

Plan for Vitalisation of Application of Big Data for e-Learning in South Korea

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Abstract

Recently, as big data have emerged, analysis-based decision-making, problem-solving and business opportunity creation come to the fore as important issues in business. As the effects of using big data have been proven, the range of the application is rapidly expanding to the industrial, public and social sectors. Keeping pace with this trend, the educational world is facing a new turning point: e.g. Building up a big data-based education environment is attempted. However, in South Korea, there are few studies related to big data-based education and almost no applications to the field of education, yet. As a result of the study, it was analysed that the e-Learning industry recognises the importance of big data, and yet, it has not yet considered the introduction due to a lack of human resources, the absence of technologies and a lack of successful cases. Thus, it is necessary for the government to actively develop policies such as fostering big data specialists in the field of e-Learning, supporting related technological developments and constructing technological infrastructure for the application of big data.

Keywords: Big Data, e-Learning Industry, Learning Effect, Customized Learning, Vitalisation Plan

1. Introduction

In South Korea, e-Learning started in the early 2000s. The e-Learning has played a very important role in changing the paradigm of education from schools to workplaces. In this process, the domestic and overseas e-Learning markets have continued growing by about 20%^{1,2}. However, its educational effects or learners' satisfaction does not meet the expectations. This is a phenomenon caused by the limitations of the educational effects of e-Learning, the distortion and underdevelopment of the e-Learning market and constant changes in educational paradigm.

In this context, with the spread of smart devices and technologies, as naturally, a new approach of e-Learning is necessary, smart learning emerges as a solution³. Later, studies of smart learning and efforts to apply it to industrial sites have continued. However, smart learning is also, supplier-centered one, and it is considered that consumer-centered smart learning based on analysis of learners has a long way to go, yet.

In addition to this, recently, as big data have emerged, analysis-based decision-making, problem-solving, business opportunity creation have come to the fore as important issues in business. As the effects of using big data starting from such issues have been proven, the range of the application is rapidly expanding from the industrial sector to the public and social sectors. Keeping pace with this trend, the educational world is facing a new turning point: e.g. Countries of advanced education have already attempted to construct big data-based education environment. However, in South Korea, there are few studies related to big data-based education and almost no applications to the field of education, yet. Thus, it is necessary to inquire into the reasons for poor spread of big data in the domestic e-Learning industry and study to improve them.

Therefore, this study will suggest the necessity of a paradigm shift to big data-based e-Learning based on a survey of the awareness and demand for big data in the Korea's e-Learning industry sites.

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2. Theoretical Background

2.1 Overview of e-Learning Industry

2.1.1 Concepts of e-Learning and Smart Learning

Article 2 (Definition) of Korea e-Learning Industry Development Act defines e-Learning as 'learning by electronic means, ICT and radio broadcasting technologies.' Many researchers' comments, also, define e-Learning as a form of learning that applies ICT like the Internet in order to achieve the purposes of learning such as delivering information and acquiring knowledge³. Yet, most forms of e-Learning are Internet-based services, so e-Learning is recognised as a form of learning applying the Internet. In the meantime, Kyoo-Sung Noh³ defined smart learning as "a learner-led human-centric learning method that can allow the easiest approach to learning source information by applying smart ICT to learning activities, effectively supporting the interactions between learners, and between learners and teachers and design of a self-led learning environment." The biggest characteristic of this smart learning is that it constantly evolves according to consumers' demands, and thus, the definition of its concept is not fixed, but may be changed.

2.1.2 Composition and Human Resources in e-Learning Industry

Commonly, the e-Learning industry consists of groups of 'service' business designed so as to allow interactive communications, providing education, training and learning through online and radio broadcasting; 'system (solution)' business building up hardware, software and network for this; business providing 'contents' of education designed for teaching with an intent of interaction; and business carrying out system 'consulting'⁴. Currently, the e-Learning industry is forming a market by these business groups. However, unfortunately, the most advanced business group, the consulting business group has fallen to an auxiliary means for other businesses, which does not form the right market. Thus, this study will be conducted with the three types of business.

The organisation of the personnel that promote e-Learning business may differ depending on the type of business, but it broadly consists of education planner, content expert, teaching designer, content developer, system developer and service operator⁴. An e-Learning expert comes to have a rank by the organisational structure

most companies have as growing up from beginner through intermediate to advanced expert. This study will be conducted following the classification of human resources into CEO/representative, executive, manager, staff member, academia/research and others e-Learning according to the structure of the rank at the site.

2.2 Overview of Big Data

2.2.1 Concept of Big Data

In spite of a hot interest in big data, there is no agreed definition of big data, yet. Nevertheless, several research and consulting institutions have come up with the concepts of big data, but they are generally similar in terms of contents. First, according to a report by McKinsey & Company⁵, "the definition of big data is a data set beyond the capabilities of existing database management tools for the collection, storage, management and analysis of data," which is subjective and will continue to be changed in the future. Also, standards for data volume are relative depending on the branch of industry, and the current ones range from dozens of TB to a number of PB. The Korea Council on National ICT Strategy defined it as "an informatisation technology to extract valuable information by applying and analysing a lot of data and actively respond to or predict changes based on the knowledge generated."

2.2.2 Characteristics of Big Data

Institutions classify the characteristics of big data into three or four elements, which are mostly suggested as volume, variety, velocity and complexity⁶.

First, volume means to a data set on a scale of TB to ZB. Technological evolution, such as the development of data storage and processing technology, the spread of smart phones and the rapid increase of SNS exponentially have increased the volume of digital information.

Second, variety is related to the management of data in complex and various forms, including unformatted data as well as formatted ones. Big data include unformatted data in forms of multimedia such as text, audio, photo, image and video as well as formatted data, which are relatively easy to manage as they are structured according to the fixed standards. Thus, companies should collect and analyse various forms of data flowing from traditional and non-traditional data sources, inside and outside of the companies, in a way different from the existing ones. Third, regarding velocity, as the velocity of data

production, processing and analysis constantly increases, all the cycles of the generation, distribution and consumption of data are carried out in real time. The facts that data are generated in real time and streaming data should be applied to business processes and decision-making process contribute to increasing velocity. Since the difference between the time of producing data and that of accessing and applying the data may appear as a great difference in competencies, agile detection and response are essential competencies.

Fourth, as for complexity, with the expansion of the types of data and the application of external data, the subjects of management increases and the complexity of data management and processing is deepened, so new techniques to respond to this are constantly needed. Especially, as the characteristics of data increasingly become complex, application and analysis technologies reflecting these characteristics emerge one after another.

2.3 Application of Big Data

2.3.1 Field of Application of Big Data to Industrial Sector

It is not too much to say that the application of big data began from the industrial sector. This is because the history of data analysis is in the same vein as that of the application of information system in the corporate management sector. Also, it is because the desire for the accumulation and application of big data started from corporate business. Regarding the value of the application of big data to the industrial sector, McKinsey suggested five socio-economic values of big data⁵. Yet, most of these can be understood as values of industrial application. Like Table 1, these can be summarized as increasing transparency of industry, discovery of consumer needs, forecasting of trend, experiment for enhancement of performance, segmentation of consumers for customized business, supporting for decision-making and acting as a proxy through the automatic algorithm and innovation of business model, product and service.

2.3.2 Application to Public Sector

The application of big data in the public sector can be divided into applications to the central government, public entities and local governments, and the characteristics of the application of big data and the subjects of the application are similar, so classification by organisation does not mean much.

Thus, for the public sector, classification by the sector of application and the characteristics of application of data can have a greater meaning than that according to the organisation. This study divides that into a type of analysing the accumulated data and that of analysing the data in real time (censoring)⁸. The cases and data of the application by the types of the analysis of big data in the public sector can be summarized like Tables 2 and 3.

2.3.3 Analysis of Cases in Corporate Sector

Google analysed data of retirees as its turnover rate rapidly increased. As a result, it found that the turnover rate of women who recently gave birth was over two times the average of its employees. Accordingly, Google changed its maternity leave policy: e.g. providing five-month salaries and leave of absence paid with allowances 100%. In particular, it carried out a customized support policy actively reflecting the individual wish list of female staff members who gave birth. Like this, as a result of the change of its policy for female staff members who gave birth, their turnover rate decreased by 50% and the costs for new hiring were drastically reduced. Recently, in South Korea, the margins of the pharmaceutical industry of Ethical-The-Counter (ETC) Drugs have continuously decreased. In addition, with increasing intrusion of large foreign pharmaceutical companies, it has come to a situation in which domestic pharmaceutical companies have to be worried about their survival. Accordingly, Yuyu Pharma, Inc. entered into a contract with text mining specialist company 'Daum Soft' and analysed 2.6 billion SNS data through Twitter, Facebook and blogs since the beginning of 2012. As a result, it found out that there was no medicine or ointment specially recognised by consumers for 'bruise' alone among the multiple benefits of Venoplus-Gel, such as relief of swelling, cuts, bruises and bites by insects. In addition, as a result of keyword combinations, it was found that there were far more keyword combinations of 'bruise-female' rather than 'bruise-child.' Yuyu Pharma, Inc. decided to connect the positioning of Venoplus-Gel to the cosmetic market beyond a simple OTC. Thus, actively asserting, 'Venoplus-Gel has a special efficacy in getting rid of bruises,' it communicated with pharmacists. Also, it actively, let the bloggers who were writing medical supplies-related reviews and power bloggers who were reviewing cosmetics or beauty-related products the existence of Venoplus-Gel. As a result, in only one year, its sales increased by about 60%

as compared to the same period last year, and the count of searches for it increased by approximately five times.

In the auto insurance industry in the U.S., as price sensitivity of universalized automobile insurance increases, direct auto insurance companies that do not charge brokers' commissions emerges rapidly. In addition, as all technologies for taking care of accidents with GPS and smart phone in real time become institutionalized, they can provide equal levels of services without brokers' help. Thus, Progressive decided to focus on the sector of auto insurance in 'a high-cost, high-risk group' through a 'system estimating insurance rate.' In other words, it developed a program that would be able to discount the insurance rate up to 30%, according to the level of risk by diagnosing driving habits through digital equipment installed on the customers' automobiles. Also, based on the data accumulated for 15 years, the impacts of mileage, sudden acceleration, sudden braking, sharp curve and driving at night on the rate of the risks of accidents were analysed and reflected⁷.

While other insurance companies put high-risk group drivers into several categories to estimate the average cost and common insurance rate, Progressive introduced detailed standards for classification over 10 times those of its competitors, so a lower insurance rate could be estimated for subscribers in a 'low-risk group' as compared to that of its competitors. Consequently, as Progressive actively applied brokers' observation program, it achieved sales over \$1 billion in the following year.

2.4 Status of Application of Big Data to e-Learning Industry

2.4.1 Status of Application of Major Advanced Countries

Educational big data started being used in major colleges and the field of education in companies in the U.S. Along with this, numerous educational companies have already developed services and applications to apply big data to high school education. Colleges apply big data to increase the efficiency of all sectors students can use for their success. Teachers, also, use educational big data as a means of increasing students' performance, and various services and applications are released. The contents of the major big data services in the U.S. are summarized like Table 4. However, no appropriate plan for the application of these technologies to a policy is yet evident⁹.

2.4.2 Domestic Situation

In South Korea, it can be said that there is almost no application of big data to the e-Learning sector. As a result of an analysis of the results of survey research, it is not too much to say that its application of big data remains at a level of analysing data on students' learning accumulated in Korea National Open University and some Cyber Universities themselves, providing the students with customized learning courses and applying them to improving learning services.

This domestic situation can be said to be a very underdeveloped status as compared

Table 1. Industrial application and value of big data

Classification	Contents
Increase of transparency of industry	Times of searching and processing can be reduced only by providing related sectors with big data timely
Discovery of consumer needs Prediction of trend Experiment of improvement of performance	As companies accumulate more transaction data in digital form, more accurate and detailed collection of performance data is possible They can use the data for analysis of performance variability occurring naturally or by controlled experiment and analysis of the fundamental cause and effect
Segmentation of customers for customized business	Companies can provide customized services for customer needs through very specific classifications of them
Supporting for decision-making and acting as a proxy through automatic algorithm	It is possible to improve decision-making, minimize risks and discover valuable insights by sophisticated analysis
Innovation of business model, product and service	Companies can develop new products and services, improve the existing products and services, and design new business models

(Source: McKinsey Global Institute, 2011, recited from Big Data Analytics for Business, The Society of Digital Policy & Management, 2014)⁵

Table 2. Application of big data to public sector – analysis of accumulated data

Institution of Application	Case of Application	Data of Application
National Institute of Health (USA)	Reforming health care through PillBox Project	Applying statistical data on users' various diseases obtained through drug search service (pillbox.nlm.nih.gov)
The New York State Syracuse City (USA)	Promoting a smart city	Analysing regional characteristics such as housing status, education level and vocational training status in underdeveloped areas
Veterans Benefits Bureau (USA)	A system to support for customized medical service	Analysing electronic medical records of veterans / Collecting data on information about 22 million veterans through the arrangement of 25 data warehouses
Singapore government	Managing national security through RAHS	Collecting and analysing all national risks such as diseases and financial crises through Risk Assessment and Horizon Scanning (RAHS)
Singapore government	Implementing customized welfare society through residents' committee network center	Analysing data collected from more than 1,800 residents' committee center, according to a variety of race, age, culture, income and connection and connecting them with a network

(Source: Excerpted and modified from Big Data Analytics for Business, The Society of Digital Policy & Management, 2014) ⁵

Table 3. Application of big data to public sector – Analysis of real-time data

Institution of Application	Case of Application	Data of Application
National Tax Service (United States)	Strengthening state finance through a system for prevention of tax evasion	Tax-related data, social data and integrated data
London (United Kingdom)	A system to impose Stockholm congestion pricing	Road traffic in congestion pricing areas in Central London and status of usage of public transportation in congested areas
MC and MITI (Japan)	Building up an intelligent transportation information system	Real-time GPS information, Taxi information and traffic information obtained from users of a navigator, who agreed to provide their information
Seoul	A system that detects signs of flooding of water in the city	Analysis of scenario-based risk of flooding based on precipitation information, private information (complaints/Safety Monitoring Corps/disaster signs information/press release/SNS)

(Source: Excerpted and modified from Big Data Analytics for Business, The Society of Digital Policy & Management, 2014) ⁵

to those of advanced countries. This is because the actual industrial sites do not see education and learning as investment in spite of their importance and they tend to recognise e-Learning as a means of cost reduction rather than as that of expansion of educational

opportunities. Regarding these symptoms, this study will look into the recognition in the industrial fields related to big data, and based on this, it will suggest a direction for analytics-based environmental improvement and development of e-Learning.

Table 4. List of major big data service contents for e-Learning in the U.S. (Summary)

Service Name	Main Contents
Declar	Providing a dynamic map to study and learn various topics
Knewton	Individualized education technology to provide customized courses
Noel-Levitz	Predictive modeling tool for the management of registration for recruiting learners
Blackboard Analytics	Providing learners with data on ratings, design department and college
Desire2Learn Insights	Providing the powerful function of predictive analysis to allow educational institutions to provide insight and next-generation experience
iDashboards	Providing Key Performance Indicator (KPI) with information on individual data
McGraw-Hill Connect	Providing information on a series of questions about the class at a glance

(Source: Excerpted from Korea Software Engineers Association, Working Paper, 2014)

3. Survey Research

3.1 Overview of Survey

This study conducted a survey on the status of the application of big data to e-Learning with 52 persons who are CEOs of e-Learning companies and professionals in the academia from October 1 through 15, 2014. The contents of the survey consisted of 10 questions, including an understanding of big data, types of data collection, levels of the application of big data, sectors of the application of big data, difficulty and the cause for that in the application of big data and policy proposal. This study could understand the overall domestic situations of big data and e-Learning through this survey. In particular, it gained an important insight to find implications for policy.

3.2 Result of Survey

3.2.1 Understanding and Impact of Big Data

To a question about the degree of perception of big data by the staff members of e-Learning companies, 32.4% of all respondents responded that they were aware of them to some degree; 29.7%, had a slight awareness of them; and 13.5%, well-aware of them. To sum up, it was found that the members of the e-Learning companies usually recognised big data.

To a question on the extent to which big data would have impacts on the e-Learning industry, 44.1% of all respondents responded that they would have impacts while 38.2% responded that they would have big impacts.

To sum up, it was found that the members of the e-Learning companies perceived that the impacts of big data would be great.

3.2.2 Type of Application and Recognition of Value of Data

To a question about the data collected most often in e-Learning services, 51.4% of all respondents responded that the data would be learners' access (logging) data; 20%, conversations, Q&A and survey data. Also, to a question about the data with the highest value for application in e-Learning development and service strategic planning, 50% responded that the data would be conversations, Q&A and survey data; and 21.8%, learners' access data.

To a question about the activities done for the application of the data to the actual e-Learning companies, 39.3% of the respondents responded that they analysed the tendency of learning to give learners feedback while 18.1% responded that they never analysed the data.

3.2.3 Difficulties and Intentions of Application of Big Data

To a question about the difficulties in developing e-Learning systems, contents and services applying big data, 65.7% picked up the difficulty caused by the absence of experts, followed by the difficulty in securing data (17.1%) and a lack of security of related technologies (11.4%). To a question on the sector to which big data would be applied if they held analysis tools and experts, 41.1% responded that they would apply them to the development

of customized individualized learning courses, followed by service strategic planning (35.2%).

3.2.4 Conditions for Vitalisation and Suggestion of Policy for Application of Big Data to e-Learning

To a question on what would be most necessary for the vitalisation of big data-type e-Learning, 62.8% responded that securing experts would be most necessary, followed by technological development (17.1%) and the client's intent to introduce it (11.4%). To a question about the policy for which the government should support preferentially in applying big data to the e-Learning sector, the respondents responded with support for fostering experts, followed by that for technological development; that for data building infrastructure; that for the construction of a common platform; and that for opening education data.

4. Interpretations and Concluding Remarks

This study aims to suggest a paradigm shift and strategic direction regarding the application of big data to e-Learning. Thus, it has significance it could analyse the perceptions and attitudes of the members with the results of a survey of the field of the e-Learning industry. In a situation with a level of perception of big data which is still not high, it can be said that it was an effective survey and analysis of their opinions. To sum up, it is found that they were usually well aware of big data. However, the reason why the level of introduction was not yet high is that there were insufficient introduction to the industry and success stories in spite of the necessity of the introduction. In contrast, it was found that big data would have great impacts on the e-Learning industry. In other words, although the level of application is not high now, it is expected that, in the future, big data will be vitally introduced and applied to e-Learning.

In addition, as a result of the survey, it was analysed that there was a dominant perception that customized learning courses should be developed through learners' personal disposition. In other words, there is a perception that the data would play an important role in developing the customized learning courses by individual. In spite of this necessity and current situations, big data are not actively applied to the development of e-Learning mostly because of a lack of experts, among several other reasons. Moreover, the absence of related technologies

was picked as one of the main reasons. Thus, it seems that the government should foster big data experts in the e-Learning sector and support for the construction of related technological infrastructure so that it could actively apply big data as well as support for the technological development. In addition, it would be very critical to support with a policy, so that e-Learning consumers (institutions and companies etc.) could introduce big data-type e-Learning services to secure the initial demands for big data along with the improvement of their perceptions.

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