WG1 Terminology Work of IEC SyC on Smart City Systems

Dr. Xiaomi An, Professor at Renmin University of China

Convener of WG1, IEC SyC on Smart Cities

January 14, 2019, Seoul, Korea

Third ITU Workshop on Data Processing and Management for IoT and Smart Cities and Communities

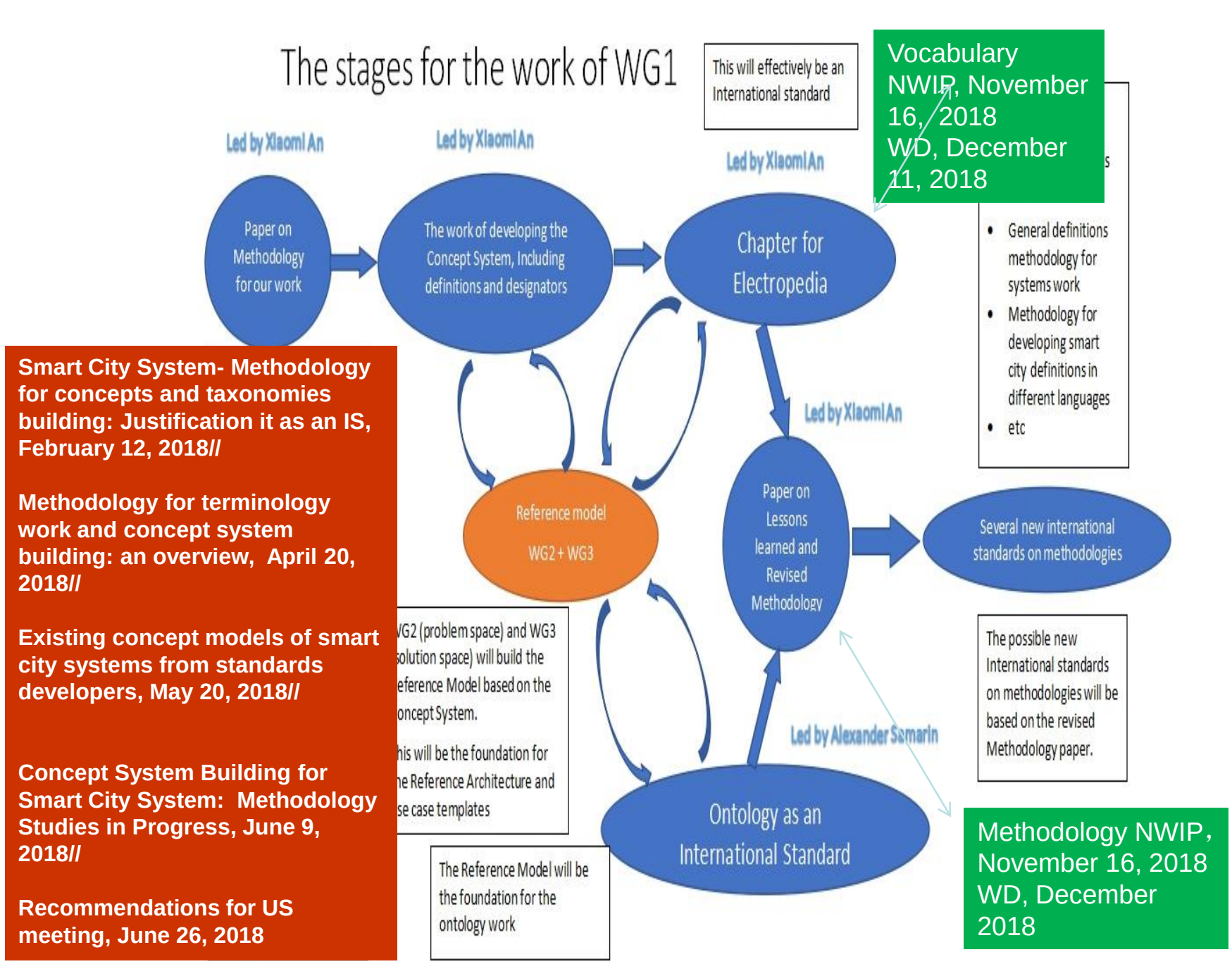
INTERNATIONAL ELECTROTECHNICAL COMMISSION

Outline

- Members of the WG1
- The stages of work of WG1
- The work plan of WG1
- Joint work of WG1 with ISO and ITU
- An Integrated methodology frameworks for smart city system concept system building: common concerns of SDOs
- An integrated methodology framework for smart city system concept system building: applications to the two NWIPs

Members of the WG1

- 35 experts
- 11 countries
  - China 8
  - US 7
  - India 5
  - Korea 4
  - RU 4
  - GB 2
  - CH 1
  - DE 1
  - JP 1
  - SE 1
  - ZA 1



Smart City System- Methodology for concepts and taxonomies building: Justification it as an IS, February 12, 2018//

Methodology for terminology work and concept system building: an overview, April 20, 2018//

Existing concept models of smart city systems from standards developers, May 20, 2018//

Concept System Building for Smart City System: Methodology Studies in Progress, June 9, 2018//

Recommendations for US meeting, June 26, 2018

Project team of Vocabulary

Chair: Xiaomi An　Experts：from 6 countries

Experts: Document SyCSmartCities/50/NP		
Country: CH		
First name	Last name	Email
Alexander	Samarin	alexandre.samarine@gmail.com
Country: CN		
First name	Last name	Email
Wanzhong	Ma	wanzhong.ma@gmail.com
Xiaoshuang	Jia	jiaxs1219@sina.com
Dapeng	Zhang	iecseg1@163.com
Jinghua	Min	minjinghua@qq.com
Country: DE		
First name	Last name	Email
Kliesch	Mario	mario.kliesch@westnetz.de
Country: IN		
First name	Last name	Email
Krishnankutty	Manikandan	maniyan@bis.gov.in
Narang	N Kishor	kishor@narnix.com
Country: JP		
First name	Last name	Email
Shuji	Hirakawa	hirakawa@c05.itscom.net
Country: ZA		
First name	Last name	Email
Hunsley	Jonathan	HunsleyJP@elec.durban.gov.za

Project team of Methodology

Experts: Document SyCSmartCities/51/NP, 5 countries

EXPERTS			
LAST NAME:	FIRST NAME:	E-MAIL:	COUNTRY:
Min	Jinghua	minjinghua@qq.com	China
Gao	Yongchao	gaoyc@sdis.cn	China
Zhang	Dapeng	iecseg1@163.com	China
Ma	Wanzhong	wanzhong.ma@gmail.com	China
Kliesch	Mario	mario.kliesch@westnetz.de	Germany
N Kishor	Narang	kishor@narnix.com	India
Jonathan	Hunsley	HunsleyJP@elec.durban.gov.za	South Africa
Samarin	Alexander	alexandre.samarine@gmail.com	Switzerland

S. No.	FUNCTIONS	ACTORS	2017				2018				2019				2020				2021			
			01	02	03	04	01	02	03	04	01	02	03	04	01	02	03	04	01	02	03	04
	Methodology for concepts and taxonomies building	WG1	Initiatives	Consensus on work item			Submission of NWIP		Start work on NWIP					CD				DTS				TS (SRD)
	Vocabulary (chapter for electropedia)	WG1	Initiatives	Consensus on work item			Submission of NWIP		Start work on NWIP					CD				CDV				IS
	Smart City Ontology	WG1			Initial Ideation	Consensus on work item	Submission of NWIP						Start work on NWIP									
	Develop “Smart City Context Setting Framework” jointly with WG1&WG2	WG1, WG2 & WG3				Initial Ideation/Consensus on Work Item	Start joint work		Complete joint work													
	Develop Definitions for each new NW	WG1 + relevant PT	Ongoing																			
	Develop glossary for whole committee		Ongoing																			
	Liaison with the IEC/ISO/ITU-T smart city terminology WG	**WG1**		**Initatives**	**work on core concepts**	**agrement on core concepts**			**common defintions**	**common defintions**	**Ongoing**											
	Liaision with IEC/TC1 on terminology and the methodology	**WH1**								**Start**	**ongoing**											

Joint work of WG1 with ISO and ITU

IEC/ISO/ITU Smart Cities Coordination Task Group Draft White Paper: Suggested Priority Terms in Need of Common Definitions to Support Standards Activities for Smart Cities

- Task Group Members: Dr. Xiaomi An (IEC/CN); Maria Cristina Buet (ITU); Etienne Cailleau (ISO/FR); John Devaney (ISO/UK); Meghan Housewright (ISO/US); Janna Lingenfelder (IEC/DE); Michael Mulquin (IEC/UK); Dave Welsh (ISO/US); and Dr. Ziqin Sang (ITU/CN).

- 2017
  - A list of 24 terms are identified as most in need of coordination and a commonly agreed to definition. The terms are listed alphabetically with the relevant definitions used in any of the IEC, ISO, or ITU international standards that use them.
- 2018
  - Half of the terms have discussed and agreed on unified single definition
- 2019
  - Continue work on unified single definition for the rest of terms

Integrated methodology frameworks for smart city system concept system building: Common concerns of SDOs

- Basic concepts
- System of systems view on smart city as a complex system
- Multi-dimension governance framework towards shared visions.
- Multi-level interaction framework towards shared goals.
- Multi-domain application framework towards shared solutions.
- Lifecycle technical framework towards shared problems
- Case studies

Definition of system of systems

- set of systems that integrate or interoperate to provide a unique capability that none of the constituent systems can accomplish on its own
- Note 1 to entry: Each constituent system is a useful system by itself, having its own management, goals, and resources, but coordinates within the SoS to provide the unique capability of the SoS.
- [SOURCE: ISO/IEC/IEEE 24748-1:2018, 3.56; ISO/IEC/IEEE 15288:2015]

Definitions of framework

- particular **set of beliefs, ideas** referred to in order to describe a scenario or solve a problem [ISO 15638-1:2012, 4.20; ISO 15638-8:2014, 4.28; ISO 15638-10:2017, 3.22; ISO 15638-12:2014, 4.23; ; ISO/TS 15638-13:2015, 4.28; ISO 15638-15:2014, 4.22; ISO 15638-17:2014, 4.24;ISO 15638-18:2017, 3.24; ISO 15638-21:2018, 3.21]
- documented set of guidelines to create **a common understanding of the ways of working** [ISO 37500:2014, 3.5]
- essential **supporting or underlying structure**[ISO/TR 17791:2013, 2.1]
    - a structural diagram that relates the component parts of a conceptual entity to each other[ISO 15704:2000, 3.9]
    - structure for supporting or enclosing something else, often acting to partition something complex into simple components[ISO/TR 17119:2005, 2.6;ISO/TS 18790-1:2015, 3.9]
    - structure of processes and specifications designed to support the accomplishment of a specific task[ISO/TS 12911:2012, 3.10]
    - logical structure for classifying and organizing complex information [ISO/TS 27790:2009, 3.27; ISO/TS 19150-1:2012,4.6]
    - structure composed of related parts that are designed to support something[ISO/IEC 20006-1:2014, 4.10]
    - structure expressed in diagrams, text, and formal rules which relates the components of a conceptual entity to each other[ISO 19439:2006, 3.31;ISO 17185-1:2014, 3.6; ISO/TR 17185-3:2015, 3.7]
  - a set of application programming interface (API) classes for developing applications and for providing system services to those applications.[ITU-T Q.1741 (11/2011); ITU-T Q.1743 (09/2016)]
- A **stereotyped package** that **contains model elements which specify a reusable architecture for all or part of a system.**
  - Frameworks typically include **classes, patterns or templates.** When frameworks arespecialized for an application domain, they are sometimes referred to as application frameworks.[ISO/IEC 19501:2005, 0000_91; ISO 14813-5:2010(en), B.1.59]

Definitions of 'methodology'

A coherent, integrated set of methods from which a coherent sub-set can be selected for particular applications. A **methodology should contain at least four components:**

1. a conceptual model of constructs essential to the problem,

2. a set of procedures suggesting the direction and order to proceed,

3. a series of guidelines identifying things to be avoided, and

4. a collection of evaluative criteria for assessing the quality of the product.

(ISO/IEC 16500-8:1999, 3.14)

- Note1: Methodology can refer to set of instructions (e.g. provided through text, computer programs, tools) that is a step-by-step aid to the user (ISO 15704:2000 3.14; ISO 19439:2006, 3.45)
- Note2: Methodology can also refer to specific set of means or procedures used in attaining an end (ISO 14813-5:2010, B.185)
- Note 3: Methodology can refer to collection of standards, procedures and supporting methods that define the complete approach to the development of a product or system (ISO/IEC 21827:2008, 3.22)

Definitions of methodology framework

- a way, or structure, that supports a number of methods and languages to be used together when developing a system.

[ISO/IEC 16500-8:1999, 3.15.]

Definitions of ‘concept’

- **unit of knowledge created by a unique combination of characteristics.**

(**ISO 1087-1:2000, 3.2.4;** ISO/IEC 11179-4:2004,3.2; ISO/IEC 11179-2:2005, 3.10 ISO 17115:2007, A.3.2.1; ISO 13606-2:2008, 4.6; ISO/IEC 15944-7:2009, 3.4; ISO/TS 22789:2010, 2.9; ISO 22745-2:2010, B.2.3; ISO 10241-1:2011, 3.2.1; ISO 18308:2011, 3.15; ISO 10241-2:2012, 2.4.1.1 ;ISO/IEC 15944-10:2013, 3.32; ISO 22274:2013, 3.7; ISO/IEC 11179-3:2013, 3.2.18;ISO/IEC TR 20943-6:2013, 3.1.2; ISO/TR 12300:2014, 2.2.6; ISO 18104:2014, 3.1.1; ISO/TS 17439:2014, 3.3; ISO 13940:2015, 3.2.1; ISO/TS 13972:2015, 2.12; ISO/TS 16843-2:2015, 3.1; ISO/TS 16277-1:2015, 3.1.1; ISO/TS 18790-1:2015, 3.2; ISO/IEC 11179-5:2015, 4.3; ISO/TS 19256:2016, 3.6; ISO 19104:2016, 4.3; ISO/IEC 30182:2017, 2.3; ISO 19465:2017, 3.1; ISO 5127:2017, 3.1.1.02; ISO 19146:2018, 3.1.4; ISO 17117-1:2018, 3.1.1)

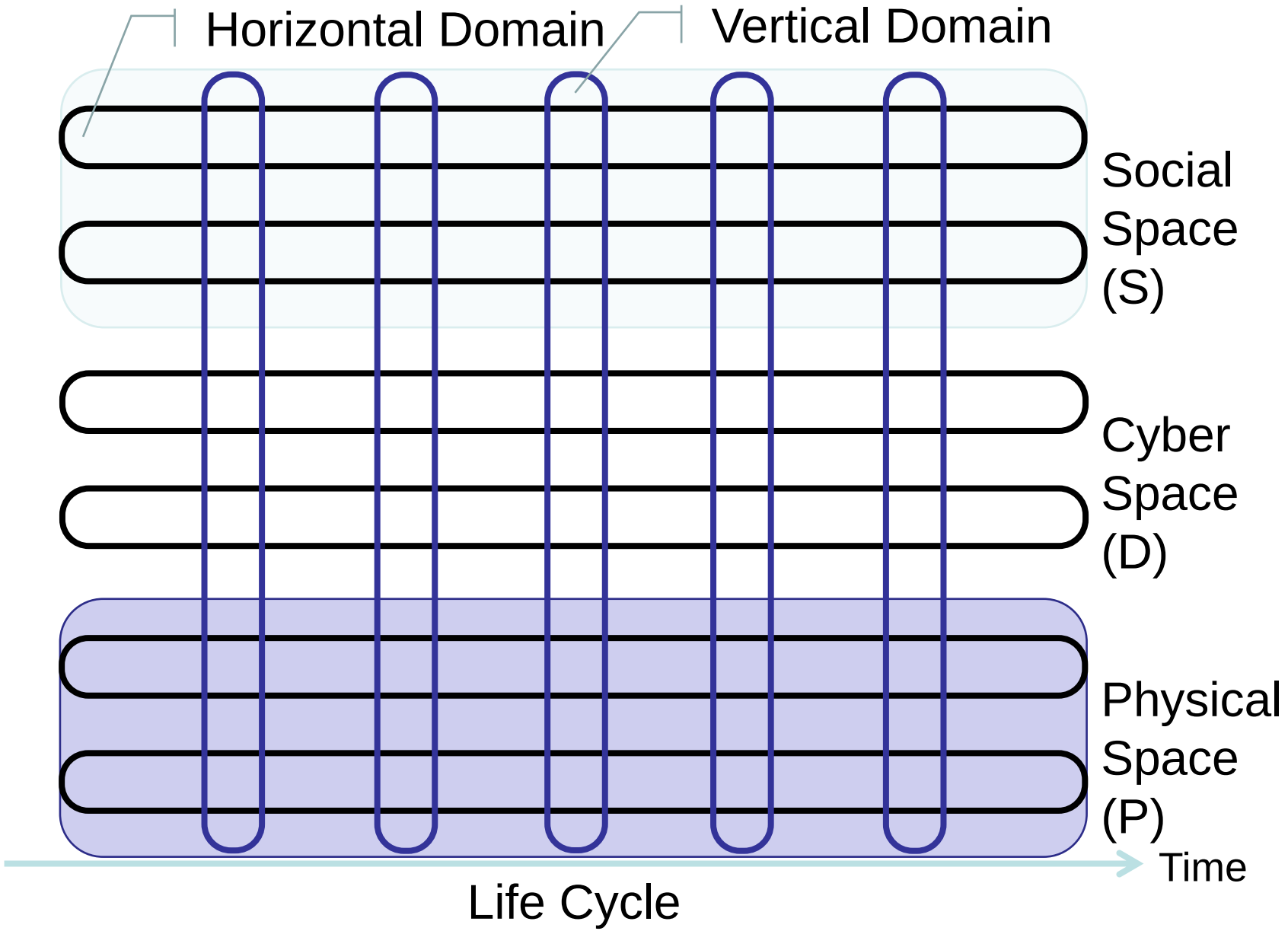
- NOTE1:
- (1) unit of thought (ISO/TS 29002-4:2009, 3.2; ISO/TS 29002-5:2009, 3.1; ISO/TS 29002-10:2009, 3.3; ISO/TS 29002-31:2009, 3.3; ISO 25964-1:2011, 2.11)
- (2)units of thought **constituted through abstraction on the basis of properties common to a set of objects** (ISO 15143-1:2010, 3.3.9; ISO/TR 13054:2012, 2.1;
- (**3)unit of thought constituted by a unique set of necessary characteristics** (ISO 22745-2:2010, 4.1)

Definition of ‘concept systems’

- set of concepts structured according to the relations among them.

(Source: ISO 1087-1:2000 Terminology work -- Vocabulary -- Part 1: Theory and application, 3.2.11)

(ISO 17115:2007, A.3.2.11; ISO/TS 22789:2010, 2.10; ISO 22745-2:2010, B.2.5;ISO 10241-1:2011, 3.2.3;ISO 10241-2:2012, 2.4.2.1; ISO 22274:2013, 3.8; ISO/IEC 11179-3:2013, 3.2.19; ISO/IEC TR 20943-6:2013, 3.1.3; ISO 24156-1:2014, 3.4;ISO/IEC 11179-1:2015, 3.2.4; ISO 13940:2015, 3.2.2;ISO 19104:2016, 4.6;ISO 5127:2017, 3.1.2.04 ; ISO 19465:2017, 3.2; ISO 19146:2018, 3.1.5)



System of systems view on Smart City Systems

A multi-dimensional governance framework for smart city :
from ISO, IEC, ITU smart city definitions
(An, Mulquin, Song,2017)

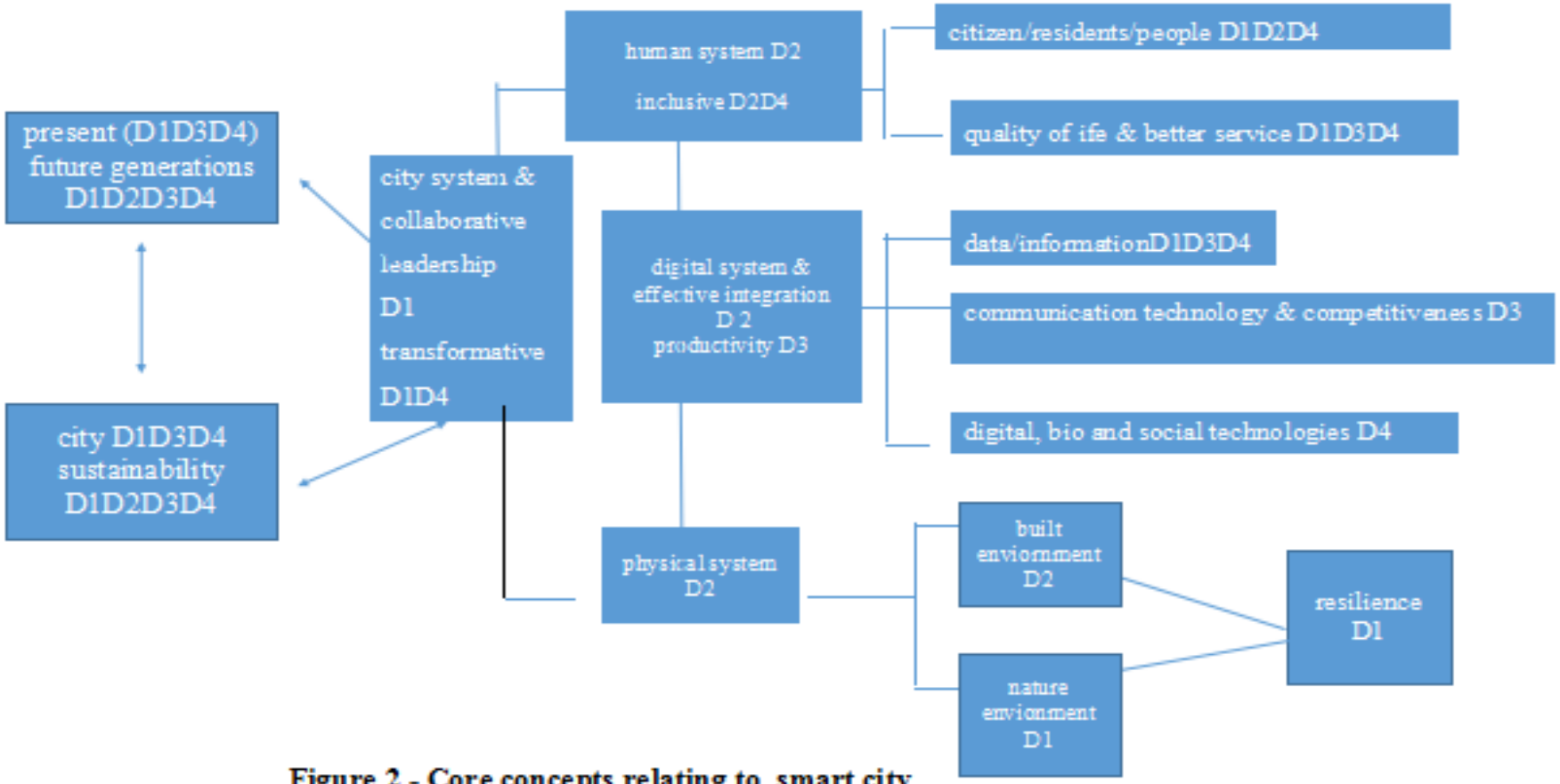
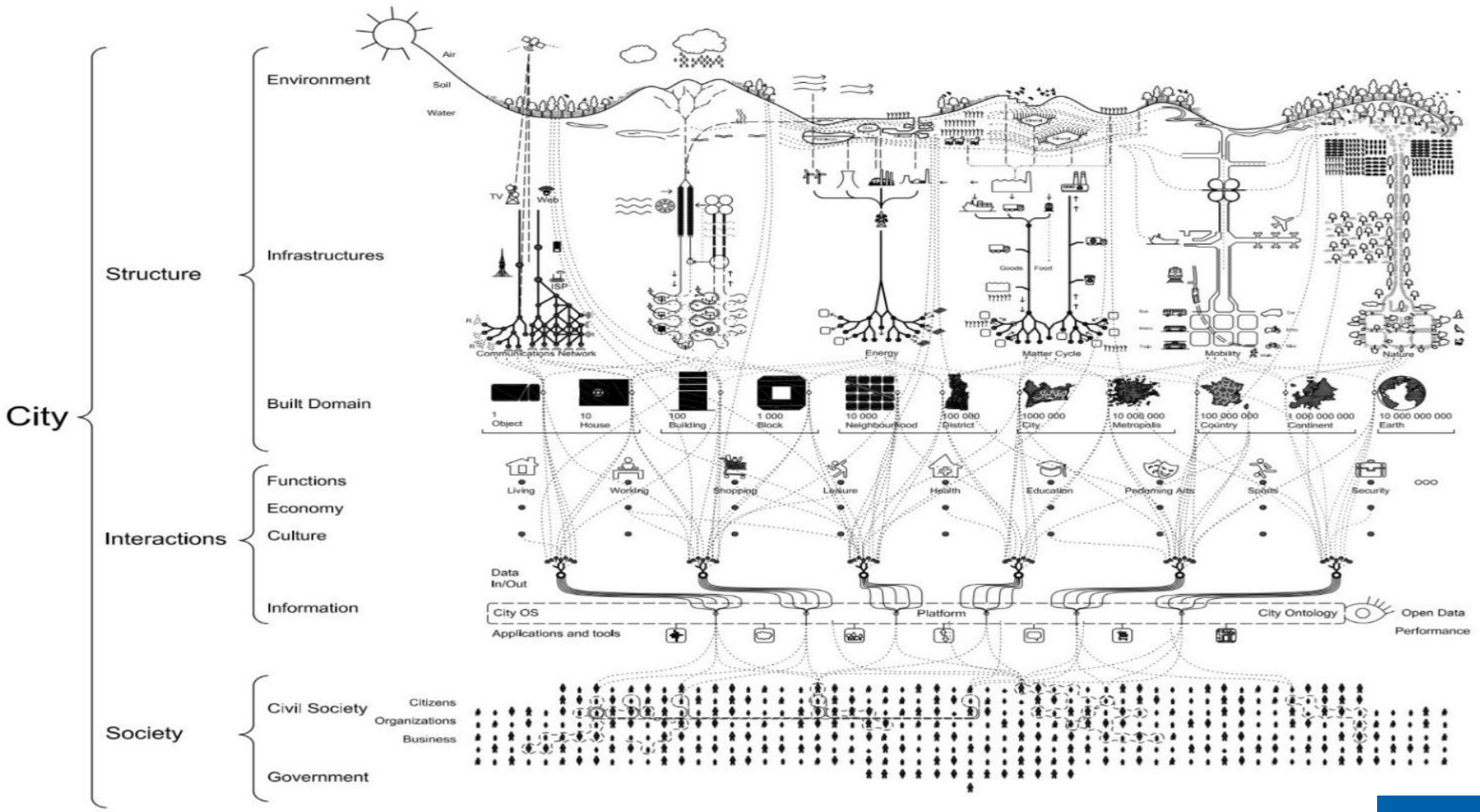


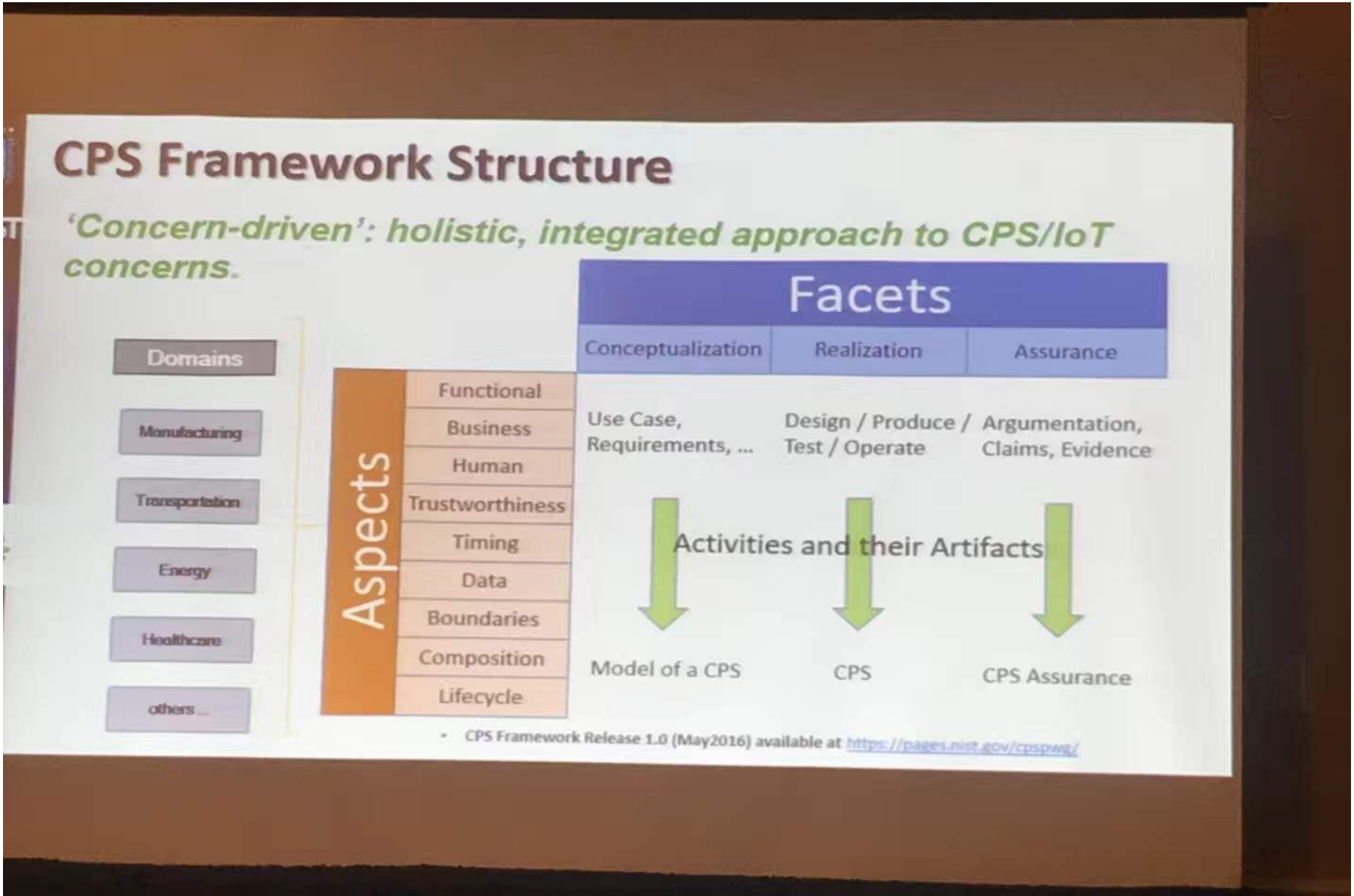
Figure 2 - Core concepts relating to smart city

Definitions1(D1):ISO/TMB SAG on Smart Cities (2015)
Definition 2 (D2):ISO 37106 :2018;ISO/IEC 30182:2017
Definition3 (D3): ITU-T L. 1503(06/2016),ITU-T Y. 4900(06/2016),ITU-T TR SSC DEF(2014);ITU-T Y.SSC. Terms, TD125 R1 (2017)
Defintion4 (D4): IEC SyC WG1

A multi-level interaction framework for smart city:
from the ISO/CD 37105 Descriptive framework for cities and communities



A multi-domain application framework for smart city: from the NIST CPS framework, 2018



A S-D-P three dimensional setting framework for smart city system from BSI

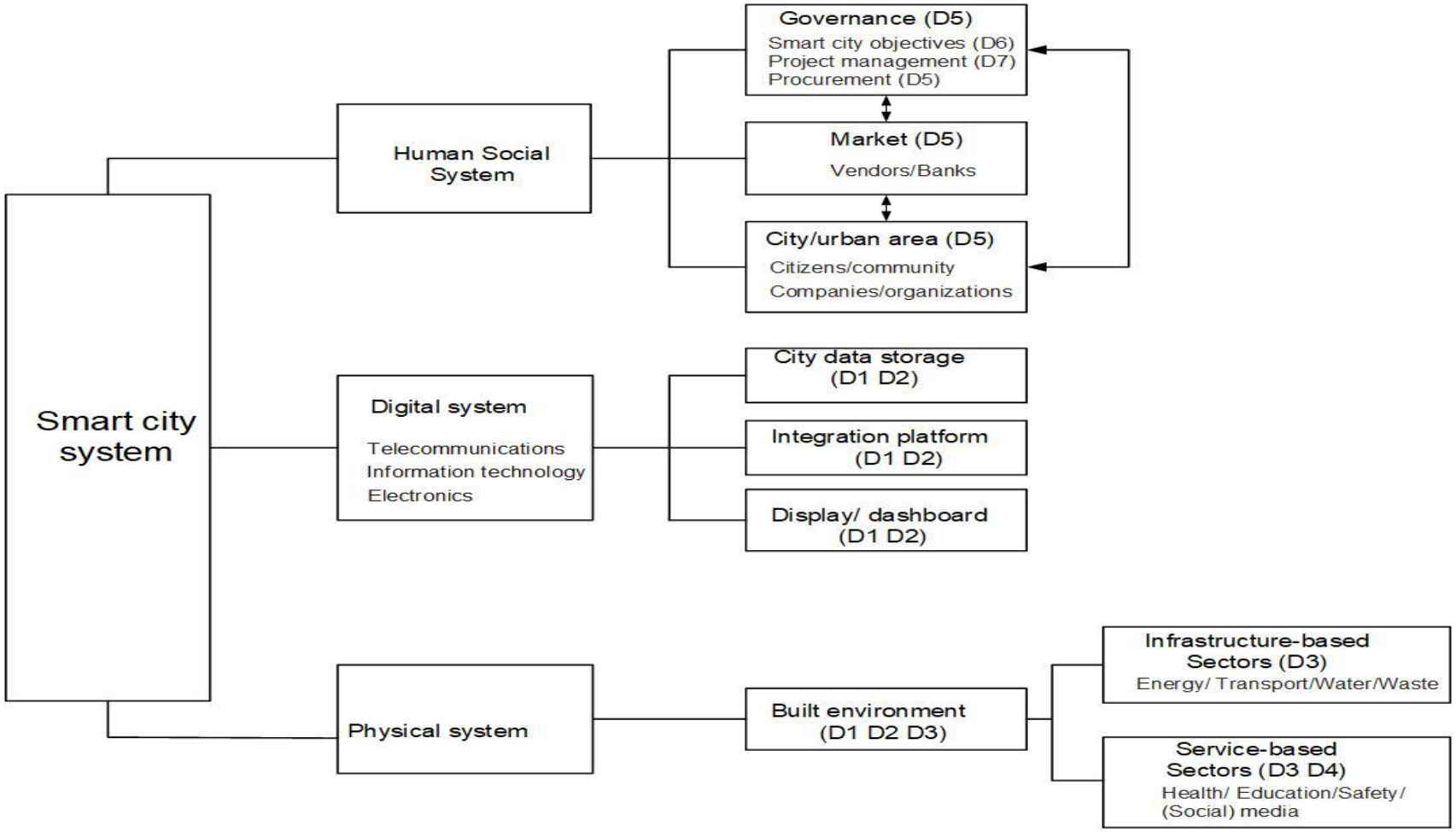


Figure1 BSI Mapping smart city standards （2013）

A S-D-P three dimensional setting framework for smart city system from Germany

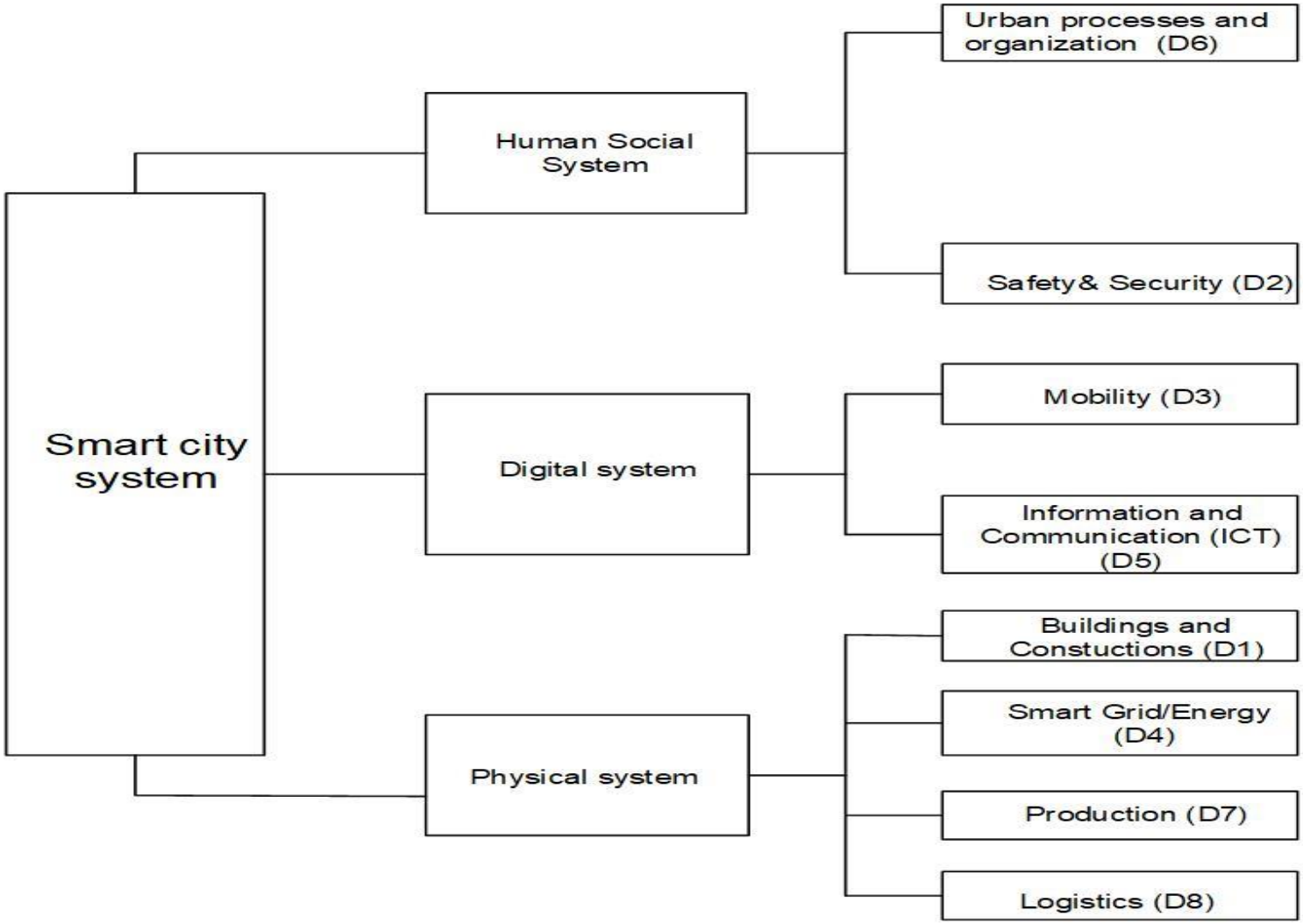


Figure 2 The German standardization roadmap smart city (2014)

A S-D-P three dimensional setting framework for smart city system from SF-SSCC

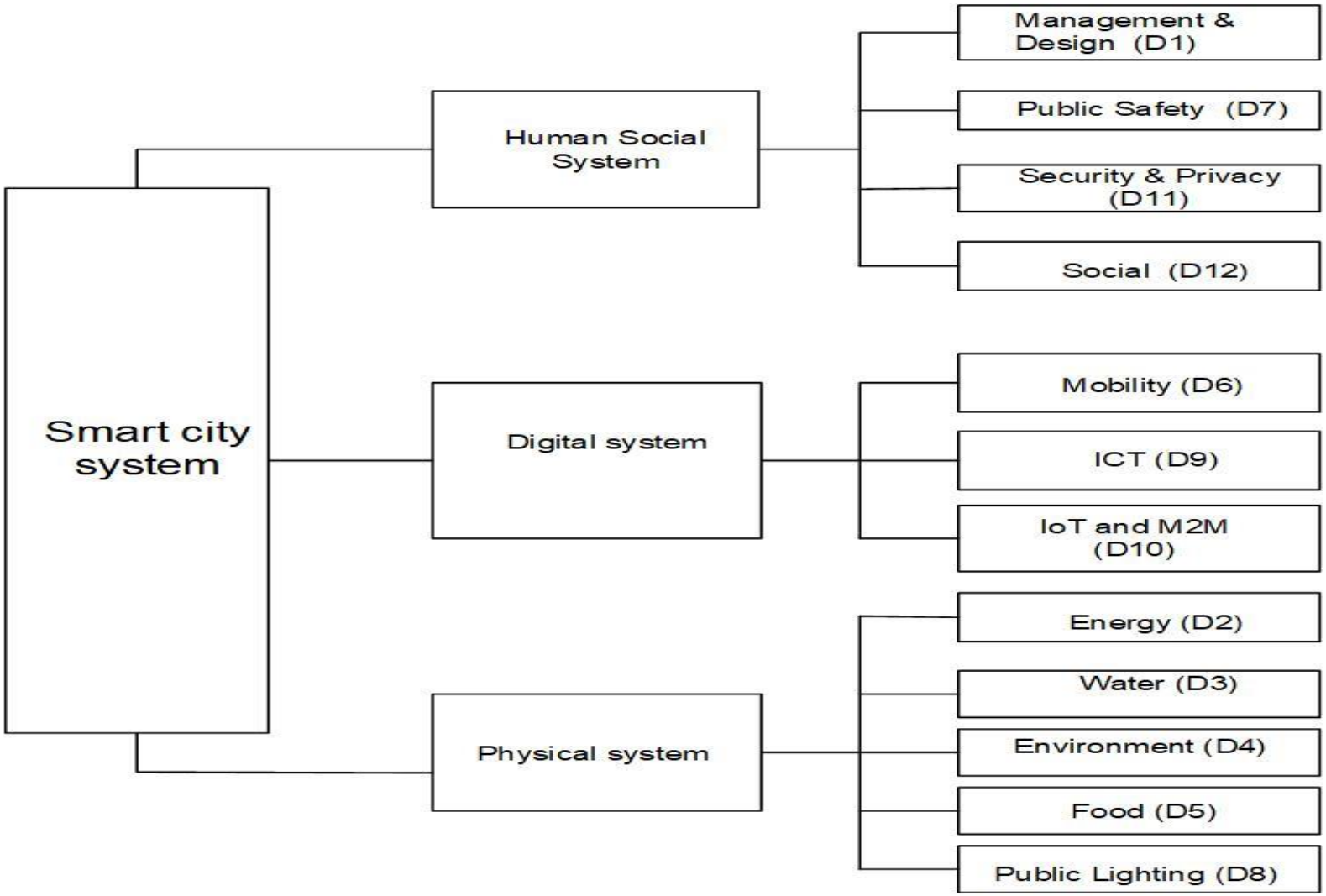


Figure 3 SF-SSCC Overview of standards and specifications relevant to smart cities (2018)

A life-cycle technical framework for smart city system from SyC WG3

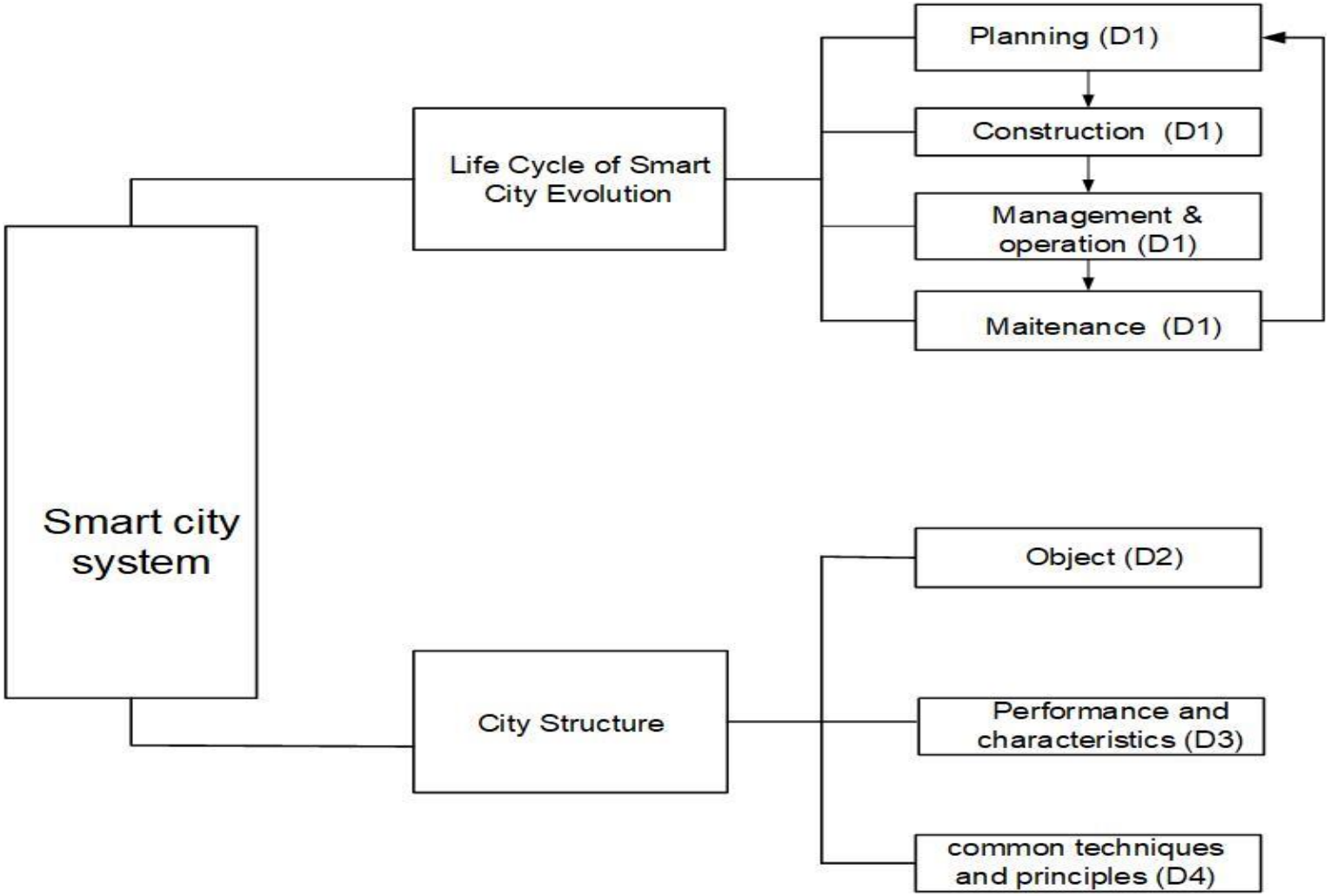


Figure 4 IEC Smart City Standards Inventory and Mapping, 2018

Review of BSI smart city framework:
BSI Mapping smart city standards, 2013

Ways of working	Operational views	Underlying structure	Stereotype package
Multi-dimensional	By considering a smart city as a socio-technical system the interactions between the social and technical elements of the system can be taken into account as well, leading to a model applicable to the wide array of challenges as	Technical: • The model should be descriptive, not prescriptive. That means the model should, as best as possible, cover the breadth of existing and proposed smart city initiatives but not add any limitations as there is no one-size-fits-all smart city solution. • The model should be useful to support a mapping exercise. It is not meant as a technical design for a smart city solution or smart city platform, but it should highlight relevant links between city domains and help suggest keywords for the overview study. • Closely linked to the previous point; the model should enable identification of gaps in existing standard initiatives. • The model should make clear how data and information flow through the city and between elements in the city. Social: 1) Representatives of international standards bodies who are active in the smart city domain and involved in coordination activities at the European level1. 2) Representatives of private and public sector organizations who are members of smart city standards advisory committees2.	**combination of aspects and/or components**
Governance framework	A smart city model – technical view; Smart city model – Social view	• Technical view: The city is divided into the built environment (including homes, offices and shops and the devices within them), infrastructure-based sectors (e.g. energy and waste) and service-based sectors (e.g. healthcare and education). There is possible interaction between elements within any of these subsystems as well as between subsystems. Smart city infrastructure sectors, such as telecommunications, information technology and electronics, enable and support this interaction. A common theme in the example smart city models is the use of sensors to collect data from the city which, through platforms, can be combined, stored, analyzed and displayed. This provides decision support for actors in the city who can then act and make changes, the effect of which can in turn be measured. • Social view: Citizens and the community in neighborhoods within the city are represented and governed by city leaders (often in the form of a mayor) supported by local authorities or councils. Guided by smart city objectives such as creating a more transparent way to govern the city, increasing the number of jobs or improving sustainability, projects can be managed and funding for them sought, in close cooperation with the market. Through the market technology vendors, banks and other companies provide services and jobs for the city.	**combination of aspects and/or components**

Review of SF-SSCC smart city framework:
Overview of standards and specifications relevant to smart cities, 2018

Ways of working	Operational views	Underlying structure	Stereotype packagemulti-levels
Multi-level	An useful way to categorize these different types of standardization activities	• Level 1: Strategic. These are smart city standards that aim to provide guidance to city leadership and other bodies on the "process of developing a clear and effective overall smart city strategy." They include guidance in identifying priorities, how to develop a roadmap for implementation, and how to effectively monitor and evaluate progress along the roadmap. • Level 2: Process. Standards in this category are focused on procuring and managing smart city projects– particularly those that cross both organizations and sectors. Essentially these offer best practices and associated guidelines. • Level 3: Technical. This level covers the myriad technical specifications that are needed to actually implement smart city products and services so that they meet the overall objectives	**sets of relationships**
Interaction framework	A single "best" way to present information is difficult. Of the options considered, this work uses mind maps, but the results can be exported into other tools	Advantages/Disadvantages: a) Mind map: a graphical hierarchical "tree" of topics where in theory no topic appears twice and the "trace" or "path" to reach a topic name provides progressively finer sub-categories. Advantages: simple top-down approach; people can focus on what they want and ignore the rest; static viewpoint can serve as common orientation for all kinds of users. Disadvantages: it is difficult to show a multi-dimensional approach, or prioritizing for different criteria; space to give a synopsis of topics is limited; keeping it updated needs collaborations. b) SQL Database: a matrix of topics (e.g. specifications, SDO groups, KPI areas) which are associated with a series of properties (e.g. title, creator, domain of application, etc.) and which can be searched, filtered, sorted or used to create dynamic web pages in any desired way. Advantages: very flexible so everyone can optimize their viewpoint. Disadvantages: each user re-arranges info so anyone else has great trouble to find/understand it. c) Word Document: a hierarchical list of topics, functionally equivalent to a fully expanded Mind map, with any notes desired including graphics. Advantages: familiar to all users; very flexible input; change-tracking easy. Disadvantages: hierarchy is static (like mind map); cannot easily "hide" material which is uninteresting to a particular user so it feels like finding a needle in a haystack.	Sets of relationships

Review of Germany smart city framework:
The German Standardization roadmap smart city, 2014

Ways of working	Operational views	Underlying structure	Stereotyped package
Multi-domain	Based on perspectives of domain relative standard cases	joint steering body and joint working groups	an atomic unit of thought
Application framework	The smart city topic is subdivided into a total of eight thematic blocks. Already published on the topics of AA L, e-Mobility, e-Energy/Smart Grids, Smart Home + Building, Industry 4.0 and IT-Security.	The work on the German Standardization Roadmap is strategically controlled by the joint steering body. The other eight joint working groups take care of discussing and documenting all standardization-related information within the topic areas in close collaboration with the national bodies, especially the joint steering body. Buildings and Constructions, Security and protection, Mobility, Energy, Information and Communication (ICT), Urban processes and organization, Production, Logistics	**an atomic unit of thought**

Review of IEC Smart City Standards Inventory and Mapping, 2018

Ways of working	Operational view	Underlying structure	Stereotyped package
Life-cycle control	Considering the whole life of conceptual object as well as its every factors.	under High-level Reference Architecture under Some Key Viewpoints under capability map viewpoint under design viewpoint under System Viewpoint (Technical Components) under Engineering Framework under Security Framework Viewpoint under Platform-Based Implementation Framework Viewpoint under Implementation framework viewpoint under Deployment Framework Viewpoint	properties common to a set of objects
Technical framework	Life Cycle of Smart City Evolution City Structure	The round process of a smart city evolution covers the stages from planning, construction, management & operation to maintenance, and back to planning with governance above all these stages, sharing the common goals throughout the evolution process. Horizontally, the vertical domains are interrelated with one another, therefore the cooperative mechanism among these vertical domains, for instance, Integration, interoperability, interaction and security, are ought to be discussed. The above-mentioned commonalities include generic supporting technique and flows of digital, physical, living, social, political and legal aspects.	**properties common to a set of objects**

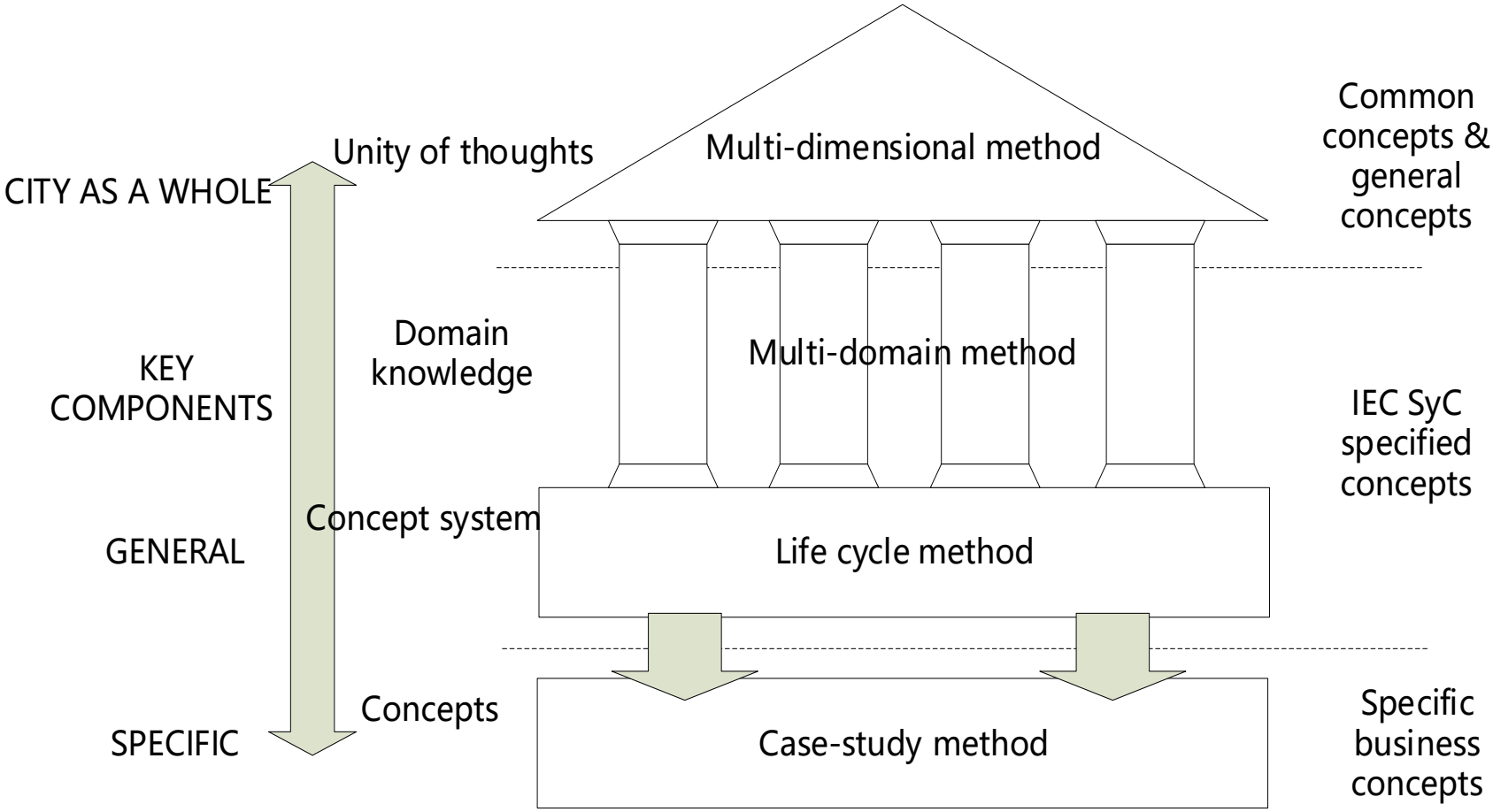
An integrated methodology framework for smart city system concept system building: applications to the two NWIPs

An integrated setting frameworks for smart city and smart city system concept system building

- City as a complex adaptive system- **common understanding of the ways of working**
  - **social system, data system and physical system (S-D-P)** as organic whole
  - synergy of cross-dimension and cross-domain concerns

  » convergence of governance framework, application framework and technical frameworks for interaction framework
- IEC-ISO-ITU community capacity building **(3C-3P-3A interaction framework)**
  - collaboration-people-arrangement
    - social space-governance framework
  - coordination-process-activity
    - cyber space-application framework
  - connectivity-productivity- artifacts
    - physical space- technical framework

Recommendations for an integrated methodology framework



Principles for selecting terms

Criteria for not selecting terms are subjective and partial. **If a definition of a concept is controversial, but is a core concept, should be included**.

The whole terminological work must be discussed and approved by the IEC Terminology Coordinator and the IEC TC 1.

The terms included in the vocabulary are terms that are:

a) highly relevant **and pertinent** to smart city system domain;

b) highly relevant to **reaching clarity and consensus** in the smart city system domain;

c) highly relevant to **electro technical, digital or system domain scoping and positioning**, where there is a need for clarity and consensus on a **coordinated lifecycle control cross-dimensional and cross-domain continuity service for setting governance frameworks , applications frameworks and technical frameworks**;

d) **in frequent use** and **applicable throughout all ISO, IEC, ITU-T current and future products.**

Process for selecting terms

- We use the principles given above to develop a list of terms for which clear definitions are needed by the Smart Cities SyC
- We review whether those terms have already been defined by IEC, ISO or ITU
- If they have already been defined, we consider whether those definitions are relevant and appropriate to the SyC
- If there are definitions that are more or less appropriate and simply need to be modified to meet the needs of the SyC then the preferred option would be to add extra notes to the existing definition. Should more fundamental changes be required, then we will either coordinate this process with the relevant committee, with the aim of developing a definition that is suitable for all, or develop a new definition, based on the generic one, but explicitly focused on smart cities, electrotechnology, or the systems approach.
- If there are no definitions that are relevant or appropriate, then we create our own definition
- Where there are terms that might be useful for other IEC Systems Committees or System Evaluation Groups, then we will work with the SRG to ensure that the way the terms are defined will allow them to be used across all the IEC systems work.

(Draft Scope of IEC Smart Cities SyC WG1 work on definitions, Version 3. May 26th 2017)

FROM Joanna Goodwin

"Technical terms appearing in a definition should be defined either in the IEV, or in another authoritative publication. If there is more than one term for a concept (see SK.3.1.3.4), the entry term shall be used in other definitions." [see the IEC Supplement to the ISO/IEC Directives, SK.3.1.4.3

ISO/IEC Directives, Annex SK (Normative) Rules for terminology work，107-131 procedural rules (Clause SK.4). 2018,05)

Workshop testing and continual improvement in Washington D.C

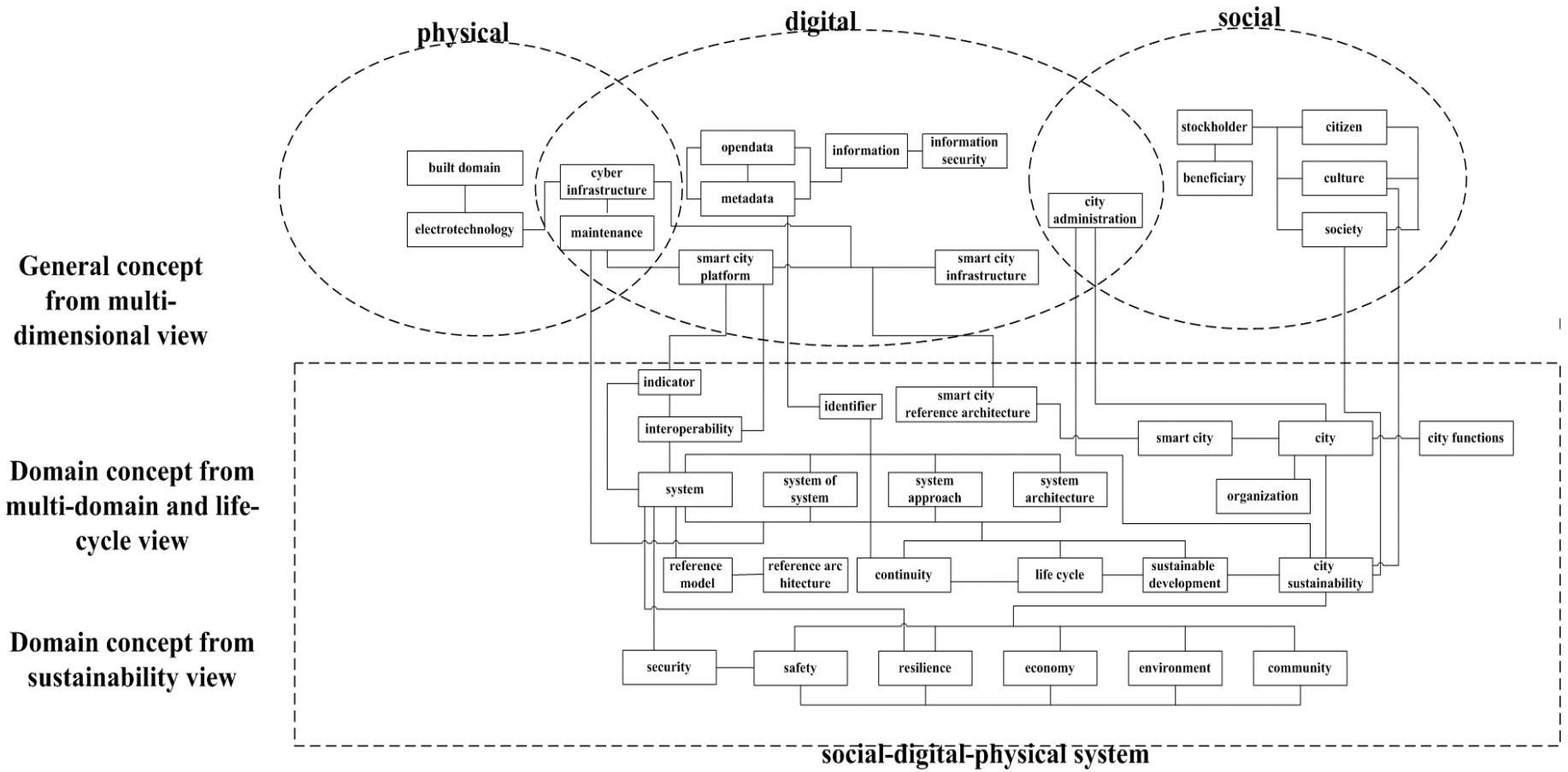
- 40 terms were selected based on 33 terms identified in last year's IEC SyC meeting held in Shanghai and 25 terms identified in last year's IEC-ISO-ITU joint working white paper, based on these terms, we invite all experts to build concept system as follows:
- 1. concepts analysis with general & common levels, domain levels, and case levels by using IMS;
- 2. new concepts recognition and extraction from smart city use cases within different levels;
- 3. similar concepts (semantic similarity) clustering form bottom up to match with IMS; new concepts may come out during this stage (concept lattice tools);
- 4. drawing concept graphs mapping with IMS; graphs can be hierarchical structure (general or partitative relationships) or network structure (associative relationships) depending on different types of concept relations

Alphabetical Index

Concept systems built on the smart city system

The IEC SyC Smart Cities meeting, July 11, 2018, Washington D.C

A S-D-P interaction framework for smart city system concept system building



PNW SYCSMARTCITIES-50 Smart City System- Vocabulary (chapter for electropedia)

SyCSmartCities/63/RVN: IEC63234 ED1 Smart Cities System –Vocabulary (chapter for electropedia)

"International Electrotechnical Vocabulary (IEV) – Part 831: Smart city systems"

Core concepts of a smart city system and their taxonomy

Concept	Characteristics and relationships	Number
beneficiary	social system	3.1
built domain	physical system	3.2
citizen	social system	3.3
city	social-digital-physical system	3.4
city administration	social-digital system	3.5
city functions	social-digital-physical system	3.6
city sustainability	social-digital-physical system	3.7
community	social-digital-physical system	3.8
continuity	social-digital-physical system	3.9
culture	social system	3.10
cyber infrastructure	digital-physical system	3.11
economy	social-digital-physical system	3.12
electrotechnology	physical system	3.13
environment	social-digital-physical system	3.14
identifier	social-digital-physical system	3.15
indicator	social-digital-physical system	3.16
information	digital system	3.17
information security	digital system	3.18
interoperability	social-digital-physical system	3.19
life cycle	social-digital-physical system	3.20
maintenance	digital-physical system	3.21
metadata	digital system	3.23
open data	digital system	3.24
organization	social-digital-physical system	3.25
reference architecture	social-digital-physical system	3.26
reference model	social-digital-physical system	3.27
resilience	social-digital-physical system	3.28
safety	social-digital-physical system	3.29
security	social-digital-physical system	3.29
smart city	social-digital-physical system	3.30
smart city infrastructure	physical system	3.31
smart city platform	digital system	3.32
smart city reference architecture	social-digital-physical system	3.33
society	social system	3.34
stakeholder	social system	3.35
sustainable development	social-digital-physical system	3.36
system	social-digital-physical system	3.37
system approach	social-digital-physical system	3.38
system architecture	social-digital-physical system	3.39
system of system	social-digital-physical system	3.40

Acknowledgement

Many thanks for Michael Mulquin, Wanzhong Ma，Jinghua Min, Yongchao Gao, Xiaoshuang Jia, Dapeng Zhang, Wei Wei, Sunyang Sun, Yu Dong, Yi Song for their contributions to the WG1 work done.

References

- ISO 15638-1:2012 Intelligent transport systems — Framework for collaborative Telematics Applications for Regulated commercial freight Vehicles (TARV) — Part 1: Framework and architecture
- ISO 15638-8:2014Intelligent transport systems — Framework for cooperative telematics applications for regulated vehicles (TARV) — Part 8: Vehicle access management
- ISO/TS 15638-13:2015 Intelligent transport systems — Framework for cooperative telematics applications for regulated commercial freight vehicles (TARV) — Part 13: "Mass" information for jurisdictional control and enforcement
- ISO 15638-15:2014 Intelligent transport systems — Framework for cooperative telematics applications for regulated vehicles (TARV) — Part 15: Vehicle location monitoring
- ISO 15638-17:2014Intelligent transport systems — Framework for cooperative telematics applications for regulated vehicles (TARV) — Part 17: Consignment and location monitoring
- ISO 15638-18:2017 Intelligent transport systems — Framework for cooperative telematics applications for regulated commercial freight vehicles (TARV) — Part 18: ADR (Dangerous Goods)
- ISO 15638-21:2018 Intelligent transport systems — Framework for cooperative telematics applications for regulated commercial freight vehicles (TARV) — Part 21: Monitoring of regulated vehicles using roadside sensors and data collected from the vehicle for enforcement and other purposes
- ISO 14813-5:2010 Intelligent transport systems — Reference model architecture(s) for the ITS sector — Part 5: Requirements for architecture description in ITS standards
- ISO/TR 17185-3:2015Intelligent transport systems — Public transport user information — Part 3: Use cases for journey planning systems and their interoperation
- ISO/IEEE 11073-10201:2004 Health informatics — Point-of-care medical device communication — Part 10201: Domain information model
- ISO/TR 17119:2005Health informatics - Health informatics profiling framework
- ISO 19439:2006 Enterprise integration — Framework for enterprise modelling
- ISO/TS 12911:2012 Framework for building information modelling (BIM) guidance
- ISO/TS 19150-1:2012 Geographic information — Ontology — Part 1: Framework
- ISO/TR 17791:2013Health informatics — Guidance on standards for enabling safety in health software
- ISO 17185-1:2014 Intelligent transport systems — Public transport user information — Part 1: Standards framework for public information systems
- ISO/IEC 20006-1:2014 Information technology for learning, education and training — Information model for competency — Part 1: Competency general framework and information model
- ISO 37500:2014 Guidance on outsourcing
- ISO/TS 18790-1:2015Health informatics — Profiling framework and classification for Traditional Medicine informatics standards development — Part 1: Traditional Chinese Medicine
- ISO/IEC TR 38502:2017 Information technology — Governance of IT — Framework and model

Thanks for your attention!

Email: anxiaomi@ruc.edu.cn