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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Human Factors.

Modal verbs terminology

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Executive summary

[To be drafted last]

Introduction

This Report concerns the standardization requirements of the citizen, in the context of being an inhabitant of, or visitor to, a smart city or community.

Since industrialisation, our world has been considerably weakened by unsustainable development and rampant over-consumption. Humanity faces several environmental sustainability challenges including, but not limited to, declining biodiversity, degraded land and soil, depleting natural resources, polluted air and water, and increasingly severe climate changes. Closely interlinked are issues of population increase and rural-to-urban migration, which is occurring at an extraordinary pace: since 2008, more than half of the global population has been and is living in cities.

Adapting to these challenges will require increased cooperation among local actors, along with comprehensive systems that can create and maintain synergies for sustainable urban societies in which people want to work, live and maximise their well-being. Cities can also be seen as one of the ‘driving forces’ in generating European economic and sustainable growth, given, for example, the opportunities provided by the green economy.

Cities are becoming more and more of a focal point for our economies and societies at large, particularly because of on-going urbanisation, and the trend towards increasingly knowledge-intensive economies as well as their growing share of resource consumption and emissions. To meet public policy objectives under these circumstances, cities need to change and develop, but in times of ever tighter budgets this change needs to be achieved in a smart way: our cities need to become “smart/sustainable-cities/communities”.

It is important that initiatives strive towards a triple bottom line gain for Europe: a significant improvement of citizens' quality of life, an increased competitiveness of Europe's industry and innovative SMEs together with a strong contribution towards sustainability and the EU’s 20/20/20 energy and climate targets. This will be achieved through the wide-reaching roll out of integrated, scalable, sustainable smart city/community solutions – specifically in areas where energy production, distribution and use, mobility and transport, and information and communication technologies, are intimately linked.

Linking and upgrading infrastructures, technologies and services in key urban sectors (transport, buildings, energy, ICT) in a smart way will improve quality of life, competitiveness, and sustainability of our cities.

The smart community offers considerable opportunity not only for citizens to have an improved living environment in which they can benefit from effective services, but also for them to influence matters affecting their daily lives. At the same time, equal treatment for all citizens needs to be ensured, and account needs to be taken of "big data" risks to their personal information.

At the European level, the CEN-CENELEC-ETSI Smart and Sustainable Cities Co-ordination Group (SSCC-CG) originally proposed the development of a Technical Report on these citizen-related issues, later taken up in the ICT Standardisation Rolling Action Plans for 2016 and 2017.

The present TR is intended to clarify whether further standardization is needed on citizen issues related to smart cities (e.g. on what, where, when, etc.), and to take full account of other standards activities under way. The TR also supports recommendations that are being made at policy levels.

The TR has been originally drafted by ETSI Specialist Task Force 561, supported by the European Commission and the EFTA Secretariat under the ICT standardization grant scheme, and validated by ETSI TC HF.

1 Scope

The present document assesses the different citizen-related issues that smart city-related standardization in the ICT domain needs to address. These include fundamental aspects such as accessibility, usability, interoperability, personal data protection and security, and how services to citizens are to be designed to maximise benefits to the community.

For each of these issues, this Report:

- provides a short statement of the subject area;
- makes a short statement of the key citizen concerns (for example accessibility or privacy) related to the subject;
- lists relevant current standards and ongoing relevant standards activities;
- assesses whether it appears the activities are in practice taking reasonable account of the smart city/community dimension from the perspective of citizen welfare, and if not, what might be needed to rectify the position;
- identifies any further general legal and ethical issues that require attention outside the standardization domain, or other issues not covered.

The issues which this Report assesses are grouped into the following:

- citizens' general needs - smart cities should have citizen welfare at their core. The needs of the citizens should therefore be properly considered in every standardization activity relevant to smart cities;
- citizens and their local authorities – the standards aspects of citizens' day-to-day interfaces with their local authorities;
- citizens and their local services – the standards aspects of citizens' day-to-day interfaces with the providers of their local services;
- citizen indicators – how the impact of smart city solutions on the citizens can be measured;
- recommendations – to improve citizen outcomes, filling gaps in, or making adjustments to, existing standards; aspects not related to standardization, including policy aspects.

2 References

2.1 Normative references

Normative references are not applicable in the present document.

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long-term validity.

The following referenced documents are not necessary for the application of the present document, but they assist the user with regard to a particular subject area.

[i.1] "Human Factors (HF); Definitions, abbreviations and symbols", ETSI Guide 201 013, ETSI, 1997.

[i.2] "Ergonomics of human-system interaction - Part 11: Usability: Definitions and concepts", CEN EN-ISO 9241-11:2018.

[i.3] "Accessibility requirements for ICT products and services", ETSI EN 301 549, ETSI, 2019.

[i.4] United Nations (2018), Sustainable Development Goals, Goal 11: Make cities inclusive, safe, resilient and sustainable [online]. Retrieved, May 2019 from https://www.un.org/sustainabledevelopment/cities/

[i.5] Giffinger, R.C., Fertner, H., Kramar, H., Kalasek, R., Pichler-Milanovic, N. and Meijers, E. (2007). Smart cities: Ranking of European medium-sized cities [online]. Retrieved, May 2019 from http://www.smartcities.eu/download/smart_cities_final_report.pdf

[i.6] European Commission (2018), Smart Cities [online]. Retrieved, May 2019 from https://ec.europa.eu/info/eu-regional-and-urban-development/topics/cities-and-urban-development/city-initiatives/smart-cities_en

[i.7] ETSI (2015), Smart Cities [online]. Retrieved, May 2019 from https://www.etsi.org/technologies/smart-cities

[i.8] ITU-T (2014), Smart Sustainable Cities [online]. Retrieved, May 2019 from https://www.itu.int/en/ITU-T/focusgroups/ssc/Documents/Approved_Deliverables/TR-Definitions.docx

[i.9] ISO (2014), Smart cities Preliminary Report 2014 [online]. Retrieved, May 2019 from https://www.iso.org/files/live/sites/isoorg/files/developing_standards/docs/en/smart_cities_report-jtc1.pdf

[i.10] EU SCIS (2017), Smart Cities and Community Lighthouse projects [online]. Retrieved, May 2019 from https://smartcities-infosystem.eu/scc-lighthouse-projects

[i.11] UN-HABITAT (2014), Energy [online]. Retrieved, May 2019 from https://unhabitat.org/urban-themes/energy/

[i.12] CEN/CENELEC (2017), Smart Cities [online]. Retrieved, May 2019 from https://www.cencenelec.eu/standards/Sectors/SmartLiving/smartcities/Pages/default.aspx

[i.13] EIP-SCC (2014), Action Clusters [online]. Retrieved, May 2019 from https://eu-smartcities.eu/clusters

[i.14] EIP-SCC (2017), Initiatives [online]. Retrieved, May 2019 from https://eu-smartcities.eu/initiatives

[i.15] EUROCITIES (2012), about [online]. Retrieved, May 2019 from http://eurocities.eu/eurocities/about_us

[i.16] Major Cities of Europe (2013), About Us [online]. Retrieved, May 2019 from https://www.majorcities.eu/about-us/

[i.17] OASC (2018), About [online]. Retrieved, May 2019 from https://oascities.org/about-oasc/

[i.18] Cities4Europe (2017) About [online]. Retrieved, May 2019 from http://cities4europe.eurocities.eu/eu-campaign/index.html#/about

[i.19] European Commission (2015), Public Procurement [online]. Retrieved, May 2019 from https://ec.europa.eu/growth/single-market/public-procurement_en

[i.20] European Commission (2019), European Pillar of Social Rights [online]. Retrieved, May 2019 from https://ec.europa.eu/commission/priorities/deeper-and-fairer-economic-and-monetary-union/european-pillar-social-rights_en

[i.21] EUROCITIES (2018), Annual Report 2018 [online]. Retrieved, May 2019 from http://www.eurocities.eu/eurocities/documents/EUROCITIES-annual-report-2018-WSPO-B75ECV

[i.22] OASC (2019), What Will Keep the Smart City Industry Busy in 2019? [online]. Retrieved, May 2019 from https://oascities.org/what-will-keep-the-smart-city-industry-busy-in-2019/

[i.23] OASC (2019), Highlights: Releasing the Power of Procurement [online]. Retrieved, May 2019 from https://oascities.org/highlights-releasing-the-power-of-procurement/

[i.24] European Commission (2017), Public Procurement strategy [online]. Retrieved, May 2019 from http://ec.europa.eu/growth/single-market/public-procurement/strategy_en

[i.25] Major Cities of Europe (2019), Annual conference “Channelling Change” [online]. Retrieved, June 2019 from https://www.majorcities.eu/conferences/2019-venice/

[i.26] European Commission (2017), E-procurement [online]. Retrieved, June 2019 from https://ec.europa.eu/growth/single-market/public-procurement/e-procurement_en

[i.27] Directive 2013/11/EU of the European Parliament and Council of 21 May 2013 on alternative dispute resolution for consumer disputes and amending Regulation (EC) No 2006/2004 and Directive 2009/22/EC

[i.28] ISO 37122:2019 “Sustainable cities and communities - Indicators for smart cities”

[i.29] Directive (EU) 2016/1148 of the European Parliament and of the Council of 6 July 2016 concerning measures for a high common level of security of network and information systems across the Union (“the NIS Directive”)

[i.30] BSI PAS 185:2017 “Smart Cities. Specification for establishing and implementing a security-minded approach” [online]

[i.31] Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation)

[i.32] BSI PAS 183:2017 - Smart cities. Guide to establishing a decision-making framework for sharing data and information services

[i.33] ISO 37156: Smart City infrastructures - Guidelines on data exchange and sharing for smart community infrastructures

[i.34] ISO 37160: Smart City infrastructures – Measurement methods for quality of thermal power station infrastructure and requirements for plant operations and management for smart community infrastructures

[i.35] Directive (EU) 2019/882 of the European Parliament and Council of 17 April 2019 on the accessibility requirements for products and services (“the European Accessibility Act”)

[i.36] Regulation (EU) No 1025/2012 of the European Parliament and the Council on European standardisation, amending Council Directives 89/686/EEC and 93/15/EEC and Directives 94/9/EC, 94/25/EC, 95/16/EC, 97/23/EC, 98/34/EC, 2004/22/EC, 2007/23/EC, 2009/23/EC and 2009/105/EC of the European Parliament and of the Council and repealing Council Decision 87/95/EEC and Decision No 1673/2006/EC of the European Parliament and of the Council

[i.37] CEN-CENELEC-ETSI Smart and Sustainable Cities Sector Forum (SF-SSCC): Overview of Standards and Specifications relevant to Smart Cities (latest version available at ftp://ftp.cencenelec.eu/EN/EuropeanStandardization/Fields/SmartLiving/City/SF-SSCC_Overview_of_Standards_for_SmartCities.pdf

[i.38] BSI PAS 181:2014 – Smart Cities Framework [online]

[i.39] International Organization for Standardization ISO 37104:2019 – Sustainable cities and communities — Transforming our cities — Guidance for practical local implementation of ISO 37101

[i.40] https:// CITYkeys (2017), CITYkeys indicators for smart city projects and smart cities [online]

[i.41] International Organization for Standardization ISO 37120:2018 – Sustainable cities and communities – Indicators for city services and quality of life

[i.42] International Organization for Standardization ISO 37122:2019 – Sustainable cities and communities – Indicators for smart cities

[i.43] International Organization for Standardization ISO F-DIS 37123:2019 – Sustainable cities and communities – Indicators for resilient cities

[i.44] United Nations (2018), Sustainable Development Goals [online]. from https://www.un.org/sustainabledevelopment/sustainable-development-goals/

[i.45] ETSI TS 103 463: Access, Terminals, Transmission and Multiplexing (ATTM); Key Performance Indicators for Sustainable Digital Multiservice Cities

[i.46] ETSI GS OEU 019: Operational energy Efficiency for Users (OEU); KPIs for Smart Cities

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms and definitions given in ETSI EG 201 013 [i.1] and the following terms and definitions apply:

accessibility: extent to which products, systems, services, environments and facilities can be used by people from a population with the widest range of user needs, characteristics and capabilities, to achieve identified goals in identified contexts of use (from EN ISO 9241-11:2018) [2]

NOTE 1: Context of use includes direct use or use supported by assistive technologies.

NOTE 2: The context in which the ICT is used may affect its overall accessibility. This context could include other products and services with which the ICT may interact

access space: space intended to be occupied by the person, including their Assistive Technology, while they are using the product

assistive technology: hardware or software added to or connected to a system that increases accessibility for an individual

NOTE 1: Examples are Braille displays, screen readers, screen magnification software and eye tracking devices that are added to the ICT

NOTE 2: Where ICT does not support directly connected assistive technology, but which can be operated by a system connected over a network or other remote connection, such a separate system (with any included assistive technology) can also be considered assistive technology

citizen: according to UNESCO[1], citizenship can be defined as a collection of rights and obligations that give individuals a formal juridical identity, i.e. *"the status of having the right to participate in and to be represented*

[1] http://www.unesco.org/new/en/social-and-human-sciences/themes/international-migration/glossary/citizenship/

in politics." It is today considered to be the binding element of a national community and is an instrument and object of social closure. The British Standards Institution use the word “citizens” in their Publicly Available Specifications (PAS) to include residents, businesses, visitors and commuters to the city

consumer: a natural person who is acting outside the scope of an economic activity (trade, business, craft, liberal profession)

cyber-physical system: these comprise interacting digital, analogue, physical, and human components engineered for function through integrated physics and logic. These systems will provide the foundation of our critical infrastructure, form the basis of emerging and future smart services, and improve our quality of life in many areas

Information and Communication Technology (ICT): technology, equipment, or interconnected system or subsystem of equipment for which the principal function is the creation, conversion, duplication, automatic acquisition, storage, analysis, evaluation, manipulation, management, movement, control, display, switching, interchange, transmission, reception, or broadcast of data or information

NOTE: Examples of ICT are web pages, electronic content, telecommunications products, computers and ancillary equipment, software including mobile applications, information kiosks and transaction machines, videos, IT services, and multifunction office machines which copy, scan, and fax documents

smart city: city that increases the pace at which it provides social, economic and environmental sustainability outcomes and responds to challenges such as climate change, rapid population growth, and political and economic instability by fundamentally improving how it engages society, applies collaborative leadership methods, works across disciplines and city systems, and uses data information and modern technologies to deliver better services and quality of life to those in the city (residents, businesses, visitors), now and for the foreseeable future, without unfair disadvantage of others or degradation of the natural environment

NOTE 1: A smart city also faces the challenge of respecting planetary boundaries and taking into account the limitations these boundaries impose

NOTE 2: There are numerous definitions of a smart city; this one is used by ISO Technical Committee 268, whose work is dedicated to the topic

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

BSI	British Standards Institution
CEN	Comité européen de normalisation (European Standards Committee)
CENELEC	Comité européen de normalisation électrotechnique (European Electrotechnical Standards Committee)
EC	European Commission
ETSI	European Telecommunications Standards Institute
EU	European Union
GDPR	General Data Protection Regulation
ICT	Information and Communication Technology
IEC	International Electrotechnical Commission
IoT	Internet of Things
ISO	International Organization for Standardization
IT	Information Technology
ITU	International Telecommunication Union
ITU-T	ITU Telecommunication Standardization Sector
JTC1	Joint Technical Committee 1 (of ISO and IEC)
OASC	Open and Agile Smart Cities
SDO	Standards Development Organisation [nowadays used to describe both formal standards bodies and consortia]

4 Setting the scene

4.1 Citizens and cities

The United Nations (UN) estimate that half of humanity, around 3.5 billion people, lives in cities today, projecting an increase of this number to 5 billion by 2030 [i.4]. Due to this overwhelming growth of population cities are struggling to continue creating jobs and prosperity without straining land and resources, with cities still being responsible for around 75% of the global energy consumption and between 50 and 60 percent of total greenhouse gas emissions [i.11]. While urban infrastructure such as utilities, transport, environmental services and housing is overtaxed and under-maintained, social services, healthcare and education are becoming difficult to sustain.

These issues affect numerous cities and have become more and more difficult to solve using traditional methodologies. Considering this, the concept of "*smart growth*", recently adopted in city planning, requires a more intelligent method of urban management, which implies achieving greater city efficiency better co-ordinating the forces that lead to growth: transportation, economic development as well as land speculation and conservation.

Considering that cities are complex adaptive systems, not only comprising physical resources and processes, but especially people both living in and visiting, and interacting within the city's boundaries, a clear definition of smart city has become ambiguous. After first appearing in the literature around the late 1990s, more recent definitions present many alternatives from "*metropolitan-wide information and communications technology (ICT)-based environment*", up to "*large-scale living labs for innovation testing*", while not disregarding "*smart energy consumption, transportation and other hard asset management*", "*smartness footprint measured with capacity indexes (people, economy, living, environment, mobility and governance)*" [i.5] and "*innovative solutions - not limited to but mainly based on the ICT - that improve urban everyday life and enhance local sustainability in terms of people, governance, economy, mobility, environment and living*".

According to the European Commission (EC), a smart city is a place "*where traditional networks and services are made more efficient with the use of digital and telecommunication technologies for the benefit of its inhabitants and business*" [i.6]. The former funding programmes from the European Commission already envisioned the city as a platform to enhance citizen engagement and their willing to "co-create", as a "*user-driven open innovation environment*", with such openness being applied as multiple kinds of relationships between people, services, infrastructure and technology.

If the concept of the smart city has been extensively considered, the place of the citizen in that concept has not, at least on the evidence available. As just noted, there have been European project funding programmes [i.10], but it is very difficult to see specific impacts from these except in the narrow field of activity within the scope of specific projects.

Standardization bodies have also shared their vision on the concept of a smart city, especially international ones. The European Telecommunications Standards Institute (ETSI), to begin with, notes that ICT plays an important role connecting key city services and infrastructures (transport, energy, healthcare, water and waste management) to securely manage the massive amounts of data generated by them. With the constant rise of population in urban areas, placing new demands on these services, a smart city uses digital technologies to "*enhance the city performance and the wellbeing of the citizens, reduce operational costs and the city resource consumption*", while engaging more effectively and actively with its citizens [i.7].

The International Telecommunications Union (ITU), concretely its Telecom Sector (ITU-T) and Focus Group (FG) on Smart Sustainable Cities, analysed around 120 definitions and published a report providing an insight into what is meant by a "smart sustainable city" (SSC) and the underlying factors that make a city smart. ITU-T also gives a lot of importance to ICT and considers a smart sustainable city as *"an innovative city that uses information and communication technologies and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social and environmental aspects*" [i.8]. In a similar way, the International Standards Organization (ISO) describes a smart city as a new concept "*which applies the new generation of information technologies, such as the internet of things, cloud computing, big data and space/geographical information integration, to facilitate the planning, construction, management and smart services of cities*" [i.9].

With the EC defining priorities and strategies for smart cities as "*going beyond the use of information and communication technologies (ICT) for better resource use and less emissions*", through smarter urban transport networks, upgraded water supply and waste disposal facilities and more efficient ways to light and heat buildings, safer public spaces and meeting the needs of an ageing population, cities require a more interactive and responsive city administration. To become globally competitive, cities are lacking the complete roll-out of scalable, interoperable and sustainable solutions in the areas of energy, transport, mobility, infrastructure and ICT, requiring a standardization approach to be holistic and cross-sectorial (thus breaking the 'vertical silos' of the diverse domains).

The Sector Forum on Smart Cities and Communities, organised by CEN, CENELEC and ETSI[2], states that standards for smart cities provide a common language and understanding (facilitating consensus driven solutions and boosting private and public partnerships), being used to monitor technical and functional performance, but also to ensure safety, interoperability, costs' reduction, efficient and strategic planning and management of resources as well as 'assessment' through city indicators and sharing of best practices. Finally, they represent tools, guidelines for cities for deployment of city solutions with high market potential and broad stakeholders' acceptance [i.12].

Given the added-value that standards bring to municipalities, their decision-makers and ultimately the citizens, along with the great number of Standards Developing Organisations (SDOs) researching the best approaches in multiple and different domains for smart cities, as it is documented in the present report, not only it is important to understand the scope and results of these efforts but it is essential to involve the cities as participants in the standardization process. After going through the processes of the industry driving their cities to their results, and after having networks of cities together with stakeholders from both research and industry working together to identify, adapt, pilot and validate the published specifications, factoring the needs of the citizens into the standards will help cities immeasurably, given their importance in this inexorable progress to a smart digital environment.

4.2 Challenges for the city

The definitions above have led to six main challenges (or focus areas) for the city, when one analyses the main Action Clusters from the European Innovation Partnership on Smart Cities and Communities, the assemblies of partners "*committing to work on specific issues related to smart cities, by sharing the knowledge and expertise with their peers, giving added-value to their national and local experience and identifying gaps that need to be fulfilled at European level*" [i.13], as detailed in Annex D. The work of each Action Cluster is collected under thematic *Initiatives*, which then pool the work of the various partners around a particular objective, promoting learning beyond project and geographic borders, and opening the results to the world at large, linking with EU-funded projects to allow results to be consumed by the thousands of people active on the Marketplace [i.14].

Besides the EIP-SCC, there are other well-known networks and associations, joining cities with research and industry, to share their knowledge, experience, and potentiate collaborations to solve the challenges:

- EUROCITIES was established in 1986 to further economic, political and social development in its member cities. Now linking the local governments of more than 140 largest cities of Europe and over 45 partner cities, EUROCITIES is organized in six thematic forums: Culture, Economic Development, Environment, Knowledge Society, Mobility and Social Affairs, which monitor developments in these specific policy areas, addressing issues and coordinating activities, providing a platform for sharing knowledge and exchanging ideas [i.15];

- Major Cities of Europe is an organisation composed of experts of Innovation in cities, contributing to the continuous improvement of the value proposition of the association organizing a yearly conference to interact and exchange directly with other European municipalities in a non-commercial environment, discussing about the real challenges that municipalities currently deal about digitization, as well as understanding how to involve citizens in designing and achieving better outcomes [i.16];

[2] https://www.cencenelec.eu/standards/sectorsold/smartliving/smartcities/pages/default.aspx

- Open and Agile Smart Cities (OASC), a non-profit, international smart city network of more than 140 cities with the goal of creating and shaping the nascent global smart city data and services market. By working based on city needs, with the support of the industry, OASC focuses on standards for city data, with the vision to create an open smart city market based on the needs of cities and communities, by advocating cities to adopt facto standards with a "*driven-by-implementation"* attitude [i.17].

According to EUROCITIES, the priorities for 2019 start with the campaign "*Cities4Europe – Europe for citizens",* where people come first and where trust between people and public authorities is strengthened [i.18]. Moreover, the group will continue to support long term investments at the local levels and monitor the implementation of new EU procurement measures [i.19], while engaging cities with the implementation of the European Pillar of Social Rights [i.20], as well as continuing a dialogue with policy makers on circular economy, waste management, water and noise pollution [i.21].

From the perspective of OASC, three major challenges (with respect to technology and business) will be faced by the smart city value chain in 2019 [i.22]:

- *Data security, sustainability and governance*, referring to the need for *"a set of common best practices for modern data management where data from legacy silos, such as city departments, can be stored in a central repository and managed according to a governance strategy. Cities clearly see value in such an approach, an approach which could also be linked to IoT platforms. (…)* But a *city-centric approach is not enough: [it] should be built in a way that takes advantage of data from a larger set of stakeholders interacting with local governments or offering services to citizens, such as energy, utility, port, airport, mobility, environment, finance and media. A variety of issues remain to be solved when it comes to the governance and sustainability (…), especially in relation to public-private infrastructure partnerships*";

- *Unlocking the potential of open data*, where "*Open data portals should consider uniform, standards-based APIs if they are to attract larger developer communities. A significant amount of the data we collect never gets leveraged. And this relates directly to challenges surrounding data models and API standards for utilizing the data. Opening-up both public and private-sector information, on common technical ground and within a governance framework accepted by all stakeholders, would be a key step towards delivering on the promises of an IoT and AI-enabled future. Smart cities and communities are driving this convergence*";

- *5G-ready cities*, as smart cities and communities who *"have the potential to play an instrumental role in expediting 5G deployment and time to market. City infrastructure – multiservice lampposts, for instance – could offer valuable support to the deployment of 5G equipment, especially where high densities of 5G equipment are required. As cities rethink, maintain or revamp their infrastructure, it is very important that they keep 5G in mind. A 5G-ready city – a city ready for 5G as well as IoT – is one that is already thinking about 5G requirements and the business models needed to support 5G deployment. As these investigations intensify, we will see cities paying increasing attention to infrastructure partnerships, especially as they relate to cities and network operators' respective roles, benefits and revenue streams".*

While such innovation is happening in Europe, SMEs and start-ups are facing barriers to accelerate market uptake. In May 2019, OASC organised a workshop in Brussels where procurement experts came together to discuss the state of innovation procurement in Europe and find a solution to better reap the benefits of procuring ICT solutions for both public administrations and SMEs. "*Procurement can be a concrete tool to foster European innovation, but during the workshop it has become clear that public procurers need to open up procurement processes and integrate SMEs and start-ups to stimulate innovation. Also, it was evident that a clear policy and pre-defined objectives are needed to push investments in innovative and data-driven solution to drive large-scale adoption*" [i.23]. One of the major outcomes of this workshop has been the understanding of urgency in defining a policy strategy to push investments and defined goals, to then engage the networks of stakeholders so as to bring demand-side together and prioritise the needs.

As one of the European Commission priorities [i.24], and one of the most discussed topics in the latest Major Cities of Europe Conference [i.25], procurement remains one of the major challenges for municipalities, as part of their digitalization process. On the one hand, it can act as an enabler for smart city opportunities, especially for cities of lower dimensions or less equipped, while on the other, it requires training the staff of the local services to enable them to help citizens taking advantage of these opportunities. Public procurement accounts for a substantial amount of public

investment (around €2 trillion per year, representing 14% of EU GDP), with high-quality public services depending on modern, well-managed and efficient procurement. Improving it can yield big savings: the EC states that even a 1% efficiency gain could save €20 billion per year. With the need to be able to choose from a set of instruments (local, national, financial or not) to create opportunities for businesses, jobs and help improve people's quality of life, their ability to effectively use social, environmental and innovation clauses in their public procurement has a long-term impact on jobs and sustainable growth. However, the digitalization of public procurement has been slow: in 2016, only four EU countries relied on digital technologies for all the major steps of the procurement process [i.26].

4.3 The many citizen profiles

There is not something as "the citizen", there are only citizens. To efficiently capture the citizen requirements, one must keep in mind that "the citizen" is a rationalisation and an abstraction. For the present document, a few definitions of "citizen" are used (as defined in clause 3) that refer to citizenship and the rights and obligations associated. Actually, "the" citizen will correspond to a large variety of potential profiles with specific characteristics and requirements. Some of these characteristics are listed below, identified by a list of adjectives (without any meaning of priority): each has some associated requirements and can be present or not in the profile of a given citizen.

We do not make any specific recommendation here, rather we need the citizen's need to be at the forefront of the recommendations for standards activities we have listed in Clause 10 below, and of the "organisational" recommendations in **Annex A.**

Consuming:

In most cases, the citizen is also a consumer, in particular of goods and services that are available in the context of the city. Though it is in general not the role of the city to intervene in private transactions, it can be necessary when the goods consumed are part of services provided by the city such as energy, transportation or communications (depending on the city offering).

Associated requirements: redress procedures(?)

Impaired:

In Europe alone, around 16% of citizens have a disability that ranges from mild to severe. This means that around 80 million people must be granted equal rights to fully take part in society as well as in economy without being disadvantaged by the barriers they face. This is true for the physical aspects (street access, transportation, etc.) as well as the Information Technology related aspects.

Associated requirements: (enforceable) accessibility standards

Impatient:

In general, citizens are very busy and need to address many issues in parallel to cope with their life. As a result, they cannot spend much time in the interaction with the city services, in particular the on-line ones. A slow and poorly designed web site will generate frustration that may lead to rapidly giving up. Another example is the average time of 6 seconds that a citizen is willing to spend before giving consent for data collection, giving up in face of in front of huge amounts of privacy terms and conditions.

Associated requirements: citizen-centred design processes, simple privacy standards

Interacting:

In face of the growing complexity of the city environment, the days of the passive citizen are gone. The citizens require growing access to all sorts of city services, beyond the traditional ones associated to emergencies, employment or welfare. This means transferring part of the existing services towards on-line services and creating new ones. The potential access to a growing number of on-line services can generate citizen's expectations (with required clear and transparent prioritisation) and the need for the city to have a global and coherent offer that can serve all citizens.

Associated requirements: citizen-centred design processes

Private:

Though the interactions between the citizen and the smart city are happening in the public space, some elements of these interactions should (and often must) be kept private. As an example, the simple history of the exchanges can bring significant information to third-parties that would have undue access to it. This can be obvious in the case of interaction concerning health, but as well for electoral lists and rights to vote or even energy.

Associated requirements: enforceable privacy standards

Public:

The citizens are asking for more contribution to the decision-making processes within the city. The cities themselves have embraced this trend and propose new ways to empower the citizens by providing them with all sorts of public data as well as associating them to the design of the on-line services.

Associated requirements: open data, citizen-centred design processes

Vulnerable:

A (smart) city is a highly complex ecosystem in which all sorts of new threats can materialise on top of the existing ones and need to be dealt with. A major primary need for the citizen is to benefit from a safe environment that can guaranty at best its physical well-being and its protection against all forms of cybercrime. On the other hand, this safe environment should not be granted at the expense of the citizen's right to privacy and data protection.

Associated requirements: global approach to security, including cybersecurity and privacy

As a result, the development of smart city services for the citizen will have to take into account these (sometimes conflicting) requirements and any effective form of citizen empowerment will have to be based on the careful association of citizens to citizen-centred design processes in order to provide usable, intuitive, accessible and protective services.

There are many opportunities for the citizen arising from the digitalisation of the people's living environment in cities and communities that can bring effective solutions for the development of such citizen-centred design processes. However, there are still problems blocking peoples' empowerment such as the lack of human interaction, accessibility issues, or the digital divide. These problems need to be addressed with a clear characterization of the issues, the definition of improvement approaches and of objective ways to measure the progress. From this standpoint, it is expected that standardization can help.

5 Citizens' general needs

5.1 What are these?

In a future smart city context, citizens need:

- services that meet their needs effectively;
- ease of use for, and intuitive understanding of, city smart services so as not to require too much time to understand services and use them;
- transparent information about the public and commercial services being provided in a smart/sustainable-city/community, what is their cost, what are their rights and the redress procedures when they go wrong, etc;
- mechanisms to ensure their individual voice is heard;
- assurances that the security of their personal information is properly protected and that this data will not be misused for commercial purposes;
- support and education for those unable to take immediate and full advantage of smart community living; a physical environment that ensures accessibility for very young and older people and those with disabilities.

These propositions were borne out by an on-line survey carried out within ETSI TC HF in preparing the draft of this current Report. Six specific issues related to citizen requirement needs were identified. The online survey asked

respondents to rank citizen requirement needs from the most important through to the least important. These six general needs are presented in order of importance based on priorities determined by survey respondents:

- Facilitating citizen participation in decisions
- Access to services, online and offline
- Effective measurement of citizen services
- Protecting people's physical and cyber security
- Declaring ethical priorities
- Ensuring people's' privacy and the protection of their data.

The top three most important city standardization requirements of those proposed in the survey were deemed to be facilitating citizen participation in decisions, access to services online and offline and effective measurement. Other priorities not proposed, but suggested by respondents as needing to be included, were internet availability and the need for cities to co-design services with citizens.

Annex B (informative): Survey Analysis**"** contains the detailed analysis of the online survey results.

5.2 Access to city services

Access to services is a priority area for future standardization. Smart cities have so far approached the transformation required by introducing technology to both existing and new services. The roadmap each city is using for this transformation is to prioritise a move to the provision of online services instead of purely offline city services.

This is all very well in theory, but in practice there are serious issues concerning digital inclusion. Across Europe not all citizens are digitally included, and these people include the elderly and handicapped, who frequently by definition will need assistance to access online services. No less than 47% of our survey respondents asserted that smart cities would continue to need to provide physical buildings to manage offline city services. This physical service provision (which could of course include support staff visiting peoples' homes) seems necessary to deliver and support the provision of digitally excluded citizens and non-digital city services (**Recommendation 1)**.

5.3 Citizen complaint and redress procedures

As citizen services in cities increasingly move online it is important that cities ensure that from a citizen perspective issues with services can be easily communicated to their staff, using a variety of mechanisms, both online and offline. A citizen complaint and the appropriate redress process need to consider not just how the city addresses the complaint, but also the communication which needs to be made about it. Appropriate feedback mechanisms, and possibly dialogue with the citizen, will need to be created to ensure the resolution of the issue. It is important that the move to online city services provide complaint and redress mechanisms which are both online and offline, and which support the citizen make any appeal regarding city decisions. A city needs to clearly communicate the redress the city will make as a result of addressing the complaint, taking into account any accessibility needs of the citizen.

On-line procedures should be aligned as far as possible with the European Union principles laid down for Alternative Dispute Resolution between traders and consumers [[i.27]]. More generally, it would be advantageous to consider dedicated standardized guidance to help cities establish complaint and redress procedures **(Recommendation 7).**

5.4 Ethical priorities

Smart cities have tended to deploy technology without any specific communication or regard for the ethical concerns of citizens, or in the design of the transformed services they create. The introduction of European legislation to articulate privacy and security considerations for an increasingly digital world has caused some cities to review this. For example, a small number of smart cities have specifically created a charter to communicate their approach to citizens.

Our survey responses did not provide any additional resources or evidence which related to the ethical concerns of citizens, but these ethical considerations are an area which should be considered for standardisation activity. As a minimum the creation of guidance material to support smart cities to produce a transparent and open declaration of the ethical approach a city has taken to the design and delivery of citizen services is needed **(Recommendation 8)**. The requirements for improved service design are considered in Clause 7 below.

5.5 Measurement v Outcomes

5.5.1 Introduction

International standardization has focused for a number of years on the publication of indicators. Indicators allow comparisons of city data to be made based on agreed data and definitions related to the structure and services of cities. A series of indicator standards have been developed for sustainable cities and communities. In May 2019 an additional dedicated international smart city indicator standard has been published, ISO 37122:2019 “Sustainable cities and communities - Indicators for smart cities” [i.28]. This smart cities indicator standard is designed to support the curation and measurement of individual city service and environmental data.

Clause 9 contains more detailed information on indicator standards.

5.5.2 Improvement of outcomes

Citizen standardization requirements are not however focused on measurement, they are focused on outcomes, specifically the improvement of outcomes for citizens as a result of the design, transformation and delivery of citizen services.

In our survey 83% of respondents asserted that smart cities are not measuring the impact of their activities, 67% asserted that outcomes are not improving for citizens, 33% asserted that outcomes were known to be improving by the use of surveys, availability of City KPIs, and noticeable improvements in specific services for example the travel time taken for a specific transport service.

In order to improve outcomes respondents suggested that codes of conduct and guidance for cities should also be considered as part of citizen standardization activities. These standards are deemed to be needed due to the fact that existing standardization is top down, too complex, and needs a more practical approach to be taken. Standardization with an outcomes-based approach would directly support the inclusion of citizens in the delivery of citizen services.

Current measurement is via KPIs or indicators related to the service provision in a city. Citizen requirements are for smart cities to measure how they are changing the outcomes citizens experience. The focus needs to move from the publication of indicators related to city service provision, to measurable differences which is focused on the improvements smart cities are making for citizens and the outcomes they experience. The creation of a “local” Digital Economy and Society Index (DESI) would provide the relevant outcomes measures to track the evolution of city services and the benefits they are providing to citizens **(Recommendation 3).**

5.5.3 Use of Certification

In our survey respondents suggested that certification should be used as a mechanism to improve outcomes for citizens. Smart cities are at the beginning of their journey to utilise technology to deliver better outcomes for citizens. Whilst certification at some point may be an appropriate mechanism to support the delivery of outcomes for citizens this would be considered an additional burden and barrier to cities as they begin their transformation journey. Whereas codes of conduct and guidance would by comparison be easier to establish and not present an additional burden and barrier to cities.

5.6 Keeping a safe environment

Smart cities are complex, each city has its own priorities and specific communities which forms the focus for the services it provides for its citizens. In addition, cities are increasingly at the centre of complex ecosystems where city services are increasingly provided by non-government organisations and third parties. Individual city services vary considerably between cities, and services are based on the identified and evolving citizen needs and the resources available to elected leaders. In order to manage this complicated environment, cities will declare their key priorities which determine the focus of city service provision, such as health transport or environment.

However, despite the individual focus of each smart city there are a number of areas where a more horizontal approach to meeting citizens' requirements needs to be taken.

5.6.1 Security-minded approach

Smart cities deploy complex distributed technologies which have required a new holistic approach to security not confined to the traditional cyber security approaches. The holistic approach to security includes physical, cyber security, cyber physical and personnel security. This holistic approach is referred to as a security-minded approach and is based on an appropriate and proportional response to security in a smart city.

Security-minded approaches for smart cities in the UK have been introduced in response to the recent European Directive concerning measures for a high common level of security of Network and Information Systems (NIS) across the Union [i.29]. British Standards Institute Publicly-Available Specification (PAS) 185 has been developed to support the introduction of a security-minded approach for UK cities, which combines existing UK Critical National Infrastructure security approaches and the NIS Directive to address the specific security-minded approach which should be adopted by smart cities [i.30].

5.6.2 Privacy-preserving approach

The complex provision of city services by many organisations alongside those provided by the local authority requires a new trust model to be developed with citizens. The approach which has been taken both in Europe and Internationally is to use a privacy- preserving approach to the change and development of city services. This privacy-preserving focus in Europe has also been required as a result of the entry into force of the General Data Protection Regulation (GDPR) [i.31]. Smart cities need to share and exchange personal information and personally identifiable information across a complex services ecosystem in a multi-agency model setting. The privacy-preserving approach taken to city services varies in smart cities, based on the purpose for which data is exchanged and shared, and the city service where this applies.

A BSI PAS, PAS 183:2017. Smart Cities. Guide to establishing a decision-making framework for sharing information services [i.32] has been published to articulate the implementation of the GDPR in the complex smart city setting. PAS 183 has been adopted internationally and is being fast-tracked to an international standard in 2020.

5.6.3 International standards landscape

European privacy regulation and cyber legislation has influenced international smart cities and nation states. For most international settings security and privacy legislation is complex.

In advance of PAS 183 becoming an international standard as referenced above, two additional international standards have been created to support the complex data exchange and sharing needs of smart cities and the city infrastructure which provides city services. ISO 37156 Smart City infrastructures -Guidelines on data exchange and sharing for smart community infrastructures will be published in 2020 [[i.34]]. ISO 37160 Smart City infrastructures – Measurement methods for quality of thermal power station infrastructure and requirements for plant operations and management for smart community infrastructures [i.34] will also be published in 2020. These additional international data-sharing standards utilise privacy-preserving principles in the complex landscape of international legislation and regulation for smart cities.

Internationally smart cities have increasingly utilised technology to create online services for citizens which has led to both the security-minded and privacy guidelines being adopted by nation states. It is important that the city setting is

understood in the context of the particular national jurisdiction, as the specific implementation of the principles vary between nation states. The complex smart city multi agency model which creates a safe environment in smart cities is particularly important to understand in the context of infrastructure provision due to the variety of data which needs to be exchanged and/or shared.

5.7 Elements relating to citizen security

5.7.1 Introduction

Due to the complexities of the services provided for citizens or visitors to a smart city a multi-layered approach is needed when considering the requirements to be met for citizens' cyber security. The provision will vary between cities and will need to take account of the requirements of specific communities with the development of an appropriate governance approach.

In all cases cities need to consider what is required and appropriate for each service and across the city or community on a regular basis. Additionally, citizen cyber-security requirements need to be considered on an exceptional one-off basis, for example during an emergency or for a city-wide event.

The key areas a city needs to consider for the citizen cyber requirement are addressed below.

5.7.2 Citizen security considerations

Smart city services are a blend of technology, with both offline and online provision. City personnel are often the facilitators who orchestrate the service and deal with issues and complaints. Guidance for cities to include citizen security considerations as part of the implementation of the cyber-security measures across the city, and for individual services. A focus on citizen cyber-security requirements is a standardization opportunity which would have direct benefit to citizens **(Recommendation 4)**.

There are other consumer digital safety issues that are particularly relevant for cities. For example, 5G is offering the potential for interaction times with remote IoT objects of more or less a few milliseconds to open up remote control by central services (including vehicles in future). If that interaction time is critical to the safe operation of the remote item then there are safety risks associated with slow 5G data transfer in bad weather, loss of 5G service, central service applications "hanging" or going off-line. As 5G will grow fastest in cities, we recommend that there be a study into these issues (**Recommendation 9**).

5.7.3 Personnel security

A security-minded approach to the procedures and policies to manage the risk related to city personnel who have legitimate access to city services and technology is required. This is an area which should be considered for guidance to ensure that exploitation or unauthorised use of this legitimate access to city services does not compromise citizen cyber security. Staff training will be a significant issue., and a code of good practice for management of these aspects would be of benefit (Recommendation 5).

5.7.4 Physical security

The physical security of city services, the built environment or infrastructure require a layered security approach to deter the misuse, attack or delay which may compromise the cyber security of the citizen. Physical security arrangements in cities often present a single point of failure for city services, as a result of a combination of physical barriers and procedures staffed by people.

Physical security arrangements need to be specifically reviewed by cities in the context of the vulnerabilities these create for city services, and the requirements to ensure the safety and security of citizens. This layered approach to

physical security in a city will be specific to an individual city and needs to be created based on the vulnerabilities which have been identified **(Recommendations 6 and 10)**.

5.7.5 Cyber-physical systems

Increasingly technology is deployed by cities to improve or create new city services or in response to efficiency drives. The connectivity of devices across cities may support a single city service, may be city-wide, or for the benefit of a specific community. Citizens' requirements are not usually the prime reason for the choice of the technology or the way in which devices are deployed in a city: citizens may be unaware of these cyber- physical systems and how they may affect their own cyber security requirements. There are also aspects of cyber physical systems which may affect not just citizens' cyber security but also their privacy requirements.

Whilst there are standardization activities in place to consider individual cyber physical assets within a city or specific city services these activities are from a device perspective not from the perspective of a city or citizen. As referenced above, the British Standards Institution (BSI) has issued a Publicly-Available Specification [[i.32] to address the key security-minded requirements with the participation of UK cities. This UK work did not include the requirements from a citizen perspective, or include the participation or consultation of citizens. Our consultation has indicated this is a key area which highlights citizen cyber security as a future standardisation opportunity **(Recommendation 4)**.

5.8 Citizen data

The privacy preserving approaches taken by smart cities has been underpinned by European legislation, but is also included in international smart city standards.

The transparency movement has focused on the release of open data from government. This work has been echoed by cities with the creation of open data portals allowing citizens and other interested parties such as entrepreneurs and journalists to consume the data being published. However only 3% of the world's data has so far been opened.

The constant evolution of technology and the move to a privacy-preserving and security minded-approach has highlighted the ease with which it is possible to impute pattern of life data, even if personal data or personally identifiable data are not included.

International smart city standardisation has created a new approach to data about the citizen which classifies data as "open", "closed" or "shared". Shared data has been classified into three broad group depending on what purpose it is being used for, and what security and access controls are required to meet both privacy-preserving and security-minded requirements for the citizen.

The data spectrum approach has unlocked new business and commercial models for smart cities and created a custodian role for the city. Whilst the citizen may be the owner of the data the city assumes a custodian role on behalf of the citizen to create and improve city services. New publication models have also emerged as a result of the use of shared city data underpinned by data sharing agreements for organisations delivering city services.

Citizen uses and requirements from data have not been explored as part of the current smart city standardization activities. The emergence of the data spectrum and the opportunities that shared data unlocks for smart cities and their citizens has yet to be explored and represents a significant standardization opportunity **(Recommendation 11**).

5.9 Accessibility

5.9.1 Accessibility priorities

According to the European Accessibility Act preamble [[i.34], 1 in 6 people in the EU has a disability that ranges from mild to severe, making around 80 million people who are often prevented from taking part fully in society and the economy because of barriers they face. It is expected that by 2020, there will be 120 million people with disabilities in the EU. European Commission has issued the European Disability Strategy 2010-2020 in line with Article 9 of the UN Convention on the Rights of Person with Disabilities that refers to 'accessibility' as meaning that people with

disabilities have access, on an equal basis with others, to the physical environment, transportation, information and communications technologies and systems (ICT), and other facilities and services open or provided to the public[3]. Therefore, accessibility should be one of the first priorities for the smart cities seeking to become friendly to citizens.

Existing European standardization in the ICT arena is provided by European Standard EN 301 549, which provides minimum accessibility criteria for different ICT domains. This Standard is innovative in that it represents a joint initiative of all three European Standardization Organisations. Extracts from the requirements of the standard relevant to smart cities are provided in **Annex E** to this Report.

For the particular issue of Active and Healthy Ageing (AHA), the relevant European Integrated Project has apparently the EIP on AHA (Active and Healthy Ageing) has compiled a list of standards which they consider relevant for that domain, including a specific section on smart cities[4] https://ec.europa.eu/eip/ageing/standards_en

5.9.2 Functional accessibility aspects

The European Accessibility Act [i.34], which will enter into force in 2023, aims to improve the functioning of the internal market for accessible products and services by removing barriers created by divergent legislation.

The European Accessibility Act covers the products and services that have been identified as having the highest risk of being concerned with diverging accessibility requirements across the EU countries:-

- computers and operating systems
- ATMs, ticketing and check-in machines
- smartphones
- TV equipment related to digital television services
- telephony services and related equipment
- audiovisual media services such as television broadcast and related consumer equipment
- services related to air, bus, rail and waterborne passenger transport
- banking services
- e-books
- e-commerce

All the above products and services can be considered as key enabling components in smart cities and any accessibility requirements related to them will facilitate the work of businesses active in smart cities. A focus on accessibility will by smart cities will bring benefits for citizens with disabilities and elderly people.

Smart Cities and businesses will benefit from:

- common rules on accessibility in the EU leading to costs reduction in building and maintaining smart cities
- easier cross-border trading and interoperability
- more market opportunities for their accessible products and services for smart cities.

Persons with disabilities and elderly people as citizens of smart cities will also benefit from:

- more accessible products and services in smart cities
- accessible products and services at more competitive prices in smart cities.

3 The international standard ISO 9241-171:2008 defines accessibility as “usability of a product, service, environment or facility by people with the widest range of capabilities”

4 https://ec.europa.eu/eip/ageing/standards_en

Special attention should be given not only to having more accessible products and services in smart cities but also for any product or service in smart cities to be comprehensive and usable by all citizens in smart cities including people with disabilities and the elderly.

6 Citizens' and their local authorities

6.1 What's involved?

Digitisation has already extensively changed citizens' interactions with their local authorities. These have taken advantage of the money-saving opportunities offered by electronics, in terms of saving administrative burden and hence manpower. In terms of citizens' perceptions of service provision, things are not so clear: often service provision is thought to have deteriorated, with a large reduction in the opportunity to engage in dialogue with the provider of the service. Often, however, this may be the result of pure cost-cutting as a consequence of recession rather than simple digitisation.

This said, enlightened local cities and communities will use the advantages offered by the digital revolution to try not just to preserve citizen engagement but to enhance it. A number of possibilities may be used to do this, for example:

- clear and easy-to-use electronic interfaces, with background supporting information easily available;
- human interface possibilities always there (in whatever form) as back-up;
- avoidance of digital divide issues, by providing special interfaces designed for the less able, and support provided for these persons.

Standardization in this area is rudimentary to say the least. Performance standards work on efficiency rather than customer experience. But there are opportunities to provide some standardization, in terms of the basic elements for service design in a smart city (as discussed in Clause 7 below), and also to lay down principles for guidance, such as best practice to meet citizen needs (**Recommendations 2 and 12**). The latter in particular emerged from our stakeholder survey.

6.2 Designing services for the citizen

At present many design aspects take more account of the convenience requirements of service providers than of citizens. Work needs to be done to encourage good practice in design of services, whether these are new services or existing ones which are being increasingly digitised.

The level of maturity of services poses different considerations, for example:

- **Current mature service:** smart city objectives should be to keep services the same, but deliver them at lower cost, better quality and faster. This requires a process to review citizen needs;
- **Enhancing current service:** smart city objectives should be to enhance facilities, or to provide additional features to meet citizen needs better. This requires a process to check that incremental improvements do in fact do this;
- **New service:** smart city objectives should be to innovate to meet new needs with a process that captures and tests citizens' needs and ensures their correct implementation.

Standardization of city service design is largely absent; such work needs to be centred around the requirements of the citizens using the city services, with a specific focus on user interface design and supporting accessibility needs of citizens. **(Recommendations 2 and 12**).

6.3 What services are we talking about?

Depending on the context in individual countries, these services may in practice be public sector, or provided by the private sector under contract, or purely private. But the essential requirements of citizens being served are going to be

the same. In the case of private sector-provided services, of course the “citizens'” interests and those of consumers will overlap.

The range of services is extremely wide. Citizens interact with local service providers in an enormous range of ways, for example concerning:

- mobility and transport;
- education and child-care services;
- recreational services;
- healthcare services;
- sanitation;
- utilities;
- emergency services.

There are standardization activities in respect of all of these (though for some services more comprehensively than others). But so far many of these efforts do not take sufficient account of smart city aspects.

6.4 Individual services

Based on existing smart city standardization work there are barriers to the transformation of city services. Smart cities use a decision-making framework for sharing data and information related to unlock the barriers to city services.

The decision-making framework:

- uses a concept model to ensure the interoperability of smart city data:
- uses the data spectrum, containing open, shared and closed data to create a data sharing culture;
- establishes the roles and responsibilities for all organisations in the data value chain;
- defines the purpose of data and information services in the city;
- uses declarations for the data states which apply in the framework;
- controls access rights to data and information services;
- defines the data formats and the format of transportation used for city services.

BSI PAS183 [i.32] is the normative reference for this work and is itself being fast tracked to an International Standard in ISO.

The data and IT services decision-making framework contained in this specification can be used by cities to decide on their city service priorities. This was used as the basis for our consultation to understand the priorities and gaps in current standardization work, as discussed further below. Although individual city services are not discussed in any detail there are specific issues and requirements for some city services which need to be considered in the context of future citizen standardization.

6.5 Supporting citizen participation

Survey respondents and research across the international landscape have highlighted the need to co-design with citizens the changes to city services in smart cities. This new co-design approach is designed to create an opportunity for citizens to participate in smart city changes. Currently smart cities use open data to inform citizens regarding smart city services. Since the introduction of GDPR and the NIS directive and a move to privacy preserving and security-minded principles for shred rather than open data have been developed. The development of BSI PAS 183 was accompanied by 10 case studies which demonstrated how shared data can be used to resolve privacy and security concerns with open data and facilitate a citizen participation agenda. The development of BSI PAS 185 and ISO 37156 and ISO 37160 have confirmed that facilitation of citizen participation using shared data can be used beyond Europe in an international setting. **(Recommendation 13**).

7 Our on-line survey

7.1 Introduction

We created an online survey which could be distributed easily across the many smart city networks which exist to understand the current standardization landscape for citizens.

The survey contained 29 questions sent to many networks with many hundreds of members, despite reminders only 36 responses were received. This is a low number of survey returns, however despite the low numbers valuable responses were received. 100% of the survey respondents wished to be kept informed of the progress of the STF.

For a full summary of the survey responses see the Editor's Note in **Annex B**.

7.2 Survey respondents

The stakeholder survey received 52% of its responses from citizens or organisation which represent citizens. 36% of respondents were involved in standardization, the remainder of respondents were from local authorities, vendors and researchers. All survey responses were checked to ensure that views were current, ie within the last two years.

67% of survey respondents were not currently involved in smart city standardization, although 58% were aware of current smart city standardization efforts. 70% were not using standards from other domains. Accessibility requirements were considered a priority by 94% of survey respondents.

7.3 Citizen requirements

Respondents ranked the top three citizen requirement priorities proposed as access to services, effective measurement and protecting people's privacy and data security. Other priorities not proposed in the survey, but suggested by respondents as needing to be included as citizen requirements, were internet availability, and the need for cities to co-design services with citizens.

7.4 Future services

The future citizen services were predicted to be online by respondents, however 47% still expected physical buildings to be needed to support the citizen requirements for smart city services.

All respondents submitted ideas for smart cities to meet citizen requirements. 75% of respondents did not think that citizens were considered specifically either by the use of surveys, consultations or the engagement of expert resources.

Some additional areas raised such as data privacy and security issues and data management standards are already under development in Europe and internationally, in the latter case sometimes specifically related to smart city aspects.

Some additional ideas such as how to achieve citizen co-design, and anticipate or ensure accessibility of city services are not the subject of current smart city standardization. This represents a future standardization opportunity to meet citizen requirements from cities.

7.5 Outcomes

In the survey 83% of respondents asserted that smart cities were not measuring the impact of their activities, 67% asserted that outcomes were not improving for citizens, 33% asserted that outcomes were known to be improving by the use of surveys, availability of City KPIs, and noticeable specific improvements, such as improved travel times for a transport service.

In order to improve outcomes respondents suggested that codes of conduct, guidance and certification for cities should also be considered as part of standardization activities. These activities are deemed to be needed as existing

standardization is thought to be top down, complex, and needs to be a more practical approach which will allow citizens can be included. This represents a major standardization opportunity to include the citizen requirements for smart cities.

7.6 Citizen strategy

The survey sought to understand whether any smart cities had a citizen strategy in place. 64% of respondents said "no", of the 36 % who said "yes", 30 cities were cited as having a Citizen Strategy (only 2 of which were non-European cities). However, these cities are predominantly large urban cities with considerable resources, whereas 85% of European smart cities are termed "small giants" and typically do not have any resources which they can use to create a citizen strategy.

8 The smart city standards landscape

8.1 Introduction

As part of a non-exhaustive standardization overview exercise which has been conducted in the European Smart and Sustainable Cities and Communities Sector Forum 10,000 standards have been identified as potentially applicable to smart cities. Note that first and foremost none but a very few of these were drawn up with smart cities in mind. Many deal with technology aspects, and without standards in the ICT area interoperability issues would be even worse than they are at present.

In addition, the end-users – consumers or non-ICT industries are rarely given consideration in the development of these technological standards. Although at European level, the current EU Regulation governing standards processes [i.36] has helped to encourage the participation of societal stakeholders (consumers, environmental organisations and the labour movement), the resource and expertise available to these stakeholder categories remains very limited in comparison with industry. And the participation of local authorities is also very limited.

Furthermore, understanding and participation is not helped at all by a bewildering landscape of standards organisations, both "formal" at national, European and international levels, and informally through industry standards consortia (both open and closed).

The present section is no more than a high-level overview of the current landscape. Ways in which the current landscape – at least at European level – can be made more transparent and helpful to smart cities are discussed in **Annex A**. Information on the CEN-CENELEC-ETSI "Mindmap" overview [i.37] is provided at **Annex C**.

8.2 International smart city standardization

At international level the International Organization for Standardization (ISO) and ISO/IEC Joint Technical Committee (JTC 1) have specific smart city standardization activities. The International Electrotechnical Committee (IEC) does not create smart city standards in its own right, but has a "Systems Committee" which focuses on electrotechnical needs of smart cities. ITU-T – which is a UN Agency - coordinates telecommunication standardization for smart cities, and the drafting processes are open to any interested party.

Within ISO, there is a dedicated Technical Committee on smart city issues, TC268, "Sustainable Cities and Communities". The scope includes "the development of requirements, frameworks, guidance and supporting techniques and tools related to the achievement of sustainable development considering smartness and resilience, to help all Cities and Communities and their interested parties in both rural and urban areas become more sustainable".

Most TC268 standards have a management system, infrastructure and technical focus, and ISO is seeking to encourage the adoption of these international standards in collaboration with cities across the world. An ISO TC268 committee Task Group (TG2) implements the standards alongside the city agreeing a '"package' of standards" which meet the objectives of the city. This activity creates a feedback loop where the cities identify changes to existing standards or new standard requirements.

International smart city infrastructure standards have utilised European Legislation and Regulation to frame the data exchange and sharing requirements and have based these smart city standards on the BSI Publicly-Available Specification for this [i.38]. These smart city infrastructure standards implement both privacy-preserving and security-minded principles within the setting of the smart city's national jurisdiction.

This said, a lot of different Technical Committees in the three formal international standardization organisations formed for other purposes have some interest in smart city issues, and there have been efforts to improve co-ordination.

8.3 International standardization alignment

There is a series of initiatives aimed at improving co-ordination of the international Standards Development Organisations (SDOs). The smart cities standardization agenda has been recognised as not serving the ultimate customers - the cities. This has now been deemed a priority` area for alignment. For example, ISO, IEC and ITU-T have formulated a Joint Smart Cities Task Force to improve co-ordination of overall policy, and this will start work before the end of 2019. The Global Standards Collaboration, which embraces ITU-T and regional communications standards organisations, including ETSI, and has participation from other organisations such as IEEE, has also considered how to improve co-ordination on smart city standards issues.

8.4 European standardization

Within the three European Standardization Organisations, there is currently no dedicated technical group on smart cities, rather there are a number of different activities in committees formed for other purposes. However, coordination is assured by the CEN-CENELEC-ETSI Smart and Sustainable Cities and Communities Sector Forum, which orchestrates the European standardisation for Smart Cities. The Sector Forum is not a standardization body but coordinates policies at a strategic level, with the participation of national standards organisations and interested associations at a European level, such as Eurocities and OASC.

At the time of writing, a proposal is being drawn up for a CEN (or CEN-CENELEC) Technical Committee at European level. If approved, this is likely to focus initially on adopting relevant international standards from ISO TC268 as European ones, but the Committee would also explore scope for additional European Standards.

If there has so far not been European-level work, there has been some national work referencing a citizen-based approach. From BSI PAS 181 Smart City Framework [i.28] the work has been taken to an international level, in ISO 37104 [i.39] This is a guide to establishing strategies for smart cities and communities. Giving guidance on a framework for decision-makers in smart cities and communities (from the public, private and voluntary sectors) to develop, agree and deliver smart city strategies that can transform their cities' ability to meet future challenges and deliver future aspirations. Four concrete recommendations take a citizen-centric approach:

- **Empowering stakeholder-led service transformation**: "*Empower stakeholders to create new sorts of services and value, by opening up city data via open platforms, and by driving forward the internal culture changes and the external market enablers that are needed to create a flourishing city information marketplace*";

- **Delivering city-led service transformation**:
  - "*Provide citizens and businesses with public services that are accessible in one stop, over multiple channels, and built around user needs not the city's organizational structures*"
  - "*Establish an integrated business and information architecture to support this, enabling a whole-of-city view of specific customer groups for city services*"
  - "*Do so in a phased, low-cost and low-risk way, by rolling out a number of agile, cross-city, virtual franchise businesses that are based around specific customer segments and that sit within the existing delivery structures of the city.*"

- **Identity and privacy management**: "*Embed an approach to identity and privacy management that is based on:*
  a) an open and federated business model;
  b) a service-oriented IT architecture; and
  c) a citizen-centric trust model."

- **Digital inclusion and channel management**: "*Establish a digital inclusion and channel management strategy, that includes:*
  a) a clear audit of what existing channels are currently used to deliver city services, and the costs and service levels associated with these;
  b) the vision and roadmap for developing a new channel management approach, which:
  1) is centred on the needs and behaviour of citizens and businesses;
  2) identifies the opportunities for current services to be engineered out through the introduction of new smart connectivity directly between city assets and digital devices
  3) encourages access and use of digital services by stakeholder groups currently excluded from these for whatever reason."

8.5 National standardization

At national level, standards organisations are the members of CEN and ISO and/or CENELEC and IEC, and ETSI also has assigned national standards organisations in Europe (in connection with approval of formal European Standards).

A number of national organisations have Technical Committees or other groups looking at smart city standards issues. These are currently usually what are termed "mirror committees" to facilitate national consensus on proposals emerging from ISO. In addition, some countries – notably Spain and the United Kingdom – have been active at purely national level, although it seems seldom with citizen-oriented standards. But national organisations may be key to securing improved city awareness of and participation in standardization.

9 Citizen indicators

9.1 What's involved?

The European Innovation Partnership on Smart Cities and Communities (EIP-SCC) has an initiative called CitizenCity (www.citizencity.eu) whose main objective is to develop tools and platforms to make citizens central in the delivery of smart projects. One of its major developments is a societal engagement toolkit which is trying to create a knowledge pool for cities to design better, finding a common approach and involving the citizens. Aimed at facilitating the implementation of the principles of the 'European Manifesto on Citizen Engagement', the toolkit intends to bridge the needs of cities with the supply of available tool resources, based on a methodology that uses indicators and metrics as means to assess performance of such tools in meeting citizens' needs.

When cities look for solutions that solve their current issues or challenges, it is usual for them to leverage on objectives, key performance indicators and thresholds of success to assess the performance of the selected tools and validate their effectiveness. For instance, the popular project CITYkeys [i.38] funded by the European Union) has provided a "*validated, holistic performance measurement framework for monitoring and comparing the implementation of Smart City solutions, with the objective of speeding up the transition to low carbon, resource-efficient cities*", whose results have been used as reference in several activities of ETSI.

Based on the inventory of indicators from 43 existing indicator frameworks, and thanks to the collaboration with the consortia of different EU-funded projects in the smart city domain (e.g. TRIANGULUM, REMOURBAN and SMARTER TOGETHER), CITYkeys has designed a set of indicators for assessing smart city projects and smart city performance, as well as suggesting new indicators to fill gaps in existing frameworks, mostly related to specific

characteristics of smart city projects. The resulting indicator selection responds to the wishes of cities and citizens for the coverage of their priorities and reflects city goals, arranged in the triple bottom line of social sustainability (People), environmental sustainability (Planet) and economic sustainability (Prosperity), extended to include the themes governance and propagation, and finally completed with specific smart city indicators.

9.2 What are citizens' concerns?

CITYkeys organised two questionnaires to gather input from twenty cities involved in EU-funded Smart City projects as well as from their citizens and stakeholders. As it tried to incorporate citizens' needs in its outputs, cities' stakeholders were asked to give their opinion on what makes a "smart city" project useful for the citizens. One of the highlights of the answers is the need for a city to involve citizens in the process from the beginning but also give priority to projects that maximise the outcomes of public interest. With the projects' results split in four categories, citizens/stakeholders were asked to indicate the most important ones per category, which led to the following classification:

City governance	People	Environment	Economy
Better city governance	More/better recreation	Cleaner city	New jobs
Improvement of city attractiveness	Better education & skills building	Cleaner energy	Economic growth
Participation of the citizens	New skills for the citizens	Protection of natural resources	Less costly projects
More transparency in city operations	Improvement of the housing conditions	Better & cleaner private transportation	Increase of city competitiveness
	Better health	Better & cleaner public transportation	Better telecommunications
	Improvement of the social and human capital	Decrease in noise	New digital infrastructure & e-services
	Creation of cultural value	More sustainability	Creation of innovation & knowledge
	Increase of security	Protection of the environment	Creation of local enterprises
	Better integration/ acceptance of the foreigners in the city		
	Better quality of life	Better integration/ acceptance of the foreigners in the city	
	Protection of the most vulnerable citizens		

According to the surveys, citizens and stakeholders follow adequately what their cities plan and implement, looking for more results especially in three objectives: 1) improvement of quality of life, 2) better services from the city to the citizens, and 3) creation of an innovative city, competent and with high skilled jobs.

9.3 What is standardization doing?

Some SDOs are working on standards and specifications that leverage strategies or indicators for citizens, as listed below.

9.3.1 ISO indicators

According to ISO, the **International Organisation for Standardization**, cities need indicators to measure their performance. As part of a series of international standards being developed for a holistic and integrated approach to sustainable development and resilience, ISO created a set of standardized indicators to track and monitor progress on city performance to achieve sustainable development as well as quality of life, published in ISO 37120 [i.41]. In May 2019 ISO 37122:2019 [i.43] was published. This indicator standard uses ISO 37120 as a normative reference and assumes that smart cities will adopt both standards. Besides needing an annual compilation, the indicators are classified into themes according to the different sectors and services provided by a city, such as:

- Economy
  - Percentage of service contracts providing city services which contain an open data policy
  - survival rate of new businesses per 100,000 population
  - Percentage of the labour force employed in occupations in the information and communications technology sector
  - Percentage of the labour force employed in occupations in the education and research and development sectors
- Education
  - Percentage of city population with professional proficiency in more than one language
  - Number of computers, laptops, tablets or other digital learning devices available per 1,000 students
  - Number of science, technology, engineering and mathematics (STEM) higher education degrees per 100, 000 population
- Energy and climate change
  - Percentage of buildings built or refurbished within the last 5 years in conformity with green building principles
  - Number of real-time remote air quality monitoring stations per square kilometre (km2)
  - Percentage of buildings equipped for monitoring indoor air quality
- Other categories of smart cities indicators included are Finance, Governance, Health, Housing, Population and social conditions, Recreation, Safety, Solid waste, Sport and culture, Telecommunication, Transportation, Urban/local agriculture and food security, Urban planning, Wastewater, Water and Reporting and record maintenance.

ISO 37120 also contains an annex with a list of profile indicators to provide basic statistics and background information to help cities determine which cities are of interest for comparisons, as seen in the following image containing a subset of the profile indicators.

ISO 37122 contains a mapping of the indicators to the United Nations Sustainable Development Goals (SDGs). A new indicator standard is also under development, as part of the family of smart cities and communities' indicator standards within the work of ISO TC 268. This may be applicable to some smart cities who are exploring the resilience of their city: ISO/FDIS 37123 [i.43] addresses the indicators to be used to develop a reliance approach for smart cities and communities

	Indicator
People	Total city population
	Population density (per square kilometre)
	Percentage of country's population
	Percentage of population that are children (0-14)
	Percentage of population that are youth (15-24)
	Percentage of population that are adult (25-64)
	Percentage of population that are senior citizens (65+)
	Male to female ratio (number of males per 100 females)
	Annual population change
	Population dependency ratio
	Percentage of population that are foreign born
	Percentage of population that are new immigrants
	Percentage of residents who are not citizens
Housing	Total number of households
	Total number of occupied dwelling units (owned & rented)
	Persons per unit
	Dwelling density (per square kilometre)
Economy	Average household income (USD)
	Annual inflation rate based on average of last 5 years
	Cost of living
	Income distribution (Gini Coefficient)
	Country's GDP (USD)
	Country's GDP per capita (USD)
	City Product per capita (USD)
	City Product as a percentage of Country's GDP
	Employment percentage change based on the last 5 years
Government	Type of government (e.g. local, regional, county)
	Gross operating budget (USD)
	Gross operating budget per capita (USD)
	Gross capital budget (USD)
	Gross capital budget per capita (USD)
Geography and climate	Region
	Climate type
	Land area (Square kilometres)
	Percentage of non-residential area (square kilometres)
	Number of native species
	Annual average temperature (Celsius)
	Average annual rain (mm)
	Average annual snowfall (cm)

Figure 1 - Subset of indicators from ISO 37120

9.3.2 UN Sustainable Development Goals

As already referred in the first chapters of the present report, and similar to the ISO indicators for sustainability and quality of life, the United Nations have defined a blueprint to achieve a better and more sustainable future for all. Called the **Sustainable Development Goals** [i.43], they address the global challenges we face, including those related to poverty, inequality, climate, environmental degradation, prosperity, and peace and justice. These instruments have in common the concern of offering parameters of public services to citizens and promoting in a uniform manner both social and economic growth of the urban environment. The Goals interconnect and in order to leave no one behind, it is important that we achieve each Goal and target by 2030.

9.3.3 ETSI KPIs for Sustainable Digital Multiservice Cities

ETSI has published a technical specification entitled **Key Performance Indicators for Sustainable Digital Multiservice Cities** [i.45] under the umbrella of the Technical Committee "Access, Terminals, Transmission and Multiplexing (ATTM)", which describes the selection of indicators for assessing indicators on city level. Starting from the definition of a smart city, indicators have been selected that can function as Key Performance Indicators for tracking the progress towards city objectives. Based on the CITYkeys deliverable D1.4 [i.38], and with a starting point in the smart city definition, and considering the wishes of cities and citizens regarding smart city indicators, these are arranged in an extended triple bottom line sustainability framework, including the themes people, planet, prosperity, governance and propagation, and completed with specific smart city indicators. For example, the indicators of the People theme cover the following subdomains:

- Encouraging a healthy lifestyle.
- Cybersecurity and Data Privacy, Inside Safety.
- Access to (other) services, like public transport, public and commercial amenities.
- Education and digital literacy
- Quality of housing and the built environment

9.3.4 ETSI KPIs for Smart Cities

ETSI has published a Group Specification to define **Key Performance Indicators for Smart Cities** expressing city level in terms of **People, Planet, Prosperity, Governance and Propagation** [i.46]. Produced by ETSI's Industry Specification Group Operational Energy Efficiency for Users (ISG OEU), the document describes a selection of 73 indicators for assessing progress towards the objectives on a city level. Based on the CITYkeys deliverables, the majority of these indicators concern energy use, emissions from CO2 pollutants, and waste generation, with the resulting indicator selection responding to the wishes of cities and citizens for the coverage of their priorities and reflecting city goals. The ICT users' indicator set focusses on impact indicators, as these can be used for all types of interventions, together with a number of generalized input, output and outcome indicators that reflect the degree of smartness of a city.

9.4 Is standardization helping?

In general, standardization activities have specified several indicators capable of helping cities assessing the performance of smart city tools, projects and quality of life, in different levels. These indicators can then be used to justify particular guidelines and processes when replicating success stories from other smart cities. However, the indicator assessment could also benefit from standard processes and tools, to avoid reinventing new surveys whenever the need for gathering requirements and concerns from citizens arises.

10 Recommendations to standardization

10.1 Some major issues to address

Using the survey results and other outreach, including participation in conferences and relevant meetings, we can identify a number of major standardization issues that need to be addressed. The recommendations below have been proposed based on these issues; the "organisational" aspects of these are considered in more depth in **Annex A.**

The major issues are as follows:

- **Cities do not know standardization**

  Yes, there are exceptions, but these are very few. How can cities be given sensible information about standardization and participation without over-saturating them with information they will not be able to assimilate?

- **Cities cannot participate in standardization**

  On the whole they have no resource. Chicken-and-egg: standards-makers will not be interested to provide useful deliverables if cities are not present. How can SDOs capture city requirements and involve them without undue participation burdens?

- **Standardization is incoherent**

  Standardization is a bewildering maze for cities. Even if in Europe there's a sector forum, not many people outside a narrow circle are aware of it. And internationally, each of the main SDOs has an activity on smart city standards issues, but collaboration is limited. How can standardization present a more coherent image?

- **Services are not designed for citizens**

  In most cases, services are not "designed" as such. Digital services tend to be a "hodge-podge" of upgrades to non-digital services, with resulting differences in approach and incompatibilities. Citizens receiving services are often the last element thought about.

- **Services are not accessible for citizens**

  Smart Cities do not generally support independent living of people with disabilities or other accessibility needs. Some efforts have been made in the health sector for improving quality of life and independent living of people with disabilities, but overall further focus is required on the accessibility of smart city services.

  Whilst there is gradual improvement in physical accessibility – for example in transport - building/street accessibility still needs a lot of work. Use of digital support, for example for people to call for specialised transport facilities, needs to be more widespread.

  In terms of digital services themselves, the specific needs of people with particular accessibility issues are not necessarily considered. Just as one example, if there are interactive screens to seek a service, are these accessible for people with visual problems?

- **A better approach to citizen data is needed**

  Whilst of course in Europe we now have the GDPR to give better protection, and standards aspects of data protection and privacy are being given attention, the value of properly protected citizen data for cities themselves is not yet addressed - how can citizens' interests be better served if the cities don't have a coherent set of data on the use of their services?

10.2 Individual recommendations

10.2.1 Introduction to recommendations

Recommendations related to smart city standardization have to take into account a variety of actors and situations. Amongst those in charge, within the city organisation(s), of dealing with the citizens and their needs, a large number of different stakeholders is involved, with very different operational roles and responsibilities (e.g., front office, back office, technology development, integration and support teams, security enablement and enforcement, training).

As such, adoption and adherence to standards is not a solution in itself but, in order to be effective, has to take into account the stakeholders addressed by the recommendation as well as the technological background and the business processes involved.

This translates into different kinds – and levels - of recommendations that are grouped in the remainder of the clause into three categories that have a growing proximity with standardisation itself:

- Guidance. These recommendations relate to the high-level approach that smart cities could adopt in order to deal with a number of citizens requirements. They are, in particular, suggesting the development of guidelines in destination of the smart cities at large as well as more specific ones addressing particular topics (e.g., safety and security);

- Codes of Conduct. These recommendations are suggesting, for smart cities, precise approaches to the development of solutions for specific issues (e.g., design and delivery of services). The proposed Codes of Conduct are more binding than guidelines addressed in the previous paragraph;

- Standards. These recommendations are addressing the standardisation system. They are defining new work items that Standards Developments Organisations could potentially integrate to their standards development plans.

10.2.2 Guidance

Recommendation 1:

Ensure physical presence in management of city services, to support all user needs, but in particular those of vulnerable categories (sub-clause 5.2).

Recommendation 2:

Draw up guidance material for smart cities to help them implement the proposed standard for service design and delivery (ex-Recommendations 3 and 9) (sub-clauses 5.4, 5.5.2, 6.1 and 6.2)

Recommendation 3:

Prepare a Local Digital Economy and Society Index (DESI) for smart cities, which supports the cities to develop an outcome-based approach to city services, focused on improving outcomes for citizens (sub-clause 5.5.2).

Recommendation 4:
Provide guidance for cities, oriented towards protection of the citizen, on cyber-security measures to be implemented across the city, and for individual services (sub-clauses 5.7.2 and 5.7.5)

Recommendation 5:
Provide guidance to city personnel who have legitimate access to city services and technology, to protect citizen cyber security, including staff training and a code of good practice for management (sub-clause 5.7.3)

Recommendation 6:
Review physical security arrangements by cities in the context of the vulnerabilities these create for city services, and the requirements to ensure the safety and security of citizens (sub-clause 5.7.4)

10.2.3 Codes of conduct

Recommendation 7:
Draw up dedicated standardized guidance for cities concerning service complaint and redress procedures, aligned as far as possible with the EU's ADR principles (sub-clause 5.3)

Recommendation 8:

Provide standardized codes of conduct to help smart cities ensure correct design and delivery of citizen services, including a transparent and open declaration of the ethical approach taken (sub-clauses 5.4 and 6)

Recommendation 5:
Provide guidance to city personnel who have legitimate access to city services and technology, to protect citizen cyber security, including staff training and a code of good practice for management (sub-clause 5.7.3)

10.2.4 Standards

Recommendation 7:
Draw up dedicated standardized guidance for cities concerning service complaint and redress procedures, aligned as far as possible with the EU's ADR principles (sub-clause 5.3)

Recommendation 9:
Study the potential security difficulties for citizens arising from future over-dependency on ultra-fast 5G transmissions to manage and control apparatus in the city environment (sub-clause 5.7.2)

Recommendation 10:
Review physical security arrangements by cities in the context of the vulnerabilities these create for city services, and the requirements to ensure the safety and security of citizens (sub-clause 5.7.4)

Recommendation 11:
Explore a standardized approach to citizen uses for and requirements from the data spectrum (sub=clause 5.8)

Recommendation 12:
Standardize the basic elements of citizen-oriented service design, to provide clear and easy-to-use electronic interfaces, with background supporting information easily available, ensure human interface possibilities are always there (in whatever form) as back-up and avoid digital divide issues, by providing special interfaces designed for the less able, and support provided for these persons (sub-clauses 6.1 and 6.2)

Recommendation 13:
Explore a standardised approach to citizen participation without the accompanying privacy and security concerns, utilising shared data rather than open data (sub-clause 6.5)

11 Conclusions, acknowledgements

Annex A (informative): How to improve standards processes to help smart citizens

A.1 Introduction

We have only found two efforts to address standards process issues relevant to smart cities, and one of these is confined to issues related to Active and Healthy Ageing (AHA).

These are a Declaration by certain Cities for Digital Rights and the CEN-CENELEC STAIR- Group which produced a document based on the findings of the EU H2020 Project PROGRESSIVE, entitled

"Towards a new approach to standards that support active and healthy ageing to engage with users of all age groups"

The present Report makes a number of specific recommendations concerning future smart city-related standardization activities that could benefit citizens as well as the cities themselves. But even with goodwill on the part of standards organizations, in order to be as effective as possible, additional "structural" improvements are needed in terms of the way standardization engages with local government.

In particular, whilst there are a few shining exceptions, few cities, let alone smaller local authorities, have any interaction with standards organisations. Smart city standardization activities, almost by definition, faces an uphill struggle if they cannot take as direct account as possible of the requirements of the target audience.

Some of the issues identified in sub-clause 10.1 above relate to this. Whilst these were not identified in the original remit for the current project, they seem too important to ignore: this Annex therefore offers some suggestions as to how the present state of affairs can be improved.

A.2 What standards organisations might do

- **Engage better with cities, smart or otherwise**

At EU level, there seems to be a bewildering array of representative associations for local authorities. There is not a single point where standards organisations can interface with local authorities about issues affecting them, rather a large network of different points dealing with different aspects of city issues.

This constitutes a barrier to the engagement of local authorities, in the sense that communication simply tends not to happen in the right way at the right time. And, of course, local authorities are strapped for resources.

To say the least, this problem is not one that can be resolved very simply. But one suggestion that might be worth considering is the creation of a project under Horizon Europe, whose objective would be to dialogue with standards organisations and a wide range of associations and cities and, based on the results, try to reach agreement on proposals as to how engagement can be improved.

- **Engage better with policy-makers**

We know from discussions in the CEN-CENELEC-ETSI Sector Forum on smart cities that some national standards organisations have good contact and engagement with policy-makers concerning smart cities at Government level, but this is certainly far from universally the case. It would therefore be helpful if such engagement could become more systematic, for example by national organisations being in contact with the relevant ministries in charge of local government, to see if additional communication channels with cities can be opened up.

Similarly, at European level, the three ESOs should try to improve their contact with the European Commission's DG REGIO, to improve their awareness of how standardization can help local authorities.

- **Take city views into account**

The 2012 European legislation identifies certain categories of stakeholders, namely SMEs and societal stakeholders, as being particularly important contributors to standards processes, and lays down specific requirements to ensure their views are taken into account. Whilst of course local authorities have no such engagement requirements, there are similarities – the European Standards Organisations (and their counterparts at national level) can perhaps consider a similar approach whenever a standardization proposal specifically relates to smart cities.

Thus, if direct city participation is not possible, the ESOs could adopt a policy to contact cities in advance of the drafting, to make sure that their requirements are understood, and then again when there is a draft available, to allow them to comment.

This process could be facilitated through the nomination of a panel of experts familiar with cities and their requirements, who would have an informal remit to comment on standards proposals and draft texts. The panel would not have a formal role in established processes but would simply act as a focal point for city needs.

The Horizon Europe project suggested above could examine the feasibility of such a panel and perhaps carry out a trial run.

- **Think about a summit**

There are maybe far too may smart city-related "events" in the form of conferences. But few make more than a glancing reference to standards issues, few to citizen-related aspects, and almost none to both.

It might be helpful to hold a dedicated standards-related event, where the issues we have outlined can be explored. This could be timed, for example to coincide with the launch of the proposed CEN Technical Committee at European level - although it needs to be organised with the collaboration of all three European organisations and involvement of at least some national standards organisations. The CEN-CENELEC-ETSI Sector Forum may be an appropriate place to organise this.

The intention would be to focus on high-level issues concerning participation and engagement, and it would be hoped that the Commission services would participate fully. We would hope that the consultations of such a summit could be very widely disseminated to cities to help their awareness.

Annex B (informative): Survey Analysis

The charts below show the response results for the answers to Q3 on the stakeholder survey.

Q3. What do you think are the most important issues to help citizens in future smart communities?

There are six answers, and respondents were asked to rank the answers, giving a rank to every answer, using the rank values of 1-6 only once each, and using 1 for the most important through 6 for the least important. The order of the answers presented to respondents was not randomised. The number shown against each answer text is the answer position, so "1 Access to services, online and offline" appeared first in the list.

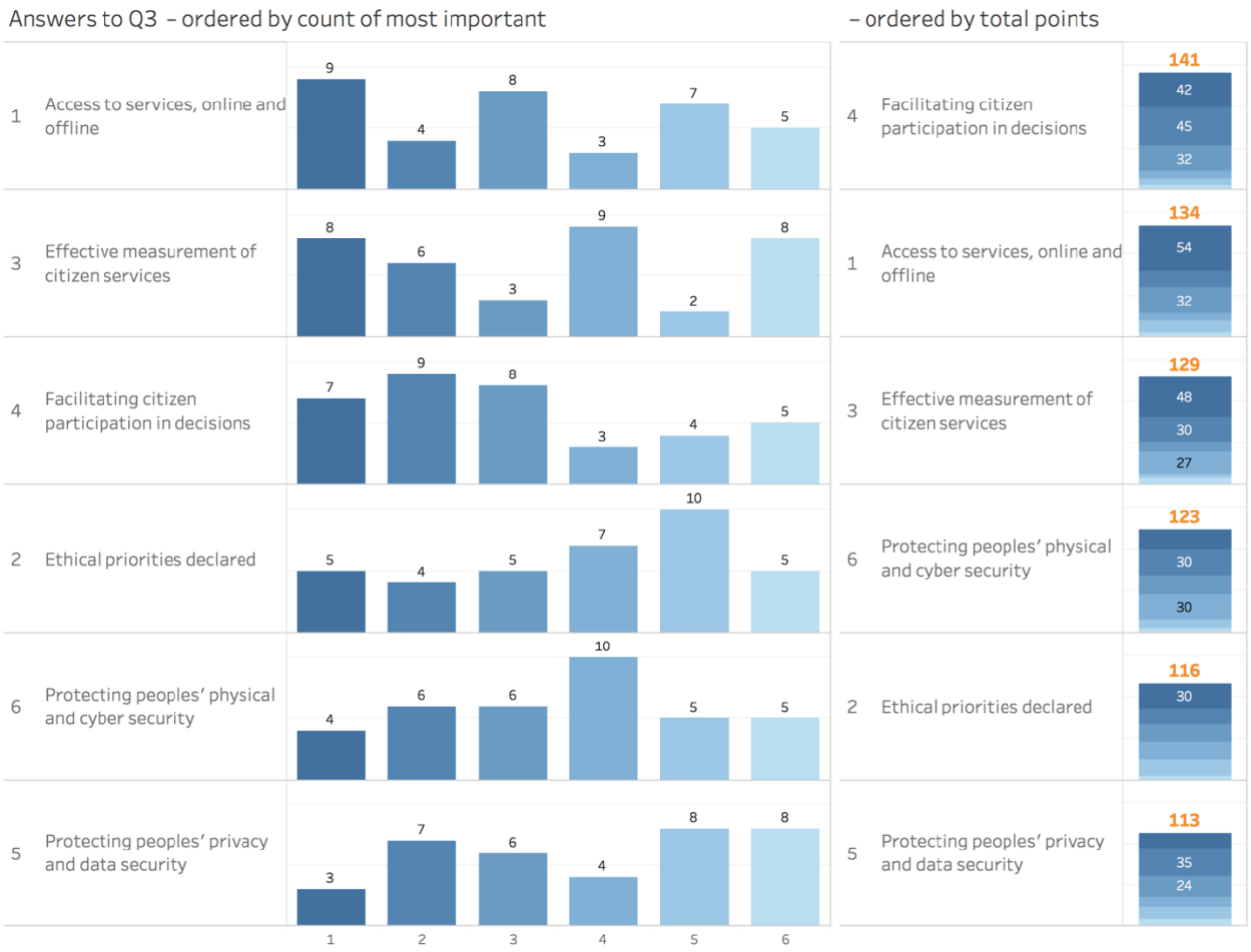
The left chart shows the answers ordered by the count of responses that selected that answer as the most important (so, rank = 1), described as "ordered by count of most important". The same chart shows the count of responses for all ranks for all answers. The rank values of 1-6 are shown at the bottom.

Having created the left chart, we observed significant counts rank values other than one. To gain some better understanding of the rank values overall for an answer, we created the right chart.

The right chart shows the answers ordered by the total points accrued for each answer across all received responses, where 6 points are allocated for rank=1, 5 points for rank=2, and so through to 1 point for rank=6.

The right chart also contains a visual breakdown of the contribution of each rank value to the total, by colouring the rank values, and also showing the response count value where there is sufficient space.

For both charts, the rank values are coloured on a blue ramp, where rank=1 takes the deepest shade, and rank=6 the lightest shade.



Annex C (informative): Mindmap

Citizens in smart cities and communities are continually affected by information and computer technology (ICT) and the recent developments in internet-of-things (IoT), including smart parking, environmental monitoring, city mobility management, etc. Many, many organisations are involved in trying to promote specifications for interoperability between the various systems and the various devices accessed by users (citizens). Organisations can spring up almost spontaneously when a number of manufacturers see a common need, or can be created by top level decision of the EU parliament when important social issues are at stake (e.g. like cyber-security and protection against cyber attacks).

Experts who are continuously working in a specific area can usually (not always) keep an overview of the ongoing work, identify overlaps, cross-communicate to reduce duplication, influence security-by-design or privacy-by-design or even just designed-for-humans … but how can citizen groups keep track and try to influence the work?

This Annex describes two small tools which are freely available and which are intended to improve crowd-sourcing and sharing of information (and evaluations) of standards groups and their documents. They are intended to allow:

- Collecting of links to official databases of specifications (i.e. enable access direct from the source)
- Collecting of names, links and summaries of standards organisations of all types
- Collecting of titles, links and abstracts of specifications and guidelines, with "like its" from users
- Sharing of the collections in the form of interactive, filterable, hierarchical graphical mind-maps, or plain-old-Excel tables of text

These tools are not magic. The necessary magic is the sorting and filtering of the information **to fit the purposes of the citizen groups.** It is rare that a standardisation group is working with the exact same mission as a specific citizen group.

For example, there are many specifications relevant to making life easier for visually-impaired people, but they are spread over groups such as W3C for web technology, ETSI Human Factors for design-for-users, CEN for size and illumination of emergency exit signs, CENELEC for smart-building specifications and elevator (building level labels) design, etc.

Therefore, the tools are designed such that each citizen group can **begin** with a basic "vanilla flavour" sorting of the collected information and then impose their own order and priorities, then share that format/filtering with like-minded groups. The basic information is the same for all, but the **view** which is imposed is the decision of the citizen group.

How is this done? Answer: using an excel sheet to collect the rows of information and a built-in macro (i.e. .xlsm file) to export the information into a mindmap format (i.e. .mm file). The mindmap file can be read, used and manipulated using free software such as from www.freeplane.org or www.xmind.com

There are 7 steps in editing the excel sheet to a convenient format for showing the SDOs as a mindmap:

a) Collect the information on SDOs from any documents or google etc and copy the following text into colums B-F
<short acronym or title><weblink><SDO full name><SDO declare scope, or summary><type of SDO>

b) Add additional keywords or categories, or copy from like-minded-groups, to label the SDO in columns G,H, … etc.

Note that a mindmap is really an ordered hierarchical list, so the labels should get more and more detailed.

c) Add a column with a comment or a priority or a "like it" score, so you can filter the list later

d) Sort the list into the hierarchy you prefer, i.e. grouping same keywords into a series of rows.

Note that a random ordering gives a VERY messy mindmap. Excel has quick sorting features.
You can also use excel "hide row" function to temporarily not show some material (or junk)

e) Run the built-in macro by placing the cursor in any cell in the sheet and typing CTRL-M to trigger the macro.

f) The macro will ask for a FIRST and a LAST column to use for the mindmap categories, then output a .mm file with the same filename as the name of the worksheet (e.g. organisations.mm) and in the same folder as the .xlsm file

g) Open the .mm file using the desired mindmap tool

The example Excel file provided has a set of categories which are related to the SDG goals, but no standardization body has looked at the labelling and agreed it is 100% correct. It is simply an example.

The exact same approach can be used to fill in the Excel sheet called Standards. To help in finding (many!) specification documents, the links to the major SDO databases are given in sheet "database links", and copied here for reference:

a) CEN/CENELEC

b) ETSI

c) ISO

d) ITU-T

Annex D (informative): The European Integrated Project on smart cities and communities (EIP-SCC)

The European Innovation Partnership on Smart Cities and Communities (https://eu-smartcities.eu/initiatives) which assembles partners "*committing to work on specific issues related to smart cities, by sharing the knowledge and expertise with their peers, giving added-value to their national and local experience and identifying gaps that need to be fulfilled at European level*" is organised in six main clusters, listed in the table below.

EIP-SCC Action Cluster	Description
Citizen Focus	*In a time of urban transformation and digitalisation of smart cities, too little attention is sometime given to citizens. Citizen Focus Action Cluster strongly believes in citizens as fundamental actors for the regeneration and development of smart cities. Civic engagement, empowerment, participation and co-creation are at the basis of our advocacy approach since we acknowledge that citizen voice can be pivotal in providing the demand-side pressure on government, service providers and organisations needed to encourage full response to citizen needs. It also ensures the setup of a trusted and sound relationship with local governments and a source of democratic legitimacy and transparency. In the context of smarter cities, citizens understanding of concrete problems and challenges can help local governments prioritise and respond consistently to inhabitants' need.*
Business Models, Finance and Procurement	*Existing business models, finance & funding instruments and procurement schemes do not always fit today's challenges within our cities. There is a strong need for knowledge sharing, innovation and expertise on business models, finance & funding and procurement. The Business Model Action Cluster is a platform where stakeholders work together to establish a dialogue, identify and remove the obstacles for the development of a smart cities market. The action cluster wants to be a focal point for the gathering and sharing of information on business models, financing opportunities and procurement methods.*
Integrated Infrastructures and Processes	*Significant and as yet insufficiently tapped value is offered by integrating the various existing and new infrastructure networks within and across cities – be they energy, transport, communications or others – rather than duplicating these needlessly. This point applies, both, to active and passive infrastructure. Many such infrastructures are ageing; budgets to replace them are stretched; they are procured and managed 'in silos'; yet the potential afforded to cities and their customers through new joined-up approaches, exploiting modern technologies is substantial.*
Integrated Planning, Policy and Regulations	*Integrated Planning, Policy and Regulation focuses on Innovative forms of smart city policies and regulations that are needed to enable large scale implementation and roll-out of smart cities. Cities need an adequate set of framework conditions in the field of policy and regulations in order to be able to smarten up. New governance concepts are required to coordinate and integrate smart city stakeholders – cities, businesses, and research organisations – within the change process so to identify strengths, weaknesses, opportunities and threats. Stakeholders need to jointly experience and learn with new forms of governance and policy concepts to further the process of becoming a sustainable, smart city.*
Sustainable Districts and Built Environment	*The main challenge in 'Sustainable Districts and Built Environment' is to reduce energy use, environmental impact and carbon footprint, entail competitive industries for jobs and growth and at the same time ensure societal and social development and the well-being of citizens. The investment needed to improve energy efficiency, generate low carbon energy, modernize infrastructure and create high quality living environments is enormous. At the same time, cities have limited access to planned financial resources for systemic change, which requires the activation of private capital combined with public investment.*

EIP-SCC Action Cluster	Description
Sustainable Urban Mobility	*Without significant deployment and penetration of new urban mobility solutions, it will be impossible to reach European urban mobility goals. Getting wide-scale deployment can be achieved in many ways; scaling in other locations, or working with new partners.* *The EIP-SCC Action Cluster Sustainable Urban Mobility brings together cities and regions with companies to show-case innovative mobility solutions and support their replication at scale in key market segments. It aims to become the leading platform for understanding (and documenting) city needs, bringing stakeholders together, building the tools that support an innovation pipeline, and directly supporting individual networks and projects that are en-route to realisation.*

The work of each Action Cluster is collected under thematic *Initiatives*, which then pool the work of the various partners around a particular objective, promoting learning beyond project and geographic borders, and opening the results to the world at large, linking with EU-funded projects to allow results to be consumed by the thousands of people active on the Marketplace.

Annex E: ICT Accessibility Requirements in EN 301 549

Alongside functional accessibility requirements applicable to ICT products and services that exist in smart cities. There is significant standardisation activity with regard to the accessibility of ICT products and services. However, smart cities cannot claim that improve the quality of life of citizens if they don't support the independent living of individuals with disabilities that is the key challenge that currently smart cities face. Consequently, the highlights of existing accessibility standardisation provisions applicable in smart cities and can enhance the quality of life of citizens and the independent living of people with disabilities.

The main guidance in this area will focus on the electronic accessibility areas that ETSI EN 301 549: "Accessibility requirements for ICT products and services" [i.3] follows and more specifically on :

- Generic Requirements
- ICT with two-way voice communication
- ICT with video capabilities
- Hardware
- Non-web content
- Non-web software
- Documentation and support services
- ICT providing relay or emergency service access

Following are some related use-case scenarios on each of the above areas:

1 Generic Requirements

This category includes ICT that uses biological characteristics. For example citizens may have to use their fingerprints or the iris of their eye for identifying themselves and accessing specific services (e.g. access to their bank account, entrance to their house, making payments, etc). Therefore, such services should not rely exclusively on the use of a particular biological characteristic as the only means of user identification or for control of ICT

2 ICT with two-way voice communication

ICT with two-way voice communication is quite common in smart cities, for example for giving oral commands and get a voice response back from an agent. However, citizens with hearing loss in most of the cases are not able to communicate via voice and they need to communicate via text or sign language. The introduction for example of Real Time Text (RTT) in smart city services as an alternative mode of communication can be beneficial for people with hearing or voice loss.

3 ICT with video capabilities

ICT with video capabilities is quite popular in smart cities for communication, accessing to information, entertainment, etc. However, citizens with sight loss require that ICT displays video with synchronized audio for accessing it as well as audio description options.

4 Hardware

Accessible hardware and more specifically access device are also one of the key issues in smart cities. For example, a future highly demanded feature in smart cities is all households to be controlled by one device. Such device should be fully accessible by people with sight/hearing loss, mobility or cognitive impairment.

5 Web

Most content in smart cities is being generated, consumed, shared and experienced on the web and consequently in order to be accessible by people with disabilities, it should comply currently with the Web Content Accessibility Guidelines 2.1

6 Non-web content

Any content outside the web (e.g. movie or public information) that has an associated user agent for accessing it such as a media player or an infokiosk respectively should be accessible by people with disabilities.

7 Documentation and support services

Provisions for smart cities that emerge from this clause of ETSI EN 301 549 relate to the accessibility of product documentation provided with the ICT as well as to ICT support services such as help desks, call-centres, technical support, relay services and training services.

8 ICT providing relay or emergency service access

This clause in ETSI EN 301 549 is applicable also in smart cities since it relates to the accessibility to relay services (Relay services enable users of different modes of communication e.g. text, sign, speech, to interact remotely through ICT with two-way communication by providing conversion between the modes of communication, normally by a human operator) and emergency services (e.g. accessibility to security or fire-brigade).

Annex F: Change History

Date	Version	Information about changes
04 March 2019	0.1	Very first draft of contents list etc. JK
04 March 2019	0.2	Updated to include table of contents and align fonts JK
06 April 2019	0.3	Enhancement to cover initial comments from TC HF and ANEC's DS WG JK
15 April 2019	0.4.1	Early draft version submitted to TC HF with Milestone report JK
18 April 2019	0.5.0	Alignment of overall layout with ETSI templates, guidelines, etc. ED
17 May 2019	0.5.1	Updated to include additional text proposals JK
20 Jun 2019	0.5.2	Updated to include Clause 5 and sub clauses of Clause 7 JAT
1 July 2019	0.5.3	Updated to include material from RV and JT
2 July 2019	0.5.4	Updated at meeting STF11
17 July 2019	0.5.5	Cleansed, then updated with new revisions from STF and with revised clause numbering, etc
18 July 2019	0.5.6	Updated to reflect revised text for Clause 9 from RV
22 July 2019	0.6	New clean version for circulation to TC HF for comment
13 Sept. 2019	0.7	New changes from all the team (including insertion of contribution to clause 4.3)`
1 Oct 2019	0.71	Marked up draft for consideration to be put to ETSI HF in respect of Milestone C
15 October 2019	0.8	Version checked by ETSI Edit-Help
14 November 2019	0.81	Revised set of recommendations included
25 November 2019	0.82	Some F2F meeting changes allocated to JT included
28 November 2019	0.83	Introduction of clause 10.2.1 and some layout improvement (ED)
30 November 2019	0.84	Reinsertion of broken reference links (ED)