

Knowledge-storage Model for Regional Innovation with Co-creation

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Abstract

Co-creation refers to when diverse stakeholders in a community utilize IT to communicate and cooperate in a manner that allows all participants to create new value. To effectively utilize co-creation for regional innovation, knowledge storage is necessary to allow users to solve problems that arise in the community. Therefore, in this study, a knowledge-storage model was developed to systematically store cases of regional innovation and community problem solving, to effectively retrieve the cases required by users, and to utilize co-creation. To this end, a literature review and expert interviews were carried out to analyze user requirements, and the concept, functions, architecture, data structures, and attributes of co-creation knowledge storage were defined. In addition, the processes through which knowledge storage was utilized for regional innovation were presented as a scenario. This study's contributions include the accumulation of research data related to co-creation knowledge storage for regional innovation and new case-based follow-up studies related to knowledge storage. This study also contributes to practical work by presenting the possibility of local governments or institutions establishing and utilizing knowledge storage to solve problems in regional innovation.

Keywords: Co-creation, Knowledge Storage Model, Local Government Innovation, Regional Innovation

1. Introduction

Diverse problems exist in communities where we live such as jobs, growth, welfare, education, and aging (Hong et al., 2014). Community problems are very extensive and complicated. Primary problems are sometimes expanded into secondary problems depending on viewpoints to approach the problems, and communities make efforts to prevent, mitigate, and solve such problems (Kim, 2002). Although local governments that are at the center of resolution of community problems develop and implement various policies, the low effectiveness of government led policies and the inefficiency of similar overlapping policies are pointed out as problems (Kim, 2011). To overcome these problems, recently, the local governments have been implementing government innovation and people oriented policies through 'opening, sharing, communication, and cooperation'.

IT enabled communication and sharing among diverse stakeholders in communities. For example, the Seoul government operates 'Wiki Seoul' as an IT platform for citizens' voluntary participation and cooperation to publicly collect ideas to solve large and small problems in living and operates 'Ten million's imagination oasis' as a window for realization of citizens' imagination and proposals into policies. Co-creation models are presented under the concept that they will enable stakeholders to cooperate so that all participants create new values. Co-creation models enable cooperation among diverse

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professional competencies to solve complicated social problems, appropriate tuning of different desires from diverse stakeholders, and consideration of histories, culture, and characteristics of communities utilizing platforms in open structures that can efficiently connect all stakeholders related to community problems so that all stakeholders including the government and residents can create values (Hong et al., 2014).

To effectively utilize co-creation models, referring to previous cases of regional innovations is also quite meaningful. Solutions for social problems can be sought from existing cases and the process and method of implementation of the solutions can be referred to. In addition, to solve regional problems and achieve regional innovation through co-creation models, referring to existing exemplary cases and similar cases is more necessary and utilizing past accumulated knowledge in such cases is effective. Therefore, knowledge storages are necessary so that measures to solve newly arising community problems can be found and related methods and procedures can be referred to by effectively utilizing success and failure cases of existing regional innovation.

In this study, co-creation knowledge storages that support regional innovation and resolution of social problems will be presented. These knowledge storages enable subdividing cases by stage of co-creation to store and utilize the cases focusing on processes and procedures. Through the foregoing, knowledge that can be utilized in the process of regional innovation based on co-creation models in which diverse stakeholders share information and participate can be provided. In addition, past cases related to regional innovation and social problems can be efficiently searched for to establish better solutions based on the results of existing cases. The knowledge storage model presented in this paper is differentiated from other knowledge storages in that it not only presents measures to solve problems but also provides cases necessary according to processes in individual stages of co-creation models by systematizing existing cases of regional innovations and storing and utilizing the cases as knowledge. To develop the knowledge storage model, requirements were analyzed, a conceptual model was presented, and a scenario for the model was organized.

2. Theoretical Background

2.1. Knowledge Storage

Knowledge storages are a tool to store and reuse knowledge in possession to create and share values (Choi, 2012). Knowledge storages enable systematizing information to store and reuse conceptualized knowledge and provide not only simple database function but also a function to store empirical knowledge and atypical data in structuralized forms so that they can be utilized in information systems. Thus, knowledge storages structuralize information, store the structuralized information, and provide knowledge to users.

Knowledge utilization has developed as it has been utilized as a method for securing enterprises' competitive advantages such as knowledge administration and knowledge management (Drucker, 1995) and is implemented in knowledge management systems(KMS) and expert systems. Knowledge management is introduced in enterprises, the government, and administrative organs. The central government and local governments have established KMS to accumulate knowledge of administrative work to enhance work efficiency and effectiveness. In South Korea, 191 organs have established and utilize KMS and the establishment of government-wide KMS is also planned (Ministry of the Interior of Korea, 2014). As studies of government's and public organs' knowledge management, many studies have been conducted in relation to the analysis of influence factors and efficiency for the production and utilization of knowledge such as studies conducted by Kim(2015), Ha et al.(2008), and Song(2014). However, studies on system design and establishment have been insufficient.

In general, knowledge storages have been perceived as sub systems belonging to KMS. In KMS, knowledge storages play the role of database to store information and knowledge focusing on effective storage of knowledge generated in organizations. Therefore, knowledge storages are important for efficient collection and storage of knowledge and are utilized as systems to prepare bases for utilization of data as knowledge later through processing. Accordingly, the forms of storage and expression, index systems, and knowledge unit connection methods have been important to concretize knowledge in knowledge storages and knowledge storages meant forms such as data warehouses (Cheon et al., 2011).

KMS are information systems intended to systematize and share individual pieces of knowledge accumulated by organization members to enhance the performance of the individuals and the organization (Gong, 2004). KMS provide knowledge services such as the creation, storage, sharing, and utilization of knowledge and manage organizations' knowledge. To this end, knowledge mapping for codification of knowledge and the formation of knowledge are important. KMS provide functions that enable all persons internal to an organization including experts to be connected online to record knowledge, utilize stored knowledge, share knowledge, and cooperate in relation to knowledge. However, KMS are not used as a single technology or for a single role but are used in diverse uses and methods depending on the using organizations' purpose of use. Studies on KMS are specialized in diverse areas such as medical care, construction, and manufacturing and definitions of knowledge are diverse.

The knowledge storage to be developed in this study is a system to provide solutions, methods, and procedures when cases of regional innovations are stored and co-creation models are applied with the knowledge. To this end, the cases stored in knowledge storages should be structuralized before being stored so that they can be utilized as knowledge. To convert the descriptive and procedural contents of cases into knowledge, basic information on cases should be divided into classified items and indexes and detailed contents regarding methods and procedures by co-creation stage should be separately entered so that the information can be stored. In addition, when co-creation methods are utilized for regional innovation or for resolution of related social problems, solutions should be searchable through existing cases and the methods and procedures implemented in the cases should be obtainable from the knowledge storage. Through the foregoing, when new problems in regional innovation should be solved utilizing co-creation, exemplary cases can be provided through procedures by stage and regional innovation can be supported by the phased storage of the processes of implementation of regional innovation.

2.2. Co-creation and Regional Innovation Model

In the area of management, co-creation refers to strategy where enterprises and consumers cooperate with each other to make new values and resultant profits are shared by participants. With co-creation, enterprises obtain creative ideas from consumers and consumer can be provided with the products and services wanted by them along with incentives by participating in enterprise activities (Hong et al., 2014). Studies on co-creation mainly utilized co-creation as a concept for management innovation and related studies have been conducted. Diverse studies have been conducted on the application of the concept co-creation, applying methods, cases of utilization, and outcomes of utilization.

Co-creation models that show methods and procedures for implementation of co-creation have been studied. In a study conducted by Hong et al.(2014), methods and procedures presented in a co-creation implementation strategy through analysis of enterprises' management environments are presented as shown in Figure 1. To implement co-creation, the processes of idea discovery and selection, development of products or services, and commercialization should be undergone. Fig.1 concretely presents the

processes through which ideas for new products are discovered with consumers' participation, products are developed and sold, and the benefits generated accordingly are shared with consumers.

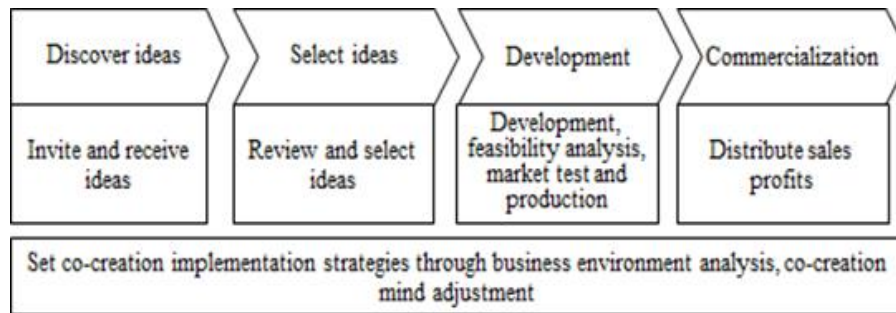


Figure 1. Co-creation Models' Methods and Procedures
 (Source: Hong *et al.*, 2014, p.94)

In addition to the area of management, co-creation models can be applied to solve social problems. In a study conducted by Hong *et al.*(2015), methods and procedure in a series of processes through which ideas for Job mismatch are collected from diverse stakeholders such as administrative organs, residents, and specialized institutions, the ideas are turned into policies, and the policies are implemented to solve the problem of job mismatch were presented. Eight stages of processes to define the problem of job mismatch and collect the ideas, evaluate the ideas, implement the best ideas, and then evaluate the results of implementation to solve the problem were presented as shown in Figure 2.

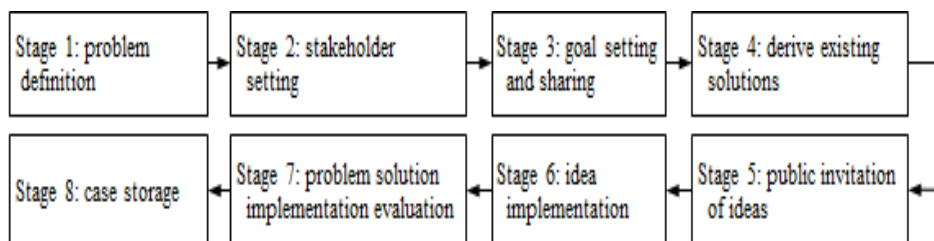


Figure 2. Co-creation Model for Resolution of Social Problems
 (Source: Hong *et al.*, 2015)

3. Co-creation Knowledge Storage Model

The knowledge storage to be developed in this study enables storing cases of regional innovation and utilizing the cases when co-creation models are applied. To this end, requirements were analyzed, functions were defined, and a co-creation knowledge storage model was developed.

3.1. Requirement Analysis

To analyze requirements for co-creation knowledge storage models, knowledge storage, co-creation model, and regional innovation related literature was reviewed and requirements necessary for knowledge storages were analyzed through interviews with experts in information system, co-creation model, and regional innovation. Through the foregoing, requirements for co-creation knowledge storages were derived.

First, co-creation knowledge storages should enable systematic storage and management of cases of regional innovations so that the cases of regional innovations can be provided as knowledge. As with existing KMS and knowledge storages, co-creation knowledge storages should be able to provide knowledge to users. Cases of regional innovation should be systematized and structuralized before being stored to provide the cases as knowledge.

Second, the co-creation knowledge storages should have structures that enable searches and inference for utilization of cases of regional innovations. Classification criteria should be prepared and indexes and classification items should set to enable searches and inference so that stored cases of regional innovations can be utilized as knowledge.

Third, cases should be stored after subdividing basic information and co-creation information. Cases of regional innovation should be stored after subdividing co-creation information including the types, stages, and stakeholders of co-creation along with basic information including the name, purpose, period, and managing institution of the cases. Co-creation information divides co-creation methods and procedures utilized in cases and the methods and procedures are utilized as important items when co-creation models and platforms are connected.

Fourth, co-creation knowledge storages should provide functions that can support connection with co-creation platforms. Since knowledge storages are information systems intended to support co-creation and are connected to or included in co-creation models and platforms when they operate, connecting functions are necessary to support the foregoing.

The first and second requirements were derived through literature review and opinions of experts in information systems and are functions required for general knowledge storages. Co-creation knowledge storages have a characteristic that the knowledge stored in them is regarding regional innovation cases and require storage and management suitable for such cases. Data structures for structuralization of atypical cases are necessary and case based analysis and inference methods are additionally required along with a function of data searches.

The third and fourth requirements were derived through literature review and opinions of experts in co-creation and regional innovation. In cases where co-creation is utilized for regional innovation, co-creation knowledge storages should be able to provide solutions for regional innovation and methods and procedures by stage of co-creation. In addition, functions to provide case information in linkage with co-creation models and platforms are also required.

3.2. Structure of Knowledge Storages

The concept and functions of co-creation knowledge storages were defined based on the requirements described in 3.1.

The co-creation knowledge storage to be developed in this paper is an information system in which cases of regional innovation can be stored and utilized when co-creation models are applied. The cases are structuralized into basic information and co-creation information before being stored and are used to provide regional innovation related knowledge to users through searches and inference. The co-creation knowledge storage supports co-creation models and platforms.

The knowledge storage is schematized into a block diagram as shown in Fig.3 The knowledge storage supports co-creation models as a subsystem or linked system of co-creation platforms or receive inputs of cases through user interfaces. Major constituting modules are case storages, case storage modules, case management modules, and case inference modules.

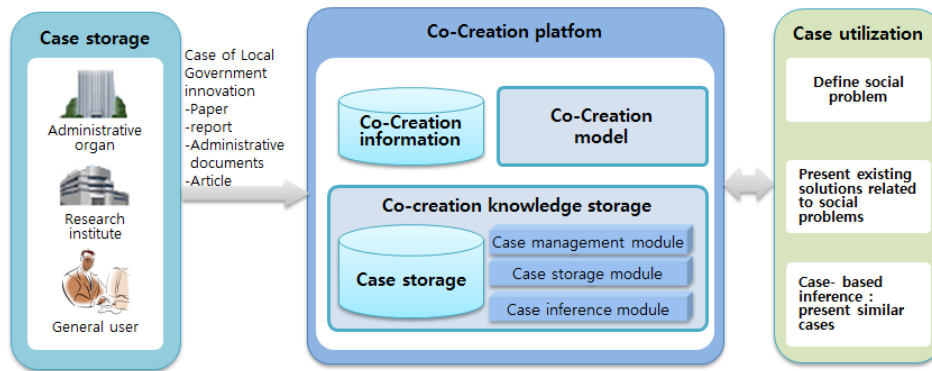


Figure 3. Block Diagram of Knowledge Storages

Case storages provide physical spaces for storage of cases of regional innovation. They are composed of databases that are defined as schemas for storage of cases. Case management modules are defined with functions to support co-creation models. These modules have functions necessary when changing case information occurring in co-creation knowledge storages such as searches, modification, and deletions of cases. The case management modules enable identifying entire cases, summaries of cases, and details of cases by stage of co-creation, provide exemplary cases that fit the stages of progression when projects are implemented through methods and procedures in co-creation models when new regional innovation projects are created, and provide functions to enter the progress and results of implementation of projects. In addition, in linkage with case inference modules, exemplary cases and similar cases are automatically retrieved in each stage additional information can be obtained from case management modules. In addition, if events implemented in the current stage are entered when the next stage is started, these events will be stored as case information for each stage and the project will be stored and managed as a new case.

The case storage modules provide interfaces that fit classification items when the contents of existing cases and new projects are entered to manage the contents and forms of inputs so that the contents of cases can be structuralized before being stored in case storages.

The case inference modules include a function to provide similar cases required by users out of stored cases through keyword searches and detailed searches for indexes and classification items. To this end, indexes and classification items of cases should be systematically composed and in addition, cases should be provided through the method inference.

The co-creation models that are include in co-creation platforms define methods and procedures by stage of co-creation and can be utilized by users when they implement new projects for regional innovation. Through co-creation models, effective measures and methods for resolution of problems in regional innovation referring to manuals for implementation methods by stage and the exemplary cases and similar cases provided by case storages. The results of implementation by stage are entered and the project is stored as a new case in the knowledge storage after completion.

3.3. Knowledge Storage Data Model and Scenario

Cases are systematically classified and subdivided before being entered into knowledge storages so that the cases can be utilized for co-creation. Cases should be systematized and structuralized for the cases to be utilized in information systems as knowledge. To this end, cases of regional innovation should be collected and the characteristics of the cases and the co-creation model should be analyzed.

Since cases that may be stored in case storages are in diverse forms such as administrative documents, papers, reports, and articles, the cases should be structuralized into a certain form. In addition, since diverse data exist for each case, multiple data are collected and made into one case in some cases.

The case information is basic information of cases for which overall matters of cases including the names of case, project areas, and purposes should be entered without any missing value as this information is data utilized for case searches. The co-creation information is co-creation related matters for which types of co-creation, stakeholders, and details by stage are entered. Since cases where co-creation methods and contents utilized by cases are omitted or changed occur, missing data should be allowed for the co-creation information.

Data structures and attributes for management in case storages were defined as shown in Table.1 below.

Table 1. Data structures and Attributes of Case Storages

Upper element	Lower element	Attribute
Case information	Case number	Serial number of case storage
	Project name	Names of the project and policy in the case
	Project area	Areas where the project was implemented (e.g., public administration, industry, job finding, welfare, etc.)
	Project purpose	Background and purpose of the project
	Project period	Project implementation period
	Progress	Summary of the progress in project implementation
	Detailed content	Detailed contents of project
	Result	Project results and the contents of evaluation
	Attached file	Storage of files, such as project result reports
	Keywords	Core keywords of cases to be used for searches
Co-creation information	Case type	Type of regional innovation
	Co-creation type	Type of co-creation model for the case
	Co-creation model stage	Stages through which the co-creation model was applied
	Division of exemplary case	Whether the case is an exemplary case and the stages of the case
	Problem-solving methodology	Problem-solving methodology used in the case
	Managing institution	Institution that implemented the project and made decisions
	Stakeholders	Stakeholders that participated in the project
	Cooperation	Subject and degree of cooperation
	Conflict	Subject and degree of conflict

The DB schema for case storage is shown in Fig.4. Through the table of basic case information, the basic information for the cases of regional innovation can be stored and managed. Information inputted in individual stages of co-creation models can be managed using the table of progression information by stage. For instance, the process of derivation in stage 4 (existing solution derivation) and the results of the derivation can be stored in the table of progression information by stage. In this case, the case number, stage number (stage 4), item name (existing solution), process of derivation, and the results of derivation can be inputted. To infer similar cases, the criteria for classification, such as the co-creation types, project forms, and case types, can be stored through the project classification table.

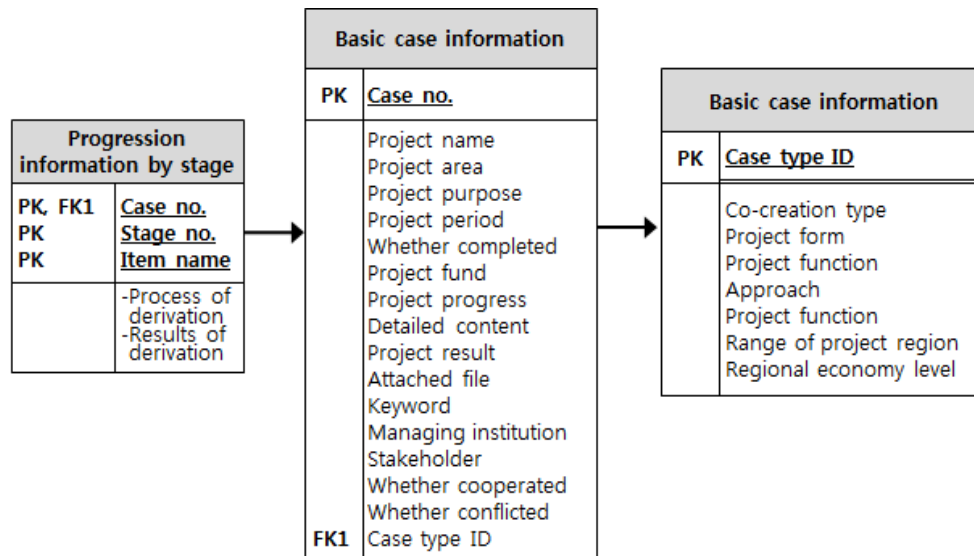


Fig.3. Case Storage DB Schema

4. Scenarios for Knowledge Storage Utilization

The co-creation knowledge storage model for regional innovation can be applied through the following theoretical examples. The situation for the scenario was set as processes to store and utilize a case of urban regeneration.

4.1. Scenario 1: Registration of Existing Cases of Regional Innovation

The knowledge storage operator collects urban regeneration cases which implemented in the past and registers the cases in the knowledge storage. The knowledge storage operator collects papers, reports, etc. and subdivides and integrates cases different sources of data for the cases in accordance with the knowledge storage data structure. When the data have been organized, the operator accesses the knowledge storage to implement the case storage function. Then, the case storage module provides an interface into which case information and co-creation information can be entered. The operator enters case information ranging from the project name to the keywords, the co-creation type, the contents of the case by stage, stakeholders and matters related to cooperation and conflicts in order. When the inputs have been completed, the information is stored in the knowledge storage and if any events should be revised later, these events can be revised or changed through the case management module.

4.2. Scenario 2: Utilization and Storage of New Projects

An administrative organ plans an urban regeneration and using the knowledge storage. The person in charge accesses the knowledge storage to create a new project through linkage with the co-creation platform. He enters basic information such as the name of the new project and the purpose of the project and begins co-creation model stages. In stage 1 for definition of problems, exemplary cases and cases of urban regeneration that can be referred to are provided together with contents to be implemented in the stage. Referring to the manuals and cases presented, the person in charge determines literature review and collection of citizens' opinions as implementing methods. Problems are defined and the process and results are entered to complete stage 1. Thereafter, in stage 2 stakeholder setting, stakeholders are set referring to the exemplary cases and similar cases provided by the knowledge storage and remaining stages up to stage 8 are implemented in the same method. When the project has been completed, the project is concluded and stored in the knowledge storage. These data are stored as new data of the knowledge storage.

4.1. Scenario 3: Retrieval and Utilization of Cases of Regional Innovation

An administrative organ wishes to solve problems in an urban regeneration. To identify existing solutions for the problems, the person in charge wants to utilize the knowledge storage. The person in charge accesses the knowledge storage to retrieve similar cases through keyword and detail searches using the case search function. The search is implemented by the case management module and the results of searches for similar cases are displayed on the screen. The contents displayed such as project names and managing institutions are checked and the representative case is selected and the details are checked. Along with the purpose and detailed contents of the project, the stage co-creation method used in the case is identified and utilized as reference data for solutions.

The feasibility of the co-creation knowledge storage model of regional innovation was identified through scenarios. The processes of entering existing cases into the knowledge storage, utilization of new projects, and searches for stored cases show that the model includes the requirements for and functions of knowledge storages presented earlier and that there is no problem for use of the knowledge storage by the users.

5. Conclusions

Currently, local governments and administrative organs make efforts to solve diverse and complicated regional social problems and achieve regional innovation. To this end, recently, Government 3.0 intended to solve problems through citizens' participation has been diffused. In addition, KMS were introduced for efficiency of administrative work and methods to enhance the degree of utilization of the systems have been presented. As such are becoming important and related studies are necessary now.

This study presented a co-creation knowledge storage model that enables utilizing cases of regional innovation for resolution of social problems. This knowledge storage model is an information system model intended to systematically store cases and provide the cases as knowledge that can be referred to for regional innovation, for resolution of social problems, and for regional innovation utilizing co-creation models.

To this end, requirements were analyzed through literature review and expert interview, the concept and functions of knowledge storages were defined and the co-creation knowledge storage model was presented through the conceptual structure and data structure of knowledge storages. Thereafter, the feasibility of the knowledge storage model was identified through theoretical examples applied with the model.

The knowledge storage presented in this study systematically structuralizes cases of regional innovation before storing them to utilize them as knowledge and provides functions to support co-creation models and platforms. To convert past case data stored in diverse forms into knowledge, classification items for cases were subdivided into case

information and co-creation information and were defined in data structures. This way enables searches and inference, effective searches for cases needed by users, and provision of exemplary cases by stage of co-creation.

This paper contributed to science as it accumulated research data related to co-creation knowledge storages and induced follow-up studies on knowledge storages. It also contributed to practical work as it presented a model that can be used by actual local governments or institutions to establish and utilize knowledge storages so that knowledge storages are implemented as a way of regional innovation and resolution of social problems.

This study has a limitation in that it presented concept models and data structures but did not actually implement them. In follow-up studies, knowledge storages should be established and utilized in actual local governments' regional innovation to examine the effects of the knowledge storages on the performance of regional innovation.

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References

- [1] M. J. Cheon and M.S. Heo, "Knowledge Management, Seoul", Hankyundsa, (2011).
- [2] S.J. Choi and S.J. Shin, "Improving Service Quality by Using Organizational Memory in Electronic Knowledge Repositories : Focusing on Shared Service Value and Knowledge Reuse", Daehan Journal of Business, vol. 25, no. 9, (2015), pp. 3511-3531.
- [3] P. Drucker, "The Information Executives Truly Need", Harvard Business Review, (1995), pp. 54-6
- [4] H. G. Gong, "Empirical Study on the Effect of Knowledge Sharing on Knowledge Management System", Ph.D thesis, Chonnam National University (2004).
- [5] M. S. Ha and Y. S. Cheun, "A Study on the Causal Model of Knowledge Generation in Governmental Organizations: Focused on Organizational Members Perception", Korean Policy Sciences Review, vol. 12, no. 2, (2008), pp. 97-123.
- [6] S. G. Hong, S. E. Han and H. M. Lee, "A Study on the Co-creation for Problem-solving of Regional Community", Journal of Korean Association for Regional Information Society, vol. 17, no. 1, (2014), pp. 1-24
- [7] S. G. Hong, H. J. Kim, H. M. Lee, N. R. Kim and J. W. Kim, "Development of Co-creation Model for Solving Job Mismatch Problem of Young Graduates", Proceedings of 2015 Spring Joint Conference, (2015); Busan. Korea.
- [8] G. S. Kim, "Local Communities-led Social Enterprise Status and Challenges", Proceedings of 2011 Regional Development Conference, Gwangjo, (2011); Korea.
- [9] D. W. Kim, "Recognizes Differences in Social Problems among Regional, Research of Area Studies", vol. 1, (2002), pp. 89-111.
- [10] S. G. Kim, "A Study on the Public Servant's Perception Types on GKMS, Journal of the Korean Cadastre Information Association", vol. 17, no. 2, (2015), pp. 207-226.
- [11] Ministry of the Interior of Korea, "2014 Pan-government Administration Knowledge Activation Plan", (2014).
- [12] C. Oughton, M. Landabaso and K. Morgan, "The Regional Innovation Paradox: Innovation Policy and Industrial Policy", The Journal of Technology Transfer, vol. 27, (2002), no. 1, pp. 97-110.
- [13] C. G. Song, "An Empirical Study on Barriers and Facilitators through Delphi Methodology", Korean Governance Review, vol. 21, no. 1, (2014), pp. 249-274

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