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External social capital and information systems development team flexibility

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ABSTRACT

Context: ISD research based on the socio-technical perspective suggests that two sources of socio-technical change have a bearing on the performance of information systems development (ISD) projects: business requirements and development technology. To enhance project effectiveness, ISD teams need to enhance their flexibility in the face of the constant changes taking place from business and technical environments in which they operate. Flexibility is conceptualized as an outcome of capability development through constantly integrating and reconfiguring available resources within and outside of the organization where the team is embedded.
Objective: The purpose of this study is to examine the relationship between a team's external social capital and team flexibility. More specifically, based on social capital theory, this study argues that external social capital leads to IS team flexibility, which in turn contributes to the successful project performance.
Method: A survey design was selected to collect data and test the proposed model. A snowballing strategy was employed to collect data. 118 information systems developers participated in the survey and the model was analyzed using partial least squares regression.
Results: The findings show that, in general, the ISD teams' external social capital does contribute to the team's response to changes. However, they exhibit unique impacts on ISD team flexibility respectively.
Conclusion: The various external social capitals have distinctive effects on a team's flexibility. Specifically, horizontal relationships are positively associated with both business and technology flexibility. Vertical relationships are positively associated with business flexibility and market relationships technology flexibility. ISD managers should establish robust relationships with its high-ups, other lateral units, and third parties outside in the market. They also need to be more adaptive to the increasingly volatile socio-technical environment, and proactively search, exploit, upgrade, and integrate resources that are essential to the development of system development team flexibility.

1. Introduction

According to a survey conducted by research firm Standish Group, United States investment in information systems development (ISD) projects in 2001 was four times that reported in 1990. However, success rate was a mere 28% [35]. Figures remained troublesome in 2009. ISD project success rate was 32%, 44% of projects were over budget and time estimated, and 24% failed outright [44]. These statistics suggest that many efforts to improve project management barely help to increase success. A high success rate is crucial to technology-backboned modern organizations. Project failures not only waste resources and lead to foregone business opportunities, but impact reputations and profits as well.

ISD research based on the socio-technical perspective suggests that performance of ISD projects is excessively affected by rapid changes in both business requirement and systems development technology [5,21,24]. Therefore, system development team flexibility (SDTF) has been proposed to play an essential role in determining project performance to hedge against high-velocity environments [14,17]. To do so, ISD teams need to integrate and reconfigure available resources in a timely manner. Based on dynamic capability perspective, SDTF in this study is conceptualized as an outcome of capability development through constantly integrating and reconfiguring available resources within and without the organization where the team is embedded [27].

Previous works on software development largely focused on a wide range of team processes, practices, or routines associated with development activities (e.g., planning, execution, and result appraisal) in an attempt to facilitate control of the project [11,29]. However, in volatile socio-technical environments, these practices become less effective as outputs of ISD projects tend to evolve

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throughout the development process [8]. In addition, resources available for a team are often circumscribed. This means that teams cannot possibly possess all the requisite resources, potentially restricting their options in response to problems due to abrupt and unexpected changes and eventually influencing project performance. To enhance project effectiveness, ISD teams are called upon to span traditional boundary and establish external linkages to access informative, financial, and administrative resources and support in a timely manner [7,12]. However, current research lacks a theoretical explanation on what these external linkages are and how they facilitate ISD teams to deliver systems successfully.

This research employs the social capital theory as theoretical lens to elucidate how external social capital enhances project performance. It argues that resources embedded in the interaction ties lead to resources exchanged and combination, which in turn result in value creation [45]. The purpose of this study is to examine the relationship between a team's external social capital and team flexibility. It argues that social capital flowing from entrenched external connections lead to ISD team flexibility, which in turn contributes to successful project performance at the end. The underlying thrust is that external relationships developed through protracted interactions provide conduits through which valuable resources can be exchanged and integrated by ISD team. By integrating and reassembling exchanged resources, the ISD team can generate innovative ideas and problem solving solutions to respond effectively to changes arising from capricious socio-technical contexts.

We validated the proposed research model by surveying 118 information systems developers across various industries. Findings reveal that, in general, ISD teams' external social capitals do contribute to project performance through team flexibility. However, each type of external social capital exhibited unique impact on flexibility outcomes. Results of this study likewise confirmed that ISD team flexibility directly impacts project performance. Both academic and practical implications of findings are discussed toward the end of this paper.

2. Literature review

2.1. ISD team flexibility

Flexibility refers to the ability to adapt to environmental changes. Two major streams of IS/IT flexibility research have been examined in literature. The first stream of research largely views flexibility from a resource-based view (RBV), in which it is conceptualized as the development and deployment of organizational resources (e.g., agile IT architecture and infrastructure, systems development methodology, tools, skills, competence, and so on) that provide a repertoire of options for rapid response to sudden and unexpected changes [14,17,38]. From this view, flexibility is made possible through heterogeneous resources.

However, validity of RBV as a frame of reference has been questioned recently for being static and neglecting the influence of dynamic environments [47]. In RBV, development and deployment of resources are historically dependent. Once established, these temporally specific resources may become rigid over time and be a source of inflexibility when the environment changes. Thus, in volatile contexts, resources and capabilities developed at a particular time period may eventually be less elastic and less capable of responding to volatile environments.

Based on and extending from the RBV, the second stream of research conceptualizes flexibility from a dynamic-based perspective. It contends that flexibility is an outcome of capability development manifesting through constant renewal, integration, and reconfiguration of a myriad of internal and/or external resources to address environmental changes [27,43]. In contrast to conventional RBV, flexibility research based on the dynamic capability perspective focuses on the product resulting from complex interaction among the resource and capability components instead of on a fixed and persistent set of resources.

Adopting the dynamic capability perspective, Lee and Xia [27], using a Delphi approach, identify the structure of ISD team flexibility (SDTF). Their findings suggest that the core of SDTF lies in the scope of response to changing business and technical contexts over the course of a particular ISD project. Business flexibility (BF) captures the extent to which ISD teams react to changes in the business context, pertaining to system scope, delivery time, business rule/processes, data structure, and user interface. Technology flexibility (TF) reflects the degree to which focal teams incorporate technical changes, such as programming tools/languages, IT architecture, network/telecom environment, and network/telecom environment. For the purpose of this study, we adopt Lee and Xia's software development team flexibility representation and define software development team flexibility as the extent to which a software development team can effectively respond to socio-technical context in the course of a software development project.

2.2. External social capital

Social capital is "the sum of actual and potential resources embedded within, available through, and derived from the network of relationships possessed by individuals or social units [31]. Extant research identifies three different aspects of social capital: structure, content, and effect [2,34,45]. Structural dimension refers to the location where the actor performs social interaction with other actors, signalling the sources of social capital. Content dimension concerns the substance embedded in social relationships, such as information, trust, and solidarity. Effects aspect of social capital regards the outcomes brought by social capital to the actor, such as viability, legitimacy, or sponsorship. Based on the tripartite scheme, social capital is defined as valuable resources that lay in the structure of relationships or ties that constitute the social network [7,12,33,40].

A review of associated literature reveals two main sources of social capital: internal and external [2,13,33,34]. Internal sources of social capital, foregrounding the bonding relationships, involve the team's internal social structure that defines relationships among team leaders, team members, and subgroups. In contrast to the bonding view of social capital, external sources, stressing on bridging relationships, highlight the extended social structure that outlines extrinsic linkages to other social units located outside the boundary of focal group.

Social capital has been examined at multiple levels of analysis in management research because it influences individual and collective (team and organization) outcomes. At the individual level, social capital has been argued as a powerful factor influencing personal career success, job placement, and turnover rate [2]. This study particularly examines external social capital at the group level, which is defined as the set of resources made available to a group through the focal group's social relationships entrenched in an intra- or extra-organizational structure [34]. Extant literature has distinguished two conceptual dimensions of external relationships: vertical and horizontal [7,33,34,40]. Vertical relationships refer to the spirit of partnership that the focal ISD team has cultivated with its higher-ups, while horizontal relationships are conceptualized as similar working relationships that the ISD team has established with other social units (e.g., functional areas, business units, or other ISD teams) in the organization [33,34].

For resources that exist outside an organization, research has shown that relationships that connect the team to the market units (e.g. consultant companies, vendors, industrial associations, and profession associations, etc.) also represent an important source of external capital [1,16,41,42]. In the current study, market relationships are therefore added to the scheme of social capital as the third dimension, and are referred to as the ISD teams' social connections to extra-organizational parties. External network ties with trade associations, suppliers and professional associations function as efficient information contacts between project teams and other related stakeholders. Thus, project teams with many contacts outside the organization may be able to gather diverse knowledge about a wide variety of potential market opportunities and technological advances.

2.3. Project performance

Project performance is defined as the degree to which a project team successfully meets project goals, budgets, schedules, and operational efficiency [4,12,25,32]. This assessment of project performance has been widely adopted in the area of system development projects. Jiang et al. [22] emphasized the ideas about the significance of the successfulness of project delivery. In addition, Jiang and Klein [23] asserted that cost, time and productivity efficiency must be taken into consideration when evaluating overall project performance.

3. Research model and hypotheses

Fig. 1 schematically shows the research model. The model contends that external social capital enhances ISD teams' capability to effectively respond to the challenges in the social–technical environments. The model also asserts that the more extensively the ISD team responds to the changes, the more likely the project will succeed. The degree of team flexibility to environmental velocity is determined by the scope of external social capitals available to an ISD team through the close relationships it has established with other social units that beyond the boundary of focal team.

3.1. Vertical relationships and team flexibility

Vertical relationships refer to the spirit of partnership that the focal group has cultivated with its superiors. This established good relationship, characterized by mutual trust and respect, is the result of protracted interaction between the two parties. Good vertical relationships suggest that those in the upper echelons are willing to take risks and share responsibility for ISD projects; they are also likely to provide access to resources that they hold in support of the ISD team. For example, team staffing quality has been noted as an important attribute of extensive flexibility [18,28]. Properly staffed teams can often adjust to fast-paced projects because they have high quality skills and a knowledge base that covers both managerial and technical aspects of project work; therefore, they are able to quickly understand and devise flexible alternatives for unexpected roadblocks that arise during projects [18]. With strong vertical relationships, the focal ISD team finds it relatively easy to obtain the necessary human resources (e.g. recruit new members from the market, reassign members from other ISD teams, or send group members to attend relevant training sessions) that offer requisite skills and knowledge in support of the socio-technical changes faced. As such, they enhance the focal team's capabilities to response to environmental uncertainty and turbulence.

Strong partnerships with senior managers also provide an umbrella of legitimacy and credibility to ISD projects [34,39]. These types of relationships facilitate the focal ISD team's ability to manage the pressure that stems from changes in systems requirements or technological advances. For example, when a client requests a sudden change in systems requirements that will seriously affect the schedule or budget, good vertical relationships motivate senior managers to assist the team by negotiating with the client, or by providing information to the team to evaluate both the necessity for the changes and their scope, if needed. Similarly, in order to cope with fast-changing development technology, the focal SD team may request upgrades to the IT infrastructure and network environment. Strong management support can provide substantial protection against potential internal resistance to the investment [34].

Based on the above, we hypothesize the following:

H1. Vertical relationships that an ISD team holds are positively associated with team flexibility.

H1a. Vertical relationships that an ISD team holds are positively associated with business flexibility.

H1b. Vertical relationships that an ISD team holds are positively associated with technical flexibility.

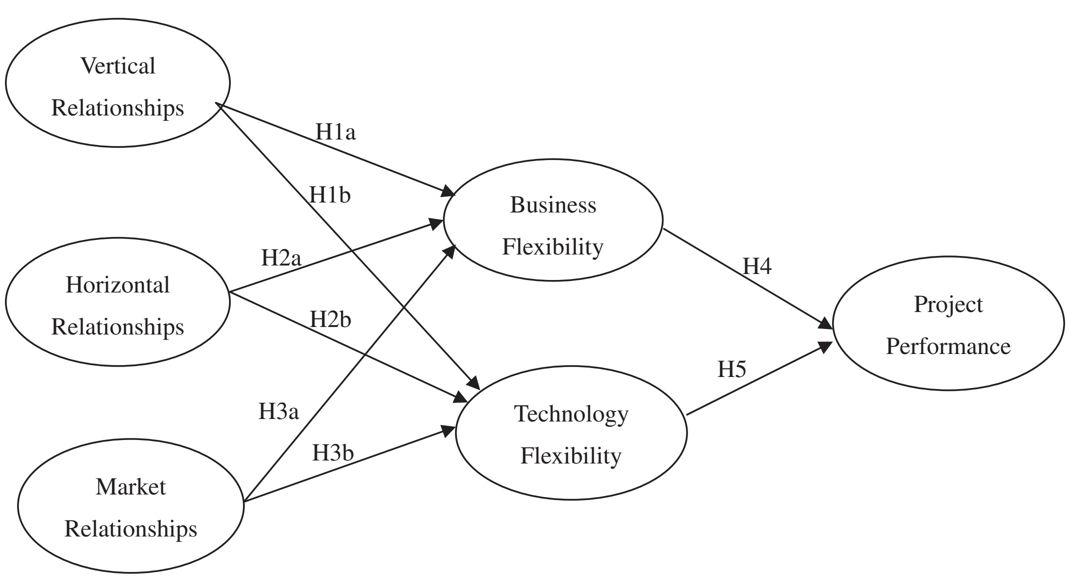

Fig. 1. Conceptual model.

3.2. Horizontal relationships and team extensive flexibility

Horizontal relationships refer to the close working relationships that the focal ISD team has cultivated with other social units (e.g. functional areas, business units, or ISD teams) within the organization. Good horizontal relationships facilitate the sharing of knowledge and work experience between organizational units. In fostered relationships, other units will be motivated to share their knowledge and skills. Thus, good horizontal relationships, like good vertical relationships, act as an additional conduit through which the ISD team can access resources held by the horizontal units to tackle the business and technical challenges that arise during the ISD process [6,7,30]. For example, when unforeseen systems requirement changes arise, the focal teams can find support from other ISD teams through the sharing of relevant information or solutions. Similarly, when unexpected technical difficulties arise, the focal ISD team can obtain the necessary technical support from other teams that may possess the required competency to effectively react to the uncertainties.

Based on the above discussion, we hypothesize the following:

H2. Horizontal relationships that an ISD team holds are positively associated with team flexibility.

H2a. Horizontal relationships that an ISD team holds are positively associated with business flexibility.

H2b. Horizontal relationships that an ISD team holds are positively associated with technical flexibility.

3.3. Market relationships and team extensive flexibility

Market relationships refer to the ISD team's social connections to extra-organizational entities (e.g. professional associations, industry associations, vendors, consultants, and research institutes) [1,16,41,42]. Extra-organizational entities, known as the "knowledge marketplace," serve as knowledge or technology diffusion outlets through which novel technologies and practices are promoted and disseminated. Good market relationships serve as an important conduit through which the ISD teams are exposed to innovative ISD technologies that are unavailable from within the organization, and subsequently help the focal team to breed its own contingencies in the development process. Swan and Newell [41] argued that professional associations work as a key reference agent in diffusing innovation knowledge because they involve members in different kind of knowledge domain, and have closer collaborative links among their organizations. Apart from professional associations, industry associations also act as a forum where ISD related knowledge and technical know-how can be disseminated to those who require it through formal transfer mechanisms (e.g. courses and conference presentations), personalized or informal transfer conduits (e.g. informal discussions and social events), and media sources (e.g. videos, audio tapes, books, or trade publication) [16].

In sum, extra-organizational parities may be important resources that an ISD team can turn to when it requires innovative ISD knowledge and expertises that are unavailable within organization where it operates. Consequently, we expect that while building strong market relationships, the focal ISD team is likely to bring in diverse expertise in an effort to enhance its ability to effectively solve emergent business and technical problems. Based on the above argument, we hypothesize:

H3. Market relationships that an ISD team holds are positively associated with team flexibility.

H3a. Market relationships that an ISD team holds are positively associated with business flexibility.

H3b. Market relationships that an ISD team holds are positively associated with technical flexibility.

3.4. Team flexibility and project performance

Researchers have espoused that ISD team expertise and capabilities have a profound impact on project performance [4,25]. Tziner and Eden [46] reported that for the highly interdependent tasks common to systems development, project performance was related positively to the summed capabilities of the team. ISD teams with high business flexibility are capable of developing a range of options to deal with socio-technical problems that arise; as such, these teams possess a high degree of freedom in terms of managing unexpected changes that occur during the system development process. By leveraging this freedom, focal teams can reduce the propensity for missed deadlines and budget overruns. Moreover, the ability to make good estimations pertaining to changes in project scope, delivery time, and business rules/processes allows focal teams to effectively allocate resources to the unique requirements associated with each project, resulting in a reduction of the amount of rework that occurs during the project life-cycle and in improvements to the overall project performance. Thus, we hypothesize:

H4. Business flexibility is positively associated with project performance.

Technology flexibility reflects a team's capability to incorporate novel design tools, hardware and software platforms, and infrastructure used for ISD. As new ISD technologies are introduced, the efficiency of systems development can be improved. For example, by introducing technology such as object-orientated programming and distribution systems, both the maintainability and reusability of information systems improves. In turn, the overall efficiency of systems development can be enhanced. However, introducing new development technologies may jeopardize project performance, as they may lack reliability. Research has suggested that ISD teams' inability to evaluate and apply new ISD technologies can lead to project failures [40]. Therefore, teams with high technology flexibility are better equipped to effectively harness and incorporate different forms of information technology, leading to a reduction in the number of potential software defects and bugs. Moreover, high technology flexibility enables the team to proficiently integrate old and new technologies. For instance, an ISD project associated with the installation of network technologies for the development of a corporate system may require the combination of an older client–server model with newer 3-tier technology. Integrating old and new systems certainly adds to the complexity of an ISD project. ISD teams that are familiar with both client–server technology and 3-tier technology are more likely to utilize an efficient development schedule and to produce quality results. Based on the above, we hypothesize:

H5. Technology flexibility is positively associated with project performance.

4. Research method and data analysis

A survey design was selected to collect data and test the proposed model. A snowballing strategy was employed to collect data. EMBA students at a leading private university in Taiwan who are a member of system development teams were asked to respond the survey. In addition, all the participant students in the classes were

Table 1
Demographic statistics.

Variables	Categories	#	%	Variables	Categories	#	%
Gender	Male	85	72.0	Project Duration	<6 months	33	27.9
	Female	33	28.0		6–18 months	62	52.6
					>18 months	23	19.5
Age	Under 30	40	33.9	ISD experience	1–5 years	50	42.3
	30–40	64	54.2		6–10 years	44	37.2
	41–50	10	8.5		11–15 years	13	11.0
	51–60	4	3.4		>16 years	11	9.113
Position	Ass. Engineer	9	7.6				
	PM	20	16.9	Budget (USD)	<$3 m.	109	92.4
	Ass. Manager	4	3.4		$3-$20 m.	7	5.9
	Sys. Analyst	17	14.4		>$20 m.	2	1.7
	Programmer	59	50.0	Time in team	3–6 months	14	11.9
	Consultant	9	7.6		7–12 months	19	16.1
Team size	<5	7	6.0		1–2 years	44	37.2
	5–25	111	94.0		>2 years	41	34.7

Note: Ass. Engineer = Assistant Engineer; Ass. Manager = Assistant Manager; Sys. Analyst = System Analyst m. = million.

encouraged to refer friends who involve ISD. Extra credits for the final grade were given as rewards to the participating students. The survey was first translated in Chinese. The translation work was done by a researcher and validated by another researcher who is not involving in this study and fluent with both English and Chinese. The validated Chinese survey was then translated back to English to ensure semantic identity. Some minor revisions were done before the survey was officially delivered. The purpose of this study and the instruction in filling the survey are provided. Particularly, the participants were asked to choose a specific project among the projects they have involved as a frame of reference. The chosen project must be the most recently completed or at least 75% completed at the time when the questionnaire was filled out [36]. Prior to answering the questionnaire, all respondents were asked to focus on one particular project they were working on. A total of 226 questionnaires were sent out, and 123 were completed and returned. The overall response rate was 54.4%. Out of the received responses, five were dropped because the respondents had been part of the ISD team for less than 3 months – members involved for such a short period may not have had sufficient time to become acquainted with other team members and may have compromised their assessment of the constructs of interest. Removal of these responses served to reduce the potential for bias. As such, the final data set consisted of 118 observations.

Table 1 presents the demographic information for the teams in the sample. Of the ISD projects in the sample, over 90% had project budgets below $3 million, 5.9% were between $3 million and $20 million, and 1.7% were over $20 million. In addition, 27.9% of team projects were scheduled for less than 6 months, 52.6% scheduled for between six and 18 months, and 19.5% scheduled for longer than 18 months. Among the respondents, 72% were male. Also, 20.3% of the respondents were project managers or assistant managers and 67.7% were technical staff (programmers, system analysts, and engineers). Over 57.2% of the respondent had over 5 years of software development experience, and 88% had been a member of their team for more than 6 months.

As revealed in Table 1, over 60% of respondents are technical staff. We acknowledge that this may influence the result. However, we believe that an overall understanding of internal and external team resources may not depend on the position of the team member. Team members may be aware of the external connections and relationships developed by the team over time through myriad formal and informal mechanisms (e.g., meetings, conversations, and personal observations). As reported in the previous section, questionnaires accomplished by those who participate a project with duration of less than 3 months were removed to mitigate the likelihood of response bias.

4.1. Measurement model

All research variables were measured using multi-item scales. The scales for business flexibility and technical flexibility were adopted from Lee and Xia [27]. The items measuring vertical relationship and horizontal relationship were adopted from Kale et al. [26]. The scale measuring market relationships was adapted from Abrahamson [1,16]. Project performance was measured using Henderson and Lee's [20] 5-item scale.

Data were subjected to a factor analysis to assess the psychometric properties of the measurements in this study. All indicators other than BEF02 and MR03 had loading values that exceeded 0.7. Therefore, these two items were removed. Table 2 presents the loading values for the items in the study. As shown in Table 2, Cronbach's α ranged from 0.86 to 0.94, indicating that the measurements were reliable. The remaining items were subject to an examination of construct validity using output from the partial least squares (PLS). As shown in Table 3, composite reliability (CR) [3,9] and the square root of average variance extracted (AVE) [15,48] were all above the recommended guidelines, suggesting strong convergent validity. In addition, the square root of AVE in Table 3 proved greater than all of the inter-construct correlations. Moreover, the loadings to a latent variable that an item intends to measure are greater than those to other latent variables (see Appendix A), suggesting adequate discriminant validity [9,19].

Common method bias was assessed by including all items in a principal components factor analysis [37]. Evidence for common method bias exists when either a single factor emerges from the factor analysis or one factor accounts for most of the covariance. The exploratory factor analysis suggests that a seven-factor pattern emerges. With the first principal component accounting for 36% of the variance in the data, the result shows that one factor is not sufficient to capture all of the variance in the data, indicating common method bias is not a major concern in this study.

5. Results of the structural model

SmartPLS 3.0 was used to estimate the structural model. Due to the relatively small sample size, a bootstrapping approach was used to generate 200 random samples of observations from the original data set to evaluate the significance of the path coefficients.

Table 2
Constructs, items, and loading values.

Items	α	Loading
Vertical relationships	0.92	
When ______ project is proceeding, the working relationships between our team and relevant higher-level managers (e.g. CEO, CIO, CFO) are characterized by		
VR1: High reciprocity		0.87
VR2: Mutual trust		0.94
VR3: Mutual respect		0.93
VR4: Personal friendship		0.84
Horizontal relationships	0.94	
When ______ project is proceeding, the working relationships between our team and other lateral units (e.g. department, ISD teams, etc.) are characterized by		
HR1: high reciprocity		0.86
HR2: mutual trust		0.95
HR3: mutual respect		0.94
HR4: personal friendship		0.91
Market relationships	0.90	
When ______ project is proceeding, our team has close and reciprocal association with ______.		
MR1: professional association(s)		0.94
MR2: industrial association(s)		0.96
MR3: systems/IT vendor(s)[a]		0.54
MR4: consultant(s)		0.73
MR5: academic institute(s) (e.g. universities)		0.93
Business flexibility	0.87	
When ______ project is proceeding, our team has the capability to incorporate each of the following changes:		
BEF1: system scope		0.72
BEF2:delivery time[a]		0.78
BEF3: system input data		0.81
BEF4: system output data		0.82
BEF5: business rules/processes		0.77
BEF6: data structure		0.70
BEF7: user interface		0.81
Technology flexibility	0.86	
When ______ project is proceeding, our team has the capability to incorporate each of the following changes:		
TEF1: programming tools/languages		0.70
TEF2: IT architecture		0.75
TEF3: network/telecom environment		0.85
TEF4: other interface systems		0.81
TEF5: IT infrastructure		0.86
Project Performance	0.93	
PP1: operations efficacy		0.82
PP2: productivity		0.88
PP3: adherence to schedules		0.85
PP4: adherence to budgets		0.82
PP5: work quality on team products		0.88
PP6: interaction effectiveness with people outside of the team		0.77
PP7: ability to meet the goals of the project	0.86	

[a] Item removed.

Table 3
Construct reliability and validity.

Latent constructs	CR	1	2	3	4	5	6
1. Vertical relationship (VR)	0.94	*0.89*					
2. Horizontal relationship (HR)	0.94	0.18	*0.89*				
3. Market relationship (MR)	0.95	0.55	0.13	*0.92*			
4. Business flexibility (BF)	0.90	0.41	0.17	0.34	*0.77*		
5. Technical flexibility (TF)	0.90	0.29	0.34	0.39	0.64	*0.80*	
6. Project performance (PP)	0.94	0.48	0.28	0.46	0.60	0.63	*0.84*

Such an approach provides valid and stable estimates of the significance of the path coefficients in the PLS model. Fig. 2 presents the results of the study.

The results of path analysis show that while the vertical relationships have a positive impact on business flexibility, validating H1a, its relationship with technology flexibility is not significant; thus, H1b is not supported. Support is found for the hypothesized influence of horizontal relationships on business flexibility and technology flexibility, validating H2a and H2b. Results also show that market relationships are positively associated with technology flexibility, supporting H3b; however, they do not have an impact on business flexibility, so H3a is not supported. Consistent with H4 and H5, business flexibility and technology flexibility have a positive and significant effect on project performance. 48.1% of the variance in project performance was explained by the research model.

6. Discussion

This study has several academic contributions. First, it re-conceptualizes the construct of flexibility. The underlying conception

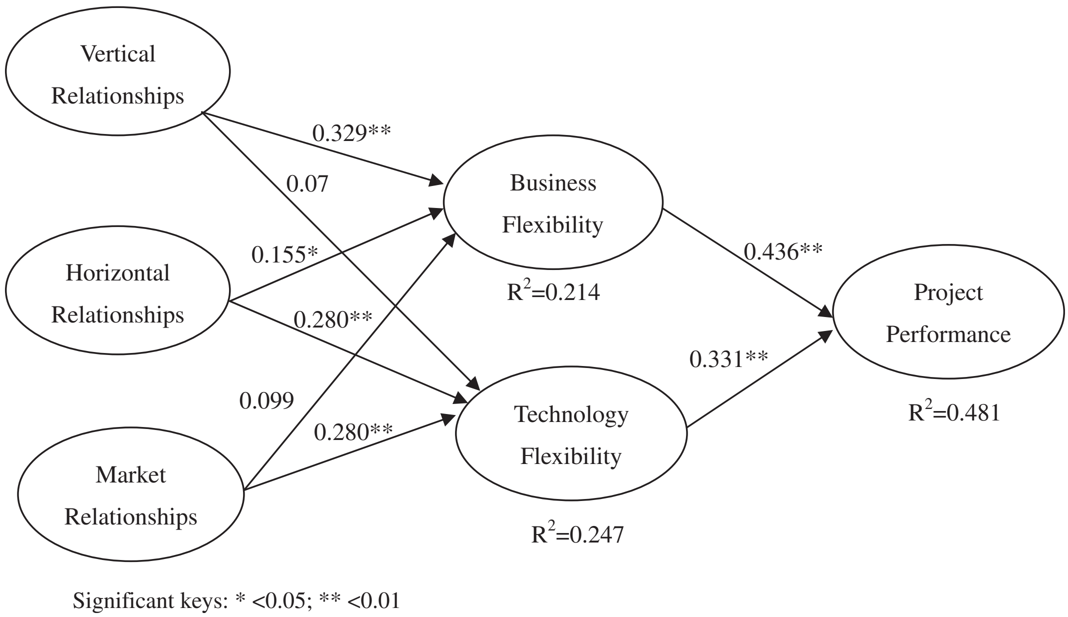

Fig. 2. Results of hypotheses tests.

on the current team flexibility is largely drawn from RBV, which focuses on a given set of resources developed and deployed at a particular time frame. Holding any particular resource or capability provides only temporary relief in developing a permanent response to environmental changes and may be less capable of responding to unforeseen changes in the course of software development. As socio-technical environments in which the system development project teams operate have observed significant changes, from relatively stationary to volatile, defining flexibility based on a dynamic perspective is more in line with ISD reality. This implies that to augment flexibility, ISD teams should continually integrate, reconfigure, or even renew the component resources and competencies at their disposal.

Secondly, this study contributes to extant research by extending the domain pertaining to external social capital. The conceptual framework developed by the extant literature largely stresses on relationships within an organization and overlooks those that exist outside the organization. The current study acknowledges this deficiency and investigates external social capitals across three salient relationship dimensions: vertical, horizontal, and market. While the first two represent the focal team's social connections with entities from within the organization, the last embodies the focal team's social associations with parties external to the organization.

Thirdly, extant research has identified different sources of external social capital and argues that effects resulting from these different social interactions may contribute to the performance of the focal social unit. Nevertheless, these effects are indiscriminate. Results of this study shed interesting insights in that the three salient social relationships respectively exhibit unique impacts on ISD team flexibility. Specifically, a team's lateral relationships with other business units (e.g., departments or ISD teams) significantly enhance a team's business and technology flexibility. Vertical relationships of the ISD team were observed to impact the ISD team's flexibility to business changes positively. Results indicate that positive interactions between the project team and senior management generate support and more resources can be assessed to achieve successful project outcomes as business changes occur. However, vertical relationships have no significant impact on technology flexibility. One plausible reason is that the senior management team generally has the most expertise and knowledge in the business domain but not in the technology domain. In addition, while management support can help the focal team to recruit a competent workforce or revamp the IT infrastructure to improve flexibility in coping with fast-changing development technology, these practices typically require extended periods for planning and implementation. As such, assistance is not timely enough to help with unexpected technology changes over the development process.

Quite opposite to the effects of vertical relationships, market relationships exhibit a significant relationship with the ISD team's technology flexibility; however, these do not have effects on business flexibility. One possible explanation is that knowledge and expertise distributed from extra-organizational institutes is typically undifferentiated and not very project-specific. Meanwhile, the focal team demands specific project-related information that will enable the team to make critical decisions quickly in response to a myriad of requirement changes in system specifications or system architecture. Therefore, when unexpected changes in system requirements occur during a given project, general knowledge and expertise may not be sufficient to deal with the volatility of business needs and user requirements. This is because each ISD project is idiosyncratic in terms of projects goals, client needs, and the stakeholders involved.

Fourthly, this study advances our understanding of relationships between social capital and organizational performance. Social capital researchers posit that social capital, whether internal or external, leads to superior performance. However, they did not specify how this transpires. Set in increasingly volatile ISD contexts, this study provides a case in which resources ingrained in external connections enhance ISD project effectiveness because they enable the ISD team to be responsive to abrupt changes resulting from capricious socio-technical environments. In other words, external capital acts on project performance through a team's effective response. To verify this postulation, an ad hoc test on mediation effects was performed following the three-step procedure suggested by Baron and Kenny [10]. Excluding non-significant paths in the original model, results of the mediation test were largely sustained. Results reveal that team flexibility fully mediates the relationship between horizontal relationships and project performance. Business flexibility partially mediates the vertical relationship–performance relationship, while technology flexibility fully mediates market relationship–performance relationship.

Appendix B presents the results. The results contribute by providing empirical evidence that strong external relationships influence ISD project performance in applying resources flowing from these external linkages to enhance team flexibility.

There are several implications for practitioners. Firstly, while it is important for ISD teams to establish robust and inclusive external relationships in the increasingly volatile environments, ISD teams must manage the network of relationships that is collectively constructed by individual members of the team. In other words, existence of a particular social relationship may be known only by team members. Therefore, it is important to develop a map exhibiting the distribution of social relationships since it provides the team with information on social ties that each team member holds. Consequently, this allows the team to locate social ties that hold the needed resources quickly and effectively.

Secondly, in the face of increasingly volatile business and technology contexts, external linkages brokering broader sources of resources are essential for SDTF development. This means that ISD projects cannot be effectively managed simply with strong technical and project management specialties. Effectively managing the project likewise depends on the ISD teams' ability to develop and maintain strong associations effectively with other actors within and outside of the organization. Desired ISD task forces should not only be technically capable, but proficient in relationship development and maintenance as well. Thirdly, ISD team members must do more than the role they traditionally play as ISD contexts become increasingly capricious. In the past, ISD team members participate in projects largely based on their special skills and expertise; nowadays, they may be required to expand, upgrade, and improve both knowledge and expertise continuously to respond to these unstable environments. ISD project managers need to develop mechanisms that encourage team members to exploit and integrate resources brought in from a variety of external conduits.

Several limitations of this study should be noted when interpreting the findings. First, the sample used in this study is certainly not random because data were initially collected from EMBA students of a university in Taiwan. Subsequently, a snowballing strategy was employed, asking participating students to refer friends to answer the survey. Potential data bias that restrains generalizability of findings may exist. Second, we acknowledge that two-thirds of the respondents are at the staff level, and they may not fully comprehend the social networks that their respective teams have developed. This concern was extenuated by removing those who have worked with their team for less than 3 months. Third, cross-sectional surveys used in this study have limitations in attributing and substantiating affirmative causality. Fourth, due to limited resources, this study uses single respondents per project. Though a statistical test reveals that common method bias does not exist, future study can involve multiple respondents in ISD teams to mitigate potential bias. Lastly, since data were collected from ISD teams in Taiwan, this indicates limitations to the generalizability of the findings due to cultural influences and localized business practices.

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Appendix A

See Table A1.

Appendix B

See Table A2.

Table A1
Factor structure matrix of loadings and cross loadings.

	VR	HR	MR	BEF	TEF	PP
VR1	*0.87*	0.50	0.18	0.30	0.16	0.37
VR2	*0.94*	0.50	0.18	0.39	0.32	0.47
VR3	*0.93*	0.49	0.16	0.35	0.25	0.48
VR4	*0.84*	0.49	0.13	0.42	0.30	0.39
HR1	0.44	*0.86*	0.06	0.27	0.27	0.33
HR2	0.54	*0.95*	0.13	0.35	0.35	0.43
HR3	0.54	*0.94*	0.16	0.36	0.42	0.47
HR4	0.49	*0.91*	0.12	0.27	0.38	0.46
MR1	0.16	0.14	*0.94*	0.17	0.32	0.26
MR2	0.19	0.11	*0.96*	0.20	0.36	0.28
MR4	0.07	0.13	*0.73*	0.12	0.24	0.21
MR5	0.21	0.09	*0.93*	0.12	0.27	0.24
BF1	0.23	0.22	0.12	*0.72*	0.46	0.41
BF3	0.21	0.21	0.20	*0.81*	0.53	0.43
BF4	0.27	0.28	0.10	*0.82*	0.52	0.39
BF5	0.39	0.25	0.23	*0.77*	0.50	0.55
BF6	0.43	0.31	0.12	*0.70*	0.44	0.54
BF7	0.37	0.33	0.04	*0.81*	0.49	0.49
TF1	0.29	0.41	0.14	0.50	*0.70*	0.54
TF2	0.17	0.19	0.28	0.47	*0.75*	0.41
TF3	0.27	0.37	0.30	0.54	*0.85*	0.51
TF4	0.13	0.29	0.24	0.56	*0.81*	0.53
TF5	0.27	0.31	0.37	0.47	*0.86*	0.52
PP1	0.41	0.43	0.17	0.50	0.50	*0.82*
PP2	0.36	0.33	0.24	0.55	0.54	*0.87*
PP3	0.36	0.31	0.22	0.47	0.55	*0.85*
PP4	0.35	0.32	0.27	0.46	0.53	*0.82*
PP5	0.40	0.42	0.28	0.50	0.59	*0.88*
PP6	0.41	0.41	0.17	0.47	0.45	*0.77*
PP7	0.53	0.50	0.28	0.58	0.54	*0.86*

Table A2
Results of mediating effects.

Structural paths	Model 1		Model 2	
	β	T-statistic	β	T-statistic
VR → Perf	0.296	3.296**	0.193	2.148*
VR → TF			0.065	0.605
VR → BF			0.295	2.975**
HR → Perf	0.289	3.673**	0.125	1.623
HR → TF			0.330	3.311**
HR → BF			0.179	1.810*
MR → Perf	0.187	2.252*	0.070	0.887
MR → TF			0.280	3.903**
MR → BF			0.098	1.391
TF → Perf			0.333	2.965**
BF → Perf			0.265	2.306**
R^2		0.334		0.547
Differ of R^2				0.213
Test of diff R^2				12.925**

TC → COL represents the path coefficient leading from TC to COL.
* $p < 0.05$.
** $p < 0.01$.

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