in your company? (Please select only one): 1 = < 1 billion NT$ (TERMINATE); 2 = 1 to 1.49; 3 = 1.5 to 4.99; 4 = 5 or more.

4.3. Measures

We adapted items from relevant prior research to operationalize the study constructs. We validated the adapted items' wording in order to tailor the instrument to our use. We measured the organizational variables on a five-point interval scale (1 = strongly disagree, 5 = strongly agree). Specifically, we modified items measuring centrifugal and centripetal forces from Sheremata (2000), Atuahene-Gima (2003), and Mahaney and Lederer (2003) to fit the ERP project context and we drew on Hong and Kim (2002) for our items related to ERP implementation success. Hong and Kim (2002) had discussions with industry executives regarding the content and the meaning of measured ERP project implementation success. To pretest the reliability and the validity of the questionnaire instruments, we conducted a pilot study with 10 respondents from three firms. We revised some items on the basis of the pilot results. The operational definitions of the variables used are summarized in the Appendix.

We performed a factor analysis to examine the convergent validity of the study constructs. Our results suggest a satisfactory level of convergent validity as these items appeared to load high on their respective constructs (factors). To determine whether the 12 centrifugal force items, 12 centripetal force items, 3 project leader expertise item, 3 characteristics of organizational incentive structure, and 6 successful ERP project management items could be reduced to a smaller group of meaningful factors, we conducted a principal component analysis on the basis of the responses obtained from all participants in the study. With no item dropped, nine components with eigenvalues greater than one emerged, and the best results were obtained with a varimax rotation. Table 3 provides the factor pattern matrix that shows the loadings of each item on measured factor variables. Results of the confirmatory factor analysis indicated that a priori assumptions were substantiated with a nine-factor solution, and the loadings for the nine components are presented in Table 3. We used factor analysis also to check discriminant validity (Hair et al., 1995). Table 3 shows that discriminant validity was confirmed when items for each variable were loaded onto single factors with loadings of greater than 0.4. The Kaiser–Meyer–Olkin Measure of Sampling Adequacy read 0.813, and the percent of variance accounted for by the ten factors was 78.7%. The alpha coefficients are all greater than the recommended 0.7 cut-off point for reliability coefficients (Nunnally, 1978). In the current analysis, we treat the three centrifugal force factors and the three centripetal force factors as the independent variables.

4.4. Analysis and results

We performed several checks on the correlational properties of the study variables before testing hypotheses. We reviewed the correlations among the variables in Table 4. The correlation with the greatest magnitude was 0.588. Kennedy (1979) indicates that correlations of 0.8 or higher are problematic. There is no definitive criterion for the level of correlation that constitutes a serious multicollinearity problem. Inspection of the correlation matrix reveals that 23 of the 36 correlations (64%) are significant at the .01 level but do not exceed .60, which would indicate that there may be some higher-level construct underlying individual variables. This provides an adequate basis for proceeding to the next level.

Following prior research, we tested the hypotheses with regression analysis, and we used procedures appropriate for assessing interdependent variables. According to our three hypotheses, we specified three models, each one containing our control variables. Every model then analyzed the influence of one pair of centrifugal/centripetal forces, both as a single variable and as an interaction of the two variables constituting one pair. Since our hypotheses propose that the *coexistence* of the pair of forces, rather than the presence of a single force, influences ERP success, we control the potential effect that each force may have. By doing so, we prevent inflation of the interaction effect that is due to the correlation between the interaction term (the coexistence of the pair of forces) and each single force (Aiken and West, 1991). An examination into the beta weights of each force suggests that none of the six forces related significantly with ERP implementation success. This provides further evidence that neither centrifugal forces nor centripetal forces alone can lead to ERP implementation success. (Table 5).

Regarding our control variables, organizational incentive structure and project leader expertise both have a significant association with project success in all but one model (project leader expertise does not

Table 3
Results of factor analyses[a]

		1	2	3	4	5	6	7	8	9	Reliability
1	SP1	0.85									.9507
	SP2	0.84									
	SP3	0.80									
	SP4	0.78									
	SP5	0.73									
	SP6	0.65									
2	CN1		0.76								
	CN2		0.76								
	CN3		0.70								
	CN4		0.63								.9227
	CN5		0.52								
3	TP1			0.80							
	TP2			0.80							
	TP3			0.72							
	TP4		0.43	0.61							.8778
4	FL1				0.83						
	FL2				0.81						
	FL3				0.78						
	FL4				0.60						.9333
5	SG1					0.81					
	SG2					0.78					
	SG3					0.59	0.42				.9549
	SG4					0.58					
6	PL1						0.84				
	PL2						0.73				.8518
	PL3			0.44			0.71				
7	PI1							0.87			
	PI2							0.87			
	PI3							0.59			.7976
8	DT1								0.88		
	DT2								0.84		
	DT3								0.79		.8378
9	SK1									0.86	
	SK2									0.85	.8612
	SK3									0.44	
% of variance		18.712	10.788	9.165	8.630	7.538	6.878	6.062	5.840	5.118	
Cumulative %		18.712	29.500	38.664	47.294	54.832	61.710	67.771	73.611	78.729	

Extraction method used is Principle Component Analysis and the rotation method used is Varimax with Kaiser Normalization.
[a]Only loading of 0.4 or above are shown.

show a significant association with project success in Model 1). Firm size shows a significant association with project success in only one model (Model 2) while the other control variables (Size of project team and Location) are not associated with project success. Regarding the impact of interactions between pairs of centrifugal/centripetal forces, all three pairs show a significant association with project success on the .05 or the .01 level of significance. Although our R^2 values are not large—implying our models account for limited variance of ERP success—significant F tests suggest that our variables are unbiased and meaningful predictors of ERP success. (Model 1, $F = 4.179$, $p < 0.01$, $R^2 = 0.126$; Model 2, $F = 3.822$, $p < 0.01$, $R^2 = .117$; Model 3, $F = 4.164$, $p < 0.01$, $R^2 = .125$). Therefore, we conclude that all three of our hypotheses are supported.

Table 4
Means, standard deviations, and correlations

Variables	Means	SD	1.	2.	3.	4.	5.	6.	7.	8.	9.
Centralization of decision making	2.98	0.87	1								
Free flow of information in project team	3.78	0.61	0.02	1							
Connectedness with user department	3.86	0.55	0.04	0.34***	1						
Temporal pacing	4.00	0.49	−0.06	0.29***	0.54***	1					
Project leader expertise	3.89	0.61	0.02	0.37***	0.46***	0.55***	1				
Existence of superordinate goal	3.87	0.49	0.05	0.40***	0.52***	0.44***	0.56***	1			
Characteristics of organizational incentive structure	2.25	0.80	0.25***	−0.35***	−0.12	−0.14*	−0.18**	−0.10	1		
Unfocused information-seeking	2.29	0.77	0.21**	−0.39***	−0.19*	−0.19*	−0.18**	−0.32***	0.49***	1	
Successful ERP project	3.14	0.76	0.03	0.18*	0.22**	0.16*	0.29***	0.26***	−0.14**	−0.17**	1

***$p<0.001$.
**$p<0.01$.
*$p<0.05$.

5. Discussion

5.1. Theoretical implications

This study is one of the first empirical inquiries into the roles that centrifugal and centripetal forces play in successful ERP implementation. Our findings provide evidence that a balance of centrifugal and centripetal forces promotes successful ERP implementation. The results indicate that the CCF model which has been developed in the context of global new product development teams can be generalized to the study of IS implementation. More importantly, this approach can be seen as an alternative to the three approaches towards IS implementation studies described by Markus (1983), viz., emphasizing human, technical and political factors, respectively. While human and technical factors represent the two dimensions of ERP research which we have discussed above (see Section 2), the approach used in this study can not be equated with the third one which focuses on political factors (of which there are many important examples in the literature, e.g. Levine and Rossmoore, 1995). Rather, the perspective emphasizes the interaction of opposing forces which, however, do not diminish one another but reinforce and help unfold their beneficial effects. This perspective is reminiscent of recent efforts to apply ideas from structuration theory in the IS field (Orlikowski, 1992, 2000; Yates et al., 1999; Johnston and Gregor, 2000). However, structuration theory sees structure as constraining and enabling action, while the CCF model sees a mutual enabling and constraining relationship: not between structure and action but between two forces which could be aspects of structure (such as existence of superordinate goals) but also could be attributes of action (such as free flow of information). Indeed, the notion of "forces" can be found in a model of organizational change in the 1950s. Kurt Lewin (1952) perceived opposing forces which have reached a state of stable balance as the ultimate reason for the emergence of organizational structures (organizational change would then require the "unfreezing" of these stable structures). Our application to IS implementation processes suggests that such a model may also be fruitful for analyzing organizational processes, not just organizational structures.

In addition, the findings also demonstrate the importance of project leader expertise and organizational incentive structure. While the former effect is well known in the literature (Harrison and Harrell, 1993; Wang et al., 2005) the latter has not received as much attention in IS implementation studies. Yet it has been shown that a principal-agent perspective emphasizing incentive structures can be usefully applied to the study of IT's impact on organizational structures (Brynjolfsson, 1994; Brynjolfsson et al., 1994). It seems that application of this perspective to IS implementation studies may be an a promising direction for future research. Regarding the influence of the other control variables, the lack of a significant association between project success and location seems most noteworthy as it suggests that economic context does not result in different determinants of ERP implementation success.

Regarding the more specific field of ERP implementation studies, our analysis shows that it is

Table 5
Results of regression analyses with successful ERP project as dependent variable[a]

Variables	Successful ERP project		
	Model 1	Model 2	Model 3
Control			
Size of project team	−.112	−.071	−.098
Firm size	.178	.232*	.183
Project leader expertise	.161	.238**	.219**
Characteristics of organizational incentive structure	.350*	.389*	.262*
Location (China vs. Taiwan) (L)	.013	.025	.046
Independent variables			
Centrifugal forces (C1)			
Free flow of information in project team (C1A)	.388		
Connectedness with user department (C1B)		.239	
Unfocused information-seeking (C1C)			.255
Centripetal forces (C2)			
Existence of superordinate goal (C2A)	.397		
Temporal pacing (C2B)		.181	
Centralization of decision making (C2C)			.254
*Centrifugal forces*Centripetal forces*			
C1A*C2A	.541**		
C1B*C2B		.314*	
C1C*C2C			.216*
R^2	.126	.117	.125
Adjusted R^2	.096	.086	.097
F	4.179**	3.822**	4.164**
n	244	244	244

[a]Standardized regression coefficients are reported.
*$p<.05$.
**$p<.01$.

probably not sufficient to focus on the impact of individual so-called critical success factors (the ERP-implementation literature based on the notion of critical success factors is very large; as an example summarizing parts of that literature see Al-Mashari et al., 2003). Rather, it seems necessary to consider how these factors interact. In this context it is noteworthy that, taken alone, none of the forces that we have used for building our pairs of centrifugal/centripetal forces displayed a significant association with project success. This highlights the dynamic nature of ERP implementation processes. Only when considering their combined effects did a significant relationship with project success emerge. Akkermans and van Helden (2002) have suggested a model which explicitly considers the interactions among a widely used set of critical success factors; while that model has been successfully used to analyze one case of ERP implementation, the authors also acknowledge that their model may be applicable to this one case only. Thus, more general models of how success factors interact are required and we think that the CCF model used in this study can show a fruitful direction for such efforts.

5.2. Managerial implications

In the past, IS implementation has often been considered the sole responsibility of IT departments, implying that IS projects were seen as purely technological. However, increasingly it has become clear to managers that information systems are becoming a crucial component in managing a firm's operations. Without an integrated, company-wide information system, firms are simply put at a competitive disadvantage when they take that little bit longer to confirm customer orders or produce and deliver their products. As a consequence, IS implementation success becomes a crucial issue for operations management as well. Therefore, learning how to implement complex and large information systems such as ERP has increasing relevance not just for IT management but also for operations management.

The first implication of the survey results for the management of ERP implementation processes is that it is imperative to strike and maintain a balance between centrifugal and centripetal forces influencing ERP implementation processes. Our study suggests that this task might be less complex than it may seem at first glance. The reason is that it may not be necessary to consider all possible influences on ERP implementation projects and then balance them simultaneously; rather, our study suggests that individual pairs of forces can be identified which need to be balanced. For example, when encouraging a project team to interact frequently with the future users of the system, project management should take measures to ensure that the project schedule is not risked as a result of users trying to insert their possibly idiosyncratic requirements into the implementation process. Thus, the balancing effort seems to be quite straightforward. The main message here is that for every measure a "countervailing" measure should be identified and applied in a proportionate manner. The approach is rather similar to a body builder who will always train two sets of muscles which together are needed for moving a body part since they are pulling that part in opposite directions. Similarly, the results of this study suggest that project managers should try to think of measures in pairs so that they can mutually constrain and enable one another (in the sense of unfolding their beneficial versus their destructive potential).

Finally, the findings again point to the importance of using project leader expertise for leading ERP implementation projects. Of course, the real problem is not knowing that experienced project leaders are required for successful projects but finding (and paying for) them.

Our finding that an organization's general incentive structure can negatively affect ERP implementation project results should catch the attention of decision makers in firms, as it suggests that organizations in which employees find it rational to hide problems or to over-report results are in acute danger of starting a doomed ERP implementation project. While such organizations would be considered in bad shape in general, it would be a particularly bad idea to hope that implementing an ERP system will help improve matters. Rather, managers should consider which reasons are responsible for this type of behavior and adjust their organization's incentive structure accordingly.

5.3. Limitations and future research

Several limitations should be addressed. First, we did not include many of the usual Critical Success Factors in our study—which may account for the low R^2 in our models. This might be justified with our different focus; we have focused on what is, in our opinion and in this specific context, the most important control variable and thus we are not interested in confirming the importance of the usual Critical Success Factors. However, we suggest that future studies incorporate the Critical Success Factors to increase the comprehensiveness of the study model. Second, the generalizability of the findings remains limited as this sample is composed only of manufacturing firms in China and Taiwan. Third, the study surveys only organizations that have completed the implementation of ERP systems and does not account for those whose ERP systems still in the planning and implementation phases. In future research, a broader perspective on these constructs may provide greater and richer insights. Specifically, it will be necessary to study the way in which centripetal and centrifugal forces interact from a process perspective (Markus and Robey, 1988). Another limitation of this study is that the measures used are subjective; the study therefore cannot completely rule out the effects of the shortcomings associated with subjectivity. However, this measurement approach was deemed appropriate here.

6. Conclusion

This study has used responses from 244 small and medium-sized manufacturers in China and Taiwan to examine the role that pairs of centripetal and centrifugal forces plays in ERP implementation success. The forces that were investigated in this study do not in themselves influence ERP project success but do so in certain combinations. Despite its limitations, we believe this study opens a fruitful avenue for future research on ERP project management. It is hoped that the new measures developed and validated in this study will prove to be useful to researchers in their future endeavors.

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Appendix. Question items used in the study

Table A.

Table A1

Construct	Item	Measure	Source
Centralization of decision making	DT1	Any decision we made had to have a higher manager's approval.	Atuahene-Gima (2003)
	DT2	There could be little action taken in the project until a higher manager approved.	Sheremata (2000)

Table A1 (*continued*)

Construct	Item	Measure	Source
	DT3	We had to ask a high manager before we could do almost anything.	
	DT4	A team member who wanted to make his/her own decisions would be quickly discouraged.	
Free flow of information in project team	FL1	Access to information from team members was quick and easy.	Atuahene-Gima (2003)
	FL2	Team members willingly kept each other informed at all times.	Sheremata (2000)
	FL3	Channels of communication among team members were open.	
	FL4	Access to information from team members was quick and easy.	
Connectedness with user department	CN1	Team members had frequent interactions with end users.	Atuahene-Gima (2003)
	CN2	Team members put a lot of effort in interacting with end users.	Sheremata (2000)
	CN3	We had frequent consultation with other departments in the firm regarding the project.	
	CN4	The project team collected information about new ERP market development affecting end users.	
	CN5	The project team had close, personal interactions with other member of the firm regarding the project.	
Temporal pacing	TP1	The project team followed a documented process with specific milestone for each activity.	Atuahene-Gima (2003)
	TP2	The progress towards the project objectives was reviewed at specific stages.	Sheremata (2000)
	TP3	The project used a formal process with different stages for major activities.	
	TP4	The project used a formal process with frequent review of progress.	
Project leader expertise	PL1	The project leader had diverse technical and management knowledge and experience in the industry.	Atuahene-Gima (2003)
	PL2	The project leader had significant technical and management skills and knowledge about the team's project.	Sheremata (2000)
	PL3	The project leader had experience in both technical and management aspects of ERP implementation project.	
Existence of superordinate goal	SG1	Team members accepted the project goals as their own.	Atuahene-Gima (2003)
	SG2	Every team member behaved in ways that supported the overall goals of the project.	Sheremata (2000)
	SG3	The project goals and objectives linked all of us together.	
	SG4	Team members were all committed to the same project goals.	
Characteristics of organizational incentive structure	PI1	Hide problems®	Mahaney and Lederer (2003)
	PI2	Skipping tasks but not reporting it®	
	PI3	Over-report percent completed®	
Unfocused information-seeking	SK1	Socializing	Mahaney and Lederer (2003)
	SK2	Surfing the Internet	
	SK3	Talking on the phone	

Table A1 (*continued*)

Construct	Item	Measure	Source
ERP implementation success	SP1	The ERP project took significantly longer than expected.®	Hong and Kim (2002)
	SP2	The system performance of ERP is significantly below the expected level.®	Tsai et al. (2005)
	SP3	The cost of ERP project was significantly higher than the expected budgets.®	
	SP4	There is no match between ERP systems and specific planned/objectives®	
	SP5	User's attitudes towards ERP are negative®	
	SP6	ERP systems did not match user's expectations®	

®Reverse-coded.

References

Aiken, L.S., West, S.G., 1991. Multiple Regression: Testing and Interpreting Interactions. Sage Publications, Newbury Park, CA.

Akkermans, H., van Helden, K., 2002. Vicious and virtuous cycles in ERP implementation: a case study of interrelations between critical success factors. European Journal of Information Systems 11 (1), 35–46.

Al-Mashari, M., Al-Mudimigh, A., Zairi, M., 2003. Enterprise Resource Planning: A Taxonomy of Critical Factors. European Journal of Operational Research 146 (2), 352–364.

Atuahene-Gima, K., 2003. The effects of centrifugal and centripetal forces on product development speed and quality: how does problem solving matter? Academy of Management Journal 46 (3), 359–373.

Boudreau, M.-C., 2003. Learning to use ERP technology: a causal model. Proceedings of the 36th Hawaii International Conference on System Sciences.

Brown, S.L., Eisenhardt, K.M., 1995. Product development: past research, present findings, and future research. Academy of Management Review 20 (2), 343–378.

Brynjolfsson, E., 1994. information assets, technology, and organization' Management Science 40 (12), 1645–1662.

Brynjolfsson, E., Malone, T.W., Gurbaxani, V., Kambil, A., 1994. Does Information technology lead to smaller firms? Management Science 40 (12), 1628–1644.

Carmel, E., 1999. Global Software Teams—Collaborating Across Borders and Time Zones. Prentice-Hall, Upper Saddle River, NJ.

Crowston, K., Kammerer, E., 1998. Coordination and collective mind in software requirements development. IBM Systems Journal 37 (2), 227–245.

Davenport, T.H., 2000. Mission Critical: Realizing the Promise of Enterprise Systems. Harvard Business School Press, Boston.

Gersick, C.J.G., 1994. Pacing strategic change: the case of new venture. Academy of Management Journal 37 (1), 9–45.

Griffin, A., 1997. The effect of project and process characteristics on product development cycle time. Journal of Marketing Research 34, 24–35.

Guzzo, R.A., Shea, D., 1992. Group performance and intergroup relations in organizations. In: Dunnette, M.D., Hough, L.M. (Eds.), Handbook of Industrial and Organizational psychology, Vol. 3. Consulting Psychologists Press, Palo Alto, CA pp. 269–313.

Hair, J.F., Anderson, R.E., Tatham, R.L., Black, W.C., 1995. Multivariate Data Analysis. Prentice-Hall, Englewood Cliffs, NJ.

Harrison, P.D., Harrell, A., 1993. Impact of adverse selection on managers' project evaluation decisions. Academy of Management Journal 36 (3), 635–643.

He, X., 2004. The ERP challenge in China: a resource-based perspective. Information Systems Journal 14, 153–167.

Hong, K.K., Kim, Y.G., 2002. The critical success factors for ERP implementation: an organizational fit perspective. Information & Management 40 (1), 25–40.

Hofstede, G., 2001. Culture's Consequences: Comparing Values, Behaviors, Institutions, and Organizations Across Nations, Second edition. Sage, London.

Hyatt, D.E., Rudy, T.M., 1997. An examination of the relationship between work group characteristics and performance: once more into the breech. Personnel Psychology 50, 553–585.

Janicik, G.A., Bartel, C.A., 2003. Talking about time: effects of temporal planning and time awareness norms on group coordination and performance. Group Dynamics: Theory, Research, and Practice 7, 122–134.

Johnston, R.B., Gregor, S., 2000. A theory of industry-level activity for understanding the adoption of interorganizational systems. European Journal of Information Systems 9 (4), 243–251.

Kennedy, P., 1979. A Guide to Econometrics. MIT Press, Cambridge, MA.

Kraut, R.E., Streeter, L.A., 1995. Coordination in software development. Communication of the ACM 38 (3), 69–81.

Levine, H.G., Rossmoore, D., 1995. Politics and the function of power in a case study of IT-implementation. Journal of Management Information Systems 11 (3), 115–133.

Lewin, K., 1952. Group Decision and Social Change. In: Swanson, G.E., Newcomb, T.M. (Eds.), Readings in Social Psychology. Henry Holt, New York pp. 459–473.

Liu, B., Zhou, Y., 2001. ERP and its application in China. Proceedings of the 1st International Conference on Electronic Business (CD-ROM).

McChesney, I.R., Gallagher, S., 2004. Communication and coordination practices in software engineering. Information and Software Technology 46, 473–489.

Mahaney, R.C., Lederer, A.L., 2003. Information systems project management: an agency theory interpretation. The Journal of Systems and Software 68 (1), 1–9.

Marble, R., in press, Culturalizing enterprise software for the chinese context: an argument for accommodating Guanxi-based business practices. International Journal of Production Economics, xx (y), aaa-bbb.

Markus, M.L., 1983. Power, politics, and MIS implementation. Communications of the ACM 26 (6), 430–444.

Markus, M.L., Robey, D., 1988. Information technology and organizational change: causal structure in theory and research. Management Science 34 (5), 583–599.

Markus, M.L., Axline, S., Petrie, D., Tanis, C., 2000. Learning from adopters' experiences with ERP: problems encountered and success achieved. Journal of Information Technology 15 (4), 245–265.

Martin, M.H., 1998. An ERP strategy. Fortune 2, 95–97.

Martinsons, M.G., 2000. Management in China after two decades of an open door policy. Journal of Applied Management Studies 8 (1), 119–126.

Martinsons, M.G., 2004. ERP in China: one package, two profiles. Communications of the ACM 47 (7), 65–68.

Nord, W.R., Tucker, S., 1987. Implementing Routine and Radical Innovations. Lexington Books, Lexington MA.

Nunnally, J.C., 1978. Psychometric Theory. McGraw-Hill, New York.

Orlikowski, W.J., 1992. The duality of technology: rethinking the concept of technology in organizations. Organization Science 3 (3), 398–427.

Pinto, M.B., Pinto, J.K., Prescott, J.E., 1993. Antecedents and consequences of project team cross-functional cooperation. Management Science 39 (10), 1281–1297.

Quan, J., Hu, Q., Wang, X., 2005. Transforming China: IT is not for everyone in China. Communications of the ACM 48 (4), 69–72.

Reimers, K., 2003. International examples of large-scale systems—theory and practice I: implementing ERP systems in China. Communications of the AIS 11, 335–356.

Sheremata, W.A., 2000. Centrifugal and centripetal forces in radical new product development under time pressure. Academy of Management Review 25 (2), 389–408.

Soh, C., Siew Kien, S., Tay-Yap, J., 2000. Cultural fits and misfits: is ERP a universal solution? Communications of the ACM 43 (4), 47–51.

Sprott, D., 2000. Componentizing the Enterprise application packages. Communications of the ACM 43 (4), 62–96.

Steiner, I.D., 1972. Group Process and Productivity. Academic Press, New York.

Tsai, W.-H., Chien, S.-W., Fan, Y.-W., Cheng, J.M.-S., 2005. Critical management issues in implementing ERP: empirical evidence from Taiwanese firms. International Journal of Services and Standards (IJSS) 1 (3), 299–318.

Wang, E., Chou, H.-W., Jiang, J., 2005. The impacts of charismatic leadership style on team cohesiveness and overall performance during ERP implementation. International Journal of Project Management 23, 173–180.

Yates, J., Orlikowski, W.J., Okamura, K., 1999. Explicit and implicit structuring of genres in electronic communication: reinforcement and change of social interaction. Organization Science 10 (1), 83–103.

Zhang, L., Lee, M.K.O., Zhang, Z., Banerjee, P., 2003. Critical Success Factors of Enterprise Resource Planning Systems Implementation Success in China. HICSS.