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A Study on Methodology of U-City Promotion
(Top-Down vs Bottom-Up Approach Model)

Sang-Hun Lee* · Hyong-Bok Kim**

U-City 추진방법론에 대한 고찰
(Top Down vs Bottom Up 모델)

이 상 훈* · 김 형 복**

ABSTRACT : Recently, a lot of local autonomous entities are promoting Ubiquitous City(U-City) Construction by integrating Information Communication Technology(ICT) with city development, and also internationally, a lot of cities are making efforts to develop U-City to intensify a city's competitive strength and improve life quality of city dwellers. In keeping with such a stream of the times, each local autonomous entity and project developer are developing a lot of methodologies to establish optimal U-City in corresponding cities and also inquiring into a variety of development procedures, such as connecting existing urban development methods with information establishment methods.

The method used usually is to establish Information strategy Plan(ISP) for a city which will be developed through consulting in the stage of city development planning. ISP is to establish vision & strategy for building the ubiquitous city and is a methodology including city vision, strategy, goal, and implementation method, etc. However, due to a lot of variables, such as a variety of city environment, establishment period, budget, information technology, and etc., it is difficult to contain establishment plans for every occasion in a similar method, in reality. Therefore, it is naturally necessary to suggest plans for city vision & strategy, and selection of element technology/service.

Thus, this paper suggests models for vision & strategy establishment of U-City and suggests Top-Down Approach and Bottom-Up Approach method as a plan for U-City establishment. In addition, this paper analyzes general promotion methodologies for constructing U-City and analyzes how these two strategic methods [Top-Down Approach and Bottom-Up Approach] for city vision establishment are composed in such a methodology, to define and analyze its

*Research Fellow, U-Eco City Test Bed Center, Korea Land Corporation(icarus@lplus.or.kr)
**Principal Investigator, U-Eco City Test Bed Center, Korea Land Corporation(hyongkim@lplus.or.kr)

constituent plan.

Keywords : U-City Vision, USP(U-City Strategy Plan), Top-Down Approach, Bottom-Up Approach, Element Technology/Service, U-City Promoting Methodology

요 약

최근 국내의 많은 지방자치단체에서는 정보통신 기술과 도시개발 기술을 융합하여 유비쿼터스 도시(U-City)를 건설하려고 하며, 세계적으로도 많은 도시들이 도시의 경쟁력 강화와 도시민의 삶의 질 향상을 위해 U-City를 개발하기 위해 노력하고 있다. 이러한 시대적 흐름에 따라 각 지방자치단체와 사업 시행자는 최적의 U-City를 구축하기 위하여 많은 방법론을 개발하고 있으며, 기존의 도시개발 방식과 정보화 구축 방식을 연계시키는 등 다양한 개발 절차를 모색하고 있다.

가장 많이 사용되고 있는 방안으로는 도시개발 계획 당시에 개발 될 도시의 정보화 전략계획(ISP)을 수립하는 것이다. 다양한 도시의 환경과 구축기간, 예산, 정보화 기술 등 여러 변수들이 있어 동일한 방법으로 모든 경우에 대한 구축 방안을 수립하기는 어렵다. 따라서 도시 비전과 전략, 서비스와 요소기술의 선정 등에 대한 방안이 필요하게 되었다.

본 논문에서는 U-City를 위한 비전, 전략 수립모형을 만들고 이를 구축할 수 있는 방안으로 하향식 그리고 상향식 접근방법을 제시한다. 또한 U-City를 건설하기 위한 일반적인 추진 방법론에 대해서 분석하고 이러한 방법론 안에서 도시 비전 수립을 위하여 두 개의 접근방법을 구성하는 방안에 대하여 논한다.

주요어 : 유시티, 도시 비전, 유비쿼터스 전략계획(USP), 하향식 접근방법, 상향식 접근방법, 요소기술/서비스

1. Introduction

U-City is a cutting edge city embodied with the convergence of countless technologies including construction, civil engineering, IT and other city planning technologies, etc. U-City is being built with the aim of ironing out the existing city problems, such as traffic jam, matter of public order, welfare, medical problem, enhancing the efficiency in city operation & management and heightening the life quality of city dwellers.

There exist a lot of promotion stages in establishing U-City, but the most important stage among those stages is the one for a vision defining a city's future course and setting up a strategy to achieve the vision. Therefore, at this stage, a number of city experts in charge of establishing U-City are doing research

on the establishment of strategy, organization of service, and method for selecting element technology/service to achieve optimal vision and goal suited for individual corresponding target cities.

However, in most cases, due to complicated elements of city environment and innumerable cases needing considerations, they are using a mixed method rather than specific methods, so there comes out a lot of confusion by stages according to the selection of each method. Consequently, recent realities are that no matter when U-City is promoted, there happens arguments about priority in relation to each stage for element technology/service and vision & strategy establishment.

This paper suggests "a model for city vision & strategy establishment" including city vision, goal, service, and element technology/service to set up more sophisticated city vision & strategy away from such a confusion and also going to deduce a plan for U-City development using two approaches [Top-Down Approach & Bottom -Up Approach] in the whole stream.

In addition, this paper makes a model deserving to be referred to in time of later U-City development by suggesting individual vision & strategy establishment plan subsequent to the lastly suggested Top-Down Approach and Bottom-Up Approach.

2. Relevant Research

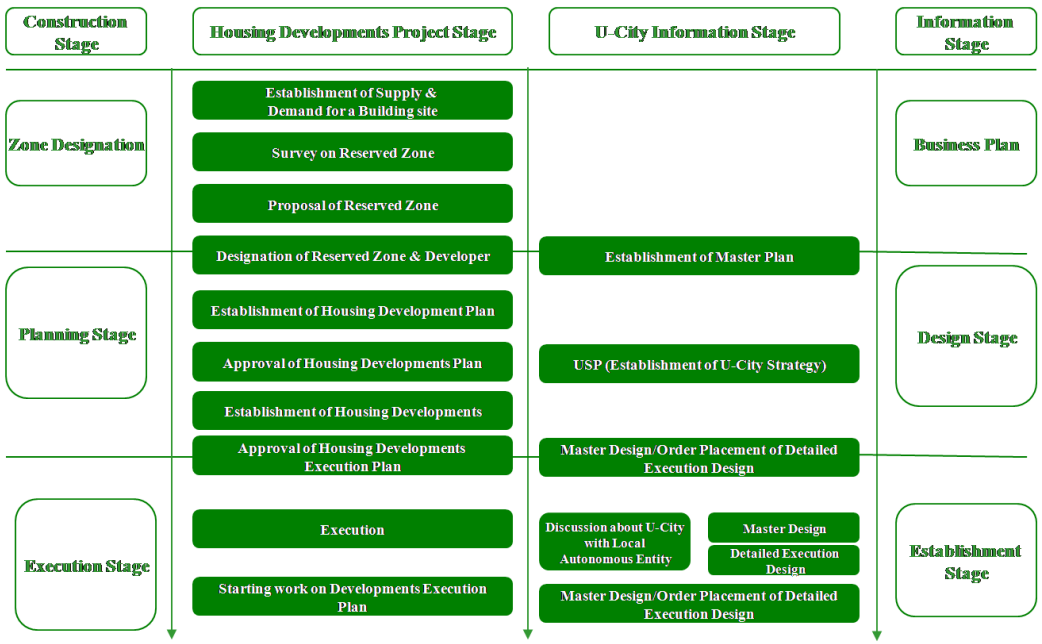
2.1 U-City Establishment Process

Project stages for U-City establishment are generally progressed in the way of combining the process of information project with the promotion stage for a general city construction project. Generally, as the project period for city construction process lasts four or five times as long as the period for information project, in most cases, information project process including project plan establishment, design, establishment, operation & maintenance is adjusted to general construction process including zone designation, planning, execution, post-management. [Fig. 1] schematizes stage 3 including the part of city strategy establishment among four promotion stages.

In U-City Development process [Fig. 1][1], the stage for "Master Plan" and "USP[U-City Strategy Plan]" achieved in the stage of "Reserved Zone and Designation of a Developer" and "Approval of Housing Development Plan" is very important as a stage in which U-City's future vision and strategic goal are decided. In this stage, vision, strategy, goal, and service and a catalog of element technologies of U-City are derived and future appearance of U-City is decided up to the results.

Once the future appearance of U-City is decided, and an execution plan for housing developments project is approved, master design and execution design are ordered, and then according to the previously decided strategy goal, and technology/service in USP stage, the

1) Lee, Sang-Hun and et al., Research on Establishment of U-City Standard Model and Standard of Analysis of Project Value, Land & Urban Institute, Korea Land Corporation, 2007.



[Fig. 1] Development Process of U-City in Housing Site Development Project

proper project comes to go through the process of designing the corresponding systems. In short, the development project of U-City consists roughly of 4 stages, but the future appearance of a city and the setting up of an establishment plan are achieved in USP stage, planning stage which reflects the future appearance of a city.

2.2 Methodology on U-City Establishment

Though in a lot of project zones this county U-Cities are established at the same time, it was not long ago that the project of U-City establishment itself appeared while the main entity of its project frequently changes hands, there has been no method for a general city construction. With such a circumstance lasting, some project operators began to make a methodology of building U-City.

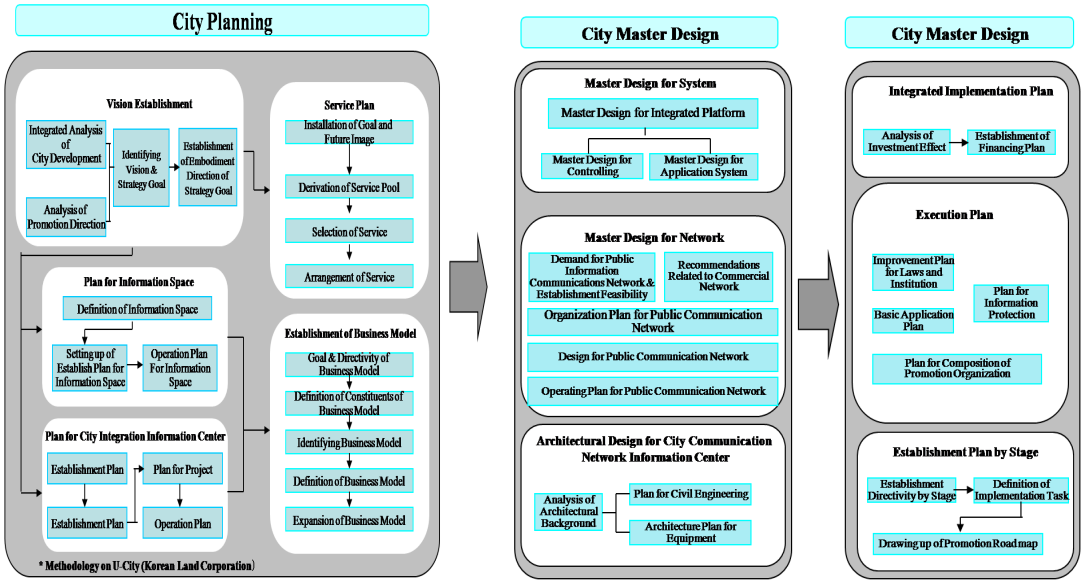
Such a discussion about such methodologies is ever continuing, some being refined and in a broad frame, U-City methodology is being used by comprising[2] city planning, design, and integrated implementation. [Fig. 2]

3. Methodology on U-City Promotion

3.1 U-City Vision/Plan for Strategy Establishment

To establish U-City strategy begins with grasping the present condition of a target city.

2) Korea Land Corporation, Methodology on the U-City Construction, 2007.



[Fig. 2] Methodology on U-City Establishment

In short, to grasp and analyze each formation element in a city, such as location, function, size, and population is the first stage for the establishment of a city vision & strategy.

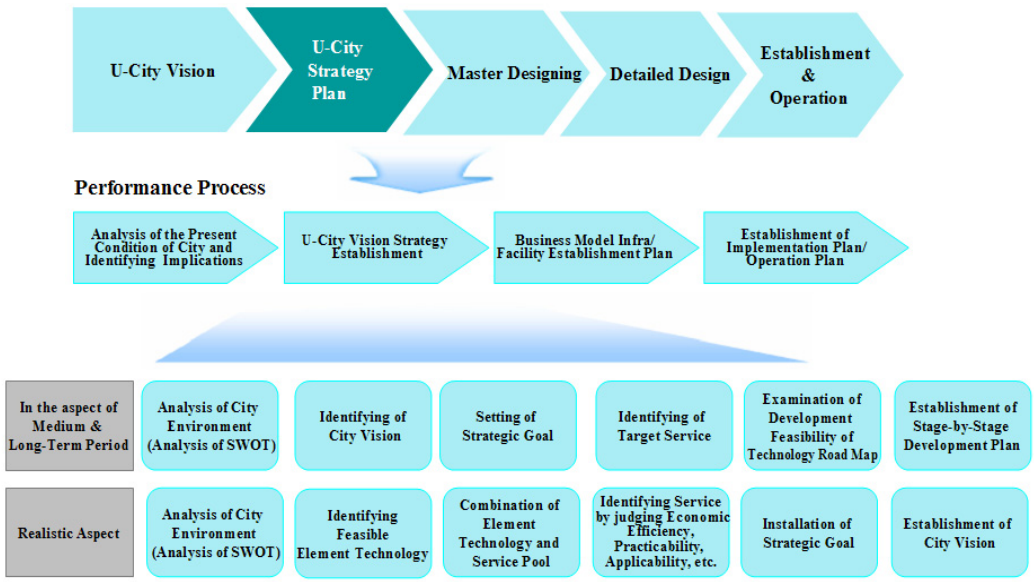
The second stage comprises the vision establishment as to what is the best way for a city to go ultimately on the basis of the analyzed data on the present condition of a city. For example, there may appear diverse types of vision a city pursues, such as a self-sufficient city, transport city, publication city, and high-tech industrial complex, etc. The 3rd stage is the one in which the established vision & strategy in a prior stage are implemented. The 3rd stage includes business procedures and contents of business scope covering design and establishment, which are actually implemented up to an operation sector for the time to come.

The part we have to take note of among these stages is the second stage - "U-City Vision & Strategy Establishment Stage."[3] [Fig. 3]

In the stage of "U-City Vision & Strategy Establishment", it should be decided whether city development should be promoted in terms of realistic aspect subject to a given budget and period or city development should be progressed by setting up medium & long term plan for it. A short-term approach and medium & long term approach will have a very great influence on not only an approach but also a city appearance as well as its operation for the time to come.

Particularly, it is because, in case of a medium& long term approach, there occur inefficient problems with expenses and manage-

3) Korea Land Corporation, U-City USP project report of Multifunctional Administrative City, 2007. - some parts revised



[Fig. 3] U-City Vision & Strategy Establishment Stage

ment in operation of infra facilities which were developed before the general frame of a city is set up. Therefore, it is necessary to make a different decision as to a vision & strategy direction according to an individual direction.

In short, the plan for identifying vision of U-City and another plan for identifying strategy, service and element technologies for its achievement could have two approach strategies those are the very Top-Down Model and Bottom-Up Model methods.

3.2 Establishment of Top-Down Model & Bottom-Up Model

Top-Down Model is an approach in which vision & strategy of a city are established before proceeding with U-City project and based on the established future vision of a city, a goal and direction of U-City are selected, and thus establishment is progressed by selecting the technology/service that correspond to the selected goal and direction[4].

Such a promotion method requires that U-City development be achieved through the much longer term & multi-level establishment process rather than in a short term in consideration of technology/service road map, service embodiment, and economic efficiency.

The other Bottom-Up Model is the approach in which technology/service elements are selected in consideration of economic efficiency and utility on the basis of the information on the present

4) Korea Land Corporation, A Study of Execution Strategy of Digital City in Yongin Hungduk, 2004.12.
Korea National Housing Corporation, Paju Unjung USP Final Report. 2006.6.
Korea Land Corporation, Detailed Design Report of Whasung Dongtan U-City, 2006.5.

condition of a city and they are applied. This approach is applicable based on the establishment date and makes the most of feasibility by classifying element technology/service group, reducing risk factors in project failure and also shortening the project period.

These two models for city development have a role and contents contrary to each other, so they are not applied consistently but used by mixing each element; thus, its consequential argument is raised about whether which of the technology/service and city vision & strategy establishment should be placed first every time U-City project is promoted.

Generally, the former is applicable to new towns while the latter is a suitable strategy for old central areas of a city, re-development or a big city. However, it is recommended that whole aspect of these two approaches be considered because city vision & strategy have a great influence on the selection of element technology /service.

1) Top-Down Approach (Top-Down Model)

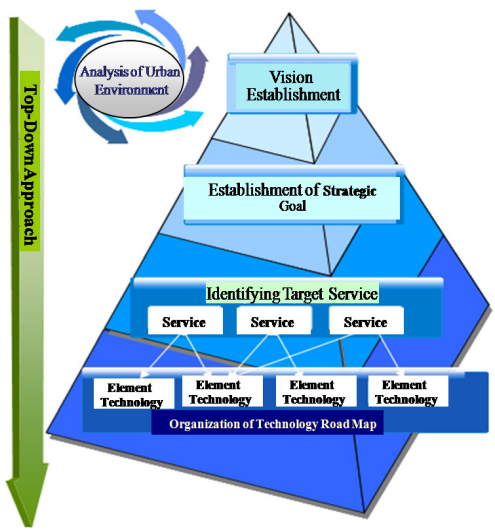
The Top-Down Model Establishment Method in "City Vision Establishment Model" is a strategic analysis method in which a strategy direction and element technology/service are selected on the basis of urban environment analysis after setting up city vision. [Fig. 4]

As a detailed performing method of Top-Down Model, first, city vision should be installed after conducting urban environment analysis.

Urban environment analysis means a diagnosis of the target city's environment on the basis of both physical environmental factors, such as a target city's location, dimension, and topography, etc. and non-physical factors, such as city population, political goal, and functional elements, etc.

Once the vision-establishment task that will decide a city's future is finished, the second stage having to be progressed is the one for strategic goal establishment. In the stage for strategic goal establishment, the goal with which a city should be equipped for vision achievement and that can iron out problems, which have remained unsolved until recently, through environment analysis should be installed and then general plans can be established to achieve these goals.

The purpose of the third stage is to identify the services that could achieve a strategic goal.



[Fig. 4] Top-Down Approach

Through U-City establishment, one or more services are selected and suggested according to each goal to be achieved. The services suggested like this might be developed in the existing research or be a newly developed one.

The purpose of the last stage is to identify element technology to be developed through such services. In addition, the road map is drawn up in relation to the technology elements constituting services and possible point of time for establishment is judged on the basis of the discernment of feasible technology, unfeasible technology and time-consuming technology. In addition, by judging the economic efficiency, economic-efficiency-guaranteed staged development plans should be set up.

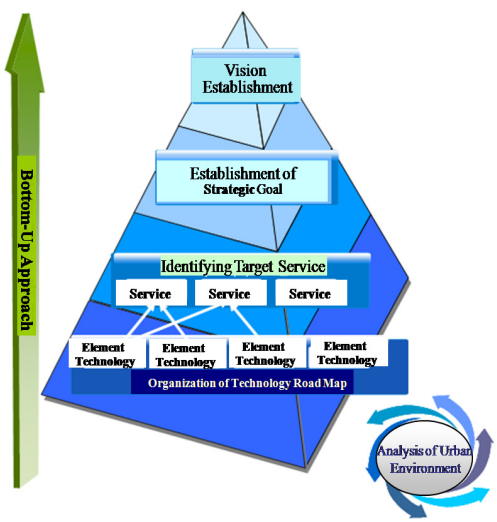
In the stage of establishing city vision and goal, this strategy doesn't consider the realistic factors, such as feasibility and economic efficiency of element technology/service and all technologies in the point of time of development can not be realistic and economical. Therefore, if economic efficiency should be formed later or in case perfect service could be achieved later 3rd stage task are done in the technological development stage, then staged city development could be carried out.

2) Bottom-Up Approach (Bottom-Up Model)

The first thing Bottom-Up Model carries out, like Top-Down Model is an urban environment analysis. Nevertheless, the urban environment analysis in Top-Down Model can be said to be an environment analysis for establishing city vision & strategy while urban environment analysis of Bottom-Up Model provides the data for inclusive reference to city vision establishment, such as element technology/service, strategic goal establishment, etc. by grasping the strength and weakness of a city. [Fig. 5]

The first job of Bottom-Up Approach begins with classification of element technology/service. This method does analysis of the present condition of information communication technology /service or installs the classification standard of the technologies coming to the front recently, and technologies going through a weeding out process and grasps feasible, applicable technologies. By installing technology/service classification pool for countless technologies, this method conducts an analysis of economic efficiency by element technology/service to make it possible to re-use it.

In the second stage, this method ascertains feasible technologies using the analysis data on



[Fig. 5] Bottom-Up Approach

urban environment in the arranged element technology/service pool and identifies a service model in consideration of economic efficiency, project value, and ripple effect, etc.

In short, when the technologies developed in the first stage or developed other research project are found to have economic efficiency and scalability, this method identifies the service consisting of such technologies, which is the purpose of this stage.

Services selected through this process can be arranged as Service Model Pool equipped with the optimum expenses and utility, and such a service Pool is combined in the third stage [goal-installing stage] and comes to compose a feasible, economically efficient city goal model. At this time, the optimum U-City vision & strategy model makes appearance with the combination of city vision and its goal,

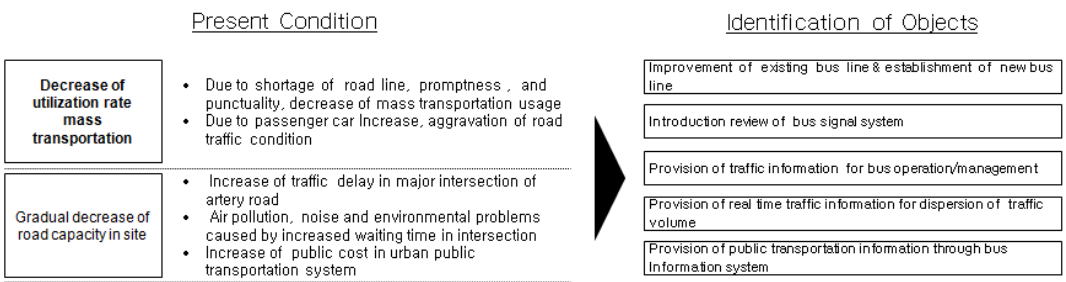
Bottom-Up Model is a method which classifies as many technology/service catalogues as possible and make the best use of their feasibility starting from the point of time of planning until the completion date of establishment later, thus reducing risk factors and shortening the project period. In addition, this method conducts the analysis of project value and economic efficiency in technology/service, goal, even goal model on every single stage, so it could be judged that this model is the optimum project promotion method, in terms of realistic aspects, that makes it possible to proceed with a desired project within the scope of budget; nevertheless, there might be a weakness in completeness of a city in terms of a medium & long term aspect.

3.3 Selection Method of Element Technology subsequent to Top-Down & Bottom-Up Strategy

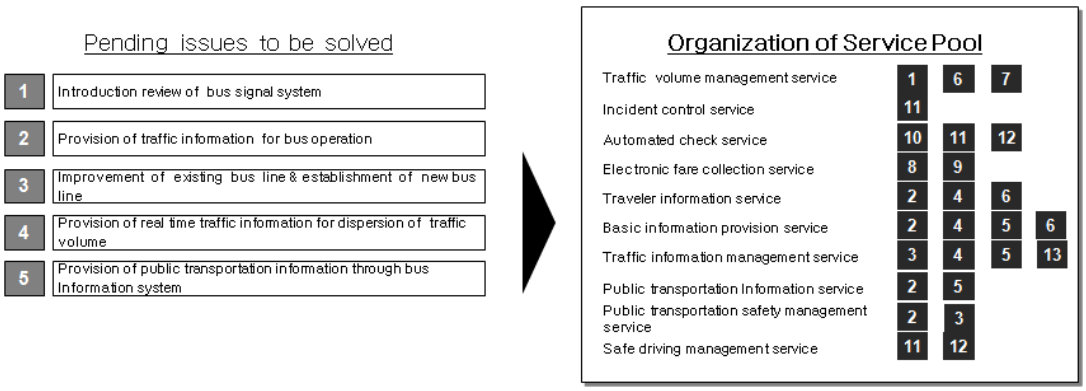
1) Service Selection Strategy subsequent to Analysis Method

In this paragraph, this research is going to take a look at service selection strategy followed by Top-Down & Bottom-Up method in "U-City Vision Establishment Model." The selection of service in Top-Down Approach can be viewed as a pattern identifying a service in service Pool.

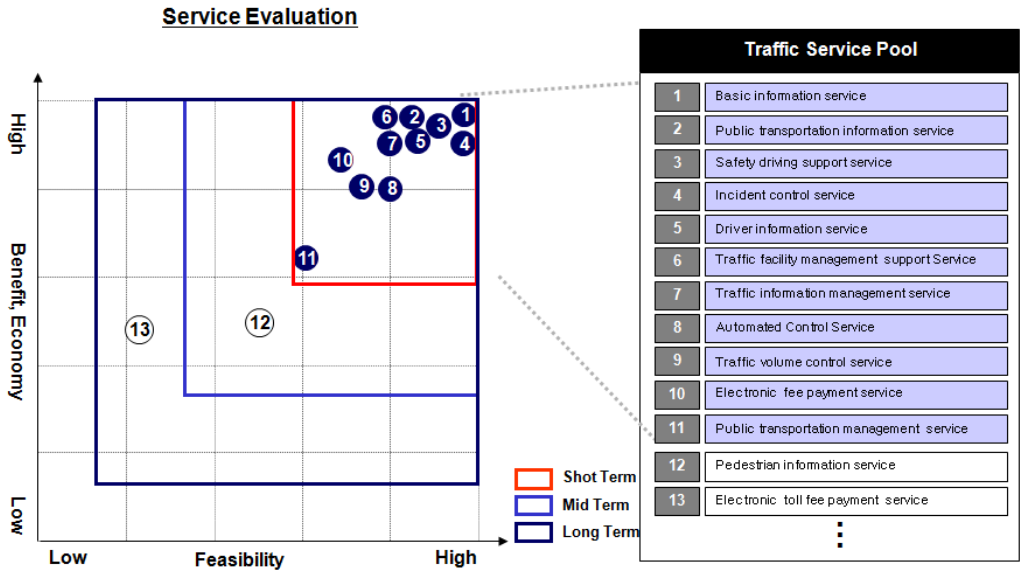
In short, as there exist problems and target



[Fig. 6] Identification of Target through Present Condition Analysis



[Fig. 7] Organization of Service Pool through Execution Projects

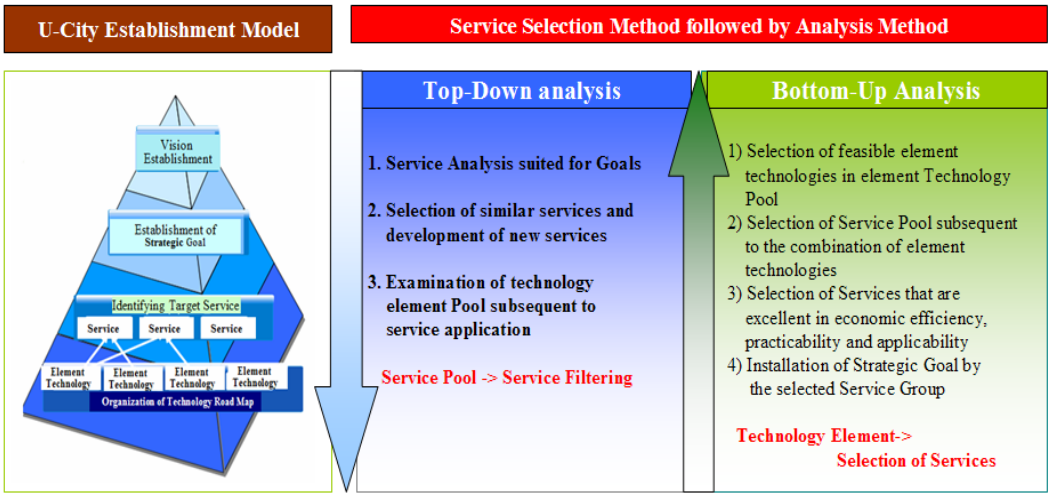


[Fig. 8] Service Selection Pool

points that should be ironed out in the stage of strategic goal establishment a prior stage to service selection, it will do if the most similar service is selected after analyzing the service suited for strategic goals or new necessary service is developed. The method of selecting services is to select the service in service pool for achieving goals. [Fig. 6-8]

Following figures shows an example of deriving objects through analysis of present condition and identifying ultimate services by organizing a service pool to reach objects[5].

5) Korea Land Corporation, A Study of Execution Strategy of Digital City in Yongin Hungduk, 2004.12.
Korea National Housing Corporation, Paju Unjung USP Final Report. 2006.6.
Korea Land Corporation, A Detailed Design Report of



[Fig. 9] Service Selection Method in U-City Vision Establishment Model

Among derived service pool, application services are selected through economic feasibility and technical effectiveness.

In contrast, in service selection in Bottom-Up Approach, feasible element technologies are selected in technology/service element pool, and after selecting the services that can be combined with the proper element technology and excellent services are selected by analyzing economic efficiency, practicability, and applicability, etc. In short, this is to select realistically applicable services by analyzing technology/service elements.

2) Selection Strategy of Element Technology subsequent to Analysis Method

Selection of element technologies to be applied to U-City is the most basic and extensive in its application field. Element technology is the one applied to intelligence of facilities installed in a city and it is possible as a unit technology as well, but it is a base unit consisting of service with the assembly of element technology units. CCTV technology/service used in crime prevention service, terminal used in the prevention of missing children, RFID technology, health information and measuring technique in U-Health belong to element technology/service. Even to selecting and applying such element technologies, Top-Down & Bottom-Up Approach are applied as well. [Fig. 9]

Selection of element technology/service in Top-Down Approach is identified by analyzing element technologies needed for U-services selected in the prior stage. The element technologies selected like this are not based on feasibility and economic efficiency, so there might be existed technologies that cannot be

Whasung Dongtan U-City, 2006.5.

<Table 1> Organization of Technology Pool

Source	Major technology catalogue	Major technology field pool
Global Hype Cycle	RFID, WiMAX, UWB, W-LAN, Mesh Network, VoIP	IPv6, MPLS, FTTH, MSPP, HomePNA, UWB, Zigbee, VoIP, Smart Card, Platform, Various sensing technology pool
U-IT 839	3 infrastructure : BcN, USN, soft infraware 8 services : WiBro, HSDPA/W-CDMA, U-Home, Telemetrics, RFID/USN application, broadband convergence service, DMB/DTV, IT service	
National R&D	Integrated platform, Various sensing technology	
New construction technology	New construction technology	

applied realistically except for a few cases.

Accordingly, it is necessary to examine feasibility and after drawing up the whole road map of the element technology selected to be used for service by the whole technology and then to divide it into the possible stage for establishment. In short, there exist a case where an element technology/service can realize all its desired goals at a time, but there also exist some technologies to be developed in the future, and some other technologies that could be actually applied immediately or in a few years in the category of technologies, so it is necessary to develop U-City by setting up establishment plan stage by stage.

The selection method of element technologies in Bottom-Up Approach lies in drawing up the catalogue of technologies which are coming to the front, and weeding out ones and the ones to be developed for the time to come by analyzing the present condition of all technologies including construction technology, and communications technology, etc.

Based on the technology catalogue drawn up like this, the method judges applicable technologies to cities and extracts technologically applicable element technologies within the given budget or project period.

<Table 1> shows a process of drawing technology catalogue to derive major technology pool. Based on promising technologies to affect IT field published by Gartner and etc. every year, IT839 strategy, and technologies to be developed through national R&D, major technology pool is derived.[6)]

In addition, this method analyzes project value, economic efficiency and scalability in a given technology/service catalogue by each technology/service, screens the element technologies that can display the maximum utility, makes technology/service pool so that it could be used in time of organizing services for the time to come.

6) IFEZ, Incheon(Song do) U-City Strategy Plan, 2005.

4. Summary & Conclusion

The method of constructing U-City is different case by case depending on every proper city's unique characteristics, and using methods are different according to the main entity in charge of development. If each city should try to proceed with the establishment of U-City on its own way, there could be no progress in the accumulation of know-how subsequent to the passage of time and methodology on technology /service, ending in an experimental pattern every time they try to establish U-City project. Moreover, the argument whether the establishment direction is appropriate or not will be aggravating as time goes by and bring about unfavorable problems related to time and economy.

Therefore, as for U-City vision & strategy and its performing method, it is desirable to find a solution more logically using the previously suggested Top-Down Approach and Bottom-Down Approach in this paper.

Generally, Top-Down Approach makes the presumption of the initial establishment expenses needed for U-City project and its completion period difficult. As a result, the people involved in the project make an attempt at staged establishment according to technology /service and feasibility.

Like this, Top-Down Approach requires several stages and time and moreover, the goal, strategy and service, etc. initially set up in time of city vision & strategy establishment are altered on every stage of embodiment; thus, there might happen a case where the initially designed project cannot be fulfilled in the final stage of establishment. Therefore, it is desirable to use this approach only when there are, determined vision, available time and favorable financial condition for the development of a new city or strategically targeted city.

It is recommended that Bottom-Up Approach should be used with budget and period already allotted for a city whose establishment purpose is clear. In this approach, every time element technology/service are selected, their economic efficiency and utility are evaluated by each stage, so it has an advantage of eradicating uncertainty over successful establishment of U-City. Nevertheless, in terms of the completion of establishment, this approach might have a weaker aspect in city vision or strategy than Top-Down Model.

However, Bottom-Up Model can have a merit of establishing the optimal U-City that can be achieved subject to given capital and time. Such an approach is being applied to U-Eco City R&D Project[7] conducted by U-Eco City Center, Korea Land Corporation.

This paper suggests two methodologies as to city vision & strategy establishment in "City Vision Establishment Model." There might be strong-points & shortcomings individually, but it is judged that what matters is not just to compare strong-points and shortcomings of these two methodologies but how to analyze

7) Korea Land Corporation , U-Eco City Center Detailed Planning Research Report, U-Eco City R&D Center, 2008.

the conditions suited for corresponding cities and to accurately follow the selected methodology. Therefore, the best way to establish U-City in pursuit of the most suitable methodology by identifying city environment and project conditions and to prevent confusion in the project progress is to use these two methodologies when in need.

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References

IFEZ, Incheon(Song do) U-City Strategy Plan, 2005.

Jeong, Keong-Seok and et al., A Study on the U-City Service Classification and the Standards of U-City Services, Korea Planners Association, 2008.

Jeong, Young-Heon, u-City Demand for the Solution of Urban Problem, Korea Planners Association, 2008.

Kim, Hee-Young, Lee Sang-Ho, U-City Demand from the New Urban Paradigm and Techniques, Korea Planners Association, 2008.

Kim, Junghoon and Cho, Chunman, Strategies for the Establishment of u-City Planning System in the Ubiquitous Computing Age, The Journal of GIS Association of Korea, Vol. 16, No.1, pp.129-155, April 2008.

Kim, Junghoon and Yi, Misook, A Study on Current Issues for the Realization of u-City, The Journal of GIS Association of Korea, Vol. 15, No.1, pp.1-14, April 2007.

Korea Land Corporation, Detailed Planning Research Report, U-Eco City Center, 2008.

Korea Land Corporation, U-City USP project report of Multi-functional Administrative City, 2007.

Korea Land Corporation, Methodology on the U-City Construction, 2007.

Korea Land Corporation, Detailed Design Report of Whasung Dongtan U-City, 2006.5.

Korea Land Corporation, A Study of Execution Strategy of Digital City in Yongin Hungduk, 2004.12.

Korea National Housing Corporation, Paju Unjung USP Final Report. 2006.6.

Kwon, Gu-hwang and Oh, Dong-Hoon, A study on Strategies for Developing U-Eco City Brand and Informing the Public, Korea Planners Association, 2008.

Lee, Sang-Ho and Youn, Taik-Leem, U-City Planning Characteristics, Korea Planners Association, 2007.

Lee, Sang-Hun and et al., Research on Establishment of U-City Standard Model and Standard of Analysis of Project Value, Land & Urban Institute, Korea Land Corporation, 2007.

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게재확정일 (2009년 4월 24일)