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# Evaluating E-Business Level of Firms and Industries: The KEBIX Case

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## ABSTRACT

For the systematic planning and implementation of e-business, an objective and quantifiable evaluation metric should be developed. Such an e-business evaluation methodology is a pre-requisite for the good e-business policy making of government as well as for the e-business decision and implementation of companies. Since 2002, Korea's Ministry of Commerce, Industry and Energy (MOCIE) have developed e-business Index. Based on the Ser-M model (Cho & Lee, 1998), a new paradigm of strategy theory, the E-business Index has five main areas for the evaluation of e-business of a company: 1) People, 2) Environment, 3) Resources & Infrastructure, 4) Process, and 5) Value. The survey result is analyzed using regression analysis, correlation analysis, and structural equation model. Especially, the structural equation analysis confirms some hypotheses of the Ser-M paradigm. In addition to the academic results, the E-Business Index study produces various and interesting business and policy implications such as supporting the efficient development of e-business strategy through the self diagnosis of individual enterprise.

## CONCEPTUAL CONSTRUCTION OF THE E-BUSINESS INDEX

For the systematic planning and implementation of e-business, an objective and quantifiable evaluation metric should be developed. Such an e-business evaluation methodology is a pre-requisite for the good e-business policy making of government as well as for the e-business decision and implementation of companies. Since 2002, Korea's Ministry of Commerce, Industry and Energy (MOCIE) has developed e-business Index, KEBIX (Korea E-Business Index) cooperating with Korea Institute of Electronic Commerce, The Federation of Korean Industries, and Steering Committee of E-Business Index.

The e-business index is based on the Ser-M model (Cho & Lee, 1998; Cho, Kim, and Rhee, 1998), which is a new paradigm of strategy theory. 'SER-M' is the abbreviation of the notions as follows:

1) Subject ('S') is the competence of major actors. It can be identified and compared with each actor's strength and weakness.
2) Environment ('E') is the influence of circumstances which can be evaluated by their emerging forces as threats and/or opportunities.
3) Resources ('R') mean physical and mental resources, natural and cultural resources which are the main capabilities of organization. So the actual and potential ability can be enumerated by these concrete variables related with.
4) Mechanism ('M') is the management system (as is the corporate governance) and the constraining variables (as is the regulation system) are the main sources of organizational culture and organizational development.

The four components of the KEBIX come from the four components of the Ser-M and the fifth component 'Value' is added. Therefore the index has the five main areas for the evaluation of e-business of a company: 1) People ('Subject' in Ser-M), 2) Environment ('Environment' in Ser-M), 3) Resources & Infrastructure ('Resources' in Ser-M), 4) Process ('Mechanism' in Ser-M), and 5) Value.

The 'people' include the subcategories such as CEO, executives, and employee carrying out e-business. The CEO and the executive category measure the recognition and the will of CEO and executives on e-business respectively. The employee category measures the capability and support of e-business organization and personnel and the e-business mind and readiness of the whole organization and personnel.

The 'environment' includes the subcategories such as customers, suppliers, industry, and the government policies that influence the e-business of an enterprise. The customer environment measures the readiness and infrastructure of customers, the supplier environment measures the readiness and infrastructure of suppliers, the industry environment evaluates the related associations and leading companies, and the policy environment evaluates the legal & institutional environment.

The 'resources & infrastructure' measures IT investment (financial resources for e-business initiative), the implementation level of computers & networks, system/process/guideline for security & risk management, database & integration, and IT personnel & institution for implementing e-business.

The 'process' measures the e-transformation of tasks and business processes such as supply-side process (e-business in work processes for procurement), operation process (e-business in production and service development), sell-side process (the e-business in sales and customer management), and supportive process (the e-business in personnel/financial/intellectual management).

Finally, the 'value' means the effects and values acquired from the e-business. Therefore it includes overall value which means the value & benefit creation from e-business general and the value by process which means the value & benefit creation in primary activities. One thing to note is that the evaluation on the value is not included in the e-business index score, but employed for analyzing the relationship between e-business and its performance.

## INDEX DEVELOPMENT AND SURVEY

Based on the conceptual structure explained in the previous section, we develop the evaluation sheet which has 100 questions (Therefore the highest score is 100). The steering committee of KEBIX selected 11 industries (Costume, Petrochemistry, Steel, Mechanics, Electronics,

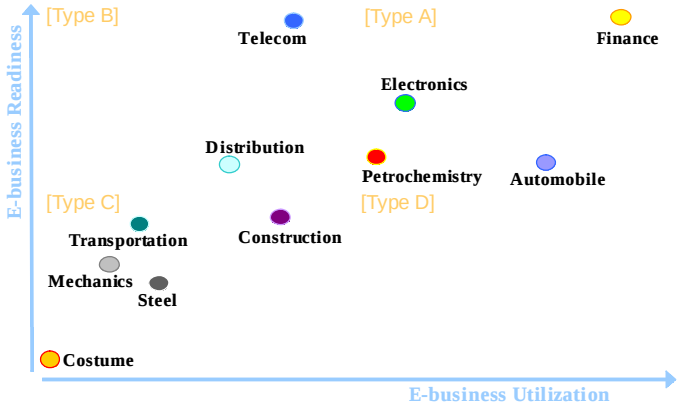
*Table 1. The Weights for the Construction of the E-Business Index*

| Main Category | % | Middle Category | % | Industry | Supply | Operation | Sell | Supportive |
|---|---|---|---|---|---|---|---|---|
| Environment | 15 | Customer Environment | 30 | Costume | 32 | 24 | 27 | 17 |
| | | Supplier Environment | 30 | Petrochemistry | 21 | 40 | 27 | 12 |
| | | Industry Environment | 20 | Steel | 24 | 34 | 26 | 16 |
| | | Policy Environment | 20 | Mechanics | 32 | 27 | 27 | 14 |
| Resources & Infra | 20 | IT Investment | 24 | Electronics | 28 | 25 | 28 | 19 |
| | | Computing & Network | 18 | Automobile | 33 | 28 | 27 | 12 |
| | | Security & Risk Mgt. | 17 | Construction | 40 | 25 | 17 | 18 |
| | | DB & Integration | 19 | Distribution | 21 | 16 | 51 | 12 |
| | | IT Personnel & Institution | 22 | Transportation | 13 | 44 | 25 | 18 |
| Process | 35 | ✸ industry-specific weights | | Telecom | 20 | 23 | 42 | 15 |
| People | 30 | CEO | 44 | Finance | 17 | 25 | 41 | 17 |
| | | Executives | 23 | | | | | |
| | | E-biz org. & Personnel | 18 | | | | | |
| | | Whole Org. & Personnel | 15 | | | | | |

*Table 2. E-Business Index Component Scores*

| | Environment | Resources & Infra | Process | People | Total |
|---|---|---|---|---|---|
| Costume | 51.9 | 40.6 | 35.0 | 35.1 | 38.7 |
| Petrochemistry | 59.8 | 49.8 | 52.5 | 54.1 | 53.5 |
| Steel | 54.8 | 44.7 | 46.9 | 41.5 | 46.0 |
| Mechanics | 59.2 | 44.0 | 45.7 | 42.1 | 46.3 |
| Electronics | 67.4 | 51.5 | 53.1 | 54.7 | 55.4 |
| Automobile | 64.5 | 49.5 | 56.7 | 49.4 | 54.2 |
| Construction | 57.5 | 47.4 | 50.0 | 48.0 | 50.0 |
| Distribution | 61.4 | 50.3 | 48.7 | 50.5 | 51.5 |
| Transportation | 59.6 | 47.1 | 46.4 | 45.9 | 48.4 |
| Telecom | 67.6 | 64.1 | 50.4 | 58.0 | 58.0 |
| Finance | 68.2 | 65.0 | 58.6 | 56.6 | 60.7 |
| **Total** | **60.7** | **50.1** | **49.2** | **48.3** | **50.8** |

*Figure 1. E-Business Maturity Matrix*




Automobile, Construction, Distribution, Transportation, Telecom, and Finance industry) and 500 companies in the industries. The companies responded to the survey using email, mail, and interview from 2002/08/01 to 2002/10/31. The 43.5% of responding companies have annual revenue from $80M to $400M and the 43.8% established after year 1980.

In order to derive the weights of the components, we use Delphi method and the expert opinions are integrated based on AHP (Analytical Hierarchy Process) technique. Table 1 shows the weights to calculate the e-business index. Since the processes of the firms are much different according to their industries, we derive the different set of weights for each industry as the right columns in Table 1.

The survey result is analyzed using regression, correlation analysis and structural equation model (Kline 1998; Wheaton, Muthén, Alwin, & Summers 1977;Carmines & McIver 1981; Chin & Todd 1995). The average e-business index was 50.8 and the highest is financial industry (60.7) while the lowest is costume industry (38.7) as in Table 2. The electronics industry is the highest among manufacturing industries (55.4) and the transportation industry is the lowest among non-manufacturing industries (48.4). Among the e-business index components, the Environment and Resources/Infra are relatively high while Process and People are relatively low. Despite good environment and infrastructure, the utilization of e-business process is relatively insufficient.

## STRATEGIC IMPLICATIONS FROM E-BUSINESS MATURITY MATRIX

Based on the survey result, we try to classify the industries. For the classification, we propose the two dimensions: E-Biz Readiness and E-Biz Utilization. E-business readiness is the function of Environment, Resources & Infra, and People, and the e-business utilization is the function of Process. Using the two dimensions, we can classify the industries into four types as in Figure 1.

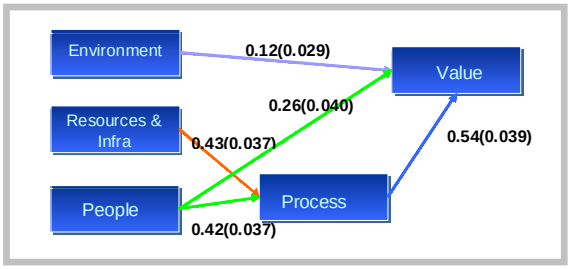
Using the e-business maturity matrix, we can derive e-business strategy. For the industries such as Costume, Steel, Mechanics, Transportation, Construction industry, which have low-level of e-business readiness and low-level of e-business utilization (Type C in Figure 1) we need to emphasize e-business mind and will by promoting e-business itself and its education. For these industries, we also need industry-level infrastructure and policy, which includes cooperative system such as Digital Industry Cluster, Enterprise Integration and support on value chain, and industry-level infrastructure.

For the Telecom and Distribution industry, which have high-level of e-business readiness but a low-level of e-business utilization (Type B in Figure 1), we need to complement e-business infrastructure by extending the scope of e-business process. For the Finance, Electronics, Automobile and Petrochemistry, which have high level of e-business readiness and e-business utilization (Type A in Figure 1), we need to emphasize more e-business utilization and systematic evaluation on the e-business performance. As such, by the utilization of E-Business Index, we can support the efficient development of e-business strategy through the self diagnosis of individual enterprise.

## HYPOTHESES FROM SER-M MODEL AND THE CONFIRMATION

The Ser-M model claims that in the early stage of a company the 'subject' will be the most important factor affecting the company

*Figure 2. Structural Equation Model for the E-Business Index*




performance. As the company grows, the important factor is claimed to be sequentially changed to 'environment', 'resource', and 'mechanism'. Therefore, according to the Ser-M theory, the expected sequence of important components in E-business index is People, Environment, Resource & Infra, and Process.

We use structural equation model for analyzing the causal relationship between the variables. Figure 2 presents the LISREL estimates for all free parameters and their standard errors (written in parentheses). All of the parameters are statistically significant at the a = 0.05 level. The $\chi^2$ for the test of the model has a probability level of 0.185, indicating a good fit. In addition, adjusted goodness of fit index (AGFI) is 0.98, which also indicates a good fit. As we see in Figure 2, the most important component for value creation of e-business is process. People are also a major variable impacting on the value as well as process. This implies that for the e-business success the will of CEO including executives, the capabilities of e-business organization, and the readiness and mind of the whole employee are very important. Resource & Infra variable was insignificant in our structural equation analysis.

Next, under the same structural equation model in Figure 2, we tried to see the revenue-dependent variation of the impacts of e-business components on the value of the firm. For this we classified 500 companies into three revenue groups, and then fit the structural equation model for the index score data of each group. The results of LISREL estimates and the probability values (*p*-value) of $\chi^2$ test for the model fit are listed in Table 3. As we see in Table 2, the impact of e-business environment on the value creation of e-business is insignificant to the small or large-size business group while statistically significant to the mid-size business group (It confirms the conjecture of the SER-M!). The impact of e-business resource on the value creation of e-business is insignificant, but the importance of people in e-business has a trend decreasing with the increase of revenue size (It also confirms SER-M!). The importance of people in e-business is the largest in the small-revenue business group (It confirms SER-M!). The importance of process in e-business is the largest in the large-revenue business group (It confirms SER-M!).

Next, we try to see the age-dependent variation of the impacts of e-business components on the value of the firm. Again we classified 500 companies into three age groups, and then fit the structural equation model for the index score data of each group. As seen in Table 2, the impact of e-business environment and people on the value creation of e-business is the largest in the middle-age business group. However, the impact of e-business resource on the value creation of e-business is insignificant. The importance of process in e-business is the largest in the old-age business group.

*Table 3. Summary of SEM Analysis ("*" denotes that path coefficient is statistically significant at the a = 0.05 level)*

| | Annual Revenue | | | Established Date | | |
|---|---|---|---|---|---|---|
| | $0.8B ~ | $80M ~ $0.8B | ~ $80M | ~1969 | 1970-89 | 1990 ~ |
| ENV-VAL | 0.01 | **0.22*** | -0.03 | 0.10* | **0.13*** | 0.09* |
| RES-VAL | 0.04 | 0.08 | 0.00 | 0.03 | 0.05 | -0.02 |
| PEO-VAL | 0.21* | 0.23* | **0.32*** | 0.23* | **0.29*** | 0.26* |
| PRO-VAL | **0.59*** | 0.42* | 0.58* | **0.56*** | **0.50*** | **0.53*** |
| RES-PRO | 0.44* | 0.45* | 0.35* | 0.50* | 0.48* | 0.22* |
| PEO-PRO | 0.42* | 0.37* | 0.33* | 0.43* | 0.36* | 0.53* |
| *p*-value | 0.329 | 0.402 | 0.396 | 0.366 | 0.372 | 0.413 |

## CONCLUSION

For the systematic planning and implementation of e-business, an objective and quantifiable evaluation metric should be developed. There have many attempts to measure e-business readiness, utilization, and the effect in various contexts (Barua, Konana, Whinston, & Yin 2001; Bharadwaj 2000) such as B2B e-procurement (Subramaniam & Shaw 2002), B2C Web site (Saeed, Hwang, & Grover 2002), B2C channel (Devaraj & Kohli 2002), online-brokerage (Chen & Hitt, 2002), and Internet business(Kim, Lee, Han, & Lee, 2002). Such an e-business evaluation methodology is a pre-requisite for the good e-business policy making of government as well as for the e-business decision and implementation of companies. Since 2002, Korea's Ministry of Commerce, Industry and Energy (MOCIE) have developed e-business Index. Based on the Ser-M model (Cho & Lee, 1998), a new paradigm of strategy theory, the E-business Index has five main areas for the evaluation of e-business of a company: 1) People, 2) Environment, 3) Resources & Infrastructure, 4) Process, and 5) Value. The survey result is analyzed using regression analysis, correlation analysis, and structural equation model. Especially, the structural equation analysis confirms some hypotheses of the Ser-M paradigm. In addition to the academic results, the E-Business Index study produces various and interesting business and policy implications such as supporting the efficient development of e-business strategy through the self diagnosis of individual enterprise.

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