

# Chapter 6

## Exemplifying Objective Information Theory: Smart Court



**Abstract** It is a worldwide engineering challenge to develop large-scale complex information systems such as Smart Court. The nationwide construction, application and promotion of the Smart Court system-of-systems engineering project of China guarantee the upgrade and reshaping of the judicial operation pattern of Chinese people's courts. It has gained remarkable achievements and brought China to the leading position in judicial informatization in the world. In this chapter, OIT is applied to explain the behavior of Smart Court for demonstrating the feasibility and practicality to investigate system-of-systems.

**Keywords** Objective information theory (OIT) · Smart Courts in China · Smart Court SoSs engineering project · Exemplification

### 6.1 Smart Court

Smart Court is a form of organization, construction, operation and management of people's courts based on modern information technology that realizes online transaction of all businesses, publishing of all the procedures according laws as well as providing comprehensive smart service. It is centered on the provision of justice for the people and judicial impartiality and adheres to the integration of judicial rules, institutional reform and technology innovation [1]. The operation of the Smart Court system is a typical complex giant system problem [2]. The factors affecting the operation results include basic equipment factors, user behavior factors, etc., and there are many cross-influences between them, so it is difficult to simply adopt a hierarchical index system [3]. According to the top-level design of the complex system, each system-level component is an information system that manages objective information.

### 6.1.1 Component Systems

The construction of Smart Courts in China involves more than 3000 regular courts, 10,000 dispatched courts, and 4000 collaborative departments nationwide. The number of information systems, such as infrastructure systems, intelligent applications, data management, network security, and operation and maintenance support, has exceeded 13,000. These systems operate relatively independently and simultaneously every day at a large scale and with a wide spatial distribution and varying durations. It is an extremely complicated SoSs engineering project, featuring heterogeneous systems, various functions and tasks, numerous collaborative departments, and close sharing and linkage.

Figure 6.1 is the reference model of the Smart Court SoSs, which presents the main components and their relations as a whole. As shown in Fig. 6.1, the core of the Smart Court SoSs of information systems is the Judicial Big Data Management and Service Platform, which gathers various types of operation data of the Smart Court and knowledge resources generated from the data. The intelligent service, intelligent trial, intelligent execution, and intelligent management systems at the inner ring are

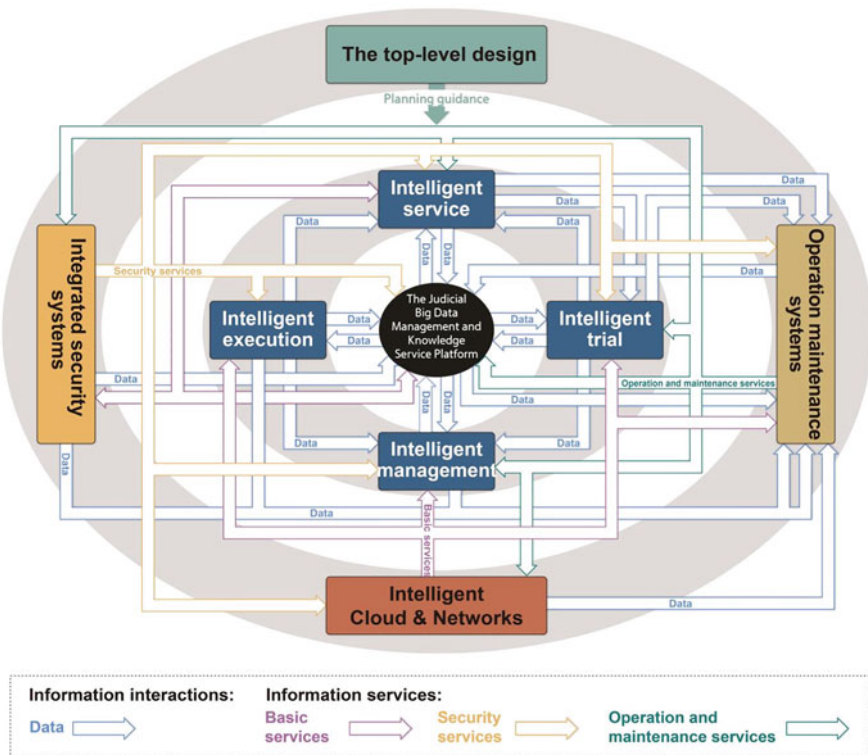


Fig. 6.1 Smart court

**Table 6.1** The typical systems in the Smart Court SoSs

| Type                   | Typical systems   |
|------------------------|---|
| Intelligent service    | People's Court Online Service (Former name: China Mobile Micro-Court)<br>People's Court Mediation Platform<br>Litigation Service Network<br>12368 Litigation Service Hotline<br>Electronic Service Platform<br>Online Preservation Platform<br>Online Identification Platform<br>etc.   |
| Intelligent trial      | Trial Process Management Platform<br>Electronic File Transfer Application<br>Intelligent Trial Assistance System<br>etc.  |
| Intelligent execution  | Executive Command Management Platform<br>Information Management System of Execution Case Process<br>Network Execution Check and Control System<br>Joint Credit Disciplinary System<br>Online Judicial Auction Platform<br>Inquiry Evaluation System<br>"One Account A Case" Management Platform<br>Mobile execution System-etc. |
| Intelligent management | Online Office Platform<br>Trial Supervision Platform<br>Electronic Archives System  |

the main carriers for the Smart Courts to serve different users, some typical systems are shown in Table 6.1. The Intelligent Cloud & Networks, integrated security systems, and operation maintenance systems at the outer ring are the basis and guarantee conditions for the operation of the Smart Courts. In addition, the top-level design is referred to as a collection of tasks such as planning, design, and always been emphasized in the construction of the Smart Court SoSs engineering project.

Not only does this reference model, featuring one-core and two-rings, take into account the characteristics of general information system, but also aims at the main operations of the Smart Court. Notably, the emphasis that designers should not only consider the main components of the SoSs but also their interactions is where this reference model mostly differs from other technical reference models. This consideration is also the key requirement that has always been emphasized in the construction of the Smart Court SoSE project. Here, the interactions are actually the information relations, on which the SoSs design methods are based. Wherein, the information relations between these four types of application systems, that is, the intelligent service, intelligent trial, intelligent execution, and intelligent management, is mainly information interaction. In the meantime, the application systems all have interactions with the Judicial Big Data Management and Knowledge Service

Platform, and are supported by information services of the Intelligent Cloud & Networks, integrated security systems, and operation maintenance systems.

The Judicial Big Data Management and Service Platform provides data and knowledge services for the four types of application systems. The Intelligent Cloud & Networks is referred to as the sum of various types of information infrastructures, which provides basic services such as computing, storage, database, and communication networks for various application systems, the Judicial Big Data Management and Service Platform, integrated security systems, and operation maintenance systems. The integrated security systems are the set of systems that provide various security protections such as identity authentication, border protection, security supervision, and so on, as well as information security services for other systems. The operation maintenance systems are a set of information systems for the insurance of system operation, treatment of system faults, and evaluation of operation quality and effectiveness, thereby providing operation and maintenance services for other systems.

### **6.1.2 Integrating Systems**

In the construction of Smart Court SoSs, besides the research, development and promotion of typical information systems, it is also a central task to integrate various systems and continuously improve the collaboration between systems, the integration of a collaborative framework includes the following main components:

- **Basic integration:** connect and integrate the information infrastructure distributed countrywide, including the private court network that connects tier-four courts and all the dispatched tribunals nationwide, to realize interconnections among the Internet, external private network, mobile private network, and confidential network on the premise of complying with the security isolation standards. Meanwhile, with the further popularization of cloud computing facilities and their deep integration with the communication network, the intelligent voice cloud platform of national courts is being constructed, utilizing cloud resources and cloud services as an integrated infrastructure to provide unified communications, computing, storage, and intelligent support capabilities.
- **Data integration:** build up the Judicial Big Data Management and Service Platform of the People's Court and the data center for higher courts and above, realize the physical or logical aggregation of data resources distributed in local courts and all types of application systems, and conduct quality inspection, correction, and association based on the corresponding data quality criteria. In addition, continue improving and consolidating the volume, delay, scope, granularity, variety, duration, sampling rate, aggregation, convergence, distortion, and mismatch of judicial big data, and build an integrated data space to fully support the data exchange and sharing of all types of information systems.

- Knowledge integration: based on the rich resources of judicial big data, comprehensively utilize multimodal artificial intelligence technologies, such as text, voice, video, and natural language processing, through large-scale manual tagging, automated deep learning, and the confluence of professional knowledge; a unified judicial knowledge base and a judicial knowledge service engine are established based on legal rules and historical cases, which are suitable for different application scenarios, fully support the full dimensional, integrated, and large-scale application of judicial artificial intelligence, and significantly improve the intelligent auxiliary ability of information systems.
- Application integration: promote intelligent services, trials, executions, and management systems, mainly through online services, trial case processing, execution case processing, and office automation, respectively. With the Judicial Big Data Management and Service Platform as the core and a series of auxiliary intelligent applications as the entrance, a highly integrated application system-of-systems, which fully supports information exchange, data sharing, and operation linkage of all types of business applications, is formed.
- Service integration: in view of the trend of reducing costs and increasing efficiency, as well as the increasing popularity of cloud service technologies and systems, such as IaaS, PaaS, and SaaS, it is necessary to promote more information system resources to support Smart Court applications in a service-oriented fashion. Consequently, a physically distributed and centralized management service resource system has been initially built up. It can efficiently support unified collection, unified evaluation, unified release, and selective services of various information services.
- Portal integration: for specific users on the court private network, Internet or confidential network, integrated, personalized, and customized unified entrance portals are provided according to the characteristics of PC, mobile, and different operating systems, respectively. Consequently, all types of users can benefit from being familiar with the access, operation, and obtaining of abundant information in the Smart Court information system.

The above integration in Smart Court can realize many collaborative capabilities, such as system interconnection, information exchange, data sharing, intelligent assistance, and operation linkage, which is impossible in a single or local system. It also can explore many collaborative services and support capabilities beyond the designer's prior knowledge. For example, the integration of multiple previously unrelated systems may produce brand-new system functions; a variety of data associations may present inherent laws that have never been realized before, leading to a new service model. These phenomena, called “emergence”, are not only an important feature of SoSE but also the key content of the integration of collaborative systems of the Smart Court, which deserve further investigation.

## 6.2 The Sextuple of Smart Court

The information resources of Smart Court include six categories: trial execution, judicial administration, judicial personnel, judicial research, information management, and external data. We selected 13 representative typical information and analyzed the six element of each information according to OIT, as shown in Table 6.2. Among them, case filing information, hearing announcement information, audio and video information of court hearing belong to trial execution, administrative document information and news information belong to judicial affairs, personnel information and people's mediation institution information belong to judicial personnel, laws and regulations information and judicial statistics information belong to judicial research, informative assets information and information system operation information belong to information management, and lawyer information and postal service information belong to external data.

The sextuple model of OIT in Smart Court indicates the specific components of an information item.

$$I = \langle o, T_h, f, c, T_m, g \rangle.$$

where,  $o, T_h, f, c, T_m, g$  denote the noumenon, state occurrence time, state set, carrier, reflection time and reflection set of information  $I$  in Smart Court respectively. Table 6.2 depicts the typical information elements of Smart Court. 6 class, 13 typical issues, wherein  $o \supseteq \bigcup_{i=1}^{13} o_i$ ,  $T_h \supseteq \bigcup_{i=1}^{13} T_{hi}$ ,  $f \supseteq \bigcup_{i=1}^{13} f_i$ ,  $c \supseteq \bigcup_{i=1}^{13} c_i$ ,  $T_m \supseteq \bigcup_{i=1}^{13} T_{mi}$  and  $g \supseteq \bigcup_{i=1}^{13} g_i$  denote the noumenon, state occurrence time, state set, carrier, reflection time and reflection set of information  $I$  in Smart Court respectively.

$$I_i = \langle o_i, T_{hi}, f_i, c_i, T_{mi}, g_i \rangle \quad (i = 1, 2, \dots, 13)$$

Here, the relation between the former and the latter items in the equations is “ $\supseteq$ ” but not “ $=$ ” because Table 6.2 only lists the typical information of Smart Court but not all.

## 6.3 The Information Metrics for Smart Court

The overall effect of the construction and application of China's Smart Court SoS depends on various efficacies produced by the integration of all the information systems as a whole. Although almost every system and every type of information movement will have an effect and impact (in part) on users' feelings and effects, the critical performance metrics of key systems will have a more important impact on the 11 metric effects of the whole system. In practice, we have formed a performance

**Table 6.2** The main elements of the typical information set in Smart Court

| No. | Information type                             | Nounemon  | State occurrence time                                      | State set   | Carrier   | Reflection time   | Reflection set   |
|-----|--|---|--|---|---|---|--|
| 1   | Case filing information                      | ( $o_1$ )<br>Subjective consciousness of litigation parties and case filing judges                          | ( $T_{h1}$ )<br>From the beginning of filing to the end    | ( $f_1$ )<br>Relevant personnel's understanding and appeal of the case  | ( $c_1$ )<br>Case Handling Platform, Litigation Service Network, People's Court Online Service, etc | ( $T_{m1}$ )<br>From data entry into the Case Handling Platform, Litigation Service Network, People's Court Online Service and other systems to the outage of these systems | ( $g_1$ )<br>Case cause, case number, filing time, litigants, main case description and other data |
| 2   | Hearing announcement information             | ( $o_2$ )<br>The subjective consciousness of the judge  | ( $T_{h2}$ )<br>From announcement to next update           | ( $f_2$ )<br>Arrangements and illustrations on the time, place, litigants and cause of action of the hearing                                | ( $c_2$ )<br>Hearing announcement system  | ( $T_{m2}$ )<br>From data entry to the outage of the Hearing Announcement Release System  | ( $g_2$ )<br>Hearing time, place, litigants, cause of action and other data                        |
| 3   | Audio and video information of court hearing | ( $o_3$ )<br>The court scene environment, the subjective consciousness of litigants and judges in the trial | ( $T_{h3}$ )<br>From the beginning of the trial to the end | ( $f_3$ )<br>The environmental status of the court scene, the language, behavior, expression, etc. of litigants and judges during the trial | ( $c_3$ )<br>Video recorder, video camera, Science and Technology Court System                      | ( $T_{m3}$ )<br>From the beginning of the trial to the outage of the audio and video recording, live broadcast, storage, recording and broadcasting systems of the trial    | ( $g_3$ )<br>Hearing audio, video, image and other data  |
| 4   |  | ( $o_4$ )<br>The subjective consciousness of the  | ( $T_{h4}$ )<br>From the drafting of                       | ( $f_4$ )   | ( $c_4$ )<br>Office platform  | ( $T_{m4}$ )  | ( $g_4$ )<br>Text description of official documents,   |

(continued)

Table 6.2 (continued)

| No. | Information type                           | Noumenon  | State occurrence time  | State set  | Carrier   | Reflection time  | Reflection set  |
|-----|--|---|--|--|---|--|---|
|     | Administrative document information        | drafters of administrative documents  | administrative documents to the submission                                       | Specific contents of relevant administrative documents                       |   | From data entry to the outage of the office platform   | pictures, audio and video and other supporting data   |
|     | $(I_4)$                                    | $(O_4)$   | $(T_{I4})$   | $(f_4)$  | $(c_4)$   | $(T_{m4})$   | $(g_4)$   |
| 5   | News information                           | Environmental status of major activities and subjective consciousness of participants | From the beginning to the end of major activities                                | Specific environment, process and participant behavior of major activities   | Court official website, microblog, WeChat official account, etc | From data entry to the outage of the court official website, microblog, WeChat official account, etc | Text reports, pictures, audio and video data of major activities  |
|     | $(I_5)$                                    | $(O_5)$   | $(T_{I5})$   | $(f_5)$  | $(c_5)$   | $(T_{m5})$   | $(g_5)$   |
| 6   | Personnel information                      | All court officers  | From the birth of a court officer to not working in the court                    | Resume, main work performance and subjective understanding of court officers | People's Court Personnel Management System                      | From data entry to the outage of the People's Court Personnel Management System                      | Name, work department, job title, job position, personal report, organization evaluation and other data |
|     | $(I_6)$                                    | $(O_6)$   | $(T_{I6})$   | $(f_6)$  | $(c_6)$   | $(T_{m6})$   | $(g_6)$   |
| 7   | People's mediation institution Information | People's mediation institutions   | From the establishment to the termination of the people's mediation institutions | Name, location and jurisdiction of people's mediation institutions           | People's Court Mediation Platform                               | From data entry to the outage of the People's Court Mediation Platform                               | Name, location, jurisdiction and other data of the people's mediation institution                       |
|     | $(I_7)$                                    | $(O_7)$   | $(T_{I7})$   | $(f_7)$  | $(c_7)$   | $(T_{m7})$   | $(g_7)$   |
| 8   |  |   | From the beginning of  | Specific contents of laws and regulations                                    | Laws and regulations database                                   | From data entry to the outage of the   | Laws and regulations, provisions,   |





Table 6.2 (continued)

| No. | Information type           | Noumenon                                  | State occurrence time  | State set   | Carrier  | Reflection time  | Reflection set   |
|-----|----------------------------|---|--|---|--|--|--|
| 12  | Lawyer information         | ( $o_{11}$ )<br>Legal practitioner        | ( $T_{h11}$ )<br>From obtaining the lawyer's qualification certificate to outage | ( $f_{11}$ )<br>Specific information about lawyers        | ( $c_{11}$ )<br>People's Court Lawyer Service Platform         | ( $T_{m11}$ )<br>From data entry to the outage of the People's Court Lawyer Service Platform         | ( $g_{11}$ )<br>Data and forms such as lawyer's name, license type, number, practice institution, etc. have been entered |
| 13  | Postal service information | ( $o_{12}$ )<br>Various service documents | ( $T_{h12}$ )<br>From the beginning to the end of service                        | ( $f_{12}$ )<br>The specific process of document delivery | ( $c_{12}$ )<br>Unified Service Platform of the People's Court | ( $T_{m12}$ )<br>From data entry to the outage of the Unified Service Platform of the People's Court | ( $g_{12}$ )<br>Document name, delivery time, signing method and other data  |
|     |                            | ( $o_{13}$ )                              | ( $T_{h13}$ )  | ( $f_{13}$ )  | ( $c_{13}$ )   | ( $T_{m13}$ )  | ( $g_{13}$ )   |

indicator system of China's Smart Court SoS. There are 65 indicators in the system corresponding to the 11 metric effects. Through monitoring the changes of these indicators, we can continuously improve the operating quality and effect of the whole Smart Court.

### **6.3.1 Performance Indicator**

The performance indicator system of China Smart Court is presented in Table 6.3. As a general SoSs can include a large number of systems, and each system may include many subsystems as well, the evaluation indicators in the table can serve as not only the comprehensive indicators but also the specific indicators for some important subsystems. Therefore, these key indicators provide an important design and evaluation basis for the implementation of the Smart Court SoSs engineering project.

### **6.3.2 Metric Illustrations**

The changing curves of the key performance indicators of China's Smart Court SoSs in recent years are illustrated in Fig. 6.2.

- In Fig. 6.2a, the total amount of data resources on the judicial big data platform reflects the volume efficacy of the Supreme Court to gather judicial big data from courts nationwide, and its steady rise shows that the accumulation of judicial big data resources is becoming more and more abundant.
- In Fig. 6.2b, the average response latency indicator of the court office platform has dropped to less than 0.8 s since November 2020, which is related to the delay efficacy and directly affect the experience of almost all users and has won the unanimous praise of users.
- In Fig. 6.2c, since November 2021, the court video network has been steadily connected to more than 93% of the S&T courts across China in real time, which reflects the scope efficacy of the courtroom video information nationwide.
- In Fig. 6.2d, since August 2015, the case coverage rate has basically reached and remained stable at 100% nationwide, which is related to the granularity efficacy of judicial information management and fully indicates that the judicial information management has reached a very fine level (single case) nationwide.
- In Fig. 6.2e, since December 2013, when the judicial data platform was officially launched, the types of information have steadily increased, basically realizing the convergence, management and application of all information types, which is related to the variety efficacy of information gathered by the judicial big data platform, reflecting the integrity of information management.

**Table 6.3** The performance indicators of Smart Court

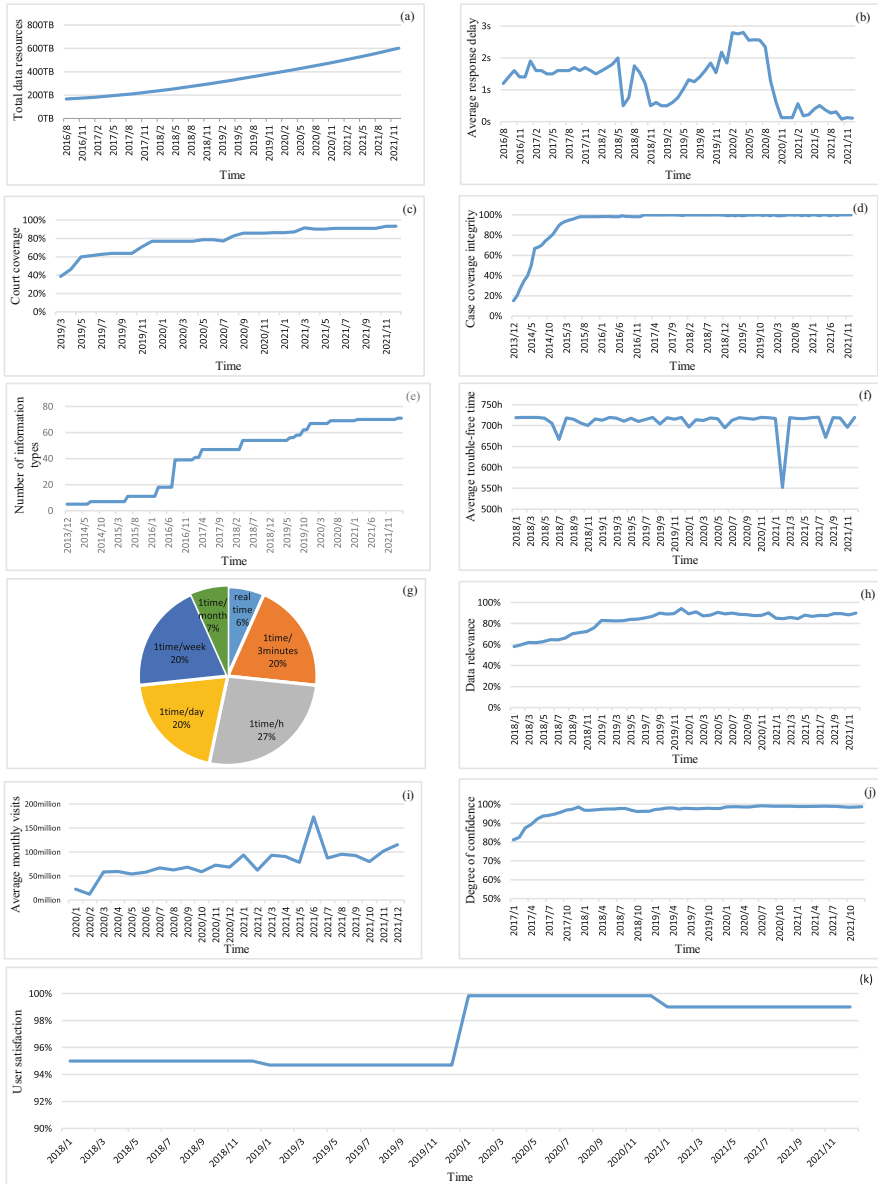
| Metric effects | Information collection   | Information action  | Information transmission   | Information processing   | Data space  |
|----------------|--|---|--|--|---|
| Volume         | <ul style="list-style-type: none"> <li>• Application system input data volume</li> </ul>   | <ul style="list-style-type: none"> <li>• Application system output data volume</li> </ul>   | <ul style="list-style-type: none"> <li>• Communication network bandwidth</li> </ul>                      | <ul style="list-style-type: none"> <li>• Information Infrastructure Storage Resources</li> <li>• Information Infrastructure Storage Resource Utilization</li> </ul>  | <ul style="list-style-type: none"> <li>• Data resources aggregated by information system</li> </ul>                                 |
| Delay          | <ul style="list-style-type: none"> <li>• Application system upload data delay</li> </ul>   | <ul style="list-style-type: none"> <li>• Application system operation response delay</li> </ul>   | <ul style="list-style-type: none"> <li>• Communication network information transmission delay</li> </ul> | <ul style="list-style-type: none"> <li>• Information infrastructure computing resources and processing rate</li> <li>• Information infrastructure computing resource utilization</li> <li>• Application system information processing delay</li> <li>• Security system safety protection processing delay</li> </ul> | <ul style="list-style-type: none"> <li>• Various data aggregation delay of information system</li> </ul>                            |
| Scope          | <ul style="list-style-type: none"> <li>• Regional coverage and number of users of the application system</li> </ul>  | <ul style="list-style-type: none"> <li>• The scope of information provided to users by the application system</li> </ul>  |  | <ul style="list-style-type: none"> <li>• The scope of application system processing information</li> </ul>   | <ul style="list-style-type: none"> <li>• Source region and department scope of all data aggregated by information system</li> </ul> |
| Granularity    | <ul style="list-style-type: none"> <li>• Integrity rate of information items collected by application system</li> <li>• Resolution of video information collected by application system</li> </ul> | <ul style="list-style-type: none"> <li>• Integrity rate of information items provided by the application system to users</li> <li>• Resolution of output video information of application system</li> </ul> |  | <ul style="list-style-type: none"> <li>• Integrity rate of information items processed by application system</li> <li>• Resolution of video information processed by application system</li> </ul>   | <ul style="list-style-type: none"> <li>• Integrity degree of information items aggregated by information system</li> </ul>          |

|               |  |  |   |  |   |
|---------------|--|--|---|--|---|
| Variety       | <ul style="list-style-type: none"> <li>Number of types and methods of application system input information</li> <li>Effective working time of application system</li> <li>Mean time between failures of application system</li> <li>Application system input data sampling rate</li> </ul> | <ul style="list-style-type: none"> <li>Number of types and methods of application system output information</li> <li>Effective working time of application system</li> <li>Mean time between failures of application system</li> <li>Application system output data sampling rate</li> </ul> | <ul style="list-style-type: none"> <li>Number of types of information transmitted over communication network</li> <li>Effective working time of communication network system</li> <li>Mean time between failures of communication network system</li> <li>Communication network bandwidth</li> <li>Communication network bandwidth utilization</li> </ul> | <ul style="list-style-type: none"> <li>Number of types of information processed by application system</li> <li>Effective working time of information processing system</li> <li>Mean time between failures of information processing system</li> <li>Computing storage facility throughput</li> <li>Application system information processing cycle</li> </ul> | <ul style="list-style-type: none"> <li>Number of types of information aggregated by information systems</li> <li>Length of time of all types of information aggregated by information system</li> <li>Sampling periods of all types of data aggregated by information system</li> </ul> |
| Duration      | <ul style="list-style-type: none"> <li>Effective working time of application system</li> <li>Mean time between failures of application system</li> </ul>   | <ul style="list-style-type: none"> <li>Effective working time of application system</li> <li>Mean time between failures of application system</li> </ul>   | <ul style="list-style-type: none"> <li>Effective working time of communication network system</li> <li>Mean time between failures of communication network system</li> </ul>  | <ul style="list-style-type: none"> <li>Effective working time of information processing system</li> <li>Mean time between failures of information processing system</li> </ul>   | <ul style="list-style-type: none"> <li>Length of time of all types of information aggregated by information system</li> </ul>   |
| Sampling-rate | <ul style="list-style-type: none"> <li>Application system input data sampling rate</li> </ul>  | <ul style="list-style-type: none"> <li>Application system output data sampling rate</li> </ul>   | <ul style="list-style-type: none"> <li>Communication network bandwidth</li> <li>Communication network bandwidth utilization</li> </ul>  | <ul style="list-style-type: none"> <li>Computing storage facility throughput</li> <li>Application system information processing cycle</li> </ul>   | <ul style="list-style-type: none"> <li>Sampling periods of all types of data aggregated by information system</li> </ul>  |
| Aggregation   |  | <ul style="list-style-type: none"> <li>Application system output data aggregation</li> </ul>   |   | <ul style="list-style-type: none"> <li>Data aggregation processed by information processing systems</li> </ul>   | <ul style="list-style-type: none"> <li>Aggregation degree of the total data aggregated by information system</li> </ul>   |
| Coverage      |  | <ul style="list-style-type: none"> <li>Distribution and the number of application system users</li> </ul>  | <ul style="list-style-type: none"> <li>Communication network coverage area network</li> </ul>   | <ul style="list-style-type: none"> <li>Security system information encryption effectiveness</li> <li>Accuracy of user authority control of security systems</li> <li>Safety isolation reliability of inter-network security systems</li> </ul>   | <ul style="list-style-type: none"> <li>Regional distribution of information system</li> </ul>   |
| Distortion    | <ul style="list-style-type: none"> <li>Input information accuracy of application system</li> </ul>   | <ul style="list-style-type: none"> <li>Output information accuracy of application system</li> </ul>  | <ul style="list-style-type: none"> <li>Bit error rate and packet loss rate of information transmitted over communication network</li> </ul>   | <ul style="list-style-type: none"> <li>Processing error of information processing system</li> </ul>  | <ul style="list-style-type: none"> <li>The confidence of the full data of information system</li> </ul>   |

(continued)

**Table 6.3** (continued)

|                |   |   |  |   |   |
|----------------|---|---|--|---|---|
| Metric effects | Information collection  | Information action  | Information transmission   | Information processing  | Data space  |
| Mismatch       | <ul style="list-style-type: none"> <li>• Application system input information mismatch</li> </ul> | <ul style="list-style-type: none"> <li>• Output information adaptability and user satisfaction of application system</li> </ul> | <ul style="list-style-type: none"> <li>• Format and type adaptability of information transmitted over communication network</li> </ul> | <ul style="list-style-type: none"> <li>• Matching accuracy of “user requirements—output data” of information processing system</li> </ul> | <ul style="list-style-type: none"> <li>• Matching accuracy of “user requirements—output data” of full data of information system</li> </ul> |



**Fig. 6.2** Examples of 11 types of metrics of Smart Court SoSs [1, 3]. **(a)** Change curve of total data resources of the judicial big data platform; **(b)** Change curve of average response delay of court office platform; **(c)** Change curve of court coverage monitored to S&T Court; **(d)** Change curve of nationwide court case coverage integrity; **(e)** Change curve of information types of the judicial big data platform; **(f)** Change curve of the average trouble-free time of the information systems; **(g)** Distribution of data sampling rate of the LawEye platform; **(h)** Change curve of data relevance of the judicial big data platform; **(i)** Change curve of average monthly visits of People’s Court Online Service; **(j)** Change curve of judicial statistics confidence of judicial big data platform; **(k)** Change curve of user satisfaction of information system

- In Fig. 6.2f, since March 2018, the average time between failures of the court information systems has basically remained stable at over 700 h, which is related to the duration efficacy of the court information systems. Individual periods of the significant decline will cause the inevitable shortening of the length of real-time information collection in the corresponding period.
- In Fig. 6.2g, the sampling rate of 53% of monitoring information is higher than 1 time/h and 73% of monitoring information is higher than 1 time/day on the LawEye platform. The LawEye platform monitors and manages the operating quality of court information systems nationwide, and its sampling intensity is related to the sampling-rate efficacy of the court information systems.
- In Fig. 6.2h, since January 2019, the information aggregation degree of the judicial big data platform has been higher than 80%, which is related to the aggregation efficacy of judicial big data and indicates that the association and application of information is at a good level.
- In Fig. 6.2i, since February 2020, the number of monthly visits to People's Court Online Service, a unified window serving the public, has steadily increased and exceeded 100 million by December 2021. The number of information system visits is related with the coverage efficacy of information systems, fully demonstrating the remarkable effectiveness in facilitating the public.
- In Fig. 6.2j, since January 2018, the confidence level of statistics on the judicial big data has been higher than 97% and is currently stable at more than 99% for a long period of time. The data confidence level is negative related to the distortion efficacy of information, i.e., the corresponding distortion level is lower than 1%, thus laying a credible foundation for various big data analyses and services.
- In Fig. 6.2k, since January 2020, the user satisfaction of the court information systems has been higher than 98%, which is the negative indicator of the mismatch efficacy of the court information systems, fully demonstrating the remarkable achievements of China Smart Court engineering project.

The excellent performance of China Smart Court is demonstrated by the indicators in Fig. 6.2. Specifically, all the 65 indicators in Table 6.3 are kept monitoring 24 h annually by the LawEye platform. It reflects the operation status of the critical information systems, including the aforementioned intelligent service, intelligent trial, intelligent execution, intelligent management, judicial openness, and etc. Any unusual changes of these indicators are analyzed and adjustment is conducted according to the dynamic configuration of information systems. For instance, the decrease of the amount of data resources means that the volume efficacy of the judicial big data platform is reduced. According to the dynamic configuration of China's Smart Court SoSs, the volume efficacy involves all the links of information collection, transmission, processing, action and data space. Therefore, the corresponding approaches, such as the enlargement of the storage of data space, the increase of the bandwidth of court private networks, and the data compression processing, are conducted accordingly. In fact, it is the systematically helps us to keep improving the operation quality and efficiency of China Smart Court.



**Table 6.4** Changes of the indicators of building up the Smart Court 2017–2021

| Court              | 2017 | 2018 | 2019 | 2020 | 2021 |
|--------------------|------|------|------|------|------|
| Nationwide         | 72   | 78   | 85   | 88   | 84.0 |
| Supreme court      | 80   | 83   | 86   | 90   | 83.3 |
| Intermediate court | 70   | 78   | 86   | 90   | 84.9 |
| Basic court        | 67   | 73   | 83   | 86   | 82.7 |

The Supreme People’s Court has been conducting comprehensive evaluation through the indicators of building up the national Smart Court since 2017. Table 6.4 reflects the changes in the indicators.

In Table 6.4, the indicators of building up the Smart Court at all levels have been increasing yearly since 2017, reaching an excellent level by 2020. 2021 was the beginning of the new five-year plan, and the evaluation criteria were raised. Although the grades in 2021 decreased compared to those in the previous year, they maintained a general level higher than 80, while the actual quality and efficiency were significantly improved.

## 6.4 Supports from China Smart Court

The major difficulty of information engineering are “making use of it” rather than “building it up”. No information system is perfect, not to mention information systems that cover all sectors vertically and main business areas—unsatisfactory aspects seem unavoidable. In the case of China Smart Court, it is precisely by relying on the strong popularization and promotion, as well as persisting in the mutual running-in and mutual promotion of “building up” and “making use” that many information applications have successfully covered the courts at all levels throughout the country to benefit the mass crowd. Meanwhile, the judicial operation pattern of Chinese courts has been reshaped in all aspects.

The Smart Court supports universal intelligent services in all time and space. In the past, mediation, filing of cases, exchange of evidence, marking, opening of hearings, consultation on litigation matters, understanding of the litigation process, attendance on court hearings, access to judicial documents, and other activities that used to be completed by parties or litigation agents in person can now be realized through the Internet. Meanwhile, the judges can utilize a dedicated network of the court to directly contact the people through the Internet based on security isolation exchanges, such that the people involved in judicial proceedings need to be present in person at most once or not even once, which significantly reduces their effort and cost in commuting.

The Smart Court supports the full process of intelligent trials assisted by intelligent technologies. The courts at all levels can instantly transmit the litigation documents presented by the parties to the trial information system, by scanning the paper-based documents submitted offline or directly uploading the electronic documents submitted online, and thus the case judges can easily review the

documents and form collegium online. Meanwhile, based on the intelligent recognition and processing of file information, the trial case handling system can almost provide judges with intelligent assistance throughout the whole process, including automatic cataloging of electronic files, intelligent recommendation of legal provisions, intelligent recommendation of similar cases, auxiliary generation of legal documents, and intelligent error correction of judicial documents, etc. In addition, it can be combined with speech recognition technology to support intelligent speech recognition of the trial and automatically generate high-accuracy court transcripts, which significantly reduces the routine work of judges and clerks.

The Smart Court supports the intelligent execution of inter-departmental coordination. Because the whole nation should be well-coordinated in the enforcement phase, the Smart Court utilizes the Internet technology to vertically connect the enforcement departments of courts at all levels across the country to realize linkages between the upper and lower levels; in the meantime, it enables the horizontal sharing of information with finance, transportation, economy, and other industries to achieve business coordination, such that the executive judges can conduct their work online without leaving the house, which was previously only possible in person, including handling of cases, process node management, executive investigation, control and punishment for breach of credibility, judicial auction, information disclosure, and executive command. The Smart Court not only reduces the time and cost spent on commuting for a large number of personnel but also provides an effective way that is difficult to achieve through traditional offline methods. Therefore, it has become a new solution for Chinese courts to solve enforcement problems effectively.

The Smart Court supports intelligent management based on judicial big data and gathers a large amount of business and technical data in real time. It has continuously accumulated six types of interrelated judicial big data resources, including trial execution, judicial personnel, judicial administration, judicial research, informatization, and external data. On this basis, online office, judicial supervision, and one-click filing can bring considerable convenience to judicial administration. The judicial statistics, personnel information management, trial situation analysis, and economic and social development research based on judicial big data have created a new approach that could not be achieved traditionally, in terms of both efficiency and accuracy.

The final effect of the Smart Court SoSE is reflected in its great contribution to the progress of judicial civilization: it enables the mass crowd to accomplish their litigation processes with the need of being in person at most one time and can reduce the clerical work of judges by more than 30%. The efficiency of the trial has been improved by more than 20%, and the solemn promise of “basically solving the difficulties in enforcement in 2–3 years” has been realized. Judicial openness has comprehensively enhanced the judicial transparency of China. The “Quality of Judicial Process Index”, which mainly reflects the judicial informatization, was ranked number one in the world by the World Bank in 2020. From 2019 to 2021, it reduced public travel costs equivalent to 200,000 man-years, and saved 302.4 billion CNY in social expenses. The Smart Court in China has not only provided

strong information support for social fairness and justice but also won wide attention and high praise globally. On this basis, the Supreme People's Court of China has successively issued "Online Litigation Rules of People's Courts", "Online Mediation Rules of People's Courts", and "Online Operation Rules of People's Courts", such that the joint force of advanced technology and judicial operation can be further refined in the form of judicial interpretation and normative documents. Therefore, the use of the online judicial model is effectively promoted towards a higher level of digital justice.

Due to the growing user demands and the rapid evolution of information technologies, there is still plenty of room for improvement regarding intelligence, integration, collaboration, universality, and convenience. First, there is an urgent need to constantly deepen and summarize the relevant academic theories and technical models equated on the methodology to construct a rich and systematic SoSE model and tool system as references for the penetration of information and intelligence in more vertical industrial sectors. Second, in view of the increasing popularity of cloud service models, it is indispensable to explore the collaboration theories and methods to implement service-oriented integration to promote the transformation and upgrading of the Smart Court SoSs engineering from self-built systems to shared services. Third, it is crucial to combine the direction of advanced technologies, such as artificial intelligence, 5G, blockchain, and meta-universe, to improve the adaptability and flexibility of the framework, and to enable deeper integration of advanced science and technologies to judicial operations. Finally, the construction and enrichment of the theoretical system dynamics of information systems can provide sufficient scientific support. Meanwhile, in addition to the technical implementation, the construction of Smart Court inevitably involves user feedback, reform of the judicial system, establishment of related systems and norms, etc. Enforcing the research work on the integration of science and technology, legal theory, and social sciences, will certainly provide more powerful support for the construction of Smart Court in China to achieve more promising results.

## 6.5 Chapter Summary

The Smart Court SoSs engineering project of China inherit the experiences and methodologies of traditional system engineering. Based on the original basic theories, such as the universal information model, information metric system, the key evaluation indicators of information system-of-systems are put forward. The Smart Court system-of-systems project has fully reshaped the operation mode of the People's Court. Through continuous monitoring and monthly analysis of a series of key evaluation indicators, the entire information system-of-systems is in a good state of progressive development and constant optimization, making an important contribution to the progress of judicial civilization in the information era. The exploration and practice of key evaluation indicators of information system-of-systems under fundamental information theories, and quality efficiency

improvement are not only applicable to the vertical sectors of Smart Court but also provide useful references for e-government, as well as other large-scale information projects.

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