

# **A Ubiquitous Service Model for Realization of Sustainable Capacity Development with Spatial Asset Mapping**

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**Keywords:** Sustainable Capacity Development, Ubiquitous Service Model, Spatial Asset Mapping,

## **SUMMARY**

A significant perspective of capacity development (CD) is one of emerging issues in international societies, but still remain in conceptual schemes in sustainable development. The main reason might be hinged on the unclear concept of CD that could not directly illuminate practical motivations and movements of agent's goals and objectives. Even more, An explication of sustainable capacity development (SCD) might be seriously required for national economic growth and balance of regional development, but just come to research arenas without sufficient preparation of CD's diffusions. A ubiquitous service based on ICT could play a major role in increases of an agent's capacity that is enormously effected by network businesses and services. A ubiquitous computing and IT (U-IT) immensely leads to the geographic change of economic development and has an effect on spatial asset mapping. A generic ubiquitous service model shows the way for discourse of an agent's capacity associated with ownerships and uses of assets, capitals and resources in value network business.

This study not only expounds the clues of SCD in the context of spatial asset mapping, but also illustrates the necessity of ubiquitous service in connection with ubiquitous IT. The relationships between spatial asset mapping and ubiquitous service are unexplored and expect to the dynamics of sustainable asset business services. It also explicates the convergences of CD, service and IT into SCD that could lead to unexpected outcomes of organizational agent's capacities. The most importance of key factors are to create ubiquitous service model linking to indicators of capacity development in sustainable manners. A research result could be applicable to community capacity building, city capacity development, and international organizations.

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## **1. INTRODUCTION**

The UN Millenium Development Goals (MDGs) establishes international yardsticks to guide a frmework for measuring development process to which the world nations and societies have committed. Achievements of the MDGs require a policy framework, practical targets and indicators, and an enabling institutional and organizational environment that have some sorts of capacities.

Several sustainability challenges of the Earth that we are now facing stem from poverty, hunger, illiteracy, gender inequality, child mortality, maternal health, HIV/AIDS, and environmental degradation. To wrestle with these problems, an appropriate method for measuring capacity building or improving capacity development (CD) through sustainable ICT has national or global intentions and awarenesses in ubiquitous society. Although a number of exisiting international reports and documents has explicated effects and impacts between ICT and sustainable development (SD), there might be still desired rooms for an effective model and method coping with issues of CD.

This paper elucidates how u-IT could have an effect on SD leading to ubiquitous sustainable urban system. As sustainable capacity enablers, a ubiquitous service model based on service-oriented architecture is newly designed for integrated and intelligent way of service clients. As an innovative business model in the ubiquitous era, sustainable business service is proposed to boost Business-based and u-IT based services impacting on sustainability management and asset's (capital, resource) capacity.

To expound u-IT contributions to sustainable urban system, sustainable capacity development is considered as a major enabler to achieve eight goals of MDG and to boost e-Biz and m-Biz in ubiquitous sustainable city. As a proof-of-concept for sustainable capacity development, spatial asset mapping is used to portray u-IT services to measure quality and quantity of assets that could determine individual, organizational and societal capacity. In particular, mobile RFID/USN provides enormous efftiveness and efficiency to track asset's transfer and enables

us to elucidate the pathway of economic, environmental and social capacities and geographical dominances.

## **2. RELATED WORK**

A wide issue of sustainable development has focused on functions and roles of ICT (Willard and Halder, 2003; Alakeson et al., 2003; InfoDev, 2003; Digital Europe, 2003; Stork, 2007) that has an enabler for one of goal of MDGs (UNDP, 2003; ITU, 2003; UNIFM/UNDP, 2004; UN, 2006) in association with capacity building and sustainable capacity development (UNDP, 2006; Liou, 2007). With the advent of ubiquitous computing and society, ubiquitous IT enables people, NGO, government and international organizations to overcome sustainable challenge and improve their capacities as a new enhancer in sustainable development.

Although there are many researches on ubiquitous society (NIA, 2006) and its service model (Nagumo, 2002; NIA, 2004a, 2004b, Antoniac, 2005), u-IT for sustainable development (NIA, 2007) and sustainable business service (Enquist, 2007; Zetterberg, 2007), any attempts to definition of ubiquitous service model for sustainable capacity development does not exist in sustainable manners. As a tool for u-IT services, spatial asset mapping is used for integrated way of service, u-IT and CD into sustainable capacity.

## **3. UBIQUITOUS IT'S ROLES FOR SUSTAINABLE DEVELOPMENT**

Many diverse urban and regional problems emanating from conflicts between economic and social developments and environmental conservations would bring about serious side-effects of industrialization and urbanization. We are now facing several sustainability challenges of the Earth associated with poverty, hunger, illiteracy, gender inequality, child mortality, maternal health, HIV/AIDS, environmental degradation, and lacks of partnership for development that are core issues of the UN Millennium Development Goals (UN, 2006).

These issues would make goals of sustainable development disappointed and are gradually aggravated by climate change, deforestation, natural disasters, and trade conflicts. In fact, most disadvantages of our circumstances of living environment must have been based on unawareness of resource overuses and licentious consumption of assets and capitals. Fig. 1 illustrates most significant risks and perils that international organizations and national societies should take into account countermeasures and preparations for not only polar ice

meltdowns and temperature increase of in the atmosphere, but also urban slum, shortage of natural resources and humman vulnerability.

To analyze and alleviate urban symptoms and shadows in the congtext of sustainable development, modern tools and methods have been used for scrutiny of MDGs. The most effective solution may be hinged on sustainable livelihood (DFID, 2001), community capacity building (Liou, 2004), spatial asset mapping (Liou, 2007), and capacity building for environment (UNEP & IISD, 2000), and ICT for sustainable development (InfoDev, 2003; Tongia et al., 2005; UNDP, 2003).

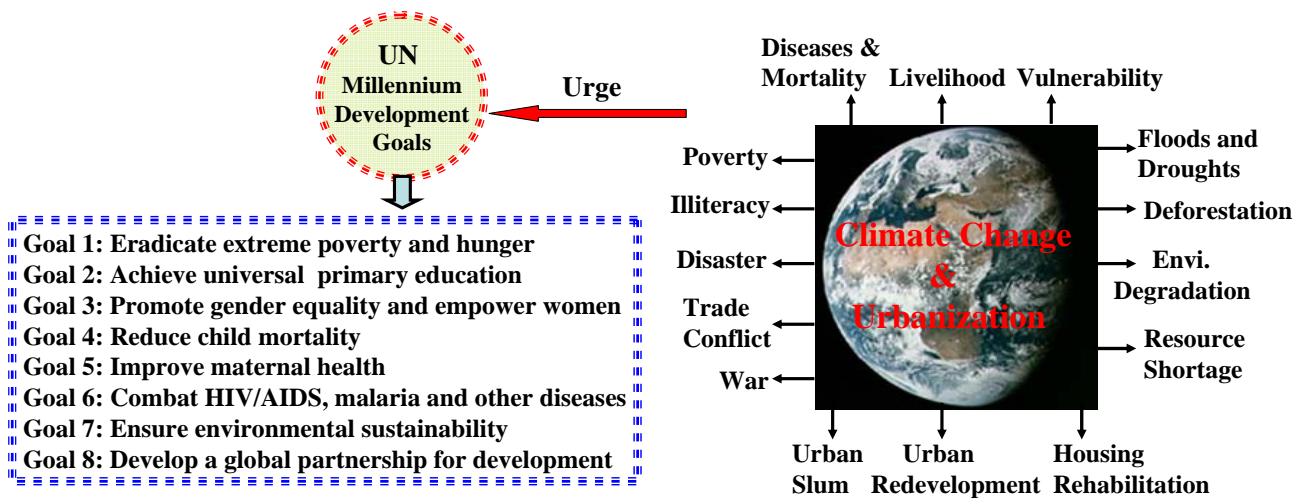


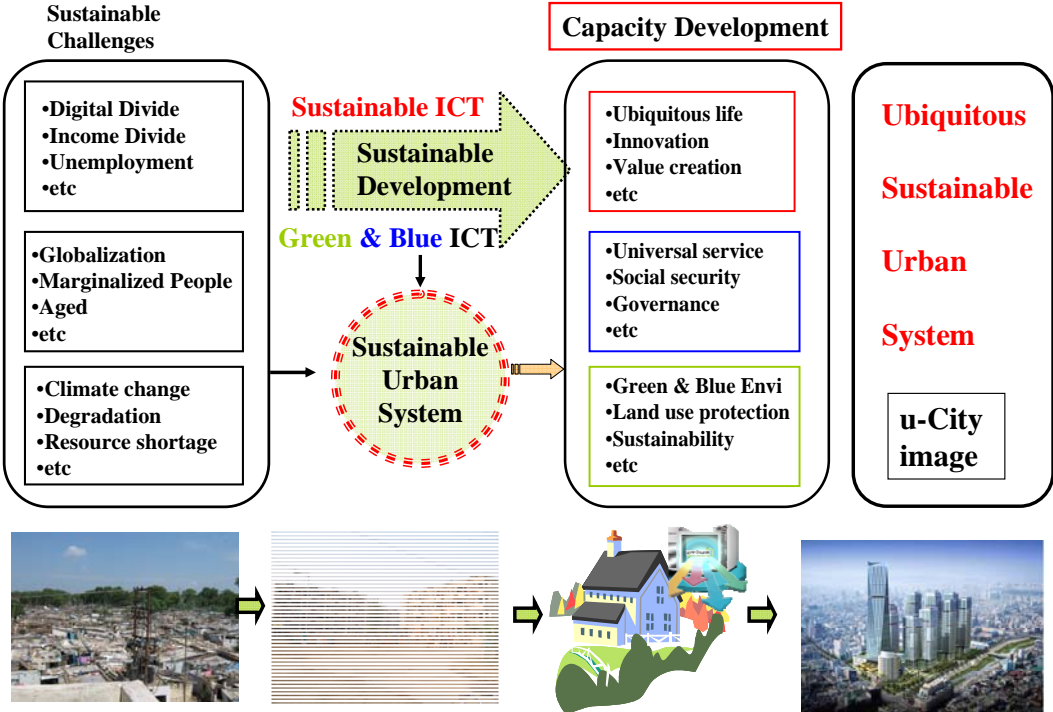
Fig. 1 Sustainable challenges of the Earth

Although there have been diverse verifications of the ICT's roles that have impacts on economic business, environmental protection and social benefits, the relationships and interactions between ICT and sustainability might have not a dominant model or framework. This means that issues of sustainable development are so complex matters that ICT could not cope with unpredictable sustainability challenges.

From the perspectives of sustainability, most developing nations are facing the challenge of the Digital Divide, marginalized circumstances, environmental pollution and land degradation, and threats of climate changes that could stem from lacks of awarenesses for sustainable urban system. There are growing proofs of the role that sustainable ICT (or Green ICT) play major roles in monitoring and evaluation of sustainable system leading to ubiquitous life, new value creation, univerial information services to green and blue environment.

Meanwhile, ICT has positive and negative characteristics that are not in themselves a force for sustainable development. But, it provides an enabler of development and an enhancer of capacity development (UNDP, 2003) for sustainable urban system through the Internet at the individual, organizational and societal levels. Despite enabling potentials and capacities of ICT, conventional industries and economic systems could hardly accept the concept of sustainable ICT due to the additional burdens for electronic products and items such as computers, chips, routers, optical fibers, switchers etc.

With the rapid innovation and development of mobile phone's uses and wireless Internet, ubiquitous computing makes it possible to more effectively and easily monitor and evaluate the process of sustainable urbanization and land managements.



**Fig. 2** Ubiquitous IT for Sustainable Development

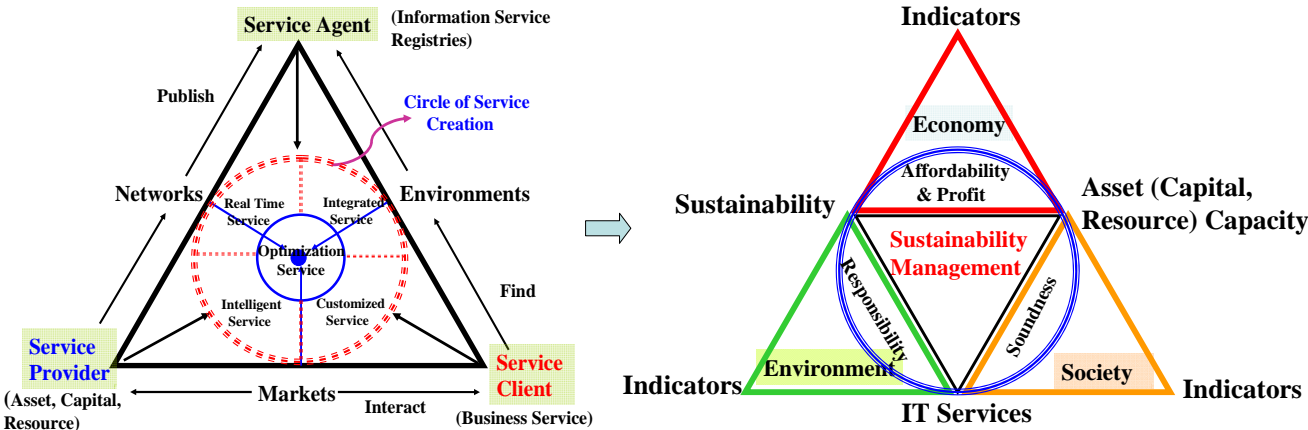
Fig. 2 shows a conceptual model for the process of sustainable urban system from urban slum and urban rehabilitation to smart village within the context of smart city or ubiquitous city (u-City). There are, of course, several hierarchies of sub-models in each system in the course of u-sustainable planning and construction. The major point of u-City makes us to efficiently monitor and analyze symptoms and shadows of urbanization through ubiquitous IT (Ipv6,

RFID/USN, etc) and devices (Wireless Internet, PDA, Mobile, etc). As one of the different MDGs, this u-IT more intelligently supports the delivery of education, health care, security and safety, traffic information that are accessible and accountable to the people.

**4. A UBIQUITOUS SERVICE MODEL IN UBIQUITOUS LIFE**

Business use of ICT aims to raise productivity and create new values boosting economic development. The availability of u-IT in business has also social responsibilities (ITU, 2003) and ecological services. In terms of IT services, they have mostly hinged on e-business and will involve with mobile-business (m-Biz) or ubiquitous-business (u-Biz) though u-IT. Mobile services have been considered as significant landmarks for daily life and basic businesses service in South Korea. Furthermore, u-IT services are applying to some cities and central business streets regarded as u-Town and u-Street. Some nations such as Finland and Denmark would consider this buzzword as a part of smart cities with ubiquitous service. There are, however, very little efforts to elucidate the terms of u-business or u-service model. Several ubiquitous computing devices and networks are used to enrich u-business and quality of u-Life.

From the perspectives of service-oriented architecture (Endrei et al., 2004), it could enhance a ubiquitous service model linking to sustainable business. There might be few attempts to integrate different contents and issues from u-service and sustainable business service. Based on service-oriented concept, a u-service model is hinged on service agent, service provider and service client that ubiquitous business environment has several characteristics consisting in personalization, mobility, intelligence, etc.



**Fig. 3 A** ubiquitous service model

Fig. 3 shows the collaboration in service-oriented architecture. The collaboration follows “find, publish and interact” principle where a service client performs dynamic service location by querying service registries for a service. Service provider has a ubiquitous network that executes client’s requests and interact marketing dealers whether assets, capitals and resources could be bargained in markets. Service agent is the enabler for service discovery about assets. In addition, each business in service-oriented architecture needs considerations for internal and external situations of finance, market and network performance that could lead to optimization service such as intelligence, customermization, real time and integration. In order to explicate the way of IT services for capacity of assets, capitals and resources in sustainable business (Zetterberg, 2007; Enquist, 2007), the concept of sustainability management is used to describe sound business, responsible enterprise for public benefits, and economic affordability for customers.

A sustainable business is a successful and profitable business that takes sustainable approach to commercial production, business process of marketing and customer’s participations. This aims to improve business productivity, soundness and responsibility by taking action on the economic, social and environmental impacts of ubiquitous business and IT services.

## **5. UBIQUITOUS IT SERVICES FOR SUSTAINABLE URBAN SYSTEM IN U-CITY**

The impacts of telecoms and IT access on rural livelihoods, urban economy, universal service to education and health, and environmental sustainability are definitive the 8th goal of MDGs. There might be, however, serious questions and doubts as to how ubiquitous IT services could improve the empowerment of three bottom line towards sustainable society.

Fig. 4 illustrates that u-IT begins with considerations of marginalized people who are in poverty traps and show them to get out of poverty through the Internet and mobile phones. In addition, it enables them to access to educational informations to maintain their healths and gender quality as well as environmental protection as a sustainable enabler. In fact, sustainable capacity development is defined as sustainable capacity for agent’s ability to perform their functions, ensure better quality of life and, achieve capacity development through sustainable use of assets, capitals and resources. However, there were before little descriptions how digital assets (capitals and respruces) could play a significant role in sustainability empowerment.

In general, 6 assets are considered as sustainable capacity enablers based on sustainable business and u-IT approach. U-IT based assets such as devices, platforms, and service S/W etc have an effects on quality of mobile life (Holmquist et al., 2007), and creation of new service values and markets towards global societies. As a digital asset, mobile RFID (Radio Frequency Identification) /USN (Ubiquitous Sensor Network) is regarded as a major key for u-Town and u-City which u-Life and u-Society are associated with urban information about quality and quantity of safety, transportation, healthcare, land management, facility management, etc. In the current stage of e-business, this refers to the use of ICT to facilitates business processes and to communicate with government, organizations, providers and clients or to buy and sell goods and services through the Web (e-commerce) in most countries (Digital Europe, 2003).

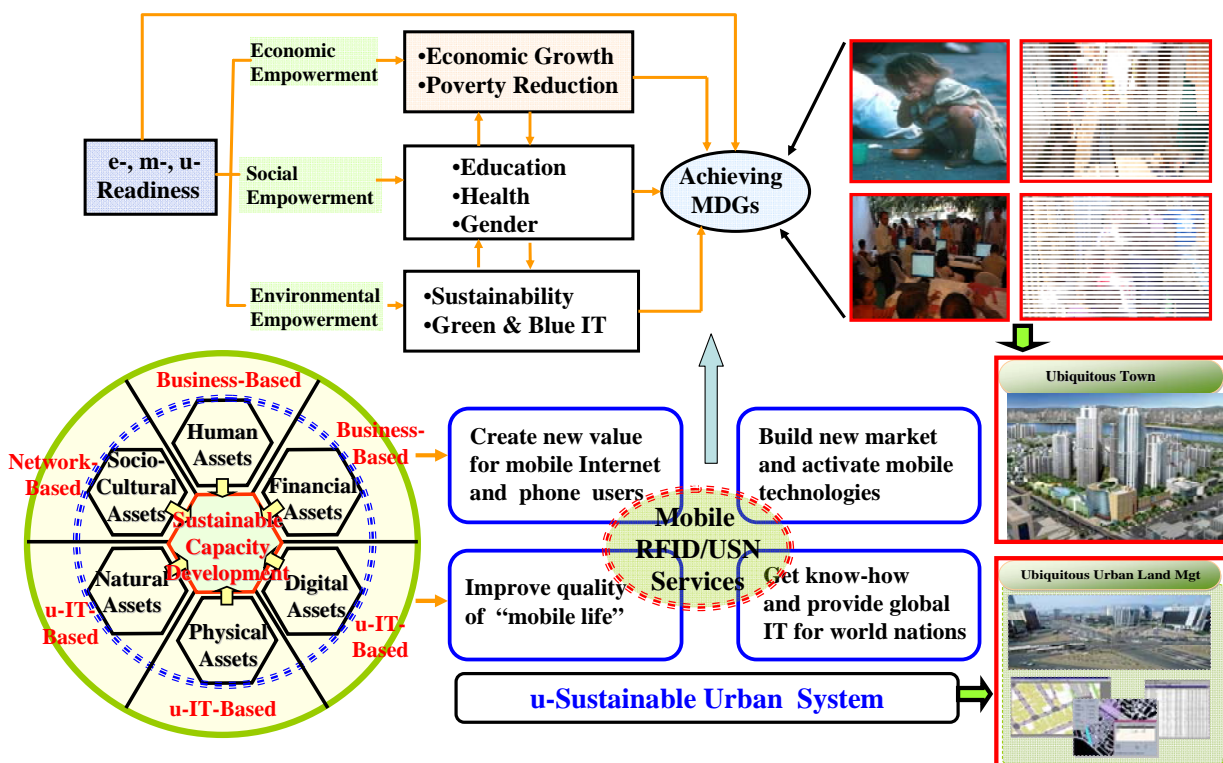


Fig.4. u-IT for sustainable urban system

Due to the lacks of mobility, personalization and real-time service in e-business, an overall framework for ebusiness transformation should be required for client-oriented satisfactions and transactions. M-business and u-business could enhance existing ebusiness functions and applications, and create new patterns of doing electronic transactions with which fixed line



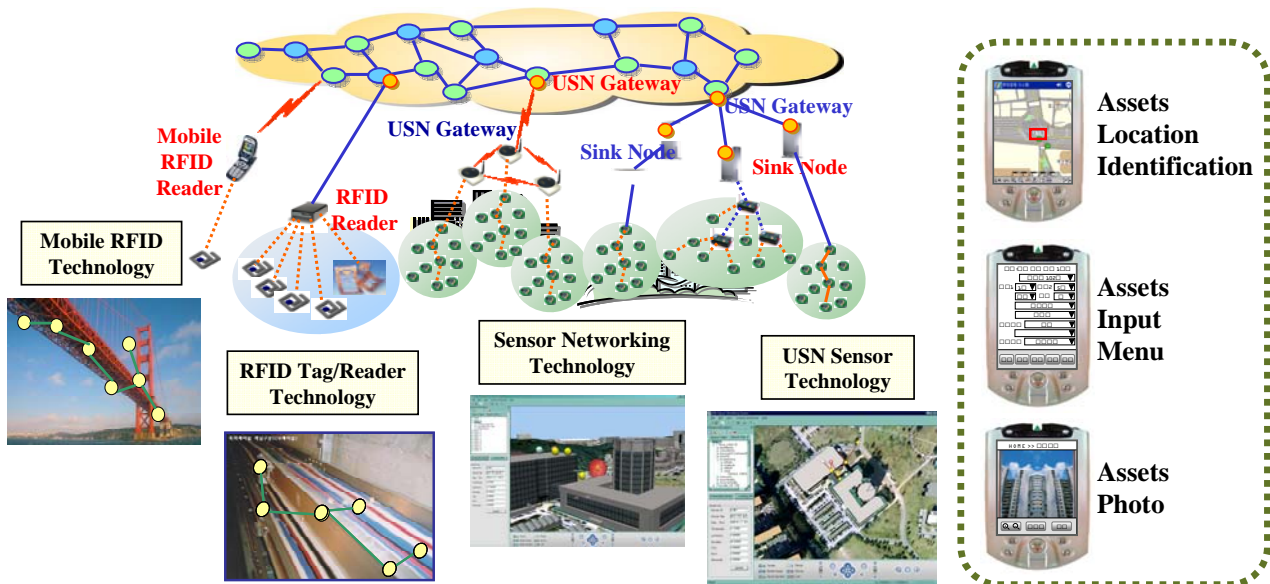
ebusiness is associated. With regard to mobile RFID/USN services in Korea and Western Europe, they are not yet prevail in u-Life, but several services come to the markets that are composed of u-Shopping & Entertainment, u-Transportation, u-Healthcare and u-Logistics.

## **6. IMPLEMENTATION OF SCD WITH UBIQUITOUS SPATIAL ASSET MAPPING**

When discussing wireless internet and mobile or ubiquitous services, it is crucial to recognize demands of clients and contribution of market values to people and society within the concept of sustainability management. Most of people, organizations and societies are seriously concerned about return on investment and IT service benefits, and even their digital capacity to improve quality of life style. One of most attractive advantage of mobile and ubiquitous services is the mobility-related opportunities for new value creation and findings of assets, capitals and resources.

The mobility arises from accessing information about people and interests on assets, and economical and social capacity of business boundary. The mobility of information could be split in two categories, applications and services (Antoniac, 2005) based on their support for mobility and the location of the things' informations. This means that location-based services are basic factors to notify status quo of spatial assets that could ofent impact on people and organizational capacity.

To deal with the mechanisms between sustainable capacity development and spatial asset mapping, physical, financial and natural assets (real estate, infrastructure, facility, etc) are required to visualize their status quo and locational landmark that are linked to national asset registers. Many technological breakthroughs have been put forward to make it easier to facilitate asset management through RFID/USN, IPv6 and wireless Internet.



**Fig. 5** Spatial asset mapping for sustainable capacity development in u-City

In the meantime, static assets provide a crucial challenge for management wrestling with their location, condition and integrity that would often influence value of future capacity. Mobile assets have an added level of management mobility from production of raw materials to merchandization of finished goods. In the course of asset's capacity change, mobile device makes easy to update information for a large numbers of spatial assets over a wide area in u-City. Mobile RFID/USN is, today's, not only spotlighted in delivery of goods, quality management of infrastructure and facility, and retail industries in economic sustainability, but also highlighted in monitoring and evaluation of water and air pollution in environmental sustainability. Spatial asset mapping plays an important role in visualization of social asset's locations and their attributes associated with networks, commercial value, and partnerships in social sustainability.

## 7. CONCLUSION

While facing serious problems of sustainability in nations and world societies, there are several alternatives to tackle challenges of sustainable development. As an enabler of sustainable capacity, u-IT provides the best solutions for alleviations of stubborn adversities and anguishes with which human have been faced. Upcoming ubiquitous computing and its services guide us to look for integrated and intelligent way of life in ubiquitous sustainable urban system.

The paper not only describes the characteristics of a ubiquitous service model and sustainable business service based on service-oriented architecture, but also proposes concrete evidences of achievements of MDGs within the context of sustainable development. Mobile RFID/ USN as an IT service are used to get out of poverty trap and overcome diseases, and support IT education and healthcare that might be a part of the purpose of sustainable capacity development.

To put the concept of CD and SD into SCD, u-spatial asset mapping is designed to estimate the quality and amenity of SD and the extent of CD when assets (capaital, resources) are considered as the primary of SD indicators.

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