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A Resource-Based Model of IT Usage in Shanghai Higher Education Institutions

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Abstract

On the basis of resource-based view, this paper analyzes the impacts of IT resource on different levels of IT usage in Shanghai higher education institutions. By analyzing the survey data from 40 Shanghai institutions, the study contributes several insights to China-context IT usage research and practice in higher education system. First of all, this study sheds lights on the impacts of IT resource on deep IT usage in Shanghai higher education system. Second, the findings suggest that organizational support has significant positive impact on higher education institutions' managerial IT usage. The study is the first few attempts to explore the process model of IT usage in China higher education institutions.

Keywords: resource-based view, higher education institution, IT usage

1. Introduction

With the fast development of information communication technologies, campus computing construction has become the common trend in higher education institutions. With rapid increase of IT investment, IT usage in higher education institutions in china is advancing in a leap frog way.

With increasing IT investment, more higher education institutions have been attaching increasing importance to the return on investment of campus networks. Since higher education institutions do not have business value, its return on investment can not be calculated by economic payoffs directly. An alternative approach is to evaluate the work efficiencies in education, research and administrative management activities that are improved by IT.

2. Literature Review

While previous IS research focused most on IT usage in commercial organizations, little attention were given to not-for-profit organizations (Chiassion and Davidson 2005), like education institutions and non-profit third-party consortiums. In this study, we analyzed the IT adoption process, from IT investment to different levels of IT usage, in education institutions that are of a typical type of not-for-profit organization.

2.1. Resource Based View (RBV)

In IT context, RBV can be used to understand the link between IT resource and competitive advantages. IT-related resources are defined and categorized diversely.

(Mata et al. 1995) defined four types of IT resources: capital, proprietary technology, technical IT skills and managerial IT skills, in which the managerial skill is empirically proved to be sustainable. (Powell et al. 1997) divided IT resources into human resources, business resources, and technology resources. (Melville et al. 2004) described two types of IT resources: technological IT resource and human IT resource. Complementary organizational resources also plays an important role in IT business value generation (Melville et al. 2004). The resources include non-IT physical resources, non-IT human resources and organizational resources (Barney 1991).

In this study, three widely-used resource types are investigated: financial resource, technological resource and organizational resource.

2.2. China Informatization and Her Higher Education Institutions

The nationwide IT adoption phase is called the informatization process in China and keeps speeding up in the decade. Among all provinces and big cities, Shanghai ranks number one in information resource, IT infrastructure and IT application, with a 33% growth rate of her informatization level (ISIC 2004).

As one of the most internationalized region in China, Shanghai higher education institutions face more pressure from global competition. So far, the strategic importance of IT usage in higher education institutions is commonly recognized by higher education institutions. However, after significant investment in IT in years, the institutions now desire a better understanding on the critical factors that may influence the IT output.

3. The Research Model and Hypotheses

With theoretical support by the RBV, we developed a research model shown in Figure 1. Schewe (1976) introduced two forms of use: general use of "routinely generated computer reports" and specific use of "personally initiated requests for additional information not ordinarily in routine reports." We categorize IT usage into basic usage and advanced usage. Advanced usage includes IT usage in teaching& research activities (Teaching& Research Usage) and management works (management Usage).

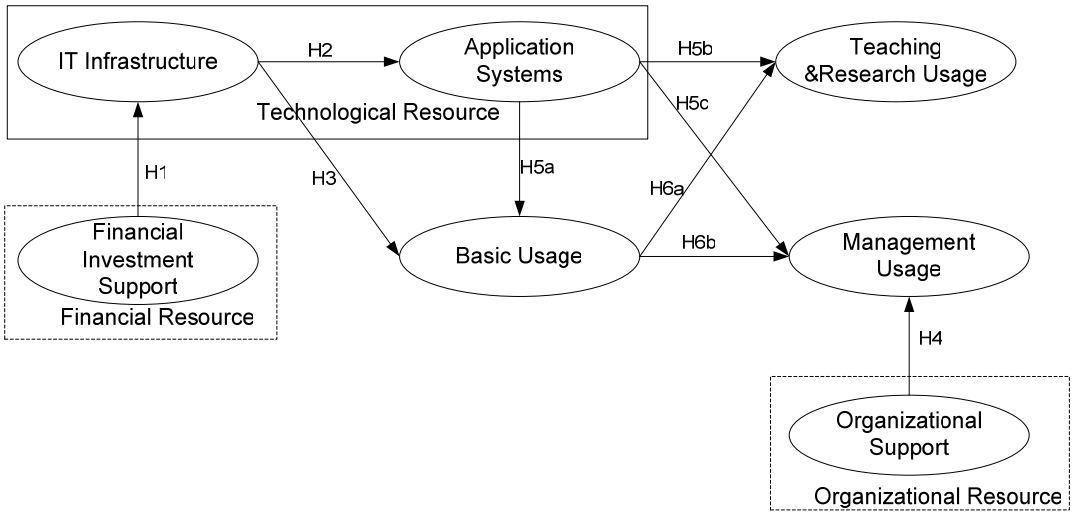

Figure 1: Research Model

Financial investment support will promise higher education institutions to improve and maintain their IT equipments, networks and software applications. Consequently,

Financial Investment Support (FIS) will help higher education institutions to build a better IT infrastructure (ITI) and to enable a greater usage. Therefore we propose:
H1: Higher education institutions' Financial Investment Support positively affects Higher education institutions' IT infrastructure.

IT infrastructure and application systems are both technological resources for higher education institutions. IT infrastructure includes hardware, campus network, etc. Application systems are various kinds of software that support higher education institutions' teaching, research activities and management work. With appropriate IT infrastructure, application systems construction can be guaranteed. Therefore we propose:
H2: Higher education institutions' IT infrastructure positively affects higher education institutions' application Systems.

Basic usage can be available only when essential hardware and network environment have been configured. IT infrastructure provides administrative staffs, teachers and students PCs, campus smart cards, and networks to facilitate their work and study. With appropriate IT infrastructure, the basic requirements of IT usage can be met. Therefore we propose:
H3: Higher education institutions' IT infrastructure positively affects higher education institutions' basic usage.

Most of managerial IT users are administrative staffs, when using application systems, they need technical support and maintenance service, IT departments can be the professional providers. Organizational support is the strongly backup force for application systems usage. What's more, organizational support determines whether IS construction can firmly and healthily go on. Therefore we propose:
H4: Higher education institutions' Organizational Support positively affects higher education institutions' Managerial IT Usage.

Application systems in higher education institutions are mainly the information platforms that support higher education institutions' teaching, research activities and management work. Research shows that IT resources, including infrastructure and application systems, play a significant role in IT adoption (Cooper et al. 1990). IT usage in higher education institutions can be categorized into basic usage, IT usage in teaching& research activities and managerial IT usage. Therefore we propose:
H5a: Higher education institutions' Application Systems positively affects higher education institutions' Basic Usage.
H5b: Higher education institutions' Application Systems positively affects higher education institutions' IT usage in teaching& research activities.
H5c: Higher education institutions' Application Systems positively affects higher education institutions' Managerial Usage.

Basic usage and advanced usage are two levels of IT usage in higher education institutions. On the first stage of the construction of IT infrastructure, only basic usage can be met in higher education institutions, on the second stage of the construction of application systems, IT usage in teaching& research activities, managerial IT usage can be available. For teachers, researchers, administrative staffs, basic usage enables them to be familiar with IT usage methods and make good use of it. With the knowledge of basic skills, advanced usage can be easier, basic usage facilitates advanced usage. Therefore we propose:

H6a: Higher education institutions' Basic Usage positively affects higher education institutions' IT Usage in teaching& research activities.
H6b: Higher education institutions' Basic Usage positively affects higher education institutions' Managerial Usage.

4. Methodology

4.1 Data and Method

A questionnaire survey method was used in the study. The survey was organized by Shanghai Educational Association in 2003, a set of large costal higher education institutions assisted Shanghai Educational Association in the preparation and eventual conduct of the questionnaire survey. During the designing process of the questionnaire, they used literature study, questionnaire investigation and expert interviews methods.

There are 58 higher education institutions in Shanghai according to the data from Shanghai Educational Association issued in 2005. 40 questionnaires were returned and valid. Those institutions are categorized into two types: university and others. Characteristics of the sample are shown in Table 1.

	Sample #	Full #	% of sample rate
University	26	29	89.7%
others	14	29	48.3%
Total Number	40	58	69.0%

Table 1: Sample Characteristics. Sample #: the number of questionaires returned, Full #: the number of institutions there were in Shanghai.

We used partial least squares (PLS) approach (Haenlein et al. 2004; Lohmoller 1989) to examine the model and hypotheses. The sample size requirement of PLS is either 10 times of the largest measurement number within the same construct or 10 times of the largest construct number affecting the same construct (Chin et al. 1999). Our sample size in the study is qualified to satisfy the criteria. The software we used was PLS-Graph.

4.2 Measures and Validity

Most of the constructs in the study were measures adapted from research literatures. Others were final discussion result from professionals in higher education institutions. The items for measuring the constructs were obtained after careful discussion among professionals and validated in pretest.

As shown in Table 2, the composite reliability values for the constructs in the model were all above the suggested threshold of 0.7 (Chin 1998; Straub 1989) except the Teaching& Research Usage construct (with the composite reliability of 0.67) and thus mostly supported the reliability of the measures.

Construct and Items	**Loading**
Financial Investment Support (Composite Reliability = 0.81, AVE =0.69 *)*	
Yearly financial support in IT construction (FIS1)	0.96
Yearly financial support in IT operation and maintenance (FIS2)	0.68
IT Infrastructure (Composite Reliability = 0.88, AVE = 0.71)	
Number of PCs (ITI1)	0.92
Have campus smart card or not(ITI2,)	0.65
Number of network covering points (ITI3)	0.93

Application Systems (Composite Reliability = 0.92, AVE = 0.78)	
Information platform for teaching(AS1)	0.87
Information platform for research(AS2)	0.85
Information platform for management(AS3)	0.93
Basic Usage (Composite Reliability = 0.79, AVE = 0.65)	
Number of E-mail users (BU1, nominal scale)	0.77
Average daily times that electronic resources(in digital library) are browsed(BU2)	0.84
Management Usage(Composite Reliability = 0.88, AVE = 0.71)	
Information platform for communication between operation departments and teaching departments (MU1)	0.87
Information platform for communication between operation departments and research departments (MU2)	0.76
Information platform for communication between operation departments and management departments (MU3)	0.89
Teaching& Research Usage (Composite Reliability = 0.67 , AVE = 0.51)	
Number of distance teaching courses in lately year(TRU1)	0.81
Number of information about international and domestic research items published in the internet in lately year(TRU2)	0.60
Organization Support(Composite Reliability = 0.88 , AVE = 0.72)	
Size of IT Department (OS1)	0.86
Size of Technical support and maintenance teams (OS2)	0.90
Established form of IT strategy in medium and long terms, written form or not (OS3)	0.77

Table 2: Reliability, average variance extracted of Construct and its measures' loading *($p<0.01$)*

As shown in Table 2, the shared variance between two constructs was less than the root of AVEs in Table 2. Thus, the discriminant validity was supported.

5. Data Analysis

The result of the structural model is shown in Figure 2.Most of the hypothesized paths were found significant ($p<0.01$). For example, the path coefficient from financial investment support to IT infrastructure is 0.684, from IT infrastructure to application systems is 0.652, and from application systems to managerial IT usage is 0.563. These positive and significant results show a clear map of how IT investment, after an appropriate infrastructure and application systems, finally influences higher education institutions' managerial IT Usage.

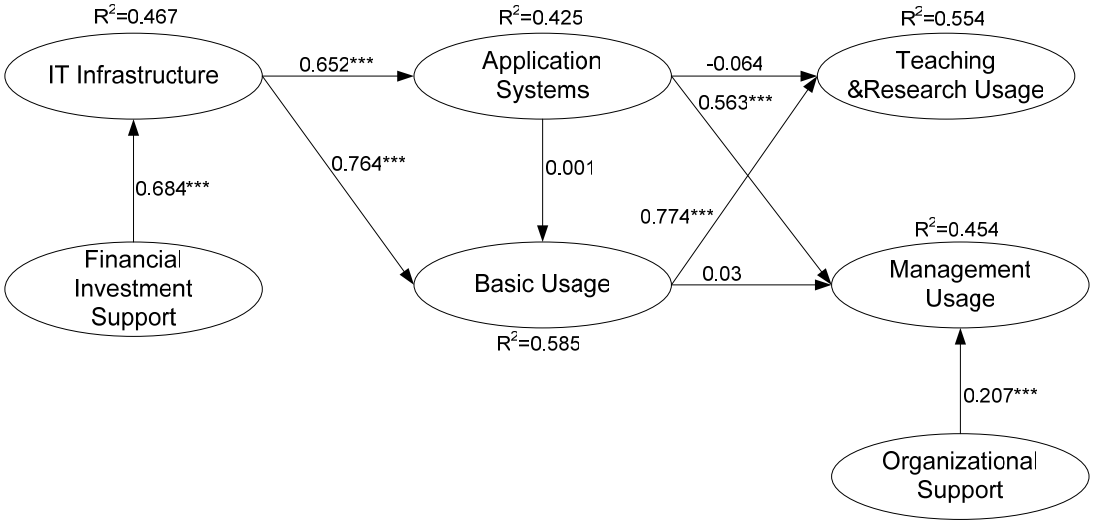

Figure 2: PLS Structural Model

6. Discussion and Conclusions

To study the influences of IT resources on IT usage in Shanghai higher education institutions, we developed a research model and examined the model with empirical data from 40 Shanghai higher education institutions. The empirical analysis reveals several major findings.

Finding 1: It is the basic usage, not application systems, plays an important role to support higher education institutions' teaching& research activities.

The users of teaching& research systems are professors whose jobs are to teach students and do researches. IT basic usage helps them do their teaching and research work well. On the other hand, application systems do not significantly influence IT usage in teaching& research activities. One reason may be the characteristics of the professors who are knowledge workers in the institution. To them, a flexible working style with basic information support, rather than comprehensive and standardized systems, is critical to their work. The other reason may be that the application systems can not support the teaching and research process.

Finding 2: Managerial IT usage has close relationship with application systems used in various departments of the higher education institutions. To improve management efficiency, corresponding application systems are needed, rather than basic IT usage service.

The result clearly proves the importance of those application systems, higher education institutions should gradually strengthen the construction of them. Basic usage has not influenced managerial IT usage so much as we hypothesized. Therefore when network resources are scarce, higher education institutions should not firstly allocate administrative staffs enough resources, instead, taking teachers, researchers and students into consideration first.

Finding 3: Organizational resource has significant and positive impacts on higher education institutions' managerial IT usage.

To really improve management efficiency, adequate technical support and maintenance staffs are powerful backup force. The result clearly proves the importance of organizational factors. Therefore, higher education institutions should shift more

attention to improving firm's organization structure and policies, encouraging the non-technical human training and competence of managerial IT usage.

With careful theoretical development and large empirical data examination, this paper contributes to China higher education institutions context research and practice. First of all, the study applies RBV theory into educational institutions. Second, the study investigates the impacts of IT resource on different levels of IT usage in higher education institutions. Finally, the model provides a useful theoretical guide to understand the informatization process in Shanghai higher education institutions.

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