City Evaluation Index Standards and their Use Cases

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Abstract

One of the critical goals of city management is to improve a city's values while achieving sustainable growth. In order to improve a city's values an objective evaluation for identifying its current status is required. Several international standardization organizations have therefore developed evaluation indices from various viewpoints. This paper introduces some city evaluation index standards and their actual use cases and discusses how NEC's smart city products can contribute to city values improvements from the viewpoint of city evaluation index standards.

Keywords

City evaluation index, international standards, ITU-T, ISO, SDGs, safety

1. Introduction

One of the critical goals of city management is to improve a city's values while achieving sustainable growth. An objective evaluation for identifying current status is required in order to assess a city's values. Since fairness is required for such evaluations, the use of evaluation indices set by a public institution is desirable. Moreover, applying a single set of evaluation indices will enable comparison of evaluation results among cities. Based on the background situation described above, objective and universally usable city evaluation indices have been standardized by various international standards organizations.

This paper introduces some internationally agreed city evaluation indices and their actual use cases. It also examines how NEC's smart city products can contribute to city values improvements from the viewpoint of city evaluation index standards.

2. City Evaluation Index Standards

City evaluation index standards are being developed by public standards organizations that include: the International Telecommunication Union (ITU), International Organization for Standardization (ISO) and ISO/IEC JTC1 (ISO/IEC Joint Technical Committee 1). The United Nations has also approved the indices of the degree of achievement of Sustainable Development Goals (SDGs). Below we introduce the city evaluation index standards that have already been published.

2.1 ITU-T Y.4900/L.1600 Series

At ITU, which is a United Nations specialized agency, standards related to city evaluation indices are being developed in the Telecommunications Standardization Sector (ITU-T). As shown in **Table 1**, four Key Performance Indicators (KPIs) have been published as ITU-T Recommendations. As the ITU-T is a standardization organization in the field of ICT, these indices focus on the introduction of ICT in cities. Other recommendations are also being developed regarding a maturity model of a city and its degree of open data utilization.

2.2 ISO 37120:2014

The ISO published international standard ISO 37120:2014 (Sustainable development of cities and communities - Indicators for city services and quality of life) in 2014. This standard was developed using unified indices with the objective of comparing and evaluating cities worldwide. It defines 100 indicators (46 core indicators and 54 supporting indicators) from the 17 themes shown in **Table 2**. For example, "Safety" specifies 5 indicators as shown in **Table 3**.

In addition to ISO 37210, the ISO also published standards related to the evaluation indices for community infrastructures. ISO 37153 (Smart community infrastructures – Maturity model for assessment and improvement) published in 2017 presents guidelines

Table 1 City evaluation indices defined in ITU-T Recommendations.

Recom. No.	Contents
Y.4900/L.1600	"Overview of KPIs in smart sustainable cities" The dimensions of KPIs are categorized as follows: ICT(4 sub-dimensions), Environmental sustainability (5 sub-dimensions), Productivity (9 sub-dimensions), Equity and social inclusion (4 sub-dimensions) and Physical infrastructures (11 sub-dimensions).
Y.4901/L.1601	"KPIs related to the use of ICT in smart sustainable cities" Defines the KPIs from the above dimensions that are used to evaluate performance related to the introduction of ICT.
Y.4902/L.1602	"KPIs related to the sustainability impacts of ICT in smart sustainable cities" Defines the KPIs from the above dimensions that are used to evaluate performance in terms of contributing to sustainability through the use of ICT.
Y.4903/L.1603	"KPIs for smart sustainable cities to assess the achievement of SDGs" Defines the dimensions as follows: Economy (14 indicators), Environment (19 indicators) and Society and culture (20 indicators), and specifies the corresponding SDG goals and targets for each of the indices.

Table 2 Seventeen themes of city evaluation indicators specified in international standard ISO 37120:2014 (The figures inside parentheses are the number of indicators.).

1. Economy (7)	7. Governance (6)	13. Telecommunications & Innovation (3)
2. Education (7)	8. Health (7)	14. Transportation (9)
3. Energy (7)	9. Recreation (2)	15. Urban Planning (4)
4. Environment (8)	10. Safety (5)	16. Wastewater (5)
5. Finance (4)	11. Shelter (3)	17. Water & Sanitation (7)
6. Fire & emergency response (6)	12. Solid waste (10)	

Table 3 Safety-related evaluation indicators defined in international standard ISO 37120:2014.

Core indicators	Supporting indicators
Number of police officers per 100,000 population	Crimes against property per 100,000 population
Number of homicides per 100,000 population	Response time for police department from initial call
	Violent crime rate per 100,000 population

for the continuing improvement of community infrastructures. It provides the indicators for assessing a community infrastructure from the three viewpoints of performance, process and interoperability and evaluates each of these in five steps to identify current issues and points to be improved. The indicators to be assessed are provided in ISO/TS 37151 (Smart community infrastructures – Principles and requirements for performance metrics).

2.3 Indicators for SDGs achievement

In September 2015, the United Nations General Assembly adopted General Assembly Resolution 70/1 "the 2030 Agenda for Sustainable Development," which defines the SDGs as the issues to be resolved in terms of human achievements by the year 2030. The SDGs consist of 17 goals and 169 targets to be achieved for them. The goals include those related to sustainable cities and communities (Goal 11: Sustainable Cities and Communities).

In July 2017, the United Nations General Assembly adopted General Assembly Resolution 71/313 on the work of the United Nations Statistical Commission that defines the methods of assessing the achievements of the goals and targets defined by the SDGs comprised of 232 indicators. As not much time has passed from the resolution so far, there is no case yet of a city applying these indicators as of May 2018. However, their use is expected to increase in the future.

3. Use Cases of City Evaluation Index Standards

Attempts of city evaluations applying the city evaluation index standards described in chapter 2 and publications of their results have been reported as detailed in the following sections.

3.1 Certification program of WCCD

The World Council on City Data (WCCD) has executed a program for the certification of international standard ISO 37120:2014 described in the above[1]. With this cer-

Table 4 Five certification levels defined by WCCD.

Certification level		Aspirational	Bronze	Silver	Gold	Platinum
Reported indicators		30~45	46~59	60~75	76~90	91~100
Details	Core indicators	30~45	46	46	46	46
	Supporting indicators	-	0~13	14~29	30~44	45~54
Certified cities		14 cities	None	None	14 cities	59 cities

tification system, a city reports the results of city evaluation based on ISO 37120:2014, a third party inspects them and the results are certified and published. As of May 2018, the results of evaluations of 55 cities worldwide are published on the WCCD website. As the evaluation results are based on unified indicators that are internationally standardized, comparison among different cities is possible. However, because some cities do not submit reports on all of the 100 indicators defined in ISO 37120:2014, an exhaustive comparison is not possible, so the ranking of cities is not provided.

In order to encourage cities to report on the evaluation results of more indicators, the WCCD performs certifications at five levels according to the number of indicators reported on the results of the evaluations. As shown in **Table 4**, 82 cities have been certified as of May 2018, and 59 among them are given the highest "Platinum" level.

No local government in Japan has yet published data or received certification at the WCCD, but it is expected that Japanese cities will soon be actively publishing their evaluation results and will receive WCCD certifications in the future.

3.2 Smart Cities Index system of India

India is known as a country that is positively inclined toward the promotion of smart cities and the government has announced a project of building smart cities in 100 of its domestic cities. The approach of this country consists of introducing unified city evaluation indices and of identifying the degree of progress of smart city building for each city that uses them. As the city evaluation indices are used exclusively inside India, they do not need to be internationally standardized. They can be designed in accordance with India's domestic properties and used in the evaluations. Research institutes including The Indian School of Business developed original indices and are evaluating domestic cities using them[2]. The index system was developed based on international index standard ISO 37120:2014 described above and by adding evaluation indicators specific to India. It is composed of six themes including Living, Economy, People, Governance, Mobility and Environment, and of 58 indicators. As of May 2018,

53 Indian cities have been evaluated and the results published, making it possible to identify the current status of each city and to recognize the issues.

3.3 Use of city evaluation indices in Dubai and Singapore

Dubai in the UAE is promoting a smart city project called "Smart Dubai" aiming at city management not relying on the oil. The city intends to ensure a sustainable growth through invitation of investments and creation of employment by arranging suitable social infrastructures. To achieve this goal, Dubai must announce its assessment of how smart it is. Dubai has executed an evaluation using the city evaluation indices defined by the ITU-T described above and has published its current status analysis stressing points to be improved in the future.

Singapore is also taking a similar approach to Dubai by promoting a smart city project under the slogan of "Smart Nation". Like Dubai, this city has also published evaluation results that define points to be improved. In the future, it is expected that more cities worldwide will attempt to promote their smartness to the world by publishing evaluation results obtained by applying city evaluation index standards.

As seen above, many cities worldwide are promoting their smartness via their efforts for enabling intercity comparisons using standardized city evaluation index systems and for enabling objective evaluations of their present situations and issues.

4. Application of City Evaluation Index Standards in Specific Themes

In chapter 3, we overviewed city evaluation index standards for the values of a whole city. The present chapter examines the application of city evaluation index standards to specific themes of interest and the identification of issues in each theme. Identifying issues and clarifying the ICT solutions for them can lead to further improvements in city values.

Let us for example consider the theme of "development of a safe, secure city". Among the city evaluation index standards described in chapter 2, examples of evaluation indicators related to this theme are shown in **Table 5**. Evaluating these indicators makes it possible to identify the current status of this field and to identify its issues. Cities where the development of a safe, secure community by introducing disaster and crime countermeasures are desirable for promoting improvement measures based on the indicators. In case more detailed analysis is needed in this theme, it is possible to utilize theme-specific index systems published in the private sector that

Table 5 Examples of evaluation indicators related to the development of safe and secure communities.

ITU-T Y.4900/L.1600 Series	ISO 37120:2014	SGDs indicators
L.1601 I4.3.1: Adoption of ICT for disaster management	Number of fire-related deaths per 100,000 population	1.5.1/11.5.1/13.1.1: Number of deaths, missing persons and persons directly affected by disaster per 100,000 people
L.1601 I4.3.2: Adoption of ICT based safety systems	Number of natural disaster related deaths per 100,000 population	1.5.4: Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies
L.1601 I6.8.1: Adoption of traffic monitoring using ICT	Response time for emergency response services from initial call	3.6.1: Death rate due to road traffic injuries
L.1603 C3.3.2: Average response time for emergency services	Number of homicides per 100,000 population	16.1.4: Proportion of the population that feel safe walking alone around the area in which they live
L.1603 A1.6.6: Proportion of major streets monitored by ICT	Response time for police department from initial call	
L.1603 A3.3.1: Natural-disaster-related deaths per 100,000 inhabitants	Violent crime rate per 100,000 population	

may be used in addition to standardized indicators. The Safe Cities Index 2017[3] is not an international standard, but introduces detailed safety-specific indicators.

The city evaluation index standards can also be used in examining the introduction of ICT solutions for solving the issues revealed by evaluations. For example, let us consider the comprehensive disaster prevention system built by NEC in the Toshima Ward, Tokyo, using the "Crowd behavior analysis technology[4]". This system detects abnormal situations in real time from live camera images obtained in the ward and enables early response measures for commuters unable to return home after a disaster as well as accident prevention in congested areas at normal times. The "Urban surveillance system[5]" in the Tigre City, Argentina introduced by NEC applies crime-prevention measures for detecting suspicious vehicles and generating crime incidence maps. These systems are expected to improve evaluation results of indicators in Table 5 and to contribute to the creation of safe and secure communities.

As seen in the above, the application of city evaluation index standards to a specific theme can identify the current status and any relevant issues. Additionally it also makes possible the selection of ICT solutions for the identified issues.

5. Conclusion

In the above, we introduced examples of city evalu-

ation index standards and described actual use cases. Approaches for enabling inter-city comparisons by using standardized city evaluation index systems and those for the objective appeal of a city's smartness are being conducted worldwide. We also examined how NEC's smart city products can contribute to city values improvements from the viewpoint of the city evaluation index standards.

Use of city evaluation index standards enables evaluation of the value of each city objectively and helps to identify the issues to be improved. At NEC, we are working to develop smart city solutions for such urban issues, and are thereby contributing our expertise to support city managements in promoting sustainable growth.

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Initiatives to revitalize regional economies by advancing *OMOTENASHI*
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City Evaluation Index Standards and their Use Cases

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Vol.13 No.1
November 2018

Special Issue TOP