



BSI Standards Publication

Smart city use case collection and analysis — Intelligent operations centre for smart cities

Part 1: High-level analysis

National foreword

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**Smart city use case collection and analysis – Intelligent operations centre for smart cities –
Part 1: High-level analysis**

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ELECTROTECHNICAL
COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SMART CITY USE CASE COLLECTION AND ANALYSIS –
INTELLIGENT OPERATIONS CENTRE FOR SMART CITIES –****Part 1: High-level analysis****FOREWORD**

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INTRODUCTION

Digital solutions are accelerating the integration of real world applications in urban areas, including city governance, healthcare, environment, traffic, education, security and so on. However, many smart solutions are still implemented within single-domains. Isolated city services, data flows and data need integration. To be effective, the coordination of data and service requires an overarching framework coupled with an intelligent operations centre (IOC). The first step to identify solution options is by collecting and analysing relevant use cases.

IOC is tailored to provide urban managers, enterprises and citizens with access to operational and organized solutions. Based on city-level database and new technologies, such as big data, AI, cloud computing, blockchain etc., IOC processes city information and provides innovative services for urban managers, operators and other stakeholders. Compared with single-domain systems, IOC can better support monitoring and visualizing, decision making and cross-domain cooperation. IOC will play an important role in integrating city services such as police, health services traffic management and rescue services, including but not limited to the following methods.

- a) The centralized operations dashboard and mobile application will allow real-time monitoring and information processing to improve response to emergencies.
- b) The centralized and intelligent platform will enable noticeable improvements in the management of public safety, like crime prevention, emergency response, threat prevention and response, and traffic management.
- c) The IOC's technologically advanced analysis, integrated communications, GPS and video surveillance capabilities will help residents and domain (energy, water, horticulture, waste and security) supervisors to collaborate in a smarter way.
- d) The integrated data visualization, near real-time collaboration and deep analytics it provides will help agencies prepare for problems, coordinate and manage response efforts and enhance the efficiency of services,
- e) IOC will enable residents to report issues such as broken street lights, electricity failure, water wastage, etc. and check resolution status using their mobile devices.

Currently, IOC solutions are being implemented in different cities around the world, and the stakeholders of these smart cities face similar challenges, including cross-domain cooperation, monitoring and visualizing, intelligent analysis, user-oriented experience, etc. The provision of standardization should be considered as one of key factors to support IOC development, including the development of the conceptual model, data exchange, IT infrastructures, services, and so on. This document focuses on collecting and analysing use cases from diversified areas, with the goal of developing consensus-based descriptions of IOC features and capabilities across all stakeholders, and uses this to scope out the standardization requirements related to the field of IOC.

SMART CITY USE CASE COLLECTION AND ANALYSIS – INTELLIGENT OPERATIONS CENTRE FOR SMART CITIES –

Part 1: High-level analysis

1 Scope

This part of IEC SRD 63302 provides use case collection and analysis, identifies the market relationships of relevant stakeholders, scopes out capabilities and a reference model of intelligent operations centre (IOC) for smart cities, and proposes the requirements for standards development in this field.

This document is for use by authorities, solution providers, utilities, citizens, and other relevant stakeholders, to identify good practices regarding IOC, and how they can implement them.

2 Normative references

There are no normative references in this document.

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.1.1

artificial intelligence

AI

capability of a machine to perform tasks that are generally associated with intelligent beings

Note 1 to entry: Artificial intelligence systems contain a certain degree of core capabilities such as reasoning, learning, perception, communication, cooperation, planning, acting and problem solving, etc.

Note 2 to entry: Swarm intelligence can be a type of AI.

Note 3 to entry: This definition of artificial intelligence was provided by the working group of ISO/IEC JTC 1/SC 42 that is developing a future International Standard on artificial intelligence concepts and terminology.

3.1.2

big data

extensive datasets – primarily in the data characteristics of volume, variety, velocity, and/or variability – that require a scalable technology for efficient storage, manipulation, management, and analysis

Note 1 to entry: Big data is commonly used in many different ways, for example as the name of the scalable technology used to handle big data extensive datasets.

[SOURCE: ISO/IEC 20546:2019, 3.1.2]

3.1.3

building information modelling

BIM

use of a shared digital representation of a built object (including buildings, bridges, roads, process plants, etc.) to facilitate design, construction and operation processes to form a reliable basis for decisions

Note 1 to entry: The acronym BIM also stands for the shared digital representation of the physical and functional characteristics of any construction works.

[SOURCE: ISO 29481-1:2016, 3.2]

3.1.4

cloud computing

paradigm for enabling network access to a scalable and elastic pool of shareable physical or virtual resources with self-service provisioning and administration on-demand

Note 1 to entry: Examples of resources include servers, operating systems, networks, software, applications, and storage equipment.

[SOURCE: ISO/IEC 17788:2014, 3.2.5]

3.1.5

geographic information system

information system dealing with information concerning phenomena associated with location relative to the Earth

[SOURCE: ISO 19101-1:2014, 4.1.20]

3.1.6

intelligent operations centre

IOC

facility that gathers and analyses data from many city systems to provide a unified view of all city agencies to enable the city to predict events and respond quickly and appropriately

Note 1 to entry: IOC is also referred to as command control centre, integrated control centre, city brain or city operation hub. No matter what name is used, these all share very similar functions, bringing together information from around the city into a common hub, translating this into insights regarding city operations and guiding city management to be more efficient.

3.1.7

Internet of Things

IoT

infrastructure of interconnected entities, people, systems and information resources together with services which processes and reacts to information from the physical world and virtual world

[SOURCE: IEC 60050-741:2020, 741-02-01]

3.1.8

stakeholder

individual, team, organization (IEV 831-01-14), or classes thereof, having an interest in a system (IEV 831-01-21)

Note 1 to entry: Usually a stakeholder can affect or is affected by the organization or the activity.

[SOURCE: IEC 60050-741:2020, 741-01-30, modified – The original Note 1 to entry has been replaced.]

3.2 Abbreviated terms

3D	three dimensional
CDC	Centers for Disease Control and Prevention
CIM	city information modelling
DRT	demand responsive transport
IOC	intelligent operations centre
IoT	Internet of Things
PC	personal computer
SOE	state-owned enterprise

4 Description of the study of intelligent operations centre

4.1 General

Intelligent operations centre (IOC) is the "nerve centre" of urban management, which demonstrates the achievements and values of smart city construction. During the first years of the twenty-first century, the development of information technology has taken urban operation management into the digital era, enabling urban traffic, medical treatment, safety, education and other city domains to be managed using information systems, forming the cornerstone of IOC. These sub-centres solved certain urban issues, but the isolated information wasted resources and limited further smart applications. In these circumstances, it was clear that a comprehensive centre was needed to integrate information across organizations and an interconnected environment was needed to promote cooperation, so as to improve efficiency and initiate effective decision-making, and realize inter-departmental integration.

IBM put forward the concept of "Smart Planet" in 2008 and proposed the initial vision of a smart city. Following that, the concept of smart city has gradually become popular and attracted attention around world. A classic example of an IOC is the Rio de Janeiro Smart City-IOC, this marked the beginning of the emergence of comprehensive IOC. This merged data from more than 30 urban departments into a single platform, and covered three smart management projects, namely public security, smart water and smart transportation. IOC in Rio de Janeiro went online at the end of 2010, and provided this megacity with more intelligent operation and management. This practice provided a great model for city operation teams around the world.

With the development and implementation of big data, cloud computing, geographic information system, artificial intelligence, sensing and control technology, the urban operation is progressing to cross-cutting comprehensive application. For example, in 2018, Sadiq Khan, the mayor of London, released the blueprint for Building a Smart City in London "Smart London Together", which proposed using urban data and information technology to improve the responsiveness, connectivity and synergy of the city. In 2019, the South Korean government formulated The Third Smart City Comprehensive Planning (2019–2023), to improve urban management quality, service and operation by data and technology. Smart City Wien Framework Strategy (2019–2050) proposes using state-of-the-art technologies and analytical methods to support accurate decision-making and real-time urban system management.

Over coming years, smart cities will focus on the integration and application of technology in city contexts, to optimize city operation and management functions and activities.

4.2 Outline of IOC conceptual reference model

Full stack IT platforms can aggregate and or integrate sources of big data with sensor based Internet of Things data to visualize the real world and be able to manage responses quickly (e.g. identify, alert, respond, triage and resolve incidents) or predict future outcomes by analysing past events, to better support city operation and management. The IOC builds an array of situation monitoring and emergency response functions to support auxiliary decision-making. Compared with the isolated systems of an enterprise or city, IOC enhances operation automation, evaluation, data sharing, service integration and cross-domain cooperation.

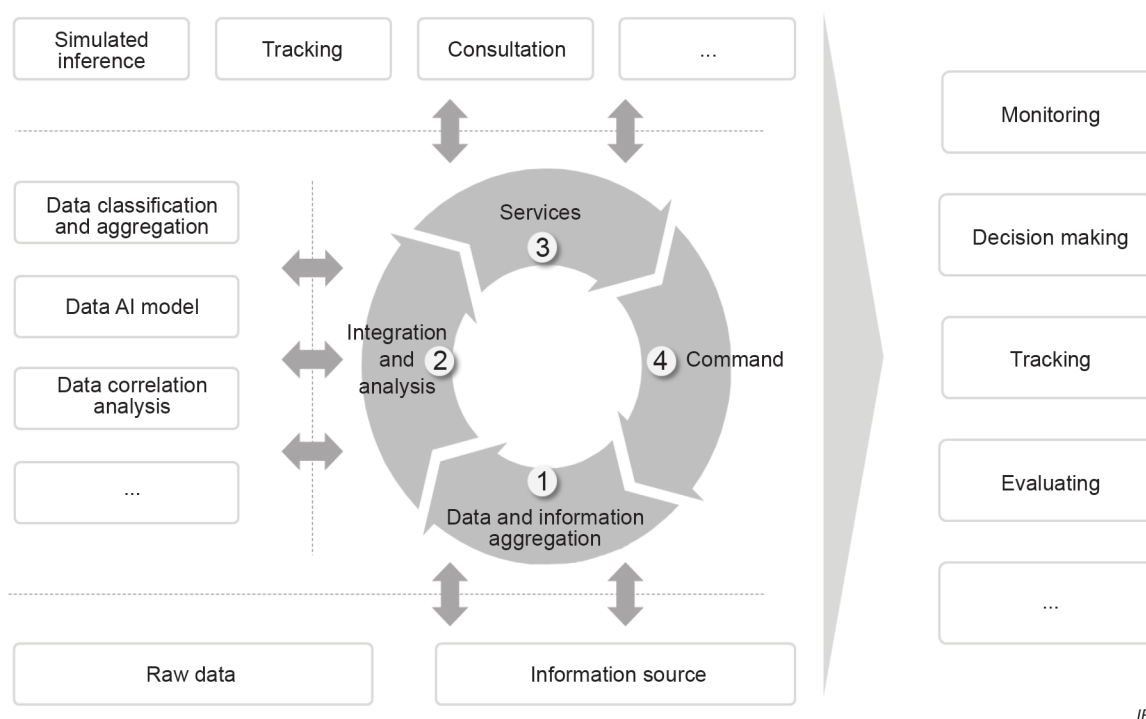


Figure 1 – Conceptual reference model

Based on big data and Internet of Things, the "operating system" of intelligent operations centre can effectively integrate the data and information scattered in various fields of urban governance, leverage massive resources, bring into action the frontier technology applications to meet city management needs. It builds an arsenal for the multiple functions of situation monitoring, emergency response and auxiliary decision-making. It is the decision-making, early warning, governance, command and exhibition centre of smart city management, which can effectively improve the efficiency of cross-function decision-making and resource coordination.

The intelligent operations centre model is evolving. On the one hand, the model provides a growing number of features in the different application scenarios and contexts, on the other hand, the functional boundary of the operation centre is still expanding. Generally, the IOC consists of four specific and discrete functional capabilities illustrated in Figure 1:

- 1) gathering data and information;
- 2) integration and analysis of intelligence;
- 3) providing a hub of internal and external services;
- 4) making decisions and executing actions.

Among these, the first two ensure the high-quality input, and the latter two guarantee the output of the operation centre.

Because each type of capability has its own emphasis in different application scenarios, its connotation and extension are also different.

- **Gathering information:**

It collects and stores data and information, mainly bringing together raw data without processing. In some cases it is essential to conduct preliminary processing through edge calculation and other methods, and then pass it to the intelligent operations centre in a controllable way. What is more, this part is generally of high quality, which can flexibly adjust the acquisition frequency, collection object, statistical calibre and other elements according to the demand. However, it also has some problems, such as high construction, operation cost and single data type; After processing, external source information, such as Open Government Data Initiative, generally obtains the data from third parties or from a data sharing centre via various interfaces.

- **Processing data:**

It carries on the secondary processing to the gathered data and information, so as to form valuable knowledge and insight. It generally classifies and aggregates the data according to the topic, and further analyses the data and the correlation between the data by using analysis tools and algorithm models, so as to identify the significance and value of the analysis results, and accurately select the corresponding internal and external services for subsequent processing. The main challenge here is to identify the relationship between data and extracting value, which is generally analysed by data scientists who are familiar with both data and the business requirements of the city, supplemented by AI and other technical means. This part requires a lot of knowledge accumulation, which is usually considered as the core competence of smart city operation centre.

- **Integrate services:**

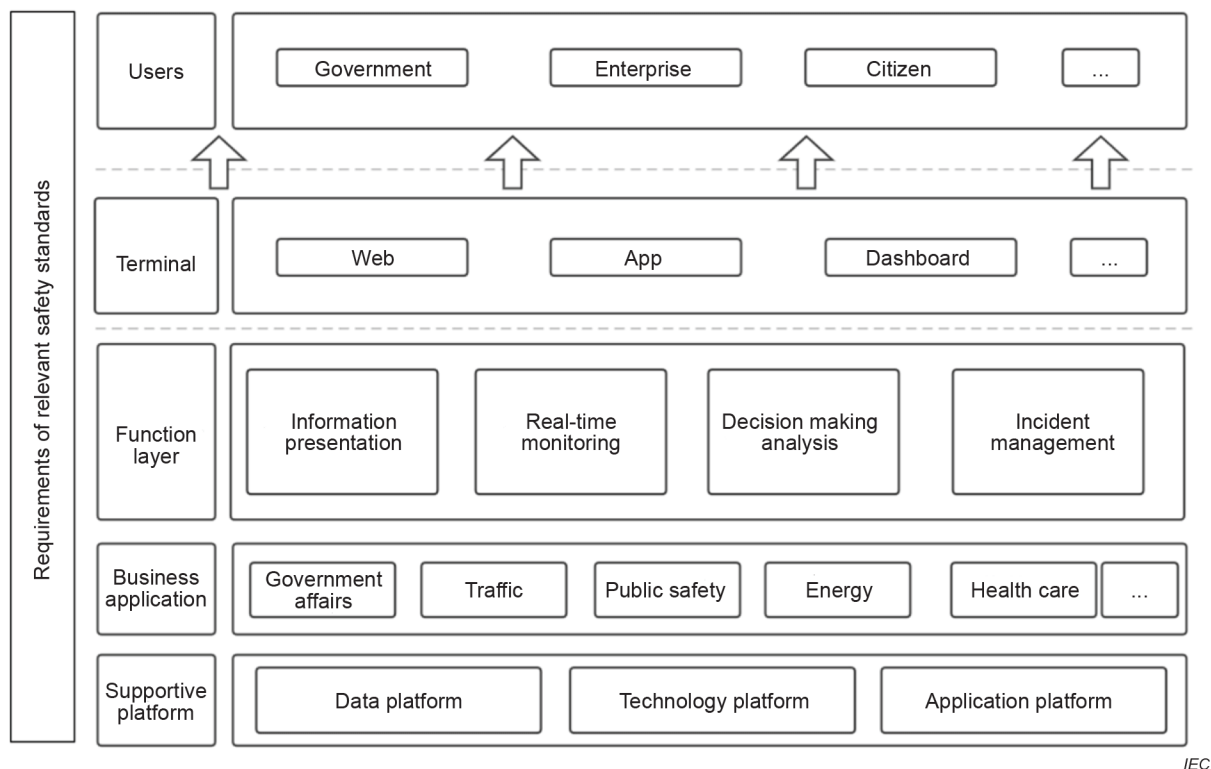
IOC is a hub of services from different sources. Services often take on different forms, such as simulation and deduction services for internal management decision makers, tracking and supervision services for staff, demonstration services for visitors, data retrieval services for data centres, etc., and information release, consultation and guidance services are provided for external needs. What is more, various services are often interwoven; however, their core support mainly comes from the output provided by information integration analysis. It is essential that services are integrated as far as possible according to the objects and scenarios, so as to avoid excessive and improper service capacity. Only in this way, can it improve the user experience of internal and external users. At the same time, in order to cope with different scenarios and emergencies, various services should be loosely coupled and modularized, so that they can be quickly assembled into new service packages to cope with different scenarios.

- **Decision and action:**

On one hand, this capability requires the monitoring, discovery, evaluation, handling and tracking of daily operations and emergencies, including the construction of information software and hardware systems. It also requires the establishment of a series of supporting measures, such as organization, personnel, process and system. On the other hand, this capability is often considered as the best showcase of the intelligent operations centre as a hub for the collection of all related abilities, which is highly concerned by internal and external personnel. However, this capability is relatively recessive, and is evaluated by means of log analysis, regular and multi-scenario exercises. In addition, it is also important to develop targeted promotion plans. At the same time, this capability is greatly affected by external factors, such as management mechanisms. That is to say, when establishing this capability, we should fully consider the external environment, so as to set a reasonable chain of command, rights and responsibilities, and make full use of the tools provided by urban operation centre to improve efficiency and accuracy.

4.3 Outline of IOC reference architecture

This subclause summarizes and explains an outline of IOC reference architecture illustrated in Figure 2, including users, terminals, service layer, platform layer, connection layer and exchange hub.



IEC

Figure 2 – IOC reference architecture

IOC processes data feeds and event information from individual departments or organizations to support identifying potential problems and making decisions. Through centralized information, IOC delivers the ability to optimize the allocation of city capabilities, respond rapidly and effectively for real-time events, and implement the standard operation procedure to solve the problem. It provides an executive dashboard to depict the overall status of a city's operations. By taking advantage of the power of advanced analytics, asset management, and collaboration tools, IOC can recognize events as they arise, promoting them for instantaneous response by necessary parties. For enterprises and citizens it can provide the services and interaction with the urban operation via mobile phones, laptops, and other means.

- **Connection layer:** Connect with internal and external source of information, including data from public internet, data from other systems, from IoT sensors, purchase data and some manually input data. All structured and un-structured information is collected and stored in a data lake for further processing.
- **Platform layer:** The major competencies of IOC are built in this layer, including data processing, work item processing, artificial intelligence, security protection and so on. It leverages the data from the connection layer and integrates with services to support the service layer.
- **Service layer:** Provides modularized services, the most deployed services include the monitoring services, forecast services, query services, decision simulation, etc. The service layer not only provides services to internal users, but also provides services to external users like public and media through an exchange hub.
- **Terminal:** The user terminal of urban operation centre includes but is not limited to PC, mobile terminal, and large screen in the operation centre display, etc. By means of various information interaction methods, the government (all commissions), other associated command or operation centres, enterprises and institutions, and the public can obtain the corresponding information or the required services.

4.4 IOC characteristics

IOC processes data feeds and event data from multiple individual departments or organizations to identify problems or patterns of common problems and provide information in ways that enhance informed decision making processes.

- **Connected:** IOC should be able to connect with IoT sensors and other internal and external data sources, it should present data in the form of information and dashboards to support key decision makers in ways that allow for dynamic or complex issues across multiple stakeholder groups to be forensically examined, checked and verified to deliver services, to shape future plans or policies.
- **Smart:** IOC should enable and support smarter decision making, through data collected that is then compared and contrasted with complementary information and the use of algorithm-based modelling to forecast and alert or be empowered to decide on actions in response to certain conditions or outcomes. Consideration should be given to the responsible and ethical use of personally identifiable data and emerging capabilities such as artificial intelligence to protect individual rights.
- **Integrated:** IOC should integrate resources and cooperate functions across sections, integrate pieces of information by setting up universal data standard and information sharing, integrate working data gathering, analysing, decision making and execution to continuously improve efficiency.
- **Secure:** Secure with governance to ensure access to and use of data and controls follows ethically sound principles set out in the UN Sustainable Development Goals and Human Rights convention.
- **Sustainable:** adopt revolution of external and internal environment such as new regulations. Be able to keep adopting new technology and knowledge such as analysing methods. Allow external suppliers to join the ecosystem and allow others to integrate this its ability as services to provide external users as a sub-model.

4.5 Roles of stakeholders

Smart city programmes cannot be delivered successfully only by the city authority. The breadth of change and need for long-term commitment requires investment from a critical mass of internal and external stakeholders. In the case of IOC issues, the major stakeholders can be identified as beneficiary, owner, designer, builder, maintainer, user, which has constructed the complicated market relationship.

- **Primary beneficiary:** Stakeholders who benefit directly from the solution.
- **Secondary beneficiary:** Stakeholders who benefit indirectly from the solution.
- **Tertiary beneficiary:** Stakeholders who benefit indirectly from the solution at one further step removed.
- **Owner (must include):** Stakeholders who own or manage the solution.
- **Designer ecosystem:** Stakeholders who can participate in designing the solution.
- **Builder ecosystem:** Stakeholders who can participate in building the solution.
- **Maintainer ecosystem:** Stakeholders who can participate in maintaining the solution.
- **User ecosystem:** Stakeholders who use the solution to help meet their needs.

A full list of stakeholders is given in Annex A.

5 IOC application area description

5.1 General

Clause 5 identifies 25 IOC use cases of a smart city and provides a common format to describe them. By including the description, purpose and outcome of IOC application scenarios, it can identify how these applications can be improved, especially including how the digital technologies can support a city to become truly smart.

5.2 Smart market supervision

5.2.1 Description

This solution integrates the information that impacts on market supervision, which covers commercial entity supervision, food and drug supervision, intellectual property supervision, special equipment supervision, etc. This enables the market to be managed holistically so that the city can further increase the application of information technology in the market supervision field, expand the means of supervision, strengthen the supervision force and improve the work efficiency.

5.2.2 Objective

- a) Gather and analyse the data to understand the requirements of market supervision.
- b) Gain a timely understanding of the implementation and progress of tasks.
- c) Assist scientific and efficient decision-making based on the data statistical analysis ability of IOC.
- d) Support front-line supervision officers to handle the emergencies in linkage with the command centre, and obtain data support relating to areas such as team, resources and disposal methods from the command centre in real time.

5.2.3 Current practice

The market supervision department has critically important supervision responsibilities of commercial, food and drug, intellectual property supervision, special equipment, standards, measurement, inspection and testing management, etc. There is a gap between supervision responsibilities and core competencies and capabilities that can be resolved through the use of information technology to more efficiently collect data and present this as valuable information sooner to better monitor and manage operations and respond to incidents.

5.2.4 Gaps

Based on the status quo of the above problems, the gap analysis is as follows:

- a) Low-level data sharing.
- b) Insufficient data application.
- c) Imperfect command and dispatch system.
- d) Inefficiency of task allocation.
- e) Lack of supervision and appraisal.

5.2.5 Stakeholders

The major stakeholders and relationships are illustrated in Figure 3.

Stakeholder 1: Mayor and market supervision official

- Roles: Owner and Primary beneficiary
- Responsibilities: Utilize the monitor, manage and control IOC functions to make informed organizational service delivery decisions, such as the completion of programmes of work, or managing the effective and efficient despatch of resources to support planned events or unplanned incidents.

Stakeholder 2: Informatization management personnel for market supervision

- Roles: Builder and Maintainer
- Responsibilities: The Command and Coordination Office is responsible for scientific overall planning, integration and distribution of various supervision and law enforcement tasks; Carry out in-depth analysis of the feedback data, find systematic and trend problems, and inform relevant business offices in time; Monitor the completion of the overall supervision and law enforcement tasks, and conduct unified notification and assessment; Organize each business office to dynamically adjust the inspection frequency according to the assessment results and data analysis results; Coordinate overall duty and emergency management.

Stakeholder 3: Business management personnel for market supervision

- Roles: User
- Responsibilities: Deploy, follow up and analyse the daily management tasks of the unit; Formulate related tasks of the business office such as daily examination, supervision and inspection, and special inspection, guide the front-line personnel to supervise and enforce the law, and organize the implementation of emergency response and disposal.

Stakeholder 4: Supervision and law enforcement officer

- Roles: User
- Responsibilities: Act as the executor of related tasks of the market supervision bureau including overall supervision, inspection, and law enforcement.

5.2.6 Stakeholder ecosystem

The mayor and senior officials of market supervision are the owners of the smart supervision IOC scheme, and they authorize decision-making to build the system. At the same time, they are also beneficiaries, and they can use IOC to monitor and grasp the overall operation situation of market supervision of various businesses, so as to support them in making decisions. Informatization management personnel for market supervision are specifically responsible for system construction (procurement information service), comprehensive management of the system, and pushing the results presented by IOC analysis to relevant business offices. Business management personnel for market supervision make deployment decisions for related work and guide law enforcement personnel through systematic analysis results. According to the instructions of superior leaders, law enforcement personnel carry out law enforcement tasks and are the executors of IOC analysis results. Enterprise users handle business matters related to market supervision through the smart supervision system, and informatization management personnel for market supervision can conduct comprehensive data analysis through acquired business data and output analysis results.

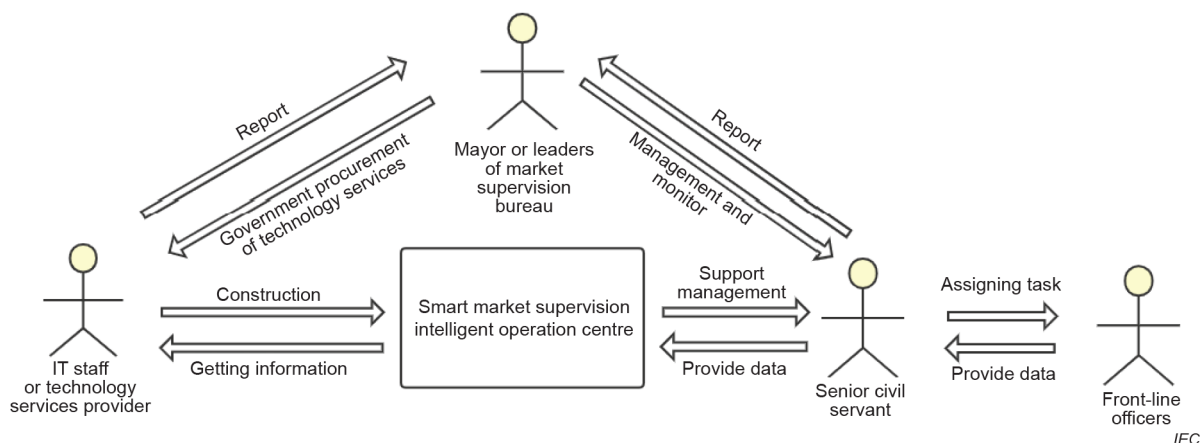


Figure 3 – Stakeholders of relationship in market supervision

5.2.7 Scenarios

1) Leaders of market supervision bureau

Assist scientific and efficient decision-making based on the data statistical analysis ability of IOC. In addition, when emergencies occur, emergency command can be carried out efficiently and reliably.

2) Relevant command and coordinate offices

Through the IOC, the city, district and office level smart command will be realized, and the monitoring, dispatching, judgment and emergency command hub of market supervision will be formed, so as to realize the "one picture for comprehensive perception, one key for overall situation, and integrated operation coordination" of smart market supervision.

3) Relevant business offices

For relevant business offices including the food production department, food management department, special equipment safety supervision department, drug safety supervision department, the IOC collects, optimizes, allocates resources and dispatches tasks, and the business management users can in a timely manner understand the implementation and progress of tasks, and get business guidance and support as needed; Implement overall monitoring and grasping of the operation situation of various regulatory businesses of the business unit, and deploy, follow up and analyse the daily management tasks of the unit; When there is a major safety accident, use the command centre function to deal with the process management; Assist scientific and efficient decision-making based on the statistical analysis of data of intelligent command centre.

4) Front-line supervision and law enforcement officer

Under normal circumstances, applications such as communication, evidence preservation, and law enforcement processing in the law enforcement process can be realized through mobile terminals, and data synchronization can be carried out with the command centre; In case of major events or emergencies, front-line supervision and law enforcement officer can handle the emergencies in linkage with the command centre, and obtain data support such as team, resources and disposal methods from the command centre in real time.

5.2.8 Requirements

Lack of a unified information construction standardization framework, such as the basic standards of the definition, acquisition, processing and application of information and data, which leads to the result that information and data definition and collection from different channels cannot achieve standardized operation. Lack of basic standards leads to the lack of consistency between departments and urban areas, which hinders the effective sharing of information and deep mining.

5.3 On-line government services

5.3.1 Description

The integrated online platform promotes the integration of offline and online government services, consolidates public data resources, strengthens business collaboration, and optimizes government services, promotes a main portal, one-time login, and integrates online services for market participants to handle affairs.

5.3.2 Objective

- a) To strengthen business collaborative handling and optimize government service processes.
- b) To build an integrated online government service platform and offline service windows.
- c) To provide whole-process government service through the platform, eliminating all unnecessary procedures.

5.3.3 Current practice

Traditionally, governmental services are provided by different departments on separate basis, without effective cross-department collaboration due to ineffective integration of transactional data and systems, which results in prolonged procedures and waste of time when acquiring government services.

5.3.4 Gaps

The most outstanding problem in this respect is that transactional data of government service cannot be sufficiently exchanged across administrative boundaries; therefore, the collaborative handling capabilities between government departments are significantly handicapped. Individuals and enterprises cannot find directions when handling business, and travel to multiple departments many times.

5.3.5 Stakeholders

Stakeholder 1: Business handling department

- Role: Designer ecosystem and owner
- Responsibilities: To provide whole-process government services, ranging from business acceptance, review, decision, delivery, to information disclosure, etc., relying on integrated online platform.

Stakeholder 2: Public data management department

- Role: Owner and Maintainer ecosystem
- Responsibilities: to build and maintain the integrated online platform, providing unified identity authentication, electronic seals, electronic licenses and customer service, ensuring the security of platform and data.

Stakeholder 3: Individuals and enterprise

- Role: Primary beneficiary and Designer ecosystem
- Responsibilities: Acquiring the information of government service and handling business.

5.3.6 Stakeholder ecosystem

On one hand, public data management department is responsible for construction and maintenance of integrated online platform relying on which business handling department provides government services to individuals and enterprise; on the other hand, stakeholder 1 and individuals and enterprise also play an important role in designing the whole solution as immediate stakeholders for the solution.

5.3.7 Scenarios

The integrated online platform promotes the integration of offline and online government services, consolidates public data resources, strengthens business collaboration, and optimizes government services, promotes a main portal, one-time login, and integrates online services for market participants to handle affairs.

All government services in this municipality are included in the integrated online platform, unless otherwise provided by laws and regulations or involving state secrets and public safety. Market participants can handle government services through the integrated online platform, and can obtain precise government services through enterprise-specific web pages.

5.3.8 Requirements

The following generic best practices can apply more broadly than for smart cities government service to other fields:

- a) Integrate public data resources.
- b) Optimize government service procedures.
- c) Unified identity authentication, electronic seals, electronic licenses and customer service.

5.4 Smart urban management

5.4.1 Description

Big data, cloud computing, Internet of Things, artificial intelligence and other technologies are used to fully integrate the information construction achievements of relevant departments, build intelligent coordinated law enforcement application, divide the coordinated supervision grid based on the urban management grid, establish unified reporting, acceptance and scheduling of coordinated supervision events, and realize dynamic coordinated supervision of all departments of urban management.

5.4.2 Objective

By integrating the urban governance business with the intelligent algorithm model, the city governance is enabled by the use of AI recognition ability and logical reasoning ability, the city governance event discovery is changed from artificial inspection and reporting to intelligent camera discovery, and the event handling is changed from independent governance to inter-departmental coordination. We will establish a "five functions" operation mechanism of "someone to inspect, someone to report, someone to take charge, someone to enforce the law and someone to supervise", effectively solve the problems existing in urban governance, such as extensive management methods, large manpower needs, and difficulties in cross-departmental coordination, and in a coordinated manner improve the ability and level of urban fine governance.

5.4.3 Current practice

The current status of urban management administrative law enforcement is as follows:

- a) Lack of whole-process records of administrative law enforcement activities. The whole process record of administrative law enforcement activities is an important guarantee of legality and effectiveness. Administrative law enforcement organs shall record the whole process of the initiation of administrative law enforcement, investigation and collection of evidence, examination and approval decisions, delivery and implementation, etc. in written, audio-visual and other forms of records, and file and save them in a coordinated manner and systematically, so as to make traces and traceable management in the whole process of law enforcement.
- b) Low efficiency of paper-based office, long case handling cycle and low efficiency.

- c) The preparation of documents is large and tedious, and the workload is large. Meanwhile, the documents and other materials are paper materials, which are inconvenient to save and inconvenient for follow-up tracking and searching.
- d) Lack of effective mobile law enforcement means and urban event automatic identification tools, many urban management events are not timely or are difficult to find.

5.4.4 Gaps

Based on the status quo of the above problems, the gap analysis is as follows:

- a) In view of the lack of standardized process planning for law enforcement personnel, the process of administrative law enforcement shall be sorted out and standardized, and the standard process of administrative law enforcement shall be designed according to, including simple process of law enforcement and general procedure, so as to standardize administrative law enforcement.
- b) With original offline law enforcement, paper office efficiency is low. Based on this problem, in order to reduce the workload of law enforcement personnel and to improve work efficiency, there is a need to provide an intelligent law enforcement small assistant to help law enforcement personnel quickly deal with online editing of electronic documents: adding all existing content automatically without the need for law enforcement personnel to fill in again, and completing the whole process of online approval, electronic signature and seal.
- c) Current law enforcement personnel carry out law enforcement offline, and the whole process of law enforcement has no record. Therefore, it is essential to increase mobile law enforcement, truly implement the whole process of law enforcement process in the mobile field, realize law enforcement office anytime and anywhere, and introduce mobile terminals, such as on-site printers, to improve work efficiency.
- d) In view of the time and effort of human inspection of urban management personnel, it is essential to provide cameras combined with image AI intelligent recognition, and capture the major matters in urban management from multiple angles all day long, such as garbage exposure, road occupation by tourist merchants, indiscriminate parking of motor vehicles and non-motor vehicles, etc., to push the smart platform to close the loop.

5.4.5 Stakeholders

The major stakeholders and relationships are illustrated in Figure 4.

Stakeholder 1:

- Role: Dispatcher
- Responsibilities: event acceptance, case source registration, event scheduling and dispatching, can cancel invalid events, or directly handle simple events that can be solved by video or pictures.

Stakeholder 2:

- Role: Law enforcement personnel
- Responsibilities: event reporting, event handling, filing and reporting, completion of outdoor advertising, road occupation, construction survey tasks, document printing, confiscation management, etc.

Stakeholder 3:

- Role: Regulatory personnel
- Responsibilities: supervise the handling of incidents of various departments, filing and approval, other process approval, issuing notices and announcements, collecting key data, supervising law enforcement personnel, etc.

5.4.6 Stakeholder ecosystem

The main stakeholders in the smart coordinated law enforcement scenario are the command centre dispatcher, law enforcement personnel, and regulatory leaders at all levels (such as law enforcement captains, leaders in charge, etc.), law enforcement personnel and dispatcher personnel as the source of the incident: Law enforcement personnel can report and dispatcher personnel can register the source of the case. After the incident occurs, the dispatcher is assigned to the law enforcement personnel to deal with the incident, and the general procedures involved in the filing of the case are approved by leaders at all levels.

Leaders at all levels can also supervise the work progress of dispatchers and law enforcement personnel, trace the whole process of incidents, view statistical analysis data of the city window, and assist decision-making.

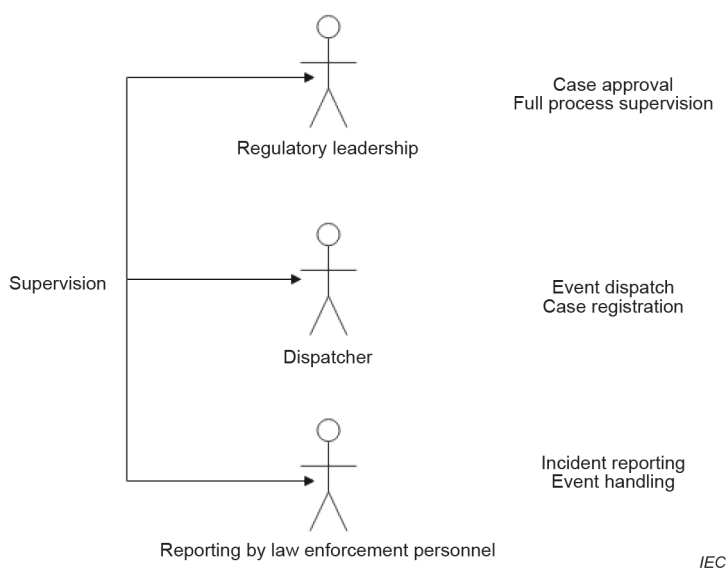


Figure 4 – Stakeholders of relationship in smart urban management

5.4.7 Scenarios

- 1) AI intelligent identification of camera supervision: off-site supervision, intelligent discovery of daily illegal behaviours of urban management through public security videos and self-built probes, and automatic capture and push of illegal behaviours to relevant supervision departments for disposal. These include garbage exposure, out-of-store business, illegal parking of motor vehicles, illegal parking of non-motor vehicles, and outdoor road occupying business.
- 2) Law enforcement personnel management: to achieve the management of law enforcement personnel. On the map, you can view the current location and historical track of all law enforcement personnel. It also provides law enforcement personnel with applications scanning QR code, adding, deleting, information maintenance and other management work.
- 3) Case acceptance: To realize unified acceptance and disposal of cases reported and assigned by supervisory personnel, law enforcement personnel and command centre. Through the system users through the authorization role to accept the jurisdiction of the case for disposal.

- 4) Law enforcement handling cases: cases are divided into summary cases and general cases. Summary cases are those in which the law enforcement personnel can directly carry out administrative punishment on the spot. The other is the general case, the general case is basically to go through the legal procedures of the case, the whole process involves the case registration, case filing, investigation and collection of evidence, processing and approval, penalty notification, penalty approval, penalty decision, penalty execution, closing and filing. Each process should have corresponding punishment documents and handling suggestions. Secondly, according to the clues reported by law enforcement personnel, they can be turned into cases for tracking and processing. It is divided into app side and PC side, law enforcement personnel mobile law enforcement, supervision and inquiry of background supervisors at all levels online approval, and the whole process can be traced.
- 5) City window: The number of law enforcement cases handled, the number of cases in process, online law enforcement personnel, law enforcement information statistics and other information are displayed to reflect the law enforcement situation of the city from a macro perspective, so as to facilitate the decision-making of regulatory leaders.
- 6) Intelligent law enforcement assistant: By using natural language understanding and natural language processing technology, intelligent learning of administrative law enforcement knowledge such as coordinated law enforcement laws and regulations, law enforcement and case handling, and establishing AI-assisted research and judgment model, auxiliary research and judgment of reported illegal behaviours can be realized. Including illegal behaviour extraction, involving laws and regulations, law enforcement departments, punishment measures, etc.

5.4.8 Requirements

- a) Management needs of law enforcement personnel. To realize the management of law enforcement personnel, and provide management work such as adding, deleting and maintaining information of law enforcement personnel.
- b) Demand for case acceptance. All cases reported and assigned by law enforcement personnel and command centre attendants will be accepted and handled. Through the system users through the authorization role to accept the jurisdiction of the case for disposal.
- c) Demand for law enforcement handling cases. The most critical involves two kinds of cases, one is the simple case, the simple case is by the law enforcement members can be directly on the spot administrative punishment cases.
- d) Mobile law enforcement needs. Mobile law enforcement personnel carry mobile law enforcement through mobile terminals to collect clues on the scene, report patrol cases, receive and handle tasks, and carry out relevant administrative penalties according to their basic knowledge of administrative penalties and online auxiliary verification materials.
- e) Law enforcement handling data statistics demand. Information display is carried out through the number of law enforcement cases handled, the number of cases in process, penalty amount, online law enforcement personnel, law enforcement information statistics, etc., to reflect the law enforcement situation of the city from a macro perspective, which is convenient for leaders to make decisions.
- f) The camera automatically identifies the needs of Chengguan events. Through the cameras of the whole city, the intelligent recognition ability of AI can be used to automatically identify such scenes as exposed garbage, occupation of the road, overflowing garbage cans, illegal occupation of the fire channel, illegal parking of motor vehicles and non-motor vehicles, etc. Dispatchers can take photos through the cameras to directly handle or assign law enforcement personnel to quickly close the loop.

5.5 Smart emergency response

5.5.1 Description

When a major event occurs, the emergency command solution handles command and dispatch based on the reset emergency plan. Because the IOC platform has streamlined data and service processes, the police, transportation, firefighting, and rescue resources can be quickly queried, located, and centrally dispatched during emergency commanding. Cross-department, cross-region, and cross-industry collaboration shortens response time to major event and minimizes associated losses.

5.5.2 Objective

The project attempts to build a unified emergency command system for cities and provide convenient support for safe running of cities and efficient handling of emergencies.

5.5.3 Current practice

Urban emergency command platform is a platform through which the government protects the fundamental interests of the people and ensures public health and safety of life and property. The platform meets the requirements of government for emergency management. Emergency, monitoring and early warning, safety supervision and others have not been well explored yet. Urban emergency management departments unify fragmented data to establish a unified urban emergency command platform.

5.5.4 Gaps

Based on the status quo of the above problems, the gap analysis is as follows:

- a) The previous emergency command system failed to be a unified "portal" for aggregated data.
- b) The previous emergency command system was unable to carry out the monitoring and early warning of various types of emergencies in one system.
- c) The previous emergency command system is unable to efficiently carry out co-command of multiple departments.

5.5.5 Stakeholders

Stakeholder 1: Business handling department

- Role: Designer ecosystem and owner
- Responsibilities: To provide whole-process government services, ranging from business acceptance, review, decision, delivery, to information disclosure, etc., relying on integrated online platform.

Stakeholder 2: Public data management department

- Role: Owner and Maintainer ecosystem
- Responsibilities: to build and maintain the integrated online platform, providing unified identity authentication, electronic seals, electronic licenses and customer service, ensuring the security of platform and data.

Stakeholder 3: Individuals and enterprise

- Role: Primary beneficiary and Designer ecosystem
- Responsibilities: Acquiring the information of government service and handle business.

5.5.6 Stakeholder ecosystem

On-site disposal staff carry out various event reporting, video call, real-time position reporting, message notification and others via mobile phone. On-site disposal staff and command centre carry out effective communication and on-site disposal. The intelligent emergency operation system updates in real time daily event, staff on-duty, duty roll call and other day-to-day duty work in the command centre, formulates statistical list of events and information, carries out real-time tracking of events, and grasps the dynamics of daily emergency response in the whole region or district. Emergency command personnel fully understand events and rescue situation, help the commanding officer analyse the incident, and develop corresponding command strategies.

5.5.7 Scenarios

The integrated online platform promotes the integration of offline and online government services, consolidates public data resources, strengthens business collaboration, and optimizes government services, promotes a main portal, one-time login, and integrates online services for market participants to handle affairs.

All government services in this municipality are included in the integrated online platform, unless otherwise provided by laws and regulations or involving state secrets and public safety. market participants can handle government services through the integrated online platform, and can obtain precise government services through enterprise-specific web pages.

5.5.8 Requirements

- a) Physical hardware requirements: hardware provides calculation, storage and network resources required for system operation; hardware includes server, disk array, router and switch.
- b) Interface requirements: data interface connected to data centres, co-location centres or cloud hosted platforms, communication interface connected to integrated command and dispatch platform and video interface of streaming media.
- c) Data storage requirements: store event, resources, hidden risks and other business information via database and table or as unstructured data.
- d) Application service requirements: extract data and realize the corresponding service logic for access management, resource analysis, map interface, incident and hidden danger analysis and other application services; provide support for upper-level applications.
- e) Application requirements: realize event management, on-duty management, analysis of event situation, supervision of protection capability and command and scheduling and other system applications.

5.6 Emergency response through safety network

5.6.1 Description

A safety network is a system or group of measures designed to ensure the safety and protection of individuals, organizations, or communities in the face of potential hazards, threats, or risks.

To secure the golden time in emergencies related to protecting citizens' lives and property, it is essential to establish a safety network to respond to disasters in a coordinated manner.

5.6.2 Objective

The goal of the safety network is to securely monitor and observe situations accurately through cameras and urban information to respond to dangerous events promptly.

5.6.3 Current practice

Many countries have an emergency response system, where the system is a coordinated network of individuals, organizations, and resources that provide immediate assistance and support during a crisis or emergency. The system is designed to respond effectively to a wide range of emergencies, including natural disasters, public health crises, and man-made emergencies such as crimes or fires.

5.6.4 Gaps

One gap would be that if there is a disconnect or deficiency in the platform, it takes more time to respond to hazardous events, which can end the event with more consequences.

Moreover, the IOC is designed to combine various technologies and services, such as emergency response systems, video surveillance, access control, and fire alarm systems, into a unified platform. However, too many services per platform can lead to a gap or incomplete monitoring to respond. For example, there can be a cooperation gap between the fire alarm system and the emergency response system, causing delays or preventing the activation of emergency response services in the event of a fire.

5.6.5 Stakeholders

The major stakeholders and relationships are illustrated in Figure 5.

Stakeholder 1: Local government

- Role: Owner
- Responsibilities: Provide safety network and IOC management and operation.

Stakeholder 2: Incident response team (IRT): police, firefighters, etc.

- Role: Primary beneficiary
- Responsibilities: IRT can request real-time CCTV video information held by local governments at any time to solve cases quickly and accurately.

Stakeholder 3: Ministry of Justice, Ministry of National Defence, Disaster department

- Role: Primary beneficiary
- Responsibilities: Various departments of the Ministry can request real-time CCTV information to promptly responds to illegal acts, incidents, or disasters

Stakeholder 4: Telecommunications and app company

- Role: User ecosystem
- Responsibilities: Apps are created for the citizens to request help in unsafe situations without necessarily making a call

Stakeholder 5: Citizens

- Role: Primary beneficiary
- Responsibilities: Due to the safety network, only needed personal information is transmitted, and citizens' personal information is protected.

5.6.6 Stakeholder ecosystem

When resolving city issues, it can be difficult for different stakeholders to work together due to security or because of different data management systems. The safety network is an essential tool that allows diverse stakeholders to work together to resolve city issues, where the IOC plays a critical role in bringing all stakeholders as a team.