A Paradigm Shift in City Management Practices Targets the Sustainable Society

ONODA Yuji

Abstract

In Japan, which is faced with an aging society ahead of the rest of the world, achieving a sustainable society by overcoming the shortage of social security resources in the future is the biggest challenge. The country now needs to review city management practices that have continued to be used since the high growth period by aiming to bring about a transformation. This will be a radical paradigm shift from the former hard infrastructure (the type of social infrastructure composed of concrete), to the flexible and adaptable infrastructure (one that focuses on the utilization of data). In order to advance such a transformation, the application of digital measures will not in itself be enough. It will also be required to achieve a regional co-creation policy that sounds more like analog measures. Japan, as forerunner of finding answers to emerging issues, must succeed in creating social infrastructure via new concepts that are capable of resolving this hard-to-solve social issue. The results are then expected to contribute to worldwide improvements.

Keywords
city management, economic circulation model, data utilization platform, FIWARE, flexible and adaptable infrastructure, sustainability, regional co-creation

1. Introduction

By setting the Society 5.0 policy, the Japanese Government is promoting its international competitiveness through digital transformation. This is being prepared via legislation such as the Basic Act on the Advancement of Public and Private Sector Data Utilization in 2016 and the amendments to the Act on Protection of Personal Information in 2017. The Special Mission Committee on IT Strategy of the Liberal Democratic Party started to study data utilization platforms in 2016 and NEC joined positively in its proposed activities. As a result, the committee's proposed scheme entitled "Digital Nippon 2017" cited FIWARE, as a data utilization platform based on open architecture that would launch the dissemination of FIWARE within Japan. In Japan, as forerunner of finding answers to emerging issues, efforts aimed at data utilization are expected to function as an innovation prime mover.

2. A Paradigm Shift in City Creation

Each city has multiple issues that vary widely, depending on the region. These include traffic jams, food supply issues, disasters such as earthquakes and tsunamis, crime, child raising, society of health and longevity, international competitiveness and depopulation. Nevertheless, the issue that is commonly the most important for all cities is the implementation of a sustainable society.

Japan has already shifted from the growth period to the mature period. It is estimated that the population will decrease from about 120 million in 2018 to about 49 million in 2100. There is also an estimation that a half of the current local governments in Japan will risk disappearance by 2040. Japan, which leads the world in facing a super-aging society issue may also risk suffering a shortage of social security expenditure revenues.

The social infrastructure needs therefore to impose a radical paradigm shift. Moving from the former hard infrastructures composed of concrete that were applied in the high growth period to the flexible and adaptable infrastructures based on an increased utilization of data (**Fig. 1**).

For example, instead of building a library for the rental of books, it would be possible to examine if the total cost can be reduced by converting the old way into a new

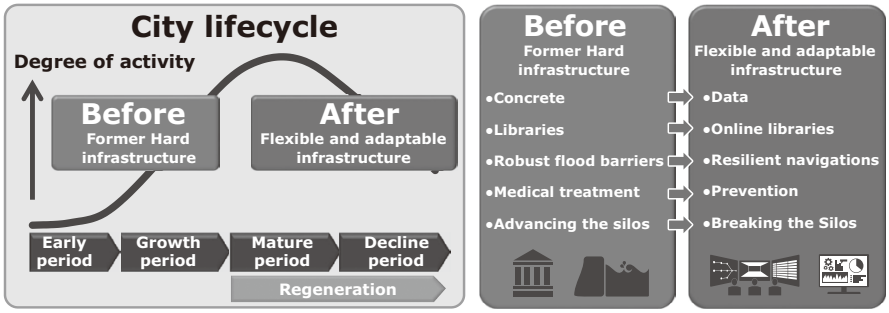

Fig. 1 A paradigm shift in social infrastructures.

way such as an online library based on data utilization. An increase in the height of robust flood barriers may be proposed as a protection measure against tsunami damage, by averting the possibility that waves of an unexpected height will pass over them. In such a case it is worth examining if this practice might be replaced by the addition of a data utilization measure that could provide better communications for citizens, such as a resilient disaster-prevention navigation service capable of flexibly transmitting information, even in the case of an unexpected event. In addition, as medical and nursing care expenses increase, it would be useful to examine whether total social security expenses can be reduced by shifting the ratio of cost from medical treatment to prevention. For such a purpose, a means of communication that utilizes personal data is useful. Instead of advancing individual fields, overall optimization should be aimed at that makes use of mutual linkages among the different fields. Discussions such the above will be essential in implementing a sustainable society in the future.

3. Creating a Flexible and Adaptable Infrastructure Based on Data Utilization

3.1 Economic circulation model

The objective of a flexible and adaptable infrastructure is the creation of a sustainable city. As this involves a large number of complex factors, the present section discusses them by associating them in the context of an economic circulation model (**Fig. 2**).

A sustainable city needs a continuous supply of financial resources. If these are insufficient, the social infrastructure cannot be maintained and the increased insecurity and inconvenience will lead to population outflow. The result is a vicious circle with increasing shortages of the requisite financial resources. Depopulation also affects consumption and results in industrial decline. The

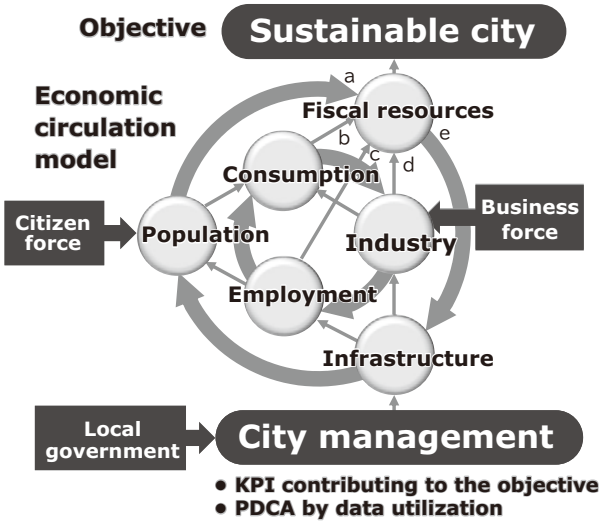

Fig. 2 Economic circulation model - Toward a sustainable city.

decline of industries inevitably reduces regional employment levels, which affects the incomes of the inhabitants and a vicious circle is again produced. Thereby reducing the consumption levels even further because of the need to conserve funds for the provision of daily life support.

3.2 Sustainable city management

In order to implement a sustainable city, the economic circulation model consisting of such double loops should be changed in a favorable direction by means of a suitable trigger. Such a trigger can be generated by means of city managements that apply changes directly to their social infrastructures and thus exert indirect influences on the various factors composing them. Just as by the fact that private enterprises have survived for many years using management systems based on data processing. Cities should also perform appropriate management practices, so that they can survive by promoting innovations according to environmental changes.

Specifically, cities set the Key Goal Indicators (KGIs) and Key Performance Indicators (KPIs) that will contribute to the achievement of targets and turn the Plan-Do-Check Act (PDCA) cycle. The means for achieving the targets consist of multiple candidates, and it is also important to review policies if the effect does not appear by hypotheses verifications based on data. The Administrative Reform Promotion Office of the Japanese Government is promoting the Evidence Based Policy Making (EBPM), by which data utilization is presupposed. Attempts have also been started to perform a correlation analysis using AI to see what kinds of measures exert what influences on each factor of the economic circulation model. Subsequently, the budget allocated to each element of social infrastructure (flow e in Fig. 2) can be reviewed according to environmental changes.

Such city management practices indispensably need multifaceted data utilizations. They cannot be started effectively without suitable data inputs (**Fig. 3**).

3.3 Organization of the new ecosystems

Innovation is also necessary for the parties providing public services. Hitherto, public services have been provided under the leadership of local governments. However, advanced cities worldwide have now begun to organize new administrative ecosystems under governmental / private sector collaborations. Places of regional co-creation are formed to promote innovations by the participation of local enterprises, universities and NPOs. Each service is not continually used in the same manner once it has been created, but is subjected to repeated evolutions in order to improve its usability. New industries are created in order to stimulate the economy via this process. The local participants involved in this process are motivated by self-realization and give to society so long as the economic circulation model operates favorably. To prepare such a situation, data should be opened and the API should be disclosed so that the API usage can be established economically (Fig. 3).

3.4 Enhanced engagement of citizens

The engagement of citizens should also be encouraged. Based on the concept of citizen-centrism, services should be transformed to improve their usability as typically represented in the one-stop governmental services. Development of services should be conscious of the need to shift from the consumption of material things to the consumption of experience.

On the other hand, it is also effective to prepare a mechanism for collecting citizens' opinions. Transformation into a sustainable city will be accompanied by painful events. The dilapidation of constructions such as bridges etc. will require the allocation of a huge amount of tax. However, if dilapidation countermeasures are not pursued and the bridges are blocked, inconvenience is likely to increase. What is essential is to adopt a convincing solution based on suitable data such as frequency of use and to hold bi-directional communications that are capable of forming a consensus for modifying the allocation of social infrastructure budgets (Fig. 3).

3.5 Cross-domain data utilization

Data utilization platforms are indispensable for promoting efforts to achieve the measures mentioned above. Furthermore, in addition to using open data, it is essential to utilize cross-domain data. FIWARE that was developed in Europe by the Future Internet Public-Private Partnership (FI-PPP) and was subsequently disseminated worldwide is optimum for such purposes. However, since it is not easy to alter those traditional local government systems that have been optimized per

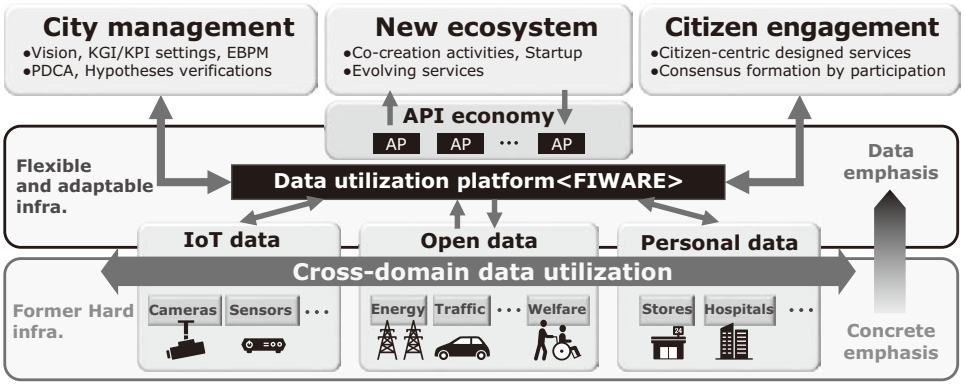

Fig. 3 Image of a flexible and adaptable infrastructure.

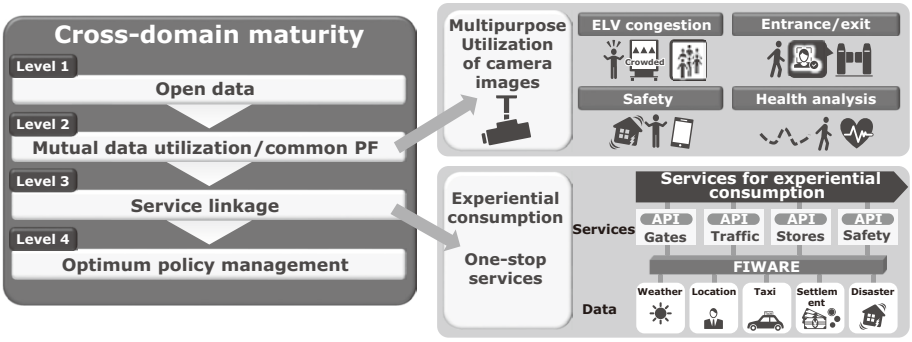

Fig. 4 Degrees of cross-domain system maturity.

domain, into a form of cross-domain systems, it will be required to increase the degree of maturity step by step (**Fig. 4**).

In the first step, the local government information is turned into open data to improve the operation efficiency. Second, a common platform should be adopted to enable mutual data utilizations between different domains and to make this the ground for the operation reform to come. For example, a single camera image offers utilization potential in multiple domains. Such as in the security management of an entrance gate, identification of health conditions and safety confirmation in the case of a disaster. Finally, individual services should be connected for value creation from the viewpoints of users such as in the implementation of one-stop services. In addition to improvements in individual services, city managements should also be based on data, so as to achieve an overall optimization of policies.

3.6 Monetization of cities

As discussed above, continuous financial resources are necessary for effective city operations. If city managements can bring about changes to the factors offered by the economic circulation model (Fig. 2), money flow from beneficiaries can also be expected. (a) to (d) below corresponds to those in Fig. 2.

Improvements in the population situation (daytime and nighttime populations) leads to; (a) increase in the resident taxes and donations (including resident tax deductible donations from non-residents). Improvements in the consumption and investment leads to; (b) increases in the consumption tax, income tax (separate tax associated with real estate, financing, etc.) and fixed assets taxes. Improvements in employment leads to; (c) increases in income taxes (comprehensive taxes on salaries, etc.). Improvements in industries lead to; (d) increases in corporate taxes, donations and advertising expenses. In addition, other funding mechanisms are beginning to be employed, including; (d) BID (Business Improvement District) into which the landowners who could be beneficiaries can invest; (b) SIB (Social Impact Bond) with which funds from the private sector are engaged and paid according to achievements, and; (b) crowd funding by which citizens contribute.

It is naturally not an easy task to improve the flow of funds immediately. However, we believe that it is important to engage in trial and error in a way tailored to each individual region and that these attempts will bring about good economic circulation.

4. Regional Co-creation for Continuous Operations

Simply implementing digital technologies based on a city's data utilization platforms will not advance the Paradigm shift. Regional co-creation where human behavior is the driving force, that is, activities regarded as analog measures is also necessary.

At NEC, we started our Future City Development Division in April 2017, and organized "sandboxes" matching the circumstances of individual regions to practice regional co-creation. Various techniques are employed via this approach, such as holding co-creation workshops, running city creation conferences, concluding comprehensive collaboration agreements, establishing Destination Management Organization (DMOs) and investing into special-purpose companies. What is common to any of these is that, instead of acting as a vendor of ICT systems, we organize ecosystems composed of different business types in each region for continuing deliberations on the solution of issues. Deliberations are advanced by repeating trial and error e exercises and by adopting an effective Deliberations are advanced by repeating trial and error e exercises and by adopting an effective design thinking approach. The large variety of participants means that new ideas may easily be born, but it is not

Photo A scene in a co-creation workshop
(Takamatsu City, Kagawa Pref. Japan).

rare that the large range of cultural differences or positions tend to easily cause collisions. As this has posed questions regarding facilitation capabilities, we are currently working hard on resolving this point (**Photo**).

5. Conclusion

In the above we set forth a grand targeted vision, but in actual fact the challenge has just begun and we cannot yet say that important results have already been achieved. We have long been contributing to city creation by building ICT systems, but the activity contributing to city management procedures discussed here is a new experience that poses a wide range of issues. We are determined to overcome each and every issue and advance our efforts step by step by means of pursuing hypothesis verifications in the various domains.

Japan, as forerunner of finding answers to emerging issues, must succeed in creating social infrastructure via new concepts that are capable of resolving this hard-to-solve social issue. When the super aging society eventually arrives in the world, these solutions are then expected to contribute to worldwide improvements.

Authors' Profiles

ONODA Yuji
General Manager
Future City Development Division

The details about this paper can be seen at the following.

Related URL:

Society 5.0
http://www8.cao.go.jp/cstp/english/society5_0/index.html

Information about the NEC Technical Journal

Thank you for reading the paper.
If you are interested in the NEC Technical Journal, you can also read other papers on our website.

Link to NEC Technical Journal website

Japanese English

Vol.13 No.1 Sustainable Data-driven City Management

Vol.13 No.1
November 2018

Special Issue TOP