International Journal of Innovation, Management and Technology, Vol. 1, No. 4, October 2010
ISSN: 2010-0248

# First-line and Middle Manager Competence, Usage Intention and IT Application Maturity

Manhui Huang and Chi-Sum Wong

***Abstract*—Past research focused on the effect of the top management on the IT application maturity. However, little is known about the roles of the first-line and middle manager during the IT application and the effect of the first-line and middle manager on the IT application maturity. In the present study, the relationships between the first-line and middle manager IT competence, IT usage intention, and IT application maturity are analyzed. With a sample size of 650, by conducting hierarchical regression analysis with the top management support as control variable, the roles of the first-line and middle manager in the IT application and the effect of the first-line and middle manager on the IT application maturity are empirically examined. Results show that when the first-line and middle managers play the role of manager, their IT competence has significant effect on the IT application maturity, whereas when the first-line and middle managers play the role of IT user, their IT usage intention has no significant effect on the IT application maturity. Theoretical and practical implications are discussed.**

***Index Terms*—First-line and middle manager, IT application maturity, IT competence, IT usage intention**

## I. Introduction

Many organizations apply information technology (IT) to support planning, decision-making and communication processes. However, IT application may be inherently risky[1], as there are many IT success stories, and equally there are as many failure stories[2]. Extant research showed that people are the key resource to the successful IT application and their behaviors will affect the outcome of the IT investments[3]. If top management does not support IT implementation, there is little hope for the project. However, first-line and middle managers and other staffs will also play important roles in the IT application[4]. Previous empirical studies have focused on the effect of the top management support on the successful IT application. However, little is known about the effect of the first-line and middle managers on the successful IT application.

Past research used the construct IT application maturity (ITAM) to describe the extent that IT can support the organization operation, management, and strategy. That is, ITAM can be used to describe the extent of the successful IT application [5]. As company consists of departments, it is obvious that the department ITAM will affect the company ITAM.

In the IT practice field, first-line and middle managers may play the roles of departmental manager and IT user. Will the first-line and middle managers affect the department ITAM? Is the effect different if the first-line and middle managers play different roles in the IT application?

Based on the competence theory and the intention theory, the current study analyzes the relationships between the first-line and middle manager IT usage intention, IT competence, and the department ITAM. By doing so, we can analyze the effect of the first-line and middle managers on the IT application, and provide empirical evidence to the roles of the first-line and middle managers in the IT application, and then give some implications for the IT application practice.

## II. Hypotheses

The construct competence has been used to predict behavior in some particular jobs in the past research. In 1973, McClelland published a paper titled by "Testing for Competence Rather Than Intelligence" which has been credited or blamed for launching the competency movement in psychology. A competency is an underlying characteristic of an individual that is causally related to criterion-referenced effective and/or superior performance in a job or situation [6].

Spencer & Spencer considered that performance is behavior[6]. Performance is something that people do and is reflected in the actions that people take, and it includes only those actions or behaviors relevant to the organization's goals. It is axiomatic that job performance is not one thing. A job is a very complex activity, and there are a number of major performance components distinguishable in terms of their determinants and covariation patterns with other variables[7]. Boyatzis considered that organizations need managers to be able to reach their objectives, and they need competent managers to be able to reach these objectives both efficiently and effectively[8]. Thus, in the IT application context, it is reasonable to assume that the department ITAM is one of the first-line and middle manager performance dimensions.

Campell considered that individual differences on a specific performance component can be viewed as a function of three major determinants, that is, declarative knowledge, procedural knowledge and skill, and motivation. Declarative knowledge is simply knowledge about facts and things, it represents an understanding of a given task's requirements. Procedural knowledge and skill is attained when declarative

This work is supported by the "National Economic Research Center" of Guangdong University of Business Studies.

Manhui Huang is with the Information Science School , Guangdong University of Business Studies, Guangzhou 510320, China (corresponding author phone: 86-20-88130422; fax: 86-20-84096908; e-mail: huangmanhui@126.com).

Chi-Sum Wong is with the Department of Management, The Chinese University of Hong Kong, Shatin, N.T., Hong Kong (e-mail: cswong@baf.msmail.cuhk.edu.hk).

knowledge, or knowing what to do, has been successfully combined with knowing how to do it. Motivation is defined as a combined effect from three choice behaviors - choice to expend effort, choice of level of effort to expend, and choice to persist in the expenditure of that level of effort. Performance is directly determined by the combination of these three elements[7]. In 1993, Spencer & Spencer divided the competency characteristics into five types: motives, traits, self-concept, knowledge, and skill. Motives are matters that a person consistently thinks about or wants that cause action. Motives "drive, direct, and select" behavior toward certain actions or goals and away from others. Traits refer to physical characteristics and consistent responses to situations or information. Self-concept refers to a person's attitude, values, or self-image. Knowledge refers to the information a person has in specific content areas. Skill refers to the ability to perform a certain physical or mental task. The competence can distinguish superior performers in a particular job[6]. Competencies predict behavior actions, which in turn predict job performance outcomes. Competencies are context sensitive, and can predict job performance[9].

Based on the competence theory, Huang analyzed the characteristics the first-line and middle managers need to hold to improve the company ITAM and called these characteristics IT competence. First-line and middle manager IT competence refers to the characteristics of the first-line and middle managers that are causally related to the superior performance in the IT application job. Overall, there are 9 competencies in the first-line and middle manager IT competence model, including IT application knowledge, IT application attitude, adaptability, communication skill, cooperation, regulation shape, thought, innovation, and initiative. With a sample of first-line and middle managers, the IT competence model is supported by the empirical research[10].

Thus, we propose the following hypothesis.

Hypothesis 1: If the first-line and managers play the role of departmental managers, their IT competence will affect the department ITAM.

Additionally, in the IT application context, first-line and middle managers may also play the role of IT user. If the users are not willing to use the available systems, IT will not improve organizational performance [1]. First-line and middle managers' unwillingness in using information systems have become the bottleneck in IT application[11]. Intention models from social psychology have been widely applied to explain the IT usage behavior in the information systems research field. In the intention models, such as the theory of reasoned action (TRA), and its extension, the technology acceptance model (TAM) and the theory of planned behavior (TPB), individual behavior is a direct function of the intention to perform behavior, that is, user's IT usage intention will affect his/her IT usage behavior[1, 12-14].

Thus, we proposed the following hypothesis.

Hypothesis 2: If the first-line and middle managers play the role of IT users, their IT usage intention will affect the department ITAM.

## III. Sample

The data of the present study are collected from two sources. One is current MBA students in two universities in Guangzhou who are first-line and middle managers in companies. The other source is 110 companies in China. In the MBA classes, we solicited the teachers to help us find some MBA students who are first-line and middle managers to fill the questionnaires. And in every company, we solicited one of the top managers to help us find some first-line and middle managers to fill the questionnaires. Overall, there are 650 valid questionnaires collected. The sample is distributed in 170 companies. The key advantage of this sampling process is the personal relationships between the teachers and the MBA students, and between the top managers and the first-line and middle managers. Among the 170 companies, 69 companies are in the manufacturing industries, and 101 companies are in the service industries. Among the 650 participant, 31.2 percent are female, and 68.8 percent are male; 56.0 percent are first-line managers, and 44.0 percent are middle managers; 67.8 percent are 21-35 years old, and 69.8 percent have received college education. The distribution of the sample is shown in Table 1.

## IV. Measures

All scales in the present study have been developed from previous studies, as using the well-established and accepted scales can provide high convergent and discriminant validity[15]. The response format for all the measurement items in the present study is a 5-point Likert-type scale ranging from strongly disagree (1) to strongly agree (5).

The scale of department ITAM is adapted and modified from the scale of company ITAM developed by Xiao [5]. Overall there are 18 items. And the internal consistency reliability of the items is 0.935.

TABLE 1 Sample distribution

| Sex | Frequencies | % | Position | Frequencies | % | Age | Frequencies | % | Education | Frequencies | % |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Female | 203 | 31.2 | First-line manager | 364 | 56.0 | 21-35 | 441 | 67.8 | College | 454 | 69.8 |
| Male | 447 | 68.8 | Middle manager | 286 | 44.0 | Other | 109 | 32.2 | Less than college | 196 | 30.2 |
| Total | 650 | 100 | | 650 | 100 | | 650 | 100 | | 650 | 100 |

The scale of IT usage intention is adopted from the previous research [16]. Overall there are 3 items. And the

internal consistency reliability of the items is 0.839.

The scales of IT competence are adopted from the previous research[10, 17]. Overall there are 9 competencies, and there are 7 items in the IT knowledge scale, 4 items in the IT attitude scale, 9 items in the adaptability scale, 6 items in the communication skill scale, 16 items in the cooperation scale, 5 items in the regulation shape scale, 7 items in the thought scale, 14 items in the innovation scale, and 7 items in the initiative scale. The internal consistency reliability of the measurement items of the 9 competencies ranges from 0.851 to 0.944.

The important role of the top management support in IT application has been well documented. Therefore, in the present study, the effect of the first-line and middle managers on the department ITAM is analyzed with the top management support as control variable. The scale of the top management support is adapted and modified from the scale developed by Xiao [5]. Overall there are 3 items, and the internal consistency reliability is 0.928.

To examine the validity of the measurement items, the sample is divided into two groups according to the investigation time. One group with 325 questionnaires is analyzed by exploratory factor analysis (EFA) to make sure that the items adopted for the department ITAM, IT competence, IT usage intention, and the top management support are appropriate. The other group with another 325 questionnaires is analyzed by confirmatory factor analysis (CFA) to test the factor structure of the items.

As comparing with the sample size, there are too many items in the scales of some constructs in the present study, we use a recommended approach by some other researchers to reduce the number of the indicators. Firstly, exploratory factor analysis for the items of each construct is conducted. Secondly, the items with the highest and lowest loading for each construct are combined by averaging until three aggregated indicators are yielded for each construct [18].

After reducing the number of indicators of the constructs with more than 4 measurement items into three indicators, we conduct the exploratory factor analysis with all the indicators. The results of EFA show that 12 factors emerge with 85.619% of the variances explained. All the indicators load on their respective factors with loadings greater than .45, while the cross-loadings are relatively small. The results of EFA and the reliability analysis are shown in Table 2.

With another group of the sample, we conduct confirmatory factor analysis with all the indicators in the current study. The results of CFA show that the fit of the 12-factors is acceptable ($\chi^2$/df = 1.937, RMSEA=0.054, NNFI=0.98, CFI=0.99). Thus, together with the reliability evidences, we conclude that the scales adopted in the present study have acceptable reliability and validity.

## V. Results

Hierarchical regression analysis is conducted to test the above hypotheses in the present study with the first-line and middle manager IT competence and IT usage intention as predicting variables, department ITAM as criterion variable, and top management support as control variable. The results are shown in Table 3.

Table 3 displays the $R^2$, as well as the $R^2$ change, F change and significance of F change after entry of the predicting variables. After the first step of the hierarchical regression analysis with the control variable, 40.4% of the variance in the department ITAM is explained ($R^2$=0.404, F=438.402, P<0.001). The second step of the hierarchical regression analysis adds the constructs IT competence and IT usage intention. It showed that 49.1% of the variance is explained ($R^2$=0.491, $\Delta R^2$=0.090, $\Delta$F=57.426, P<0.001), and the addition of the first-line and middle manager IT competence and IT usage intention results in significant incremental change in $R^2$. This result implies that the first-line and middle managers will affect the department ITAM. Table 3 also illustrates the standardized regression coefficients (Beta), and the significance of the standardized regression coefficients for the variables analyzed. It shows that first-line and middle manager IT competence is a significant predictor of the department ITAM (β=0.332, P<0.001), while the usage intention is not a significant predictor of the department ITAM (β=-0.053, P>0.05)[19]. Therefore, hypothesis 1 is supported, whereas hypothesis 2 is not supported. The results of the hypotheses testing are shown in Table 4.

## VI. Discussion

People are the key resource to the successful IT application. However, previous empirical research paid lots of attention to the effect of the top management support on IT application, whereas paid little attention to the effect of the first-line and middle manager on IT application. The present study empirically tests the effect of the first-line and middle managers on the IT application maturity and the roles of the first-line and middle manager in the IT application. Therefore, our research enriches the extant research about the key effect factors of IT application.

The results show that both the top management and the first-line and middle managers will affect the department ITAM. The first-line and middle manager IT competence has significant impact on ITAM, but their IT usage intention has no impact. This may indicate that when the first-line and middle managers play the role of IT application manager, their behavior will affect the department IT application maturity. Whereas when the first-line and middle managers play the role of IT user, their behavior will not affect the department ITAM. One reasonable explanation of this result is that when they are managers, they need the IT management competence to improve the IT performance in the whole department. Whereas when they are just users, it is not up to them to consider the IT performance in the whole department. Another possible reason is that with the wide and successful application of IT in a lot of companies, few first-line and middle-managers will object the use of IT.

TABLE 2 Results of the EFA and the Reliability Analysis

| Indicators | Factor 1 | Factor 2 | Factor 3 | Factor 4 | Factor 5 | Factor 6 | Factor 7 | Factor 8 | Factor 9 | Factor 10 | Factor 11 | Factor 12 | Cronbach α |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Attitude 1 | **.861** | .134 | .029 | .148 | .133 | .128 | .082 | .084 | .123 | .099 | .142 | .101 | .899 |
| Attitude 2 | **.853** | .159 | .074 | .131 | .112 | .160 | .091 | .096 | .077 | .147 | .146 | .092 | |
| Attitude 3 | **.859** | .129 | .079 | .151 | .106 | .115 | .076 | .101 | .081 | .130 | .204 | .073 | |
| Attitude 4 | **.641** | -.054 | -.043 | -.006 | .019 | -.039 | .033 | .054 | .229 | -.020 | .346 | -.078 | |
| Top 1 | .105 | **.870** | .051 | .053 | .042 | .040 | .285 | .079 | .079 | .094 | .066 | .039 | 0.928 |
| Top 2 | .063 | **.874** | .037 | .035 | .054 | .021 | .258 | .093 | .086 | .102 | .002 | .038 | |
| Top 3 | .152 | **.870** | .059 | .057 | .093 | .062 | .201 | .040 | .071 | .128 | .082 | .049 | |
| Regulation 1 | -.018 | .059 | **.798** | .270 | .080 | .153 | .074 | .106 | .224 | .132 | -.050 | .085 | .917 |
| Regulation 2 | .077 | .067 | **.814** | .271 | .113 | .204 | .093 | .158 | .117 | .147 | -.010 | .122 | |
| Regulation 3 | .045 | .046 | **.827** | .184 | .147 | .136 | .154 | .125 | .121 | .112 | -.011 | .108 | |
| Thought 1 | .175 | .073 | .293 | **.815** | .106 | .202 | .105 | .107 | .196 | .131 | .033 | .141 | .946 |
| Thought 2 | .163 | .044 | .248 | **.809** | .123 | .218 | .075 | .092 | .152 | .145 | .089 | .187 | |
| Thought 3 | .144 | .072 | .351 | **.788** | .062 | .227 | .111 | .119 | .193 | .108 | .022 | .160 | |
| Adaptability1 | .082 | .089 | .175 | .123 | **.774** | .205 | .162 | .233 | .141 | .233 | .043 | .127 | .932 |
| Adaptability2 | .158 | .075 | .119 | .097 | **.800** | .213 | .128 | .260 | .166 | .192 | .079 | .123 | |
| Adaptability3 | .180 | .089 | .116 | .081 | **.809** | .186 | .123 | .278 | .157 | .201 | .078 | .093 | |
| Innovation 1 | .069 | .034 | .238 | .191 | .223 | **.791** | .099 | .147 | .096 | .165 | .003 | .217 | .944 |
| Innovation 2 | .227 | .069 | .160 | .237 | .142 | **.764** | .070 | .202 | .272 | .124 | .072 | .080 | |
| Innovation 3 | .125 | .061 | .182 | .224 | .240 | **.798** | .068 | .155 | .217 | .124 | -.013 | .169 | |
| IT1 | .111 | .345 | .112 | .090 | .129 | .074 | **.805** | .101 | .068 | .220 | .048 | .067 | 0.935 |
| IT2 | .124 | .302 | .104 | .096 | .165 | .057 | **.833** | .090 | .106 | .173 | .067 | .081 | |
| IT3 | .049 | .358 | .138 | .078 | .081 | .094 | **.808** | .075 | .064 | .223 | -.029 | .096 | |
| Communication1 | .105 | .051 | .141 | .095 | .272 | .211 | .111 | **.746** | .239 | .163 | .043 | .117 | .851 |
| Communication2 | .117 | .092 | .084 | .153 | .296 | .162 | .090 | **.761** | .261 | .146 | .025 | .068 | |
| Communication3 | .113 | .110 | .181 | .062 | .163 | .106 | .070 | **.815** | .036 | .132 | .093 | .129 | |
| Cooperation 1 | .170 | .116 | .242 | .142 | .131 | .199 | .108 | .178 | **.800** | .072 | .102 | .119 | .941 |
| Cooperation 2 | .266 | .133 | .104 | .236 | .186 | .211 | .087 | .218 | **.721** | .102 | .169 | .068 | |
| Cooperation 3 | .186 | .110 | .271 | .239 | .205 | .222 | .080 | .168 | **.710** | .108 | .155 | .103 | |
| Knowledge 1 | .083 | .130 | .171 | .091 | .219 | .159 | .261 | .141 | .060 | **.743** | -.010 | .157 | .894 |
| Knowledge 2 | .137 | .148 | .191 | .138 | .222 | .100 | .244 | .205 | .063 | **.778** | .093 | .034 | |
| Knowledge 3 | .209 | .198 | .107 | .182 | .201 | .167 | .195 | .146 | .150 | **.718** | .149 | .072 | |
| Intention 1 | .333 | .227 | -.004 | .033 | .265 | .057 | .048 | .076 | .076 | .216 | **.591** | .056 | 0.839 |
| Intention 2 | .228 | .034 | -.030 | .054 | .016 | -.007 | .025 | .042 | .103 | .014 | **.903** | -.002 | |
| Intention 3 | .205 | .001 | -.010 | .030 | .003 | .025 | .011 | .041 | .080 | .032 | **.907** | .024 | |
| Initiative 1 | .029 | .038 | .134 | .185 | .106 | .216 | .144 | .128 | .083 | .047 | -.041 | **.838** | .853 |
| Initiative 2 | .198 | .152 | .189 | .307 | .219 | .161 | .056 | .169 | .126 | .251 | .168 | **.605** | |
| Initiative 3 | .150 | .061 | .270 | .216 | .205 | .392 | .085 | .246 | .294 | .142 | .043 | **.453** | |
| Eigenvalue | 14.953 | 3.577 | 3.211 | 2.076 | 1.369 | 1.308 | 1.100 | .963 | .855 | .802 | .789 | .676 | |
| Variance Explained(%) | 40.413 | 9.667 | 8.678 | 5.610 | 3.701 | 3.535 | 2.972 | 2.603 | 2.312 | 2.169 | 2.133 | 1.827 | |
| Cumulative % of Variance Explained | 40.413 | 50.080 | 58.758 | 64.368 | 68.069 | 71.604 | 74.576 | 77.178 | 79.490 | 81.659 | 83.792 | 85.619 | |

TABLE 3 RESULTS OF THE HIERARCHICAL REGRESSION ANALYSIS

| Model | Construct | Beta | $R^2$ | $\Delta R^2$ | $\Delta F$ |
|---|---|---|---|---|---|
| 1 | Top Management Support | $.635^{***}$ | .404 | $.404^{***}$ | $438.402^{***}$ |
| 2 | Top Management Support | $.516^{***}$ | .494 | $.090^{***}$ | $57.426^{***}$ |
| | Competence | $.332^{***}$ | | | |
| | Usage Intention | -.053 | | | |

Note. Model 1 predicting variable is the top management support. Model 2 predicting variables are top management support, competence, usage intention. Criterion variable is department ITAM. $^{***}P<0.001$, $^{**}P<0.01$, $^{*}P<0.05$

TABLE 4 RESULTS OF THE HYPOTHESES TEST

| Hypotheses | Results |
|---|---|
| Hypothesis 1: If the first-line and managers play the role of departmental managers, their IT competence will affect the department ITAM. | Support |
| Hypothesis 2: If the first-line and middle managers play the role of IT users, their IT usage intention will affect the department ITAM. | Not Support |

In the IT application practice field, top management support has been emphasized as the most important determinant of IT application maturity, whereas the effect of first-line and middle manager on the IT application maturity have received little attention. The results of the present study have some practical implications, that is, to improve the IT application maturity, it is important to gain top management support, and to improve the first-line and middle manager IT competence. Spencer and Spencer proposed the iceberg model and onion model to describe the structure of the competencies, as the knowledge and skill competencies tend to be visible, and relatively surface, characteristics of people, while self-concept, trait, and motive competencies are more hidden, "deeper", and central to personality, and attitude lies

somewhere in between. Spencer and Spencer considered that knowledge can be improved by training, as it is easier to develop. As traits are relatively difficult to develop, and selection is the most cost-effective method to gain this type of competencies. Whereas attitude can be changed by training, psychotherapy, and/or positive developmental experiences, it needs more time, and is more difficult [6]. In Huang's IT competence model, IT application knowledge is included in the knowledge competencies, and IT application attitude is included in the attitude competencies, while other IT competencies such as adaptability, communication skill, cooperation, regulation shape, thought, innovation, and initiative are included in the trait competencies[10]. Therefore, we concluded that it is important for the IT application companies to improve the first-line and middle manager IT application knowledge by training, and improve the first-line and middle manager adaptability, communication skill, cooperation, regulation shape, thought, innovation, and initiative by selecting, whereas improve the first-line and middle manager IT application attitude by training or positive IT application experiences.

Previous research has paid a lot of attention on the IT usage intention. However, our results show that first-line and middle manager IT usage intention does not have impact on department ITAM. Thus, the results of the present research indicate that future research needs to pay more attention on the competence rather than usage intention. Previous research indicated that the key effect factors of the ITAM are dynamic during different IT application stage[20, 21], therefore, future research may make further research about the dynamic effect of the first-line and middle manager IT competence on ITAM.

## REFERENCES

[1] F.D.,Davis, R.P. Bagozzi, and P.R. Warshaw, "User acceptance of computer technology: A comparison of two theoretical models," Management Science, vol. 35, Aug. 1989, pp. 982-1003.
[2] J. Dawson and J. Owens,"Critical success factors in the chartering phase: A case study of an ERP implementation," International Journal of Enterprise Information Systems, vol. 4, Mar. 2008,pp. 9-24.
[3] T.P. Nguyen, Attitudes toward Wireless Networking Security: An Analysis of the Relationships between Individual Behaviors and Common Practices. Doctoral Dissertation. Capella University. 2005.
[4] H. Akkermans and K.v. Helden,"Vicious and virtuous cycles in ERP implementation: A case study of interrelations between critical success factors," European Journal of Information Systems,vol. 11,Jan. 2002,pp.35-46.
[5] J. Xiao, Research on IT Application Maturity and Critical Success Factors in Mainland Enterprises. Doctoral Dissertation. San Yat- Sen University. 2007.
[6] L.M. Spencer and S.M. Spencer. Competence at Work:Models for Superior Performance. New York: Wiley, 1993.
[7] J.P. Campbell, "Modeling the performance prediction problem in industrial and organizational psychology,"in Handbook of Industrial and Organizational Psychology, M.D. Dunnette and L.M. Hough. Palo Alto, CA: Consulting Psychologists, 1990, pp. 687-732.
[8] R.E. Boyatzis, The Competent Manager: A Model for Effective Performance. New York: Wiley, 1982.
[9] D.C. McClelland, "Testing for competence rather than for 'intelligence',".American Psychologist, vol. 28, Jan. 1973, pp. 1-14.
[10] M. Huang, The Effects of the First-line and Middle Manager Competence and Usage Intention on the IT Application Maturity. Doctoral Dissertation. Sun Yat-sen University. 2009.
[11] M.J. Gallivan, "Organizational adoption and assimilation of complex technological innovations: Development and application of a new framework,"The Data Base for Advances in Information Systems, vol. 32, Mar. 2001, pp. 51 - 85.
[12] M. Huang and K. Xie,"First-line and middle manager IT usage intention: A test of TAM," 2008 International Seminar on Business and Information Management. Wuhan, China. 2008.
[13] I. Ajzen, "The theory of planned behavior," Organizational Behavior and Human Decision Processes, vol. 50, Feb. 1991, pp. 179-211.
[14] M. Fishbein and I. Ajzen. Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research. MA: Addison-Wesley Reading, 1975.
[15] D.J.V. David, Adaptive Learning Systems Technology Advisor: A Model for Business Entrepreneurs to Implement IT. Doctoral Dissertation. The City University of New York. 2004.
[16] F.D. Davis, "Perceived usefulness, perceived ease of use, and user acceptance of information technology," MIS Ouarterly, vol. 13, Mar. 1989, pp. 319-340.
[17] M. Huang and K. Xie, "An exploring research on the informatization competence of first-line and middle managers," Journal of Information, vol. 27, Oct. 2008, pp. 93-95 (in Chinese).
[18] J.E. Mathieu, D.A. Hofmann, and J.L. Farr, "Job perception-job satisfaction relations: An empirical comparison of three competing theories," Organizational Behavior and Human Decision Processes, vol. 56, 1993, pp. 370-387.
[19] M. Huang and C.-S. Wong, "The effects of the first-line and middle manager on the IT application maturity," 2010 International Conference on Innovation, Management and Service (ICIMS 2010). Singapore. 2010.
[20] F.F.-H. Nah and S. Delgado,"Critical success factors for enterprise resource planning implementation and upgrade," Journal of Computer Information Systems, vol. 46, May 2006, pp. 99-113.
[21] M. Huang and C.-S. Wong,"The stage differences of the first-line and middle manager IT Competence," 3rd International Symposium on Electronic Commerce and Security. Guangzhou,China. 2010.