Internet Information Orientation: The Link to National Competitiveness on Internet

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Abstract

Recently, the web index of Korea peaked at the top 10 among the eighty six countries, and Korea became the only Asian country ranked at the top level. Korea also has been on the top in the field of Internet penetration rate, in terms of both high-speed broadband and wireless Internet. However, such achievements did not guarantee the national level for the effective use of information utilizing Internet. According to OECD, the national informatization index of Korea has not been free from the middle of the OECD countries. Despite of the heightened pressure in practically enhancing effective information use utilizing Internet, the previous research interests and efforts to develop the Internet-related framework or to identify Internet capabilities rarely existed. The study aims to propose the framework, named "Internet Information Orientation" that illustrates the relationship between Internet capabilities and national competitiveness on Internet. The research identified the specific Internet capabilities, reclassified the capabilities based on the research issues provided at the 6th international conference on Internet held in December 2014, and finally described the rigorous research endeavors on the issues. As a result, 16 papers presented and selected as the outstanding papers at the conference handle issues to be brought together, which include: Wireless Network, Internet of Things, Green Computing, Multimedia Processing, Big Data and Text Mining, Database in Cloud Environment, Business Intelligence, Software Engineering, IT Strategy & Policy, and Social Network Services.

Keywords: Internet Information Orientation, National Informatization Index, Web Index, Internet Level, Information Orientation, Government 3.0, Internet Capabilities, National Competitiveness

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1. Introduction

Since 2000, Organization for Economic Cooperation and Development (OECD) has annually investigated national informatization index and Internet levels, and ranked the corresponding OECD member countries based on the estimation of the indicators and levels. Due to the persistent efforts of Korean governments and industries, Korea has been on the top in the field of Internet penetration rate in terms of both high-speed broadband Internet and wireless Internet. In contrast, Korean national information index has not been free from the middle of the OCED countries. [1]

Meanwhile, the World Wide Web Foundation designed and produced the Web Index. This composite statistic is the first multi-dimensional measure of the World Wide Web's contribution to development and human rights globally. It targets 86 countries, incorporating indicators that assess four areas, in terms of universal access, freedom and openness, relevant content and empowerment, and covers indicators of economic, social, and political impacts of the Web. In 2013 and 2014, Korea peaked at the top 10 in web index among the countries, and became the only Asian country ranked at the top 10. [2]

Web Index (2014)

Rank	Country	Web Index
1	Denmark	100.0
2	Finland	98.81
3	Norway	97.32
4	United Kingdom	95.67
5	Sweden	94.97
6	United States	94.52
7	Iceland	93.72
8	South Korea	92.81
9	Netherlands	91.84
10	Belgium	89.61
11	France	89.09
12	New Zealand	87.48
13	Australia	87.27

Web Index (2013)

Rank	Country	Web Index
1	Sweden	100.0
2	Norway	97.5
3	United Kingdom	95.6
4	United States	95.2
5	New Zealand	92.4
6	Denmark	92.4
7	Finland	91.9
8	Iceland	91.9
9	France	90.9
10	South Korea	87.4
11	Australia	86.4
12	Netherlands	86.4
13	Japan	86.4

Web Index (2012)

Rank	Country	Web Index
1	Sweden	100.00
2	United States	97.31
3	United Kingdom	93.83
4	Canada	93.42
5	Finland	91.88
6	Switzerland	90.49
7	New Zealand	89.15
8	Australia	88.44
9	Norway	87.76
10	Ireland	87.42
11	Singapore	86.14
12	Iceland	86.10
13	South Korea	81.06

Fig. 1. Ranks for Web Index

However, such achievements do not guarantee the national level for the effective use of information utilizing Internet. Practically, Korean governments are facing the heightened pressure in enhancing Internet-related capabilities and in linking them to the indices established by OECD or the World Wide Web Foundation. Unfortunatly, the previous research efforts to develop the Internet-related framework or to identify any type of Internet capabilities rarely existed.

The study aims to propose the framework, named "Internet Information Orientation (IIO)" that links the national level of the Internet capabilities to the national competitiveness on Internet. Other primary purposes of the research include the identification of specific Internet capabilities, the reclassifications of the identified capabilities based on the research issues

provided at the 6th international conference on Internet held in December 2014, and the description of the rigorous research endeavors in those issues.

2. Proposal of Internet Information Orientation

2.1 Basic Concepts of Information Orientation

Marchand, Kettinger, and Rolling developed the theory of effective information use, assuming that good information usage behaviors and values drive better information management, that this improves the capabilities of a company to use IT to support decision making and problem solving, that the enhanced company's capabilities in turn results in good information usage. The central premise behind the theory is that the interaction of technology, information, and people may affect effective information use within a company. [3]

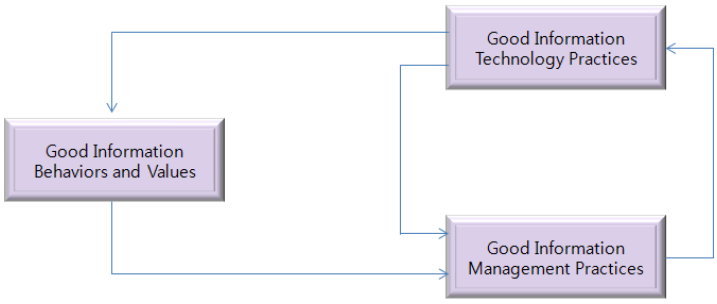

Fig. 2. Spiral of Effective Information Use

In 2001, Marchand et al. presented *Information Orientation (IO)*, a comprehensive measure of effective use of information to improve business performances, as illustrated in **Fig. 3**. They identified three broad concepts of managerial thinking and practices, including information technology, information management, and information behaviors and values.

Information technology practices refer to capabilities of a company's IT resources effectively, which include hardware, software, application system, network, and the technical expertise. Information management practices mean the company's capabilities to effective of information in support of strategic decision making and tactical problem solving. Information behaviors and values represent the company's capabilities to install and promote their information usage behaviors. This framework has been used to measure the capabilities for effective use of information and to predict the business performance. [3]

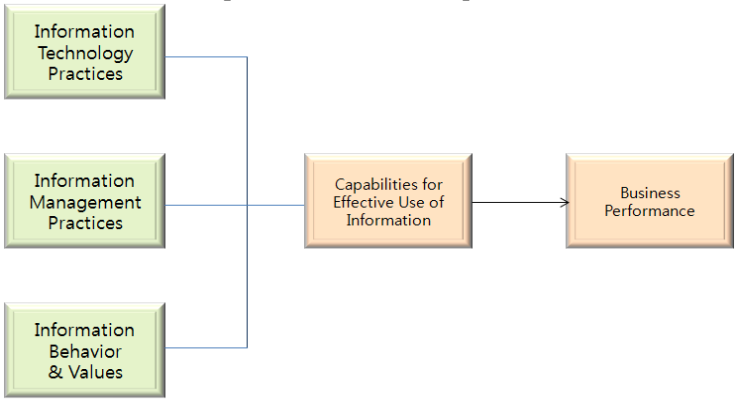

Fig. 3. Information Orientation Predicting Business Performance

2.2 Design of Internet Information Orientation (IIO)

The authors designed a framework that might link the various Internet capabilities to the national competitiveness on Internet. The study applied the concept and composition of *Information Orientation* introduced by Marchand et al. to the framework, referred to *Internet Information Orientation*. The **Fig. 4** implies that Internet capabilities can be measured in terms of Internet-related IT capabilities, information management capability utilizing Internet, and information behaviors via Internet. While *Information Orientation* focuses on business performance within a company, *Internet Information Orientation* emphasizes the national competitiveness on Internet.

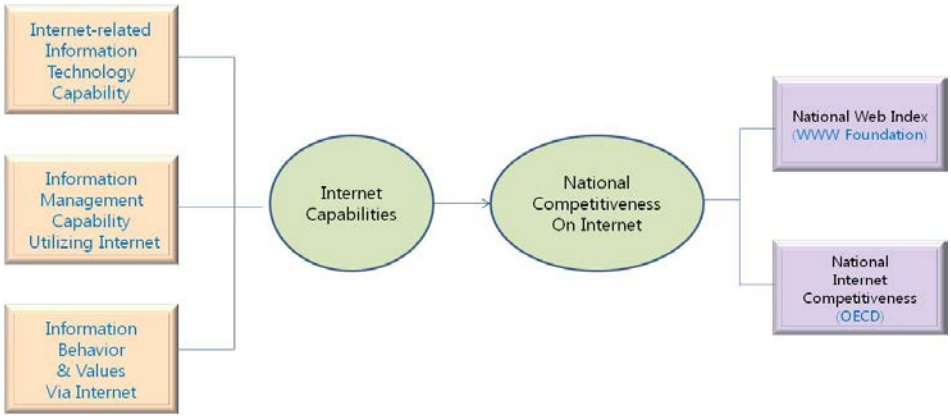

Fig. 4 Internet Information Orientation

The study developed three types of Internet capabilities. First capabilities signify the capabilities of a nation to effectively promote Internet-related application and infrastructure. Second capabilities correspond to the capabilities of a nation to manage information in support of strategic decision making and problem solving. The last capabilities are the capabilities of a nation to guide the people toward desirable behavior for their information use via Internet.

In **Fig. 5**, "national competitiveness on Internet" was considered in the framework, which can be defined as the set of institutions, policies, and factors regarding Internet that determine the level of productivity of a country. The indicator of the national competitiveness on Internet can be Web index by WWW Foundation or Internet competitiveness index by OECD.

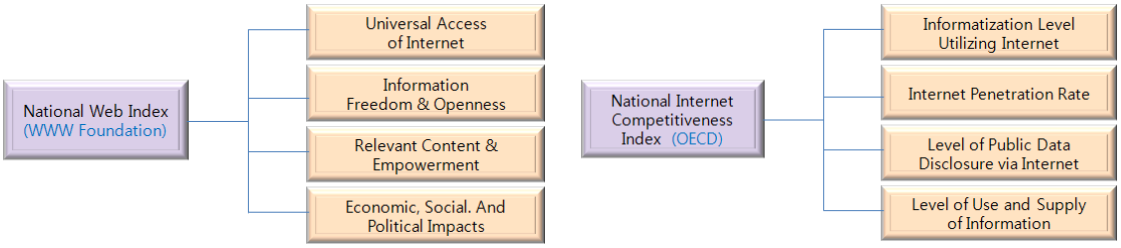

Fig. 5. Potential Internet-related National Competitiveness Index

2.3 Identification of Specific Internet Capabilities

As mentioned earlier, the primary part of *Internet Information Orientation* consists of three main types of Internet capabilities. The study has utilized the compositions of information capabilities introduced by Marchand et al. and broke down into fifteen specific Internet capabilities, as described in **Table 1**.

Table 1. Main and Sub Types of National Internet Capabilities

Main Capability	Sub Capability	Description
Internet-related Information Technology Capabilities (A)	(A-1) Internet Technology for **Management Support**	Internet-related application and infrastructure to assist in decision making
	(A-2) Internet Technology for **Innovation Support**	Internet-related application and infrastructure to facilitate the creativity and exploration of new idea
	(A-3) Internet Technology for **Business Process Support**	Internet-related application and infrastructure to manage business process
	(A-4) Internet Technology for **Operational Support**	Internet-related application and infrastructure to control business operation
Information Management Capabilities Utilizing Internet (B)	(B-1) **Sensing** Information Utilizing Internet	Information management phase utilizing Internet to detect and identify economic, social, political changes
	(B-2) **Collecting** Information Utilizing Internet	Information management phase utilizing Internet to ensure that right information is delivered at right time
	(B-3) **Organizing** Information Utilizing Internet	Information management phase utilizing Internet to index, classify, and concern information and database
	(B-4) **Processing** Information Utilizing Internet	Information management phase utilizing Internet to analyze information source to derive useful knowledge
	(B-5) **Maintaining** Information Utilizing Internet	Information management phase utilizing Internet to reuse existing information and avoid collecting again
Information Behaviors & Values on Internet (C)	(C-1) Information **Proactiveness** On Internet	Active concern to think to how to obtain new information and to use existing information on Internet
	(C-2) Information **Transparency** On Internet	Openness in reporting and presentation of information on errors, failures, and mistakes on Internet
	(C-3) Information **Integrity** On Internet	Use of information on Internet in a trustful and principled manner on Internet
	(C-4) Information **Sharing** On Internet	Willingness to provide others with information on Internet in a collaborative manner
	(C-5) Information **Control** On Internet	Extent to which information about performance is provided to manage and monitor performance on Internet
	(C-6) Information **Formality** On Internet	Willingness to use and trust the information provided on Internet

3. Reclassification of Internet Capabilities based on Each Issue

With Korea being a Internet leading country, the ICONI 2014 developed emerging Internet-related issues and invited prospective authors to submit research papers in the following tracks organized by the issues.

- Track 1: Mobile and Wireless Network
- Track 2: IoT (Internet of Things) / Machine to Machine
- Track 3: Green (Energy-efficient) Computing / Smart Grid
- Track 4: Multimedia Processing
- Track 5: Big Data / Text Mining
- Track 6: Database in Cloud Environment
- Track 7: Business Intellignece
- Track 8: Software Engineering
- Track 9: IT Strategy and Policy
- Track 10: Social Network Services

In addition, this research cited *Wikipedia* to describe the emerging issues regarding Internet, and linked each issue to the corresponding Internet capabilities, as expressed in **Table 2**.

Table 2. Issue Description and Interent Capaility Links

Research Issue (Track)	Corresponding Internet Capabilities
Wireless Network Wireless network is any type of computer network that uses wireless data connections for connecting network nodes. Wireless networking is a method by which homes, telecommunications networks and enterprise (business) installations avoid the costly process of introducing cables into a building, or as a connection between various equipment locations.	A: (A-1), (A-2), (A-3), (A-4) B: C: (C-3), (C-5)
IoT / M2M The Internet of Things (IoT) is the network of physical objects or "things" embedded with electronics, software, sensors, and connectivity to enable objects to exchange data with the production, operator and/or other connected devices. The Internet of Things allows objects to be sensed and controlled remotely across existing network infrastructure, creating opportunities for more direct integration between the physical world and computer-based systems, and resulting in improved efficiency, accuracy and economic.	A: (A-1), (A-2), (A-3), (A-4) B: C:
Green Computing A green computing is the study and practice of environmentally sustainable computing or IT. The goals of green computing are to reduce the use of hazardous materials, maximize energy efficiency during the product's lifetime, and promote the recyclability or biodegradability of defunct products and factory waste. Green computing is important for all classes of systems, ranging from handheld systems to large-scale data centers.	A: (A-1), (A-2), (A-3), (A-4) B: (B-5) C:

Research Issue (Track)	Corresponding Internet Capabilities
Multimedia Processing Image processing is a processing of images using mathematical operations by using any form of signal processing for which the input is an image, such as a photograph or video frame; the output of image processing may be either an image or a set of characteristics or parameters related to the image. Video processing is a particular case of signal processing, which often employs video filters and where the input and output signals are video files or video streams.	A: (A-2), (A-4) B: (B-1), (B-2) C:
Big Data & Text Mining Big data is a broad term for data sets so large or complex that traditional data processing applications are inadequate. Challenges include analysis, capture search, sharing, storage, transfer, visualization, and information privacy. Text mining refers to the process of deriving high-quality information from text. High-quality information is typically derived through the devising of patterns and trends through means such as statistical pattern learning.	A: (A-1), (A-4) B: (B-1), (B-2), (B-3), (B-4) C: (C-1), (C-4)
Database in Cloud Computing Environment A database is an organized collection of data. It is the collection of schemes, tables, queries, reports, views and other objects. The data is typically organized to model aspects of reality in a way that supports processes requiring information. Cloud computing is a model for enabling ubiquitous network access to a shared pool of configurable computing resources	A: (A-3), (A-4) B: (B-2), (B-3), (B-5) C: (C-3), (C-6)
Business Intelligence Business intelligence (BI) is the set of techniques and tools for the transformation of raw data into meaningful and useful information for business analysis purposes. The goal of BI is to allow for the easy interpretation of these large volumes of data. Identifying new opportunities and implementing an effective strategy based on insights can provide businesses with a competitive market advantage and long-term stability	A: (A-1), (A-2) B: (B-3), (B-4) C: (C-1), (C-5)
S/W Engineering Software engineering is the study and an application of engineering to the design, development, and maintenance of software	A: (A-1), (A-2), (A-3), (A-4) B: C:
IT Strategy and Policy IT Strategy and Policy are the overall plans which consist of objective(s), principles and tactics relating to use of the IT within a particular organization. Such strategies primarily focus on the IT and in some cases the people who directly manage those technologies. The strategy can be implied from the organization's behaviors towards technology decisions, and may be written down in a document.	A: (A-2) B: (B-1)(B-2) C: (C-1), (C-6)
Social Network Services A social networking service is a platform to build social networks or social relations among people who share similar interests, activities, backgrounds or real-life connections. Social network sites are web-based services that allow individuals to create a public profile, create a list of users with whom to share connections, and view and cross the connections within the system. Most social network services are web-based and provide means for users to interact over the Internet.	A: (A-1) B: (B-1), (B-2) C: (C-1), (C-4)

4. Research Contributions

The previously drawn issues bring revised and suggestively extended versions of sixteen papers selected as outstanding research and presented at the 6th international conference on Internet. The ICONI 2014 was hosted in Taipei, the capital of Taiwan on December 14-16, 2014. To grow into a top global Internet leading country, creative and feasible researches on both technical and managerial issues for Internet capabilities should be conducted and shared, such as the papers listed in **Table 3**. [4]

Table 3. Research Contributions based on Each Track

No.	Track	Research Contributions
1	Wireless Network	Downlink Signal Measurement Algorithm for WCDMA/HSPA/HSPA+
2		Maximum Ratio Transmission for Space-Polarization Division Multiple Access in Dual-Polarized MIMO System
3		Adaptive Power Control Using Large Scale Antenna of the Massive MIMO System in the Mobile Communication
4	IoT & M2M	Performance Evaluation of a Smart CoAP Gateway for Remote Home Safety Services
5	Green Computing	Adaptive Cloud Offloading of Augmented Reality Applications on Smart Devices for Minimum Energy Consumption
6		Single-Phase Energy Metering Chip with Built-in Calibration Function
7	Multimedia Processing	A Synchronization Scheme for Hierarchical Video Streams over Heterogeneous Networks
8		An Improved Approach for 3D Hand Pose Estimation Based on a Single Depth Image and Haar Random Forest
9		Automated Detection of Cattle Mounting using Side-View Camera
10	Big Data & Text Mining	Comparing Machine Learning Classifiers for Movie WOM Opinion Mining
11	Database & Cloud Computing	An Efficient Design and Implementation of an MdbULPS in a Cloud-Computing Environment
12		Study of Data Placement Schemes for SNS Services in Cloud Environment
13	Business Intelligence	A GraphML-based Visualization Framework for Workflow-Performers' Closeness Centrality Measurements
14	S/W Engineering	Agile Adoption in IT Organizations
15	IT Strategy & Policy	Estimation of the Demand Function of the Information and Communication Construction Business
16	Social Network Services	Investigating the use of multiple social networking services: A cross-cultural perspective in the United States and Korea

In the track of wireless network, the paper titled "Downlink Signal Measurement Algorithm for WCDMA/HSPA/HSPA+" by Bit-Na Kwon et al. has proposed the algorithm for the performance measurement of the WCDMA/HSPA/HSPA+. In addition, the performance of

the measurement algorithm is used to evaluate the generated signal by the WCDMA/HSPA/HSPA+ signal generator. Generally, the algorithm of normal modems cannot be applied to the measurement system because the signal measurement equipment needs to guarantee the high accuracy. [5]

Jun-Ki Hong et al. have analyzed the performance of SPDMA for maximum ratio transmission (MRT) in time division duplexing (TDD) system by proposed dual-polarized MIMO spatial channel model (SCM) compare to conventional SDMA. In their paper entitled "Maximum Ratio Transmission for Space-Polarization Division Multiple Access in Dual-Polarized MIMO System," simulation results indicate that how SPDMA utilizes the high XPD as the number of MS increases and SPDMA performs very close to conventional SDMA for same number of antenna elements but half size of the array at BS. [6]

The article by Chang-Bin Ha et al. entitled "Adaptive Power Control Using Large Scale Antenna of the Massive MIMO System in the Mobile Communication" introduced the massive MIMO system using large scale antenna. Because it effectively compensates interference signals and noise using large scale antenna, it supports theoretical throughput in according to the number of antenna compared to the conventional MIMO systems. [7]

Hyun-Sik Kim et al. in their paper "Performance Evaluation of a Smart CoAP Gateway for Remote Home Safety Services" have presented a novel and practical solution to provide home safety services which can be realized by the proposed smart CoAP gateway and home safety sensor node. The home safety sensor node was designed to support multiple sensors according to their applications, and the smart CoAP gateway with a border router was designed to support multiple wireless connectivity and use the CoAP to communicate interactively and seamlessly between a low-power wireless personal area network and the Internet. [8]

In the issue of green computing, the article "Adaptive Cloud Offloading of Augmented Reality Applications on Smart Devices for Minimum Energy Consumption" by Jong-Moon Chung et al. has considered mobile computation offloading of MVS AR, taking into account varying network traffic and server conditions. The study analized tradeoffs between computation time, efficiency, and mobile device energy savings. The goal is to determine potential and optimal mobile offloading points under given conditions and priorities that satisfy user quality of experience (QoE) and provide device energy savings.[9]

The next article by Youn-Sung Lee et al. entitled "Single-Phase Energy Metering Chip with Built-in Calibration Function" has made efforts to present a single-phase energy metering chip with built-in calibration function to measure electric power quantities. The entire chip consists of an analog front end, a filter block, a computation engine, a calibration engine, and an external interface block. The key design issues are how to reduce the implementation costs of the computation engine from repeatedly used arithmetic operations and how to simplify calibration procedure and reduce calibration time. [10]

In the area of multimedia processing, the paper titled "A Synchronization Scheme for Hierarchical Video Streams over Heterogeneous Networks" by Yejin Sohn et al. has proposed a synchronization scheme for video streams transported over broadcasting networks and networks based on HTTP, which is the third hybrid delivery service model suggested by MMT. [11]

Wonggi Kim et al. in their paper "An Improved Approach for 3D Hand Pose Estimation Based on a Single Depth Image and Haar Random Forest" have presented an improved approach for tracking and recovering the 3D position and orientation of a human hand using the Kinect sensor. The basic idea of the proposed method is to solve an optimization problem that minimizes the discrepancy in 3D shape between an actual hand observed by Kinect and a hypothesized 3D hand model. [12]

The article by Yongwha Chung et al. entitled “Automated Detection of Cattle Mounting using Side-View Camera” has proposed a “non-attached” method to detect estrus with an audio surveillance system. They applied computer vision techniques to mounting detection for a large-scale farm to further improve the accuracy of estrus detection, and proposed a video surveillance system with a “side-view” camera to detect mounting behavior based on motion analysis techniques. [13]

Yoosin Kim et al. conducted sentiment analysis of Koran eWOM using machine learning models and see usability through performance caparison. The paper “Comparing Machine Learning Classifiers for Movie WOM Opinion Mining” provided the process of machine learning approach for sentiment analysis from NLP of unstructured text data to algorithm validation. [14]

In the track of database in cloud environment, the paper titled “An Efficient Design and Implementation of an MdbULPS in a Cloud-Computing Environment” by Myoungjin Kim et al. has proposed MongoDB-based unstructured log processing system (MdbULPS) in a cloud-computing environment that processes large amounts of log data. The study focuses on handling the log data generated in a bank, among various types of log data. [15]

The next article by Yen-Wen Chen et al. entitled “Study of Data Placement Schemes for SNS Services in Cloud Environment” has proposed a heuristic procedure for SNS data placement to achieve the above objective. The proposed scheme adopts the correlation property to group users information by using k-means clustering and distributes users or data sources among VMs. Two data placement schemes are proposed for both pre-configured VM and dynamic VM situations. [16]

Min-Joon Kim et al. in their paper “A GraphML-based Visualization Framework for Workflow-Performers’ Closeness Centrality Measurements” have proposed a visualization framework focusing on measuring the centralizations of workflow performers, which is one of the key practice indicators to identify the important or prominent performers within a workflow procedure, and can be analyzed by the typical social network analysis technique, centrality. [17]

In the track of software engineering, the paper titled “Agile Adoption in IT Organizations” by Imran Ghani et al. has identified and analyzed the barriers that impact on the performance of IT organizations that use such agile software development methods. The contribution of this analysis is to present guideline related to avoid or overcome the barriers towards adoption of agile. [18]

The paper titled “Estimation of the Demand Function of the Information and Communication Construction Business” by Jeong Ho Kwak et al. has served to estimate quantitatively the demand function in the ICT construction business using empirical data and a statistical model and to present policy implications affecting the development of the ICT construction business, as the infrastructure business of the creative economy. Studies of the demand function in the Korean ICT construction business will provide policy implications as well as valuable insight to promote the ICT construction business. [19]

The final article “Investigating the use of multiple social networking services: A cross-cultural perspective in the United States and Korea” by Hannah Kang et al. has explored the use of multiple SNSs and lay a foundation for further examinations. The study investigated motivations and individual characteristics that are expected to influence multiple SNS usage, examined cross-cultural differences in the patterns of multiple SNS use and users’ characteristics. [20]

5. Conclusion

The study intended to establish the framework, named “Internet Information Orientation” that illustrates the relationship between effective information use utilizing Internet and the potential national competitiveness indices. The research identified various Internet capabilities, the reclassified the identified capabilities based on the research issues proposed at the 6th international conference on Internet, and finally described the rigorous research endeavors in those issues.

As a result, the authors developed the *Internet Information Orientation* that links information capabilities utilizing Internet to national competitiveness on Internet, such as national informatization index or web index. The framework illustrated three main types of Internet capabilities: Internet technology capability, information management capability via Internet, and information usage behaviors on Internet. Then fifteen specific capabilities were identified and arranged based on ten research issues. Finally, the study introduced 16 outstanding papers that may contribute to enhancing Korea national competitiveness on Internet. Hopefully, the concepts of *Internet Information Orientation* may provide both practitioners and policy-makers with practical guideline for Internet capabilities in establishing their business strategy and governmental policies regarding Internet.

To get more sophisticated, the proposed framework should be empirically verified and consistently upgraded in near future.

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