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Abstract

Any modern organization hoping to retain a competitive advantage must be capable of integrating knowledge. Recent studies have explored various factors that may affect knowledge integration in information systems development (ISD) projects. Although diversity within an ISD team has been found to significantly reduce knowledge resource risks, it has also been found to lead to conflict which may harm team performance. We argue that similarity among team members—as opposed to diversity—affects member interaction which is the basis for effective knowledge integration. Based on similarity-attraction theory, this study investigated the effects of similarity and attraction on knowledge integration. The research framework includes three similarity factors (demographic, cognitive, and goal similarity), interpersonal attraction, and social integration for knowledge integration in ISD teams. The model was tested using a field study of 264 participants from 74 ISD project teams. The results confirmed the existence of the similarity-attraction effect. That is, similarity will affect interpersonal attraction among members which inspires social integration, eventually facilitating knowledge integration. The findings suggest that ISD managers intending to promote knowledge integration should carefully consider team composition since similarity and attraction can potentially affect knowledge integration in ISD project teams.

Keywords: Knowledge Integration, Social Integration, Similarity-Attraction Theory, Demographic Similarity, Cognitive Similarity, Goal Similarity

1 INTRODUCTION

Software projects are knowledge-intensive work, and knowledge resource risks are one of the most critical issues (Gemino, et al., 2007). Knowledge resource risks include insufficient knowledge and the failure to integrate diverse knowledge. To deal with the risk of insufficient knowledge, members with diverse backgrounds are gathered to collaborate and accomplish tasks in an Information Systems Development (ISD) project. Team composition research has focused on understanding how member diversity affects teamwork processes and outcomes. Past studies suggested that team composition diversity can produce multiple views and options, leveraging a larger knowledge base to counter the high complexity and uncertainty of an ISD project. Although team member diversity has benefits and is necessary for software projects, it also leads to conflict which may harm team performance (Jehn, et al., 1999; Liang, et al., 2007).

Enhancing the team's knowledge integration capability is another way to reduce knowledge resource risks for ISD projects. Software development teams need to gather specialists in different domains to solve various problems encountered while developing highly complex information systems. The ability to integrate knowledge that is scattered over the organization becomes one of the ISD project team's more important skills (Walz, et al., 1993; Tiwana and Mclean, 2003; Newell, et al., 2004).

Past studies investigating knowledge integration on project teams focused on the effects of team characteristics (Kenney and Gudergan, 2006), knowledge features (Tiwana and Mclean, 2003), and social capital (Newell, et al., 2004). Kenney and Gudergan (2006) examined the influence of team structure on knowledge integration. Team structure cannot properly show how team composition affects the process of knowledge integration, though composition has a significant influence on knowledge integration. Some researchers emphasized the importance of knowledge characteristics in their discussion of knowledge integration (Nonaka, 1994; Tiwana and Mclean, 2003). Tiwana and Mclean (2003) investigated the effect of expertise diversity on creativity in information systems development. The diversity-conflict perspective may explain both the importance of diversifying the human resources that comprise the ISD team and the consequences of high diversity. However, these studies ignored the effect of the social context on the team's processes and work results. Therefore, a different perspective is needed to help understand how team composition leads to better team integration and work performance.

"Diversity" represents the extent to which members are different, while "similarity" indicates the degree of alikeness among team members. In this study, we adopted the similarity-attraction perspective to explore knowledge integration and argue that similarity among team members affects the extent to which members interact which is the basis for effective knowledge integration. Previous studies have demonstrated that the similarity-attraction theory was a suitable foundation for explaining the interaction within teams (Feren et al., 1988; Lankau et al., 2005; Kang et al., 2006). In the psychological domain, it successfully explained the effects of antecedents, such as group cohesiveness, marriage and interpersonal relationships (Lott and Lott, 1965; Zajonc et al, 1987; Smith, 1998). However, few studies examined whether or not team members' similarity or dissimilarity will affect the integration of knowledge in software project teams.

Through this research, we can understand how team members with similar characteristics can interact efficiently, based on similarity-attraction theory. The research questions of this study are:

1. What similarity factors can facilitate knowledge integration in ISD project teams?

2. How do member similarities affect the work processes of ISD teams?

We developed an extended theoretical model suggesting that social integration can facilitate the integration of ISD members' specialized expertise in order to jointly develop project concepts, designs, and solutions. We then focused on three types of similarity (demographic, cognitive, and goal similarity) as the antecedents of interpersonal attraction which is the root of social integration. The model was empirically tested using a field study of 264 participants from 74 ISD project teams. The results confirmed that the similarity-attraction effect does exist in ISD teams. Knowledge integration was affected by similarity and attraction through the medium of social integration.

This paper is organized into five sections, including this introduction. The second section is the literature review identifying the antecedents of interpersonal attraction in regards to knowledge integration based on similarity-attraction theory. The hypotheses are also introduced in this section. The third section discusses the research methodology, describing how the proposed constructs were measured and data was gathered. The data analysis results are described in the fourth section. Lastly, we provide the results and their implications for future research and practice.

2 THEORETICAL FOUNDATION AND MODEL DEVELOPMENT

2.1 Knowledge Integration

Knowledge is different from data and information; it is systematic and structured intuition and experience (Davenport, 1998). It can be explained and created only by human minds and is transferred among individuals. The spiral process of SECI (Socialization, Externalization, Combination, and Internalization) proposed by Nonaka (1994) emphasized the importance of interpersonal interaction for creating new knowledge. Creation of knowledge requires integrating the know-how or practical skills of particular members of organizations. Knowledge integration is one of the important activities in knowledge management that can strengthen the interior culture of an enterprise and promote work efficiency (De Boer, et al., 1999). The primary role of an organization is to integrate specialized knowledge, which is defined as an organizational "capability." Knowledge integration has become one of most important capabilities for modern organizations working to retain a competitive advantage (Grant, 1996).

Knowledge integration can be defined as the combination and synthesis of new and existing knowledge in different areas of expertise (Kogut and Zander, 1992). At the team level, it is the coordinated application of specialists' individually-held expertise in order to accomplish tasks (Tiwana and Mclean, 2003). Grant (1996) argued that knowledge integration is determined by three things: efficiency, scope, and flexibility. The efficiency of integration is the degree of ability to access and utilize specialized knowledge held by individuals within the organization. The scope of integration is the breadth of specialized knowledge available to increase the organization's capabilities. The greater the scope of integration, the higher the level of capability. The flexibility of integration is the ability to gain new knowledge and reconfigure existing knowledge.

In recent years, researchers have investigated the mechanism of knowledge integration from different perspectives. Proposed factors affecting knowledge integration included organizational structure, combinative capabilities, relational capital and absorptive capabilities (Cohen and Levinthal, 1990; De Boer, et al., 1999; Grant, 1996; Hansen, 2002; Molm, et al., 1999; Okhuysen and Eisenhardt, 2002; Tiwana and Mclean, 2003). In addition, Okhuysen and Eisenhardt (2002) found that formal intervention will improve the knowledge integration process. Ferrari and Toledo (2004) pointed out that knowledge integration contains four essential factors: principle, content, process and frame. In the process aspect, knowledge integration is determined by coordination and socialization capabilities within teams (De Boer et al., 1999). A team with higher social integration will have better cooperation, frequent communication and team identification (Lott and Lott, 1961; O'Reilly III et al., 1989). However, very little existing literature explored the formation of knowledge integration from social integration.

2.2 Social Integration

Social Integration refers to the attraction to the group, satisfaction with other members of the group, and social interaction among group members (O'Reilly, et al., 1989; Shaw, 1981; Smith, et al., 1994). It is a multifaceted compatibility phenomenon that links an individual psychologically to others in a group and determines how team members stick together (O'Reilly, et al., 1989). Diversity studies considered "social integration" to be a conceptual term that includes the behavioral and affective dimensions of team processes (O'Reilly, et al., 1989; Smith, et al., 1994). The factors of the

behavioral dimension included perceived cooperative behavior and communication, and the affective dimension included cohesion and attraction to the team (Van der Vegt, 2002).

Tiwana and Mclean (2003) examined the impact of knowledge heterogeneity on knowledge integration within ISD teams and found that expertise integration needs the support of relational capital within the team. Closer relationships reduce the costs of work, since stronger ties are associated with lower costs of sharing—and eventually integrating—complex knowledge (Hansen, 2002). Reciprocity of relational capital facilitates contributions of expertise beyond levels that can be negotiated in advance (Molm, et al., 1999). Social integration is derived from relational capital. Knowledge integration within an ISD team may be easier if team members are more willing to interact and accept each other's different perspectives, ideas and expertise during the development of information systems. Therefore, higher social integration is likely to increase individuals' willingness to integrate knowledge in ISD teams. This leads to the following hypothesis:

Hypothesis 1: Social integration is positively related to knowledge integration.

2.3 Interpersonal Attraction

Interpersonal attraction is defined conceptually as an affective evaluation of another person (Ajzen, 1974; Byrne, 1971). It is also an individual's tendency or predisposition to evaluate another person in a positive or negative way (Berscheid and Walster, 1978). It concerns judgments about whether we "like" another person, whether we "feel good" in that person's presence (McCroskey, et al., 1971). Strong evidence shows that interpersonal attraction produces socially integrated groups. Integration studies have demonstrated the positive impact of interaction on isolated groups of society. Actively engaging in social roles helps people build self-esteem, physical wellness and a sense of commitment to the community around them. Groups formed by people who frequently interact with other members tend to be socially integrated (Shelly, 1988).

In addition, interpersonal attraction was found to be associated with group cohesion (Colarelli and Boos, 1992). Kreijns, et al. (2002), highlighted that social interaction and individual's psychological processes create a social space through affiliation, impression formation, and interpersonal attraction that results in group cohesion. Social integration is a higher-order construct of cohesion because it refers to both perceived harmonious relationships and the affective component of member attraction (Carmeli and Schaubroeck, 2006). Katz and Kahn (1978) also indicated that social integration reflects the attractiveness of the team members. Therefore, the following hypothesis is proposed:

Hypothesis 2: Interpersonal attraction is positively related to social integration.

Consequences of high interpersonal attraction may include frequent communication and knowledge sharing (Zenger and Lawrence, 1989; Makela, et al., 2007). Generally, communication is central to interpersonal attraction (Duck and Barnes, 1992). A number of studies indicated that interpersonal attraction promotes frequency of communication (Kiesler, et al., 1988; McCroskey, et al., 1975; Postmes, et al., 2000). Knowledge integration depends upon the frequency of communication eliciting appropriate responses from each organization member (Grant, 1996). Knowledge sharing could also promote knowledge integration by facilitating access to new knowledge. In practice, the amount of knowledge is just one of a broader set of issues concerning knowledge integration in the development and production of goods and services. Since knowledge from experienced workers is so necessary, efficient knowledge sharing to produce more valuable knowledge is required for effective knowledge integration. Research found that interpersonal relationships, including attraction, can critically affect individual willingness to actively share personal knowledge. General attraction tendencies can influence the social relationship between individuals who actively share knowledge because the liking of others and trust are basic requirements for knowledge sharing. Therefore, we predict that knowledge integration is associated with attraction among ISD team members. The following hypothesis is posited:

Hypothesis 3: Interpersonal attraction is positively related to knowledge integration.

2.4 Similarity-Attraction Theory

Byrne (1971) developed the similarity-attraction theory through studying previous research related to attitudinal similarity. He posited that the more similar a person's attitudes and beliefs are to those of others, the more likely it is for that person to be attracted by the others. The following research showed that similarity on any dimensions may increase attraction (Baskett, 1973). Aside from attitudes, similarity in demographic characteristics, personality, and values also influences attraction (Riordan, 2000). The similarity-attraction paradigm has also been applied at the team level to describe how the more similar the members in a group, the more attracted they will be to the group (Baskett, 1973; Byrne, et al., 1966; Byrne, 1971; Jackson, et al., 1991; Lincoln and Miller, 1979).

In a refinement of the similarity categorization, Harrison, et al. (1998), developed the two-factor approach, in which heterogeneity is coded into two major types: "surface level" and "deep level" diversity. Surface level diversity was defined as differences among team members in demographic and biological features while deep level diversity was defined as differences among members' attitudes, beliefs, and values. Recent similarity research adapted the diversity category to compare the differences between demographic similarity and deep level similarity (Mannix and Neale, 2005). Lankau, et al. (2005), examined the role of surface level similarity and deep level similarity in formal mentoring relationships. They extended the measurement of surface level similarity into gender, race, education, tenure, and background. Deep level characteristics were also extended to include personality, interests, work values, outlook on organizational issues, problem-solving approach and personal values. Demographic similarity is regarded as a surface level similarity measured by age, gender, and background, etc. Cognitive similarity resembles deep level similarity which includes values, cognition, affection, and personality. In addition, goal similarity is an important factor to the success of team project development, especially for ISD teams (Weldon, et al., 1991). As a result, this study used all three similarities (demographic, cognitive and goal) to explore the antecedents of knowledge integration.

2.5 Demographic Similarity

Demographic similarity is the degree to which an individual's demographic attributes such as age, gender, race, and educational background are similar with other members in a social unit (Riordan and Shore, 1997). Individuals compare their own demographical characteristics with others to determine if they are similar or dissimilar (O'Reilly, et al., 1989; Tsui and O'Reilly, 1989). Researchers have tested the effects of demographic similarity on organizational issues (Jackson, et al., 1991; O'Reilly, et al., 1989; Tsui, et al., 1992; Zenger and Lawrence, 1989). They found that similarity of gender, race, age, tenure, education, and background affected workers' attitudes, turnover and communication with others in their teams. The results of Wharton and Baron (1987) showed that demographic similarity can offer individuals certain advantages such as the opportunity to interact with similar others and enjoy more cohesive work relations.

Attractiveness among workers may come from similar demographic characteristics. People tend to be drawn to those who are similar to them in terms of demographic characteristics (Byrne, et al., 1966). The 1995 study by Graves and Powell found that recruiters significantly preferred interacting with same-gender applicants as opposed to opposite-gender applicants during interviews. Gender similarity led the recruiters to feel that they and the applicants had common issues, and this increased their willingness to interact with the applicants. Finally, Graves and Powell concluded that gender similarity has a particularly strong influence on interpersonal attraction. Based on the above literature, the following hypothesis is posited:

Hypothesis 4: Demographic similarity is positively related to interpersonal attraction.

2.6 Cognitive Similarity

Cognitive Similarity refers to having similar characteristics with others, and a similar approach to organizing and processing information (Kang, et al., 2006). It is related to cognitive style which is a relatively static, "built-in" feature of the individual (Riding, et al., 1993; Tennant, 1997). Cognitive style affects how people look at their environment for information, how they organize and interpret this information, and how they use these interpretations to guide their actions (Hayes and Allinson, 1994). A similarity of cognitive style, including attitudes, values and beliefs, can be shaped through interpersonal interaction and verbal or non-verbal communication among people. Similarity in various cognitive characteristics has been observed to affect the degree to which people are attracted to one another (Byrne, 1971). Previous studies found that shared value, common sense, similar understanding and expectations led members to be more attractive to each other. Therefore, we consider that cognitive similarity may influence interpersonal attraction in an ISD context. The hypothesis below is proposed:

Hypothesis 5: Cognitive similarity is positively related to interpersonal attraction.

2.7 Goal Similarity

A goal is the object or the aim of an action attempted by an individual (Locke, et al., 1981). The concept of "goal" encompasses performance standards, quotas, work norms, tasks, objectives, deadlines, or budgets. A clear, consistent goal is important for developing an effective team. Katzenbach and Smith (1993) emphasized that team leaders have to develop a common understanding and direction for members at the inception of team activities. This common understanding requires establishing goals and developing a shared sense of direction among all members and the leader. Goal similarity refers to the similar purpose of actions taken by individuals (Jehn, 1995). Generally, people are attracted to and interact with those who have the same goals (Schneider, 1987). Vancouver and Schmitt (1991) explored attractiveness among supervisors and subordinates in companies. They found that goal congruence is associated with the intention to remain in the company. As a result, we thought that goal similarity would be an appropriate antecedent of interpersonal attraction. The following hypothesis is posited:

Hypothesis 6: Goal similarity is positively related to interpersonal attraction.

Figure 1 shows our research model and hypotheses.

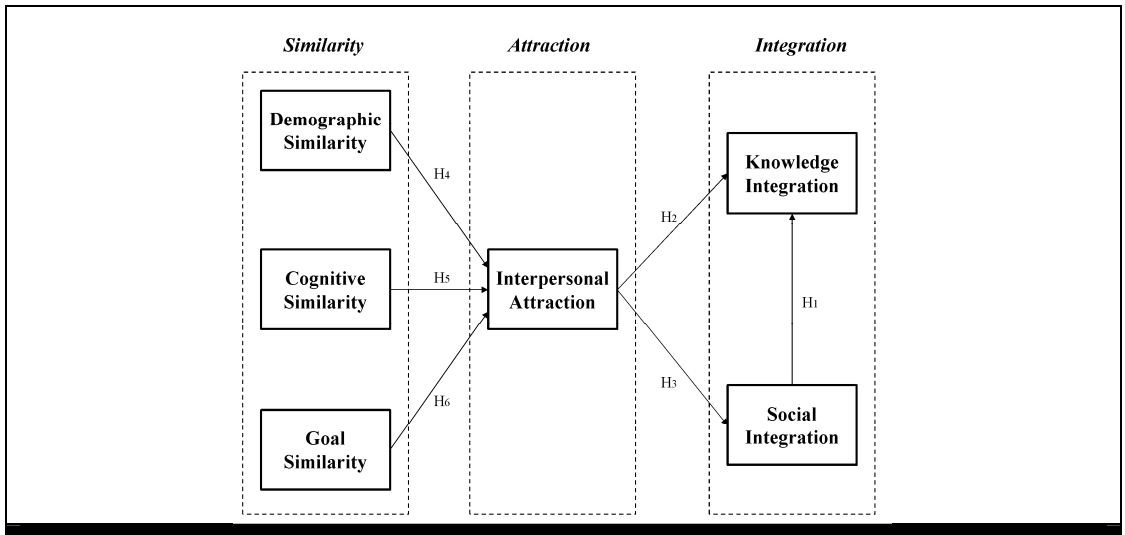

Figure 1. Research Model

3 THE RESEARCH METHOD

To test the proposed research model, we adopted the survey method for data collection, and examined the hypotheses using the partial least squares (PLS) method of data analysis. The unit of analysis was the ISD team.

3.1 Measure Development

Measurement items were developed based on literature review and expert opinions. The literature review was undertaken to identify construct definitions and existing measures in past studies. Wherever possible, the measurement of constructs in the model were adopted or adapted from valid measures in published papers. A pretest of the questionnaire was performed using a specialist in the knowledge management field, a Ph.D. student, and two professors in the IS domain to assess its logical consistencies, understandability, sequence of items, and contextual relevance. Furthermore, a pilot study was conducted involving more than 20 persons with IS development experience. Comments and suggestions on the item contents and structure of the instrument were solicited. The questionnaire was modified based on the comments collected from these experts.

Because we collected data from ISD teams in Taiwan, the measure items were translated from English into Chinese to make questionnaire completion more convenient. Chinese wording in the questionnaires was taken from Chinese dissertations that used the same sources, wherever possible. We used a backward translation method similar to the one used by Bock, et al. (2005), to ensure consistency between the Chinese and the original English version of the instrument. To increase the content validity of our study, we also discussed with ISD team members whether the Chinese measure items fit the original purpose of the study. Since the purpose of using four similarity-attraction variables (demographic similarity, cognitive similarity, goal similarity, and interpersonal attraction) was to evaluate perceived relationships among team members, the measures of these variables had to be answered by individual members. Contrarily, since team leaders were the evaluators of team performance, they had to respond to social integration and knowledge integration items. Therefore, two questionnaires were developed, one for team members to measure similarity-attraction factors, and another for team managers to measure social integration and knowledge integration. For all the measures, a seven-point Likert scale was adopted with anchors ranging from strongly disagree (1) to strongly agree (7). The measures used in the study are described below.

Demographic Similarity (DS)

Demographic similarity was measured by five characteristics of team members: age, tenure, gender, education level and expertise. Because these variables are different data types, the scale of demographic similarity was calculated using two approaches: Blau's index of heterogeneity (Blau, 1977) and Allison's coefficient of variation (Allison, 1978). Blau's index was used to calculate the heterogeneity of a group for categorical variables such as gender, education level and expertise. The formula is: $1- \sum Pi^2$, where P is the proportion of the group in the particular demographic category and i is the number of groups represented. Allison's coefficient of variation was calculated by dividing the standard deviation by the mean for continuous variables such as age and tenure. A high score of Allison's index indicates variability among team members or heterogeneity in the team; a low score represents greater homogeneity. We used these two approaches to measure demographic similarity that reversed from the heterogeneity index as was done in existing similarity research (O'Reilly, et al., 1989; Wiersema and Bantel, 1992).

Cognitive Similarity (CS)

Cognitive similarity refers to the extent to which an individual's characteristics and approach to organizing and processing information is consistent with others. We adapted the measurement items from Kang, et al. (2006). They extracted 11 measures from 25 candidate items through three pilot tests. All items were worded with the team as the subject, not the individual, because the items were used to measure the degree of perceived consistency at the team level.

Goal Similarity (GS)

Goal similarity refers to the extent to which the purposes behind the actions of individuals within the group are similar. A total of three items obtained from Jehn (1995) were used to measure goal similarity.

Interpersonal Attraction (IA)

Interpersonal attraction refers to an affective evaluation of another person. Interpersonal Judgment Scale (Byrne and Wong, 1962) included nine measurement items: four for affective attraction and five for behavioral attraction. Based on the definition of the construct in this study, the affective attraction items were adapted to measure interpersonal attraction.

Social Integration (SI)

Social integration refers to the attraction to the group, satisfaction with other members of the group, and social interaction among the group members. There were nine items adapted from Shaw (1981) and supplemented by Smith, et al. (1994). Since these items were measured at the team level, they were averaged into a composite social integration index, representing the degree of social integration for a team.

Knowledge Integration (KI)

Knowledge integration is known as the coordinated application of individually-held specialist expertise for the accomplishment of tasks at the team level. We adapted the four measurement items from Tiwana and Mclean (2003). These items measured knowledge integration by assessing the extent to which a team's members integrated their individual knowledge at the team level, combined various members' tacit knowledge and expertise in developing project concepts, understood the project from a systemic viewpoint, and combined their own expertise with such project-level knowledge (Grant, 1996; Okhuysen and Eisenhardt, 2002; Walz, et al., 1993). The measure items are listed in Table 1.

3.2 Survey Administration

The purpose of this research is to examine the relationship between member similarity and knowledge integration within ISD teams. Members of teams working on ISD projects were selected from the Information Management Association (IMA) as the research subjects. IMA is the largest non-profit organization in the IS domain in Taiwan and currently has more than 10,000 members from varied organizations and industries including government, software companies and manufacturing companies. All members of IMA are top management or supervisors of IS related departments in their companies. 100 of them were randomly selected and invited to join this research. An invitation letter including the research purpose and the survey process was sent to the selected members, asking them to recommend qualified participants who were ISD team leaders or project managers in their companies.

If the selected IMA members replied that their companies were willing to participate in the survey, we sent them a survey letter with the questionnaires and postage-paid envelopes. They were requested to forward the questionnaires to qualified project leaders and members. The survey was conducted from May 4 to June 5, 2010. To increase the response rate, the cover letter included an assurance to all respondents that their responses would be kept confidential and used for research purposes only. Follow-up phone calls were made one week later to confirm that the participants had received the survey letters. Phone calls were also made to kindly remind participants who had not replied. Finally, the second survey letters and questionnaires were mailed to those who did not respond by the third week. In total, questionnaires were sent to 194 ISD project teams. 264 valid questionnaires were returned from 74 ISD teams for data analysis, approximately a 38.1% response rate. Based on the suggestion of Sivo et al. (2006), we tested non-response bias by comparing different waves of response. 20 ISD teams in sample data were randomly selected to compare with the rest of 54 teams in gender, age, tenure, major, education, team size and duration in project. At significant level of .05, the results show that no difference between these two waves, e.g. there was no non-response bias in the research.

Table 1. The Results of Reliability (N=74)

CONSTRUCTS	INDICATORS	FACTORS	
		Loadings	ITC
Demographic Similarity (DS) *CR*= 0.76 *Alpha*= 0.72 *AVE*= 0.44	Age	0.57	0.58
	Tenure	0.60	0.73
	Education	0.82	0.66
	Major	0.63	0.53
Cognitive Similarity (CS) *CR*= 0.90 *Alpha*= 0.87 *AVE*= 0.53	Members of the team have similar sources for problem solving in regard to technologies, equipment, and tasks.	0.68	0.47
	Members of the team have similar procedural knowledge about how the task is conducted.	0.67	0.52
	Members of the team have similar understandings on the relationships between tasks.	0.58	0.56
	Members of the team have similar senses of difficulty and challenge about the team project.	0.65	0.49
	Predictions on task-related outcomes are similar among team members.	0.87	0.70
	Team members have similar expectations on the penalties and tolerance of task-related errors and mistakes.	0.83	0.65
	Team members have similar criteria on the judgment of task-related errors and mistakes.	0.81	0.58
	Team members in need of information retrieve information from similar sources.	0.69	0.70
Goal Similarity (GS) *CR*= 0.95 *Alpha*= 0.93 *AVE*= 0.87	As a team, we have similar goals.	0.93	0.80
	The main goals of my team are the same for all members.	0.95	0.84
	We all agree on what is important to our team.	0.91	0.69
Interpersonal Attraction (IA) *CR*= 0.95 *Alpha*= 0.93 *AVE*= 0.82	I like my team members.	0.92	0.75
	I want to know our team members very well.	0.94	0.77
	I enjoyed my future interaction with our members.	0.85	0.65
	I always look forward to meeting my partner.	0.90	0.78
Social Integration (SI) (low private elf-awareness) *CR*= 0.94 *Alpha*= 0.92 *AVE*= 0.71	The members of the team are quick to defend each other from criticism by outsiders.	0.88	0.83
	The successes of other members of the team help me achieve my own objectives.	0.87	0.81
	Everyone's input is incorporated into most important team decisions.	0.64	0.51
	The members of the team get along together very well.	0.88	0.83
	The members of the team are always ready to cooperate and help each other.	0.87	0.81
	The members of the team really stick together.	0.88	0.83
Knowledge Integration (KI) *CR*= 0.95 *Alpha*= 0.93 *AVE*= 0.83	Members of this team synthesize and integrate their individual expertise at the project level.	0.90	0.84
	Members of this team span several areas of expertise to develop shared project concepts.	0.91	0.82
	Members of this team can clearly see how different pieces of this project fit together.	0.90	0.83
	Members of this team competently blend new project-related knowledge with what they already know.	0.93	0.87

3.3 Demographic analysis

The demographic information of these respondents was examined. The data shows that there were slightly more males (53.79%) than females (46.21%). Most of respondents were 30-39 years old. Most of them had an IT related bachelor's degree and 2-7 years' work experience, indicating that these were experienced IS knowledge workers. 89.4% of the IS projects lasted less than two years. Overall, the sample is well qualified and the respondents had the ability to judge issues related to factors affecting knowledge integration.

4 DATA ANALYSIS AND RESULTS

The research model is multistage, suggesting the need for structural equation modeling (SEM) to simultaneously test multiple relationships. Two approaches are commonly used in SEM to assess effects: component-based (i.e., PLS) and covariance-based (i.e., LISREL) (Qureshi and Compeau, 2009). In this study, PLS was chosen to test the hypotheses for three reasons. First, PLS can be used to analyze multi-item constructs and is widely used in knowledge management research (Wasko and Faraj, 2005; Ma and Agarwal, 2007; Morris and Venkatesh, 2010). Second, PLS makes no a priori assumptions about the normality of the data and has a lower demand for sample size, compared with covariance-based approaches (Chin, 1998; Qureshi and Compeau, 2009). Third, according to Chin, et al. (2003), PLS is suited for testing complicated relationships by avoiding inadmissible solutions and factor indeterminacy, and its capability in exploring complex relationships has been proven in many other studies (Fornell and Bookstein, 1982). SmartPLS 2.0 (Ringle, et al., 2005), a software package based on structural equation modeling (SEM) techniques, was used to analyze the model. We first assessed the measurement model for reliability and validity, followed by the structural model for testing hypotheses.

4.1 Measurement Model

4.1.1 Data Aggregation

Since the unit of analysis in this study was the team, individual responses were aggregated to create a team level score. Before aggregating, we assessed inter-member agreement (Rwg) developed by James, et al. (1984), to ensure that individual level data was appropriately aggregated up to the team level. Generally, aggregation is considered appropriate when the median Rwg of the scale is greater than 0.7 (George, 1990). The results showed that the Rwg medians of cognitive similarity (0.957), goal similarity (0.959), and interpersonal attraction (0.943) were all greater than 0.7 which warrants our aggregation approach. Thus, we concluded that the individual-level data were adequate to aggregate as team-level data.

4.1.2 Reliability and Validity

Once individual level data was aggregated to the team level, the reliability and validity of the team level data were examined. Item reliability, convergent validity, and discriminant validity tests are often used to evaluate the measurement model in PLS. Reliability can be assured through composite reliability (CR), Cronbach's alpha (Alpha), and factor loading. The recommended threshold of Cronbach's alpha is 0.70 or higher (Nunnally, 1979). Acceptable values of a CR for perceptual measures should exceed 0.70 as well (Fornell and Larcker, 1981). Factor loadings higher than 0.7 can be viewed as highly reliable and factors with loadings lower than 0.5 should be dropped. The variables of SI5, SI7, SI8, and gender were dropped from the data set because their loadings were lower than 0.5. Table 1 summarizes the final reliability of the measurement model. Cronbach's alphas for all constructs in the study are above 0.72. Table 1 also shows that all CR values are greater than 0.76. The factor loadings are greater than 0.57. Hence, the values of Cronbach's alpha, CR, and factor loading met the recommended threshold values, indicating adequate reliability.

Convergent validity is the degree to which multiple items of a scale attempting to measure the same construct are in agreement. It can be examined by the Average Variance Extracted (AVE) (Fornell and Larcker, 1981). AVE values should be higher than the generally recognized .50 cut-off, indicating that the majority of the variance is specified by the construct (Fornell and Larcker, 1981). The AVEs shown in Table 1 demonstrate that this requirement was met. Discriminant validity describes the degree to which a given construct is different from other constructs. The measures of the constructs should be distinct and the indicators should load on the appropriate construct. To evaluate discriminant validity, the square root of AVE should be larger than the correlations between the constructs (Fornell and Larcker, 1981; Chin, 1998). Table 2 contains the constructs correlation matrix and the square root of AVE as the diagonal elements. All diagonal elements are greater than the off-diagonal elements in corresponding rows and columns, hence demonstrating discriminant validity. Overall, all constructs met the requirements for reliability, convergent validity, and discriminant validity. The results suggest that the measurement model is adequate, allowing us to examine the structural model for hypotheses testing.

Table 2. Descriptive statistics and correlation matrix (N=74)

Variables	Mean	Std. Dev	Correlation Matrix					
			DS	CS	GS	IA	SI	KI
Demographic similarity	0.71	0.22	0.66					
Cognitive Similarity	5.06	0.65	0.03	0.73				
Goal Similarity	5.57	1.01	0.09	0.16	0.93			
Interpersonal Attraction	4.81	0.98	0.32	0.24	0.57	0.91		
Social Integration	5.47	0.95	0.06	0.22	0.65	0.46	0.84	
Knowledge Integration	5.46	0.93	0.17	0.19	0.57	0.49	0.78	0.91

**The diagonal line of correlation matrix represents the square root of AVE

4.2 Structural Model

The research model was estimated using 200 iterations of the bootstrapping technique in SmartPLS 2.0. The explanatory power of the structural model is estimated by the R-square values in the dependent construct and the independent variables. To examine the specific hypotheses, the t-statistics for the path coefficients were assessed and p-values were calculated based on a two-tail test with a significance level of .05. The path coefficients of relationships among constructs and the R square values in the dependent construct and the independent variables are shown in Figure 2.

As shown in Figure 2, the path from social integration to knowledge integration is significant (β= 0.705, t = 8.969, $p < 0.001$), i.e., H1 was supported. Interpersonal attraction has a significant relationship with social integration (β= 0.461, t = 4.268, $p < 0.001$), i.e., H2 was supported. However, interpersonal attraction had no significant relationship with knowledge integration, i.e., H3 was not supported. 21.4% of the variance in social integration is accounted for by interpersonal attraction. Interpersonal attraction and social integration could explain 63.1% of the variance in knowledge integration. The results indicate that interpersonal attraction has an indirect effect on knowledge integration through social integration.

The path coefficients in Figure 2 indicate that demographic similarity (β = 0.266, t = 3.723, $p < 0.001$) and goal similarity (β= 0.522, t = 5.217, $p < 0.001$) have significantly positive effects on interpersonal attraction. Cognitive similarity had no significant relationship with interpersonal attraction. Thus, Hypotheses H4 and H6 were supported; whereas Hypothesis H5 was not supported. The three

similarity variables (demographic, cognitive, and goal similarity) together explain 41.9% of the variance in interpersonal attraction.

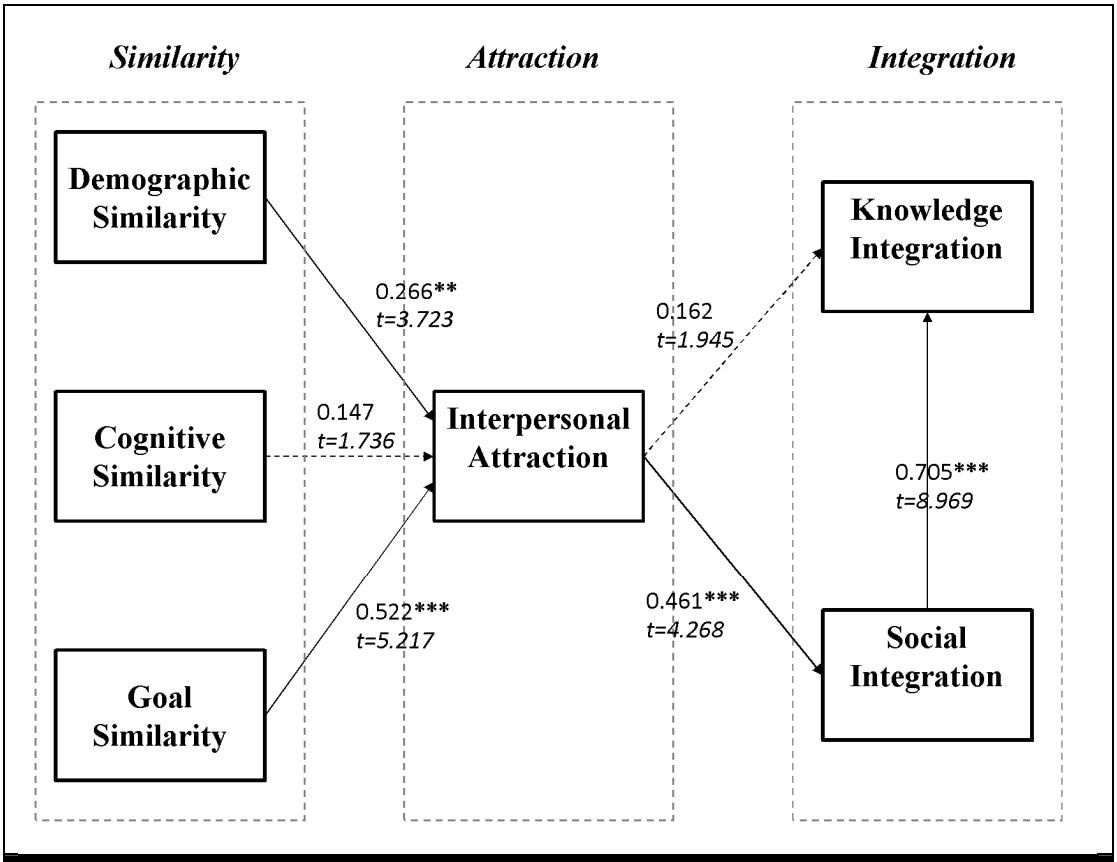

Figure 1. Structure model and paths coefficient

5 DISCUSSION AND CONCLUSION

The purpose of this study is to generate more insight into the relationships between similarities, interpersonal attraction and team integration for ISD projects. A major finding was that ISD team members with higher similarity are more likely to be attracted to each other. The results, showing that demographic and goal similarity had a strong impact on interpersonal attraction, are consistent with the prediction of similarity-attraction theory. Another finding was that interpersonal attraction has an indirect effect on knowledge integration through social integration. It shows that social integration serves as an important mediator between interpersonal attraction and knowledge integration.

5.1 Implications for Research

This study contributed to a theoretical understanding of the nature and influence of similarity on interpersonal attraction in affecting team integration. In past literature, diversity-based research indicated that team diversity is one of the major solutions that can reduce knowledge resource risks and enhance the outcome of ISD projects. In contrast to diversity-based research, this study adopted similarity-attraction theory and demonstrated that similarity can serve as another important perspective in understanding the effect of team composition on teamwork processes and performance. In addition, this study adopted social integration to understand how ISD teams integrate the knowledge owned by their members.

5.2 Implications for Practice

This study proposed some implications for ISD managers desiring to promote knowledge integration within their project teams. First, managers should seriously consider the characteristics of team members while creating ISD teams. Although composition diversity can facilitate wider viewpoints and reduce project risks, it also leads to conflict and misunderstanding among members, harming team outcomes and performance. Compared to diversified teams, teams whose members have similar backgrounds and personal goals can more easily integrate their different expertise and knowledge. Second, team knowledge may not be integrated if only similar specialists are gathered to work together without the appropriate processes or social context. It is critical for managers to foster cohesion within ISD teams since social integration is highly related to knowledge integration. Managers can hold activities to increase the frequency of formal or informal interactions among team members. In addition, it is also important to build up a culture of cooperation and an environment of reciprocity in the work place to encourage members to help each other.

5.3 Limitation

Several notable limitations of this research will require further examination and additional research. First, we focused exclusively on the influences of similarities and interpersonal attraction on knowledge integration. Process factors, such as communication and coordination mentioned in Marks, et al. (2001), may also affect the knowledge integration of project teams. We suggest that future research should include these related constructs in order to understand the mechanism of knowledge integration more widely and deeply. Second, because of the limited time schedule and budget for data collection, we collected data from developers only: the team leaders and the members. In fact, other stakeholders such as users and outsourcing vendors may also be involved in ISD processes and thus provide valuable knowledge for solving business and technical problems. More interesting insights may be found if further research can collect the viewpoint not only of developers but also these stakeholders to better understand the process and outcome of knowledge integration within ISD teams. Finally, this research was cross-sectional, so the results could not conclusively confirm the long-term impact of some factors. For example, we tested the effects of individual similarities on interpersonal attraction by evaluating the members' feelings in a snapshot. However, it may take time for team members to get close enough to form the feeling of cognitive similarity in the areas of value, belief and understanding. Researchers can conduct a longitudinal study on knowledge integration based on our results.

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