A MEASUREMENT INSTRUMENT FOR INDIVIDUAL INFORMATION COMPETENCY IN AN ENTERPRISE INFORMATION ENVIRONMENT

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Abstract: An instrument that can efficiently measure individual information competency is presented to develop and manage the information application ability of individual working in an enterprise information environment. The measurement items are extracted from the major components of a competency. By factor analysis and reliability analysis, a 14-item instrument is proposed to entirely measure individual information capability. The tool's application and utilization are discussed through a case study and the presentation of its results.

1 INTRODUCTION

Today, information technology (IT) progression makes data resources and information systems (IS) become firm's critical strategic resources. (Wu et al., 2005). The efficient utilization of IT in a firm is a critical factor to effectively improve its task performance and competitiveness in an information environment. It is important for human resources working in an enterprise information environment to have the capability to effectively execute the given tasks by applying their information systems to their business. (Mathis and Jackson, 2000; O'Leary, 2002). An individual who directly executes his or her business needs the ability to efficiently perform individual tasks by applying IT and information systems to his or her business in an enterprise information environment.

Hence, this study presents an instrument to measure the individual information competency, which focuses on the entire information capability that an individual can efficiently use information for his or her tasks in an enterprise information environment.

2 THEORETICAL RESEARCH

In previous literature, an end-user was defined as a person who directly interacts with his or her computer. (McHaney et al., 2002; Rondeau et al., 2006; Wu et al., 2007). Based on these studies, we can define an individual as a person who directly interacts with his or her information systems.

In previous literature, competency was defined as effective application of available knowledge, skills, attitudes, and values in complex situations. (Govindarajulu and Reithel, 1998; Bassellier et al., 2001; Tanner, 2001). Namely, the major components of a competency are knowledge, skills, concepts, and development. Individual competency is used to deal with the competence of a person, the collective competency is used to deal with the competence emerging from a group of persons, and global competency is used to describe the organizational ability of an enterprise. (Boucher et al., 2007).

By summarizing prior researches, an individual information competency (IIC) can be defined as the total capability that an individual can efficiently apply information knowledge, skills, attitudes, and values to his or her tasks to execute the given tasks in an enterprise information environment. In other words, IIC is defined as the total capability that an individual directly interacts with his or her information systems to efficiently perform the given tasks through using an organizational data and solutions on information systems. IIC is the entire information capability that an individual can effectively do his or her tasks on an enterprise information system. Based on the definitions and components of IIC, this study generated the 27

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measurement items that can gauge IIC in an enterprise information environment. (Govindarajulu and Reithel, 1998; Bassellier et al., 2001; Tanner, 2001; Boucher et al., 2007; Torkzadeh and Lee, 2003; McCoy, 2001).

3 METHODS

Previous literature proposed methods to verify the validity and reliability of the model construct. Most studies presented two methods for a model construct validation: (1) correlations between total scores and item scores, and (2) factor analysis. (Brancheau and Brown, 2002; McClelland, 1973; Boyatiz, 1982; Jacobs, 2002). Torkzadeh and Doll (1999) and Torkzadeh and Lee (2003) used correlation analysis to verify the validity of the model construct. Etezadi-Amoli and Farhoomand (1996), and McHancy et al. (2002) utilized factor analysis to verify the validity of the model construct. We verify the validity and reliability of the instrument construct and extracted adequate measurement items by factor analysis and reliability analysis. The ratio of sample size to number of measurement items (11:1) was above the minimum (10:1) ratio suggested for factor analysis by previous literature. (Torkzadeh and Lee, 2003; Rodriguez et al., 2002). The measurement questionnaire used a five-point Likert-type scale; where, 1: not at all; 2: a little; 3: moderately; 4: much; 5: a great deal. The questionnaire is composed of two response domains: one is answer to general data of respondents, such as degree, age, gender, major field, industry and business department, business position level and years of job experience; the other is response to the measurement items.

3.1 Sample Characteristics

A sample of 243 usable responses was obtained from a variety of industries and business departments, and from management levels. The respondents in terms of business departments were identified as strategy planning (21.1%), development and maintenance (26.8%), business application (38.4%), and administration support (13.7%). The respondents identified themselves as top manager (3.7%), middle manager (44.7%), and worker (51.6%). The respondent had on average of 8.9 years of experience (S.D. =1.118) in their field, their average age was 32.9 years old (S.D. =6.473), and their gender, male (79.8%) and female (20.2%).

3.2 Analysis and Discussion

Items were excluded when their correlation with the collected item-total was < 0.5 or when their correlation with the criterion scales was < 0.6. (Torkzadeh and Lee, 2003; Rifkin et al., 1999; McCoy, 2001). The correlations with the corrected item-total and the criterion item were significant at $p \leq 0.01$ and similar to those used by others in previous researches. (Torkzadeh and Lee, 2003; Rifkin et al., 1999; McCoy, 2001). After these analyses, the first 27 measurement items were reduced to 14 items, with 13 items were deleted. The elimination was sufficiently considered to ensure that the retained items were adequate measures of IIC. The validity and reliability of the instrument were verified by factor analysis and reliability analysis. They were used to identify the underlying factors or components that comprise the IIC construct. These deletions resulted in a 14-item scale for measuring IIC. Each of the 14 items had a factor loading > 0.637. The reliability coefficients (Cronbach's alpha) of four potential factors had values > 0.797, above the threshold recommended for exploratory research. (Rodriguez, 2002). The descriptions and loadings for the 14 items are presented in Table 1 and Table 2.

Table 1: Factor loadings obtained from factor analysis.

Variable	Factor Loadings			
	Factor 1	Factor 2	Factor 3	Factor 4
V04	0.794			
V06	0.762			
V03	0.637			
V10		0.881		
V08		0.765		
V13		0.741		
V11		0.699		
V18			0.872	
V12			0.811	
V16			0.794	
V19			0.732	
V17				0.779
V23				0.756
V26				0.659

To examine the reliability and validity of the measures, we calculated the corrected item-total correlations between each variable and its corresponding factor. These correlations along with alpha coefficients of each factor are presented in Table 2. This also shows the alpha coefficients for the measurement of factors if a measure was deleted from the scale. These coefficients indicate the relative contribution of a measure to the construction of a scale for measuring a particular factor. They are all in the acceptable range. Most corrected item-total correlations were greater than 0.600, showing that the individual measures are good indicators of their corresponding factors.

Table 2: Corrected item-total correlations and the coefficient alphas of 14-measurement items.

Variable	Corrected item-total correlation	Alpha if item deleted
V04	0.681	0.735
V06	0.721	0.791
V03	0.670	0.653
Coefficient alpha for the above 3 items as a composite measure of Factor =0.823		
V10	0.812	0.845
V08	0.744	0.812
V13	0.781	0.749
V11	0.789	0.736
Coefficient alpha for the above 4 items as a composite measure of Factor =0.903		
V18	0.841	0.817
V12	0.785	0.778
V16	0.821	0.849
V19	0.679	0.712
Coefficient alpha for the above 4 items as a composite measure of Factor =0.813		
V17	0.735	0.802
V23	0.819	0.721
V26	0.648	0.612
Coefficient alpha for the above 3 items as a composite measure of Factor =0.797		

Hence, the measurement items, with a validity and reliability, were extracted by carrying two analyses as shown in Table 1 and Table 2.

4 MEASUREMENT INSTRUMENT

These analyses classified the extracted items as 4 factor groups. These factor groups indicate the potential major factors to measure the IIC. With investigating the measurement items of each factor, we generated the 4 potential factors as follows: factor 1: information concepts; factor 2: information knowledge; factor 3: information utilization; and factor 4: information development. The 4 potential factors are considered the major factors of the instrument construct. Figure 1 shows the structure of the measurement instrument based on the 4 potential factors and 14 items. Each factor has three or four measurement items as shown in Figure 1.

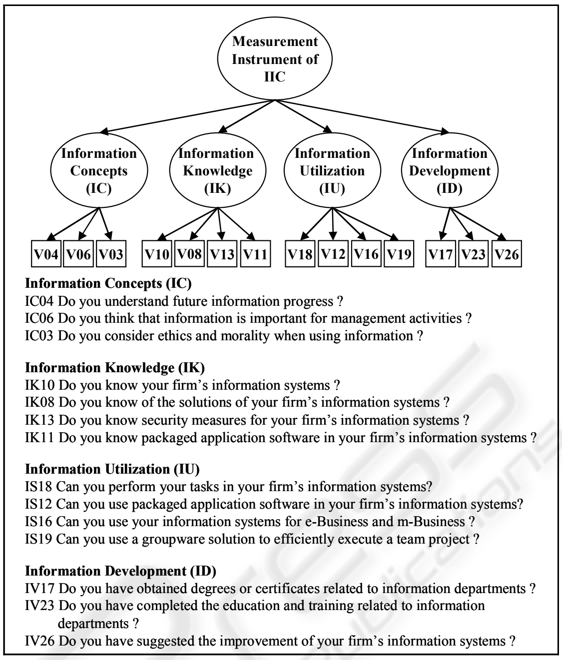

Figure 1: Structure of measurement instrument.

4.1 Measurement Factors and Items

This instrument has 4 major factors to measure IIC in an enterprise information environment.

Information concepts mean state of mind, feelings, and belief related to IT. It includes the measurement items that can identify individual attitude on the future IT progress, IT importance for a firm, and ethic and morality in using information on an enterprise information system.

Information knowledge indicates complex process of remembering, relating or judging information to efficiently use an information system. Namely, information knowledge represents IT knowledge to effectively perform the given tasks on an enterprise information system. It comprises the items that can gauge IT knowledge related to hardware, software, networks, and database for a firm information system, knowledge of packaged application software related to ERP, SCM, and CRM, knowledge related to e-Business (B2E, B2C, and B2B), and knowledge related to security measures in a firm's information system.

Information utilization is the ability that utilizes information to perform specific mental or physical tasks, and includes mental or cognitive skills. Information skills mean the ability that an individual utilize IT knowledge, solutions, and information systems to his or her tasks. It contains the skills as follows: utilization of network and server; use of packaged application software, such as ERP, SCM, and CRM; use of the information systems for e-business of the form B to E, B to C, and B to B; and the skills to use the security measures in a firm's information system.

Information development refers to the endeavor to improve knowledge and skills related to information. It provides the potential ability to efficiently improve IIC. It has the items that can measure an individual mind on degrees and certificates, domestic and overseas educations and trainings, and suggestion for the improvement of your information systems. This is the important factor for the extension of information capability in terms of the breadth and depth of IIC.

This instrument is a crucial theoretical construct to measure an individual's total information ability that can efficiently do his or her tasks in an enterprise information environment.

5 MEASUREMENT PROCESS

5.1 Framework of Measurement Process

The measurement process has two main stages, including the measurement stage and presentation stage of the measurement results (Figure 2). The measurement stage examines individuals by a questionnaire based on 4 measurement factors and 14 items. The measurement results are analyzed by extracting the measurement values of each factor and by applying each weight value to the measurement values of each factor.

The presentation stage provides the measurement results based on each factor. The results are explained by each measurement index extracted from each factor. The interpretation of the results presents the present states and problems of the IIC, and the directions and methods to efficiently improve the IIC based on the extracted measurement indices.

5.2 Measurement Method

We used the weight values for each measurement factor in order to develop an efficient instrument considered the relative importance of each factor in measuring IIC. The weight values, Table 3, were extracted from the analysis results of the questionnaire survey (AHP) for about 30 experts working in our IT research center.

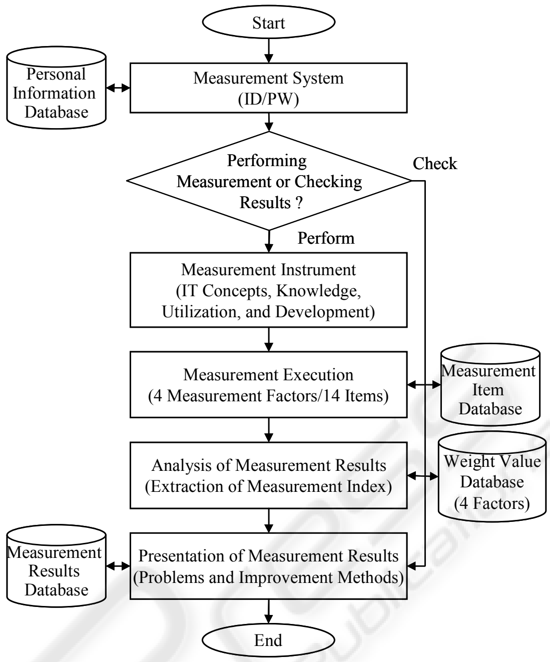

Figure 2: Measurement process.

The measurement method first calculates the measurement values of each factor based on the analysis results that an individual is tested by the measurement items of each factor. It figures out the measurement indices of each factor by multiplying each weight value by the measurement value of each factor.

Table 3: Weight values for each measurement factor.

Measurement Factor	Weight Value
Information Concepts	0.20
Information Knowledge	0.25
Information Utilization	0.33
Information Development	0.22

The measurement index (MI) means the value extracted by multiplying the weight value by the measurement value. The sum of the measurement indices of each factor becomes the individual entire MI.

Hence, the measurement index (MI) of each factor can be presented as Equation (1).

$$MI_{MFi} = MV_{MFi} \times WV_{MFi} \quad (1)$$

Where, MI_{MFi} : Measurement index (MI) of the *i* th Measurement Factor

MV_{MFi} : Measurement Value (MV) of the *i* th Measurement Factor

WV_{MFi} : Weight Value (WV) of the i th Measurement Factor

Here, the sum of the weight values of each factor is 1.00 and i = 1, 2, 3 and 4 indicate four measurement factors.

Therefore, the total MI can be defined as Equation (2) by Equation (1):

$$\text{Total MI} = \sum_{i=1}^{4} MI_{MFi} \tag{2}$$

Here, the i = 1, 2, 3 and 4 mean the four measurement factors.

In this way, this instrument presents the measurement results of IIC based on the total MI and measurement indices of each factor. The problems of the IIC are presented by the results. The efficient methods to improve the IIC are also provided by the total MI and measurement indices of each factor.

6 CASE STUDY AND DISCUSSION

This case study applied the developed tool to 137 workers working in "B" enterprise, Republic of Korea.

6.1 Analysis and Discussion: Overall Organization

We presented the measurement results of each business department and overall organization. The total MI of the overall organization was 62.73, and it was quite high. The business application department (BAD) and the administration support department (ASD) were 65.27 and 63.16 as shown in Figure 3.

The measurement results of each business department represented that the MI of the BAD was higher than those of the other departments. This is due to the ability to effectively accomplish their tasks by frequently applying information knowledge and systems to e-Business of the form B to C, B to B and B to E, and the knowledge and abilities to utilize the various solutions, such as ERP, SCM, and CRM to effectively perform their business tasks on an enterprise information system.

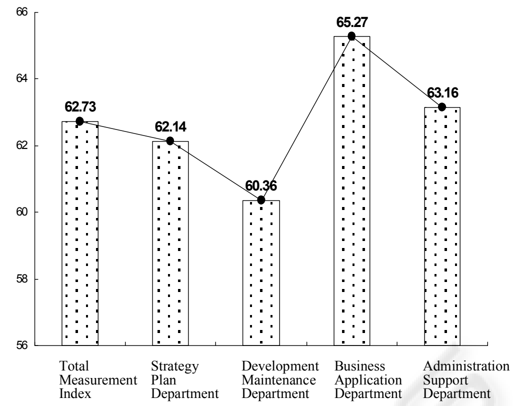

Figure 3: Measurement indices of each business department and overall organization.

Figure 4 presents the measurement indices of each factor for each business department within the organization. The MI of the BAD in all measurement factors was higher than those of the other departments. Especially, the BAD was very high level in information utilization. It indicates that the BAD had the distinguished skills to utilize information solutions and systems to efficiently perform the given tasks. The strategy plan department (SPD) was quite high in the information development. It means that they completed the endeavor to improve knowledge and skills related to information

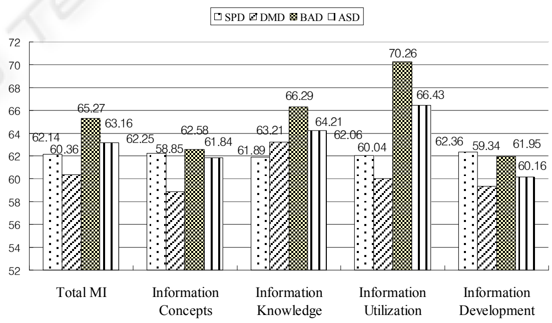

Figure 4: Measurement indices of each factor for each business department.

6.2 Analysis and Discussion: an Individual

The total MI of the individual was 64.89, and it was a little high. Especially, the MI of the information utilization was very high. This means the outstanding skills to utilize the information knowledge, solutions, and systems to his or her tasks in an enterprise information environment. However, the MI of the information concepts and development were low as indicated in Figure 6.

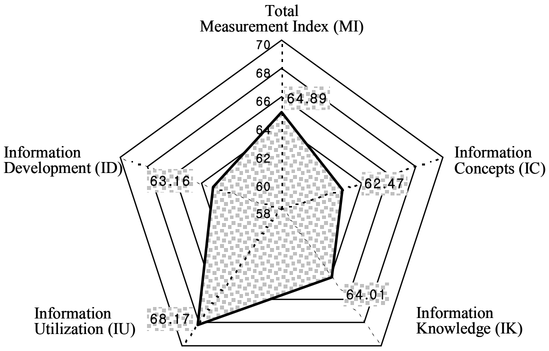

Figure 6: Measurement indices of an individual in the BAD.

Therefore, this individual should make an effort to improve the information concepts and development to effectively raise his or her information competency in general.

7 CONCLUSIONS

We presented an instrument that can efficiently measure an IIC in an enterprise information environment. This instrument includes structure, concrete items, and measurement process and method. This instrument has a nature as a global standard across industries, and business departments and positions.

Therefore, this study provides an instrument that can measure IIC required to efficiently execute an individual's given tasks in an enterprise information environment.

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