

Understanding Employees' Information System Innovative Usage Behavior within an Enterprise: A Social Network Perspective

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Abstract—Employees' usage behavior of information systems post-adoption has been regarded as an important issue in the field of information systems adoption. Prior most studies primarily examine cognitive factors. This paper argues that employees should be embedded in the social network of the organizational unit, and their interactions with coworkers can contribute to getting more help and capture about information systems' reasonable exploitation and exploration. Draw from related studies on social network, constructs of valued network density and valued network centrality are conceptualized and measured. We combine constructs from individual-level information systems post-adoption research with social network constructs to propose the research model. With 4-month longitudinal study in one business unit within a large-scale enterprise, we take the empirical study to analyze to collected valid data. The results confirm our hypotheses that social network constructs have the positive influence on the individual-level information system innovative usage behavior.

Keywords; *information systems; innovative usage; behavior evolution; social network valued network density; valued network centrality*

I. INTRODUCTION

Many of current information systems are complex and pose significant challenges for final users, especially by large information systems with numerous features. Modern enterprises mainly depend on these advanced information systems as the important platform to get more competitive advantages [1]. Therefore, it is important for enterprises to encourage their employees' information systems usage behavior in an effective way.

Individual-level adoption and use of information systems is one of the most mature streams of IS research [2]. Although social influences have been incorporated in prior models and have been suggested to be critical determinants in the early stages of use [3], such social influences have mainly been treated as external pressures and have not fully taken into account the richness of social interactions [4].

Social networks have received extensive attention in the management and organizational behavior literatures to study various phenomena. We suggest social network perspective will help us gain more insights into the dynamics of workplace interactions. This paper starts with a brief literature review about individual-level innovative usage behavior of post-adoption information systems and social network perspective. Then the paper gives some social

network constructs, and proposes a research model and research hypotheses. Next it describes the research context and introduces research methods. Through data collected and analyzed, some results are showed. At the end of paper, some conclusions and implication are briefly given.

II. THEORETICAL BACKGROUND

A. Information System Innovative Usage Behavior

Studying on IS adoption research literature, we can find that there are many proposed conceptions about different types of individual-level IT/IS usage behaviors in the post-adoptive stage, such as continued usage, habitual usage [5], deep structure usage [6], mindful usage, creative usage [7] and so on. Generally speaking, innovative usage behavior can be regarded as the most important and the highest-level usage behavior after initial adoption.

The conception of IS innovative usage can be understood to contain the following two meanings: ①users exploit and extend the more functions/features of systems to perform business tasks [8]; ②users explore or yield novel ways to use organizational systems, and new ways goes beyond the simply using of IT in a prescribed way [9]. Theoretically, both individual or internal factors (knowledge, behavioral intention, ability,...) and organizational or external factors (support, climate, facilitating conditions,...) are more likely to influence an employee's IS innovative usage behaviors.

B. Social Network Perspective

The social network perspective draws on the patterns of interactions and exchanges within social units in which an actor is embedded to explain outcomes experienced by the actor [10]. According to this perspective, an employee's position in a social network is associated with the access to network information and resources. The structure of social interactions enhances or constrains to valued resources and valued information. Work-related resources, such as task advices and strategic information, are accessible through social networks [11].

People usually learn new idea through associating those ideas with existing knowledge. It is easier for knowledge to transfer among people with similar training, background, and job characteristics [12]. This implies that employees in an enterprise unit are more likely to be fruitfully engaged in knowledge sharing that shapes their continued or innovative usage of systems.

C. Network Density & Valued Network Density

We pay more attention on two key mechanisms by which social networks can influence coadaptation: through ties to other employees conferring social support and through the position in the social network conferring influence. Ties refer to relationships between two or more individuals and such ties typically involve different kinds of resource exchange. In this paper, two types of ties are chosen: obtaining help from others that contributes to the effective usage of systems, and giving help to others that helps an employee influence how the system is configured and deployed.

Network density describes the connectedness of a network and is defined as the actual number of ties in a network as a proportion of the maximum possible number of ties [13]. In this research, we adopt an egocentric conceptualization of density referring to an individual's interaction with others in an organizational unit to obtain help, which means each employee has a score that marks how much help he or she gets from colleagues. We term valued network density.

D. Network Centrality & Valued Network Centrality

Network centrality is defined as the extent of an individual's involvement in assistance exchanges with coworkers [14]. Based on the existing research, we focus on centrality based on the number of ties an individual has with others in an organizational unit to provide help, which we term valued network centrality, refers to peer's perceptions of the level of system-related resources controlled by a focal employee.

III. RESEARCH METHODOLOGY

A. Research Model and Hypothesis Development

We integrate the constructs from individual-level IT/IS post-adoption research (including behavioral intention to effectively use systems and facilitating conditions) and social network constructs (including network density, valued network density, network centrality and valued network centrality) to develop a proposed research model. Fig.1 presents the proposed research model.

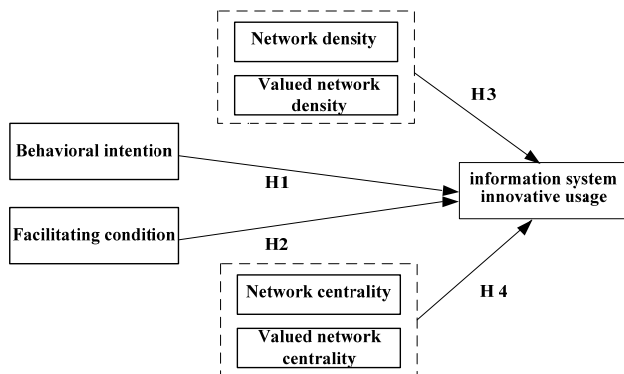


Figure1. The research model of IS innovative usage

B. IT/IS Post-adoption Usage Hypotheses

The focus of research on IT/IS post-adoption has been on mainly cognition-oriented behavioral models. According to the theory of planned behavior [15], behavioral intention is determined by the attitude to behavior, and the internal (e.g. ability, efficacy) and external (e.g., resources) constraint associated with behavioral performance. In IS and other fields, behavioral intention to perform a behavior has been strongly associated with behavioral performance. Therefore, we have the following hypothesis:

H1: Behavioral intention to effectively use systems is positively associated with individual innovative usage behavior.

Facilitating conditions predicts behavior in situations where the behavior is not fully volitional. Generally, the facilitating conditions construct in IS research has focused on formal training, guidance, infrastructure and help-desk support that is available to employees. These facilitating conditions can foster effective usage of system within enterprise [16]. Therefore, we have the following hypothesis:

H2: Facilitating conditions are positively associated with individual innovative usage behavior.

C. Social Network Hypotheses

Within an enterprise, an employee's perceptions of system-related density and centrality can be anchored to general friendship and advice networks. Effective and innovative information systems usage requires coadaptation of the information system and the organization [17]. Resources accessed through the social network at the workplace can help employees learn features unique to the system, gain the skills needed to effectively use the system, and deal with the adjusted work processes [18]. The support received by employees through their social network is more likely to be greater if the network consists of people who occupy social positions that control resources, such as information, system-related knowledge and so on [19]. Valued network density takes into account the focal actor's social ties weighted by the control of knowledge, information, and other resources that support and direct how to use information systems in an effective way. Therefore, we have the following hypotheses:

H3(a): Network density is positively associated with individual innovative usage behavior.

H3(b): Valued network density is positively associated with individual innovative usage behavior.

A relative central position in help network is expected to augment an employee's access to knowledge, thus affecting his ability to recognize opportunities and get information [20]. Centrally positioned employees tend to be more active in organizational innovation and can be expected to be early and more proficient users of information systems, thus leading to innovative usage behavior. Valued network centrality reflects the perception of an employee's peers about the extent to which the controls system-related

resources that can contribute to the effective usage of systems. Therefore, we have the following hypotheses:

H4(a): Network centrality is positively associated with individual innovative usage behavior.

H4(b): Valued network centrality is positively associated with individual innovative usage behavior.

D. Research Context

We took a social network study in one business unit of a large-scale Chinese pharmaceutical group company in Jiangxi Province. This pharmaceutical enterprise began to introduce SAP/ERP system in 2002, and by 2008 has successfully implemented the majority of modules in ERP system, including sales distribution (SD), material management (MM), production planning (PP), financial accounting & controlling (FICO), human resource (HR), quality management (QM), plant management (PM), etc. Besides these introduced systems, professional employees in information management department have self-developed many simple systems according to the internal departments' requirements. Almost all important business processes are operated through IS platform. On the whole, the employees' IS usage status within this enterprise is fitted for our research.

E. Data Sampling & Construct Measurement

The unit of analysis in this study is an individual employee, that is, a mandatory user of enterprise's systems. There are 115 employees in the business unit, not including secretarial staff. The average age of participants was 37.5 with a standard deviation of 7.9. The average length of the time employed in this enterprise was 7.6 years.

The construct of behavioral intention to effectively use systems was adjusted and measured using five items from [7] and [8]. The construct of facilitating conditions was adjusted and measured using four items from [1] and [4].

The construct of IS innovative usage behavior, that is, dependent variable was measured using six items based on [21] and [22].

We used the get-help network to create the network density measures because these measures reflect the employee's ability to effectively use systems, and the give-help network to create the network centrality measures because the centrality measures reflect the employee's ability to influence the deployment of systems.

The social network constructs were measured as following:

- Network density was computed for each employee, considering the out-neighborhood, and in this study it means get-help network. The density is given by number of dichotomized ties divided by the number of possible pairs.
- Valued network density was measured for each employee by weighting tie-strength by the average assessment of controlled resources.
- Network centrality was measured for every vertex in the give-help network.

- Valued network centrality was computed based on an assessment derived from respondents' evaluations of resources controlled by other employees.

IV. RESULT ANALYSIS

We illustrate the social network analysis conducted on the full sample with the help of a small subsample of the sociometric data. We asked 14 respondents to classify their help ties and beliefs of others using Likert scales during the past 4 months. This allows us a more in-depth examination of the relationships. In order to illustrate actual get-help and give help networks, we only show network links of strength 3 or above in the network diagrams, indicating the existence of a tie. Fig.2 shows a visual representation of 14 employees' average give-help and get-help ties per week using UCINET6.212.

A. Measure Model Results

We used partial least squares (PLS) to test the research model. The measurement model estimation provides information regarding reliability, internal consistency, and discriminant validity. Of the various constructs used in our model, three constructs for which reliability and validity are assessed using the measurement model are behavioral intention, facilitating conditions and IS innovative usage because they are measured using multiple items.

Network centrality, valued network centrality, network density and valued network density are each determined using the measurement and formulas presented earlier, resulting in one score per construct per individual.

Due to space constraints, we report the descriptive statistics and correlations in Tab.1. Internal consistency is adequate when constructs have an average variance extracted (AVE) of at least 0.5. For satisfactory discriminant validity, the AVE should be greater than the variance shared between the construct and other constructs in the model. All data results are quietly accepted.

B. Structural Model Results

The structural model is tested and results are showed in Tab.2. Both behavioral intention and facilitating conditions are significant predictors of systems innovative usage.

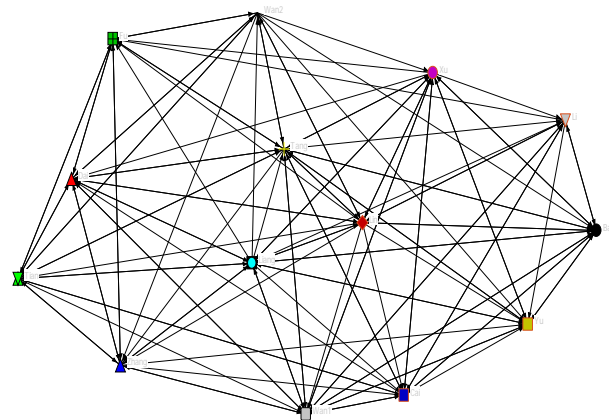


Figure2. Dichotomized get-help and give-help ties

TABLE I. DESCRIPTIVE STATISTICS AND CORRELATIONS

	Mean	Std. Dev.	IS innovative usage
BI	4.39	1.32	0.58**
FC	3.76	0.89	0.33**
ND	3.89	2.01	0.35**
VND	2.93	1.90	0.31**
NC	4.57	2.25	0.29**
VNC	3.02	2.11	0.30**

TABLE II. STRUCTURAL MODEL RESULTS

	BI	FC	ND	NC	VND	VNC
Model	0.33**	0.18*	0.17*	0.15*	0.22**	0.21**

All four social network constructs (network density, network centrality, valued network density and valued network centrality) as predictors explained over 40 percent of the variance in IS innovative usage behavior. In sum, the results here provide strong support for our model in Fig. 1.

V. DISCUSSION AND IMPLICATIONS

This paper contributes to IS post-adoption usage by understanding the importance of the social network within enterprise. The social network constructs can help us to better understand the key predictors of IS innovative usage. This study suggests that the social network constructs effectively capture interpersonal help.

ACKNOWLEDGMENT

This project is sponsored by following Foundation: ① National Science Foundation of China (71262023) ; ② Humanities & Social Science Youth Foundation of Ministry of Education (10YJC630194) ; ③ Soft Science Research Foundation of Jiangxi Province (20112BAA10032) ; ④ Humanities & Social Science Foundation of Jiangxi Province (GL1143) ; ⑤ Science and Technology Support Project of Jiangxi Province (2009ZDG04700) ; ⑥ Doctoral Foundation of Jiangxi Normal University.

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