A Methodology to Measure e-HR Capability in an e-Business Environment

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e-Business 환경에서 e-Business 인력의 능력 측정을 위한 방법론

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Abstract

기업 인력의 e-Business 적용 능력은 e-Business 환경에서 개인에게 주어진 업무를 효율적으로 수행하고 업무성과를 향상하기 위해 필요하다. 본 연구는 e-Business 인력의 측정도구, 측정체계 및 방법을 제시한다. 개발된 측정도구는 요인분석과 신뢰성 분석을 통하여 그 구조의 타당성을 검증하였고, e-Business 인력을 효과적으로 측정할 수 있는 16 개의 측정항목을 갖는 측정 도구를 제시하였다. 개발된 측정도구의 적용성과 활용성은 실제 e-Business 환경의 기업에서 근무하는e-Business 인력에 적용하여 그 결과를 제시함으로써 확인 하였다. 본 연구는 e-Business 환경의 기업에서 근무하는 인력의 e-Business 능력을 측정하고 개선하는 방법론을 개발하는 데 공헌할 것이다.

Keywords : E-Business Capability, Measurement Tool, Measurement System, Measurement Method

1. Introduction

Nowadays, human resources use e-Business (Electronic Business) systems to efficiently perform their tasks and to improve task performance in an enterprise of e-Business environment. In this environment, their e-Business ability affects on the performance of their tasks in an e-Business environment. The measurement of e-HR (e-Business Human Resources) is important to improve and manage their e-Business capability that can effectively execute their given tasks. Hence, we need the measurement tool that can totally gauge the e-Business capability of e-HR. But study related to measurement of e-HR's capability has barely executed, literature on measurement of end-user computing skills focuses on specific software skills, professional skills, and operational skills and so on [1][2][3]. For e-HR effectively accomplish their tasks on an e-Business system, they have to be qualified with not fragmentary e-Business skills but total e-Business capability.

Therefore, we present a tool to measure e-HR's e-Business capability in terms of total e-Business capability that can efficiently perform their given tasks on an e-Business system.

2. Related Research

E-Business is a term that IBM first used in 1997. Realizing that it was a core paradigm of enterprise management, researchers defined it variously, depending on their views [4].

By researching previous studies, this study defines e-Business as the approach to increase competitiveness of organizations by improving management activities through using IT and the Internet.

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Table 1- Definition of e-Business

Leem (2000)[5]	E-Business is an approach to improve effectiveness of business process and quality of products/services through standardized data and communication using the internet and information technology.
Lientz & Rea (2001)[6]	E-Business is a management activity including not only e-commerce activities between customer and supplier but also internal work support of the enterprise.
Schubert & Hausler (2001)[7]	E-Business is a business that supports strengthening business processes and business partners, employees, and customer relationships by using electronic media.

Human Resources are defined as workers (employee) directly interact with e-Business application software and e-Business system in his or her departments. With these definitions, we include the creative application of e-Business technology and e-Business systems to the e-Business tasks of human resources in order to improve his or her task performance in the concepts of e-Business capability. Additionally, we are researching on e-Business capability in terms of competency that means a total ability.

The term of competency has been variously defined by many researchers. Generally speaking, competency is the total set of knowledge, skills, and attitudes as the action characteristics of an organizational member that can do his or her tasks outstandingly in an organizational environment [8].

The competency is a set of observable performance dimensions, including individual knowledge, skills, attitudes, and behaviors, as well as collective team, process, and organization capabilities that is linked to high performance, and provides the organization with sustainable competitive advantage [9]. And, the competency is a measurable pattern of knowledge, skill, abilities, behaviors, and other characteristics that an individual needs to perform work roles or occupational functions successfully [10].

Spencer & Spencer (1993) presented five major components of competency: Motives, Traits, Self-concepts, Knowledge, and Cognitive and Behavioral Skills [11]. In general competency, individual characteristics such as motives, traits, self-concepts and knowledge lead to skills, and the action of a person with skills has an effect on the performance of his or her business from e-Business perspective. In other words, e-Business competency is to transform general competency into a type of competency based on e-Business perspective.

Hence, the e-Business competency of e-HR (EBCH) can be defined as the total set of knowledge, technology, skills and attitudes which function as action characteristics of an organizational member who can do his or her task outstandingly in an e-Business environment. Namely, EBCH indicates e-HR's total ability to apply e-Business technology, solution and e-Business systems to his or her tasks. Finally, EBCH means total e-Business ability that e-HR can efficiently perform their given tasks on an e-Business system.

We develop 30 measurement items for e-HR's e-Business capability from five components of competency such as motives, traits, self-concepts, knowledge, and cognitive and behavioral skills.

These measurement items were extracted by about 30 experts such as postdoctoral researchers, professors and senior developers in our research center, and the previous literature on e-Business [1][12][13][14].

3. Methods

3.1 Research method

In previous literature, many researchers presented the verification methods of a measurement tool construct. Kerlinger (1978) presented two methods of construct validation: (1) correlations between total scores and item scores, and (2) factor analysis [15].

Doll & Torkzadeh (1988) [16] and Etezadi-Amoli & Farhoodmand (1996) [17] used factor analysis to verify the validity of the measurement tool construct.

Torkzadeh & Doll (1999) [14] and Torkzadeh & Lee (2003) [1] used correlation analysis to verify the validity of the measurement tool construct. We are likely to verify the validity of the measurement tool construct and to extract the proper items by factor 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 Kerlinger.

The measurement questionnaire used a five-point Likert-type scale; where, 1: not at all; 2: a little; 3: moderate; 4: good; 5: very good. The survey was gathered data from a variety of industries, business departments, experience, and major educations.

3.2 Sample Characteristics

The questionnaire survey of 341 responses was obtained from a variety of industries and business departments, and from management levels with considerable experience. All respondents had college or university degrees in: humanities and society (11.9%), management and economics (23.8%), engineering (41.4%), and science (22.9%). The industries of the sample were manufacturing (16.3%), construction (11.3%), finance, banking and insurance (22.4%), transportation, communication and services (22.8%), and information consulting and system implementation services (27.2%). The respondents identified themselves as top managers (4.7%), middle managers (34.9%), or workers (60.4%). The respondent had on average of 6.7 years of experience (S.D. =1.129) in their field, their average age was 33.2 years old (S.D.=5.235), and their sex, male (67.6%) and female (32.4%). The survey method was executed with two kinds of collection methods: by direct collection and e-mail.

3.3 Analysis and Discussion

We used SPSS ver.12.0 software to analyze the collected questionnaires. By factor analysis on the first developed 30 measurement items, Items that their correlation with the collected item-total was < 0.5 or that their correlation with the factor loading was < 0.6 were excluded from the suitable items that can efficiently measure e-HR's e-Business capability. The correlations with the corrected item-total and the criterion item were significant at p £ 0.01 and similar to those used by others in previous studies [1][12][13].

Based on the results of factor analysis, first 30 measurement items were reduced to 16 items, and 14 items were deleted. The elimination was considered high enough to ensure that the retained items were adequate measures of the e-HR's e-Business ability.

We verified the validity of the developed tool through factor analysis, and used to identify the underlying factors or components that comprise the EBCH construct. This study expelled the inadequate items from the developed tool by the analysis results. These deletions resulted in a 16-item scale for measuring e-HR's e-Business capability. Each of the 16 items had a factor loading > 0.631 and the coefficients alpha of four potential factors had the values > 0.802. The descriptions and loadings for the 16 items are presented in Table 2. The extracted items were grouped by their high factor loading.

Each of the 16 items had a corrected item-total correlation > 0.522. The correlation for each of the 16 items was positive and significant (p = 0.01 or below). This tool had the reliability (Cronbach's alpha) of 0.90 and a criterion-related validity of 0.80.

Hence, the measurement items with a validity and reliability were extracted by carrying factor analysis as shown in Table 2 and Table 3-6.

However, efforts to provide additional evidence of the tool's validity, internal consistency, and stability are encouraged. Although there may be reasons for additional questions to measure specific aspects of e-HR's e-Business capability, the 16-item tool is general in nature, relates to e-Business concepts, kn owledge, application ability, and development poten tial, and can be used across business departments and for a variety of situations.

Table 2 - Factor loadings, corrected item-total correlation and coefficients alpha of the extracted items

Variable	Factor Loading				Corrected Item-Total Correlation	Coefficients Alpha
	Factor 1	Factor 2	Factor 3	Factor 4		
V1	0.812				0.697	
V2	0.739				0.647	0.824
V3	0.678				0.529	
V4		0.811			0.709	
V5		0.764			0.646	
V6		0.737			0.589	0.849
V7		0.713			0.536	
V8		0.671			0.542	
V9			0.824		0.725	
V10			0.761		0.639	
V11			0.722		0.572	0.891
V12			0.654		0.636	
V13			0.631		0.596	
V14				0.796	0.712	
V15				0.739	0.608	0.802
V16				0.646	0.522	

* Significant at P≤0.01

4. Measurement Tool

4.1 Structure of Measurement Tool

The extracted 16 items were classified as four factor groups. The 4 factor groups indicate the potential factors that can measure e-HR's e-Business capability. With investigating the items included in each factor, we classified the 4 potential factors as follows: factor 1: e-Business concept; factor 2: e-Business knowledge; factor 3: e-Business application; factor 4: e-Business potential.

E-Business concept means understanding, sense of value, attitude and adaptability related to e-Business, and e-Business knowledge includes the knowledge of e-Business solutions and systems. E-Business application is a skill of e-Business application to efficiently execute his tasks on an e-Business system. E-Business potential refers the potential ability to improve e-Business capability in terms of breadth and depth. The four potential factors are considered as the measurement factors of the developed tool. Figure 1 shows structure of the measurement tool for e-HR's e-Business capability based on four potential factors and sixteen measurement items.

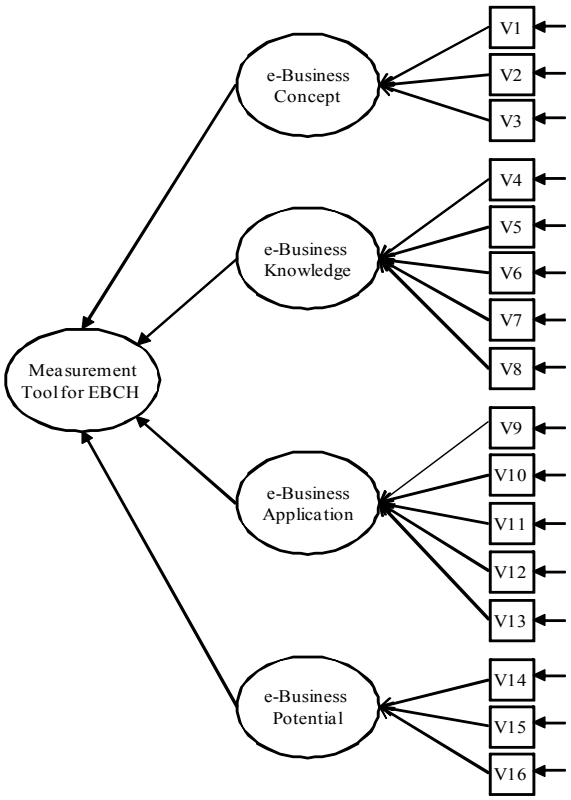

Figure 1 - Structure of Measurement Tool

4.2 Measurement Factors and Items

The e-Business concept including 3 measurement items is the factor to measure acknowledgement, attitude, a sense of value, and adaptability on e-Business. It includes the measurement items that can identify e-HR's e-Business concepts such as understanding of the Internet and e-Business, e-Business trends in developed countries, and ethic consciousness and morality of e-Business.

The e-Business knowledge with 5 measurement items indicates knowledge that e-HR has to know to efficiently apply e-Business technology and e-Business systems to his or her tasks. It comprises the items that can measure the e-Business knowledge such as knowledge related to H/W, S/W, N/W and D/B, solution knowledge related to ERP, SCM, KMS, and CRM, knowledge related to e-Business (B2E, B2C, and B2B), knowledge related to operating security system, and knowledge related to system applications as the knowledge of operation and technology of e-Business systems in their enterprises.

The e-Business application implicating 5 measurement items is the ability that e-HR effectively apply e-Business knowledge, solutions, and systems to their business tasks. It includes OA ability such as spreadsheet, presentation and word processing, the ability to use business solutions such as ERP, SCM, CRM, and KMS, the ability to use hardware, software, network and database of operating systems, the ability to apply the e-Business systems to e-HR's tasks such as e-business of the form B to E, B to C, and B to B, and the skills related to establish and manage the security system.

Table 3 - Measurement Items of e-Business concept

Factors	Extracted Measurement Items
e-Business Concept	-V1: understanding and attitude on e-Business -V2: Understanding of e-Business trends in developed countries -V3: Ethic consciousness and morality of e-Business

Table 4 - Measurement Items of e-Business knowledge

Factors	Extracted Measurement Items
e-Business Knowledge	-V4: Knowledge related to H/W, S/W, N/W and D/B etc. -V5: Knowledge related to ERP, SCM, KMS, and CRM etc. -V6: Knowledge related to e-Business (B2E, B2C, and B2B) -V7: Knowledge related to e-Business security measures -V8: Knowledge related to e-Business systems

Table 5 - Measurement Items of e-Business application

Factors	Extracted Measurement Items
e-Business Application	-V9: Ability using spreadsheet, presentation and word processing -V10: Ability using solutions of ERP, SCM, KMS, and CRM etc. -V11: Ability using H/W, S/W, N/W, and D/B of e-Business Systems -V12: Ability applying e-Business systems to Business (B to E, B to C, and B to B) -V13: Ability establishing and managing security measures

Table 6 - Measurement Items of e-Business potential

Factors	Extracted Measurement Items
e-Business Potential	-V14: Experience working in e-Business department -V15: Completion of education and training related to e-Business -V16: Publication of papers and articles in journals and web sites

The e-Business potential including 3 measurement items refers the development potential of e-HR's e-Business capability by job experience, degree and certificate, participation of domestic & overseas education and training, and publication of paper and article on journal related to e-Business and web sites. This is the important factor for the development of e-Business knowledge and ability, and the extension of e-Business ability in terms of the breadth and depth of e-HR's e-Business capability.

As shown in prior 4 tables, the tool with 4 measurement factors and 16 items is an important theoretical construct to measure the e-HR's total e-Business capability that can efficiently execute their tasks on an e-Business system.

5. Measurement System

5.1 Framework of Measurement System

As shown in Figure 2, the measurement system comprises the measurement stages and processes to gauge e-HR's e-Business capability. This system has also the presentation stage of the measurement results. The measurement stage and process extracts the measurement problems from problem database based on each factor and its items.

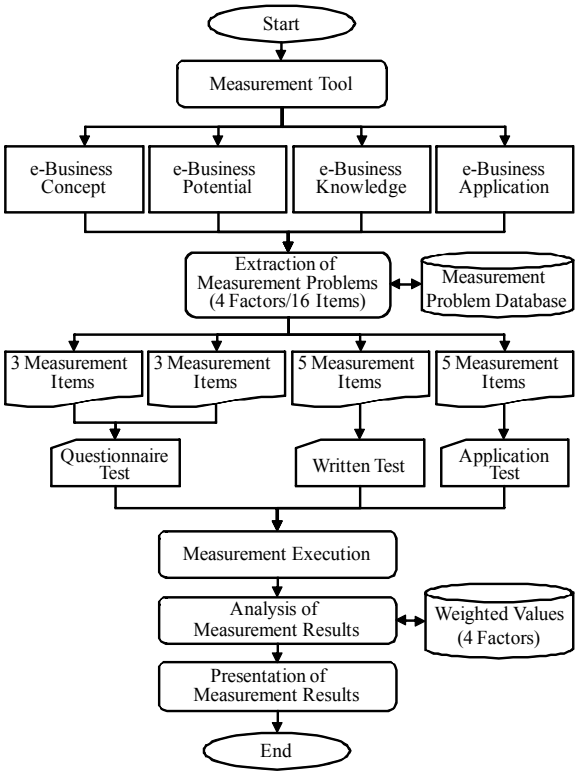

Figure 2 - Framework of Measurement System

Based on the characteristics of each factor, the measurement problems are identified as three kinds of problem forms such as a questionnaire test, written test and application test. The factors such as the e-Business concept and the e-Business potential are examined by a questionnaire form, and the e-Business knowledge and the e-Business application ability are tested by a written and an application form. For example, the questionnaires of each measurement factor are as follows: a questionnaire test (e-Business concepts and potential): "Do you know e-Business trends in developed countries?" and "How many years have you worked in e-Business departments?"; a written test: "Do you know the solutions of ERP, SCM, CRM, and KMS?"; and application test: "Have you applied sub-solutions of ERP to your tasks on an e-Business system?" and son on.

After that, the developed tool examines the e-HR by the extracted measurement problems.

The measurement results are analyzed by extracting the measurement values of each factor and applying the weight values to the measurement values of each factor. The presentation of the measurement results provides the interpretations of the measurement results of the e-HR. The results are explained by each

measurement index extracted from each measurement factor, and the interpretation presents the present states and problems of the e-HR's e-Business capability, and the directions and methods to efficiently improve the e-HR's e-Business capability 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 tool reflected the relative mportance of each factor in measuring e-HR's capability. The weight values were generated from the analysis results of the questionnaire survey for about 35experts working in IT and e-Business departments as presented in Table 7.

The method first calculates the measurement values of each factor based on the measurement results that the e-HR are tested by the extracted problems, and figures out measurement indices of each factor by multiplying each weight value by measurement values of each factor. And, the sum of measurement indices of each factor becomes the total measurement index of the end-user. In other words, the total measurement index of the e-HR's e-Business capability is the sum of measurement indices of each factor. In this way, this tool explains the measurement results of the e-HR's capability based on the total measurement index and indices of each factor.

6. Application to Case Study

6.1 Sample Characteristics

We applied the developed tool to 167 workers at "A" firm, South Korea. The business departments of respondents were identified as follows: strategy plan department: 23.1%; development and maintenance department: 20.3%; business application department: 35.2% and administration support department: 21.4%.

The business positions of respondents were classified as follows; top managers: 5.1%; middle managers: 24.7% and workers: 70.2%. The respondents had on average 7.1 years of experience (SD = 0.609), and most respondents (81.4%) had college or university degrees.

Table 7 - Weight Value of each Measurement Domain

Measurement Factor	Weight Value
e-Business concept	0.20
e-Business Knowledge	0.25
e-Business Application	0.36
e-Business Potential	0.19

6.2 Application to each business department

The case study analyzes the measurement results obtained from the strategy plan department (SPD) and each business department as the organizational unit, and from an individual working in the administration support department (ASD) as an individual unit, and explains the meanings of the measurement results on various points of view.

The total measurement index of the overall organization is 62.06, and the SPD and the business application department are 62.36 and 65.32 as shown in Figure 3.

The measurement results of each business department show that the measurement index of the business application department (BAD) is highest than those of the other departments. This is due to the ability to effectively accomplish their tasks by frequently applying e-Business knowledge and e-Business system to e-Business of the form B to E, B to C and B to B, and by the technology knowledge and abilities to utilize the various solutions such as ERP, SCM, CRM, and KMS in order to perform their business tasks in an e-Business environment. Especially, the e-HR in the ASD have to effort to raise total e-Business capability of their department.

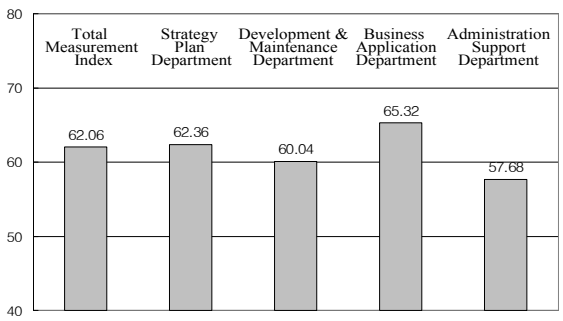

Figure 3 - Measurement Indices of Each Business Department

6.3 Application to a business department

The total measurement index of the SPD is 62.36.

The measurement indices of the SPD are quite high in the measurement factors of the e-Business concept, the e-Business knowledge, and the e-Business application, except for the e-Business potential as shown in Figure 4. But the measurement index of the e-Business potential is 59.52 and it is the lowest level among the measurement factors.

Therefore, the e-HR of the SPD should make an effort to improve and develop e-Business departments such as the completion of degree and certificate, education and training, and product of e-Business knowledge in order to effectively improve the organizational e-Business competency.

6.4 Application to an individual

The measurement results of an individual working in the (ASD) are analyzed as an example. The total measurement index of the individual capabilityis61.61as shown in Table 8 and Figure 5.

Especially, the measurement index of the e-Business application is very high. This means the outstanding application ability for applying the e-Business solution and e-Business system to his or her tasks on an e-Business system. The measurement indices of the e-Business concept, the e-Business knowledge, and the e-Business application were also quite high, and the measurement indices of the e-Business potential were very low.

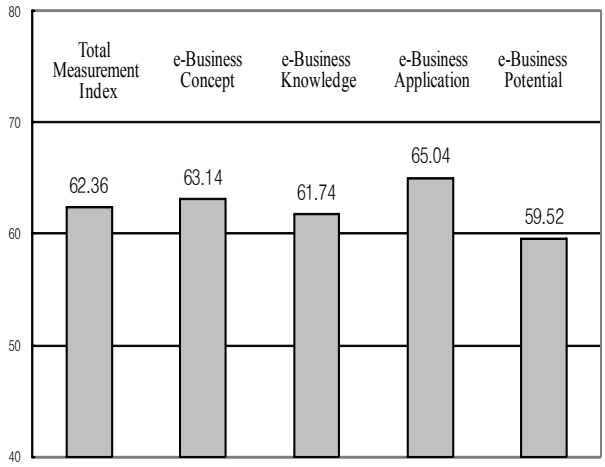

Figure 4 - Measurement Indices of Each Factor of SPD

Table 8 - Extraction process of total measurement index for an individual in the ASD

Division	e-Business Concept	e-Business Knowledge	e-Business Application	e-Business Potential	Total Measurement Index
Measurement Indices of Each Factor	61.04	60..43	66.79	53.87	-
Weight Value of Each Factor	0.21	0.26	0.35	0.18	1.00
Calculation of Total Measurement Index	12.82	15.71	23.38	9.70	**61.61**

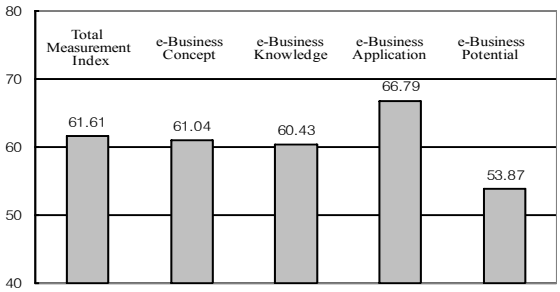

Figure 5 - Measurement Indices of an Individual in the ASD

Therefore, this individual should make an effort to complete e-Business education and training, acquire diplomas, and produce e-Business knowledge in or der to effectively develop his or her total e-Business capability.

7. Conclusions

This study presents a methodology to develop a measurement tool and measurement system that can efficiently measure e-HR's e-Business capability in an enterprise of an e-Business environment. This research provides the concrete measurement items in terms of e-HR's total e-Business capability. The developed tool opens up a new direction and possibilities of a measurement methodology since it functions as a measurement tool that can entirely measure it in respect to the required e-HR's e-Business ability in an e-Business environment.

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동국대학교 산업공학과 및 동국대학원을 졸업하고 Adamson Universtiy에서 박사를 수려한후 , University of Windsor에서 1년 6개월 간 연구원으로 재직. 한국산업개발연구원에서 연구원을 거친후 현재 충주대학교 산업경영공학과에 교수로 재직중. 관심분야는 Ergnomics와 기업에서의 인적자원에 관한 분야이다. 현재 사단법인 경영기술연구원 이사, (주)입소 경영자원위원, 한국산업인력공단 HRD전문위원, 노동부 충북고용포럼부위원장 , 국가품질상심사위원(지경부)
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