POSITION PAPER ON THE TOPICS OF:
I) "PRIVACY & DATA PROTECTION"
II) "INTEROPERABILITY"
III) "GAMIFICATION & USE OF NEW TECHNOLOGIES"

FINAL VERSION - MAY 2020

Table of Contents

1. INTRODUCTION AND CONTEXT

1.1. About Card4all:

CARD4ALL is a Transfer network focused on the implementation of innovative services and technologies through a Citizen Card System. Cities can gather information to improve their services and use it for participative processes. It can be applied to promote social inclusion, local trade, urban mobility and sustainable living, thus creating a Smart City with Smart Citizens. The technology used allows the transferability and replication in different contexts.

The partnership is led by Gijón (ES), with Suceava (RO), Jurmala (LV), phase I partners, and Aveiro (PT), Sassari (IT) and Clermont-Ferrand (FR) as enlargement partners for phase II. The network is committed with the good practice and it shares the identity of being small and medium sized European cities.

Card4all transfer methodology is based on a combination of the carrousel model - multi-lateral approach where partners learn together, and all partners participate in the transnational meetings – with the radial model – bilateral/trilateral dialogue is established between each Card4all partners and Gijon the Lead Partner. The combination of both models will make the transfer process a sharing and learning opportunity for the network, allowing to explore and strengthen the practical knowledge and skills of partners in all the fields of the Good Practice.

1.2 Scope of Ad-Hoc Expertise and Position Paper:

In order to reinforce its focus and study more in depth some of the thematic issues involved in the transferability of the solution, the project through its Lead Partner has decided to engage an Ad-Hoc Expert. The URBACT Programme Manual foresees that networks, including Transfer Networks, can engage Ad-Hoc Experts to provide support on specific needs identified by the network concerning the methodology for exchange and learning activities, thematic expertise and local support to partners.

For the Card4All project it has been asked from the Ad-Hoc Expert to draft a 'Position Paper' about the main hot topics for public services digitalization. An initial list of topics has been identified by the Lead Expert in the Transferability Study[1] and further presented by the Lead Expert at a Transnational meeting of the project held in Clermont-Ferrand on November 2019. During a session animated by the Ad-Hoc Expert, the partners have selected the 3 topics which they consider to be the most relevant for the network, and that are:

- Privacy & Data Protection
- Interoperability
- Gamification (also considering the use of new technologies)

This Position Paper now presents the conclusions of the studies performed by the Ad-Hoc expert for each of these three topics, including suggestions for its further exploitation by the network partners.

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[1] [1] https://urbact.eu/files/card4all-transferability-study

2. PRIVACY AND DATA PROTECTION

2.1. Introduction

Cities and their infrastructure are already the most complex structures ever created by men, and interweaving them with equally complex smart cities solutions, reliant on wireless sensor networks and integrated communications systems, makes them extremely vulnerable to power failure, software errors and cyber-attacks. Even a simple bug can have a huge impact on urban infrastructure.

On the other side, the exponential growth of data capture devices raises the question of who (if anyone) owns the data that smart cities produce and process in such vast amounts. Policing, surveillance, crowd control, emergency response, are all historically public functions, and citizens might expect the very sensitive data involved to be held by the public sector and local authorities. Some cities (e.g. like Gijón) have decided not to involve private partners in their 'city cards' initiatives, exactly because of data privacy issues. Yet, other cities may opt for for Public-Private-Partnerships for the governance and operation of most smart city blocks, including city cards, not least due to economic factors, which brings the risk that data finds itself (at least partially or non-exclusively) in private control, which increases the importance of privacy and data protection issues.

This section of the Position Paper presents practical suggestions and examples on how cities wishing to adopt City Cards as a further step towards Smart City policies, should address Privacy and Data protection issues.

2.2. KEY PRIVACY & DATA PROTECTION PRINCIPLES

In all smart cities initiatives, including city cards, cities and their involved partners will have to comply with the European regulation and norms related to personal data protection and privacy. The two main normative sources that will be considered and focus on are:

- Regulation EU/679/2016 (GDPR) on the protection of natural persons with regard to the processing of personal data and on the free movement of such data.

- Directive 2002/58/EC (ePrivacy Directive), concerning the processing of personal data and the protection of privacy in the electronic communications sector. This Directive complements the rules set forth by the GDPR in the field of, for example, unsolicited calls, cookies, phone traffic data and so on.

2.2.1. KEY DEFINITIONS

The following section clarifies in simple words some important and key terms and definitions used in both normative sources, and of relevance for City Card operators.

Personal Data: any information relating to an identified or identifiable natural person ('data subject'); an identifiable natural person is one who can be identified, directly or indirectly, in particular by reference to an identifier such as a name, an identification number, location data, an online identifier or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural or social identity of that natural person. In other words, you should consider as personal data, any data that is linkable to individuals, such as for instance: pictures, email addresses, phone numbers, full name, postal address, IP or MAC addresses of their personal device.

Data Controller: the natural or legal person, public authority, agency or other body which, alone or jointly with others, determines the purposes and means of the processing of personal data. In other words, the data controller is the entity which takes the decision to collect data and decides on how these data will be processed.

Data Governance: the process of engaging with stakeholders in a collaborative process to generate and use the data necessary for developing smart solutions for sustainable urban development.

Data Processor: a natural or legal person, public authority, agency or other body which processes personal data on behalf of the controller. In other words, the data processor is the entity that is processing data on behalf of a data controller.

Data Subject: an identified or identifiable natural person. In other words, all individuals are data subjects.

Prior Informed Consent: any freely given, specific, informed and unambiguous indication of the data subject's wishes by which he or she, by a statement or by a clear affirmative action, signifies agreement to the processing of personal data relating to him or her, before the actual processing of personal data takes place. In other words, it is a two steps process through which at first the data subject is informed on the purpose for which his data are requested and afterward he freely provides his express consent to the processing and use of his personal data.

Purpose limitation: an overarching privacy principle, according to which personal data must be collected for specified, explicit and legitimate purposes and not further processed in a manner that is incompatible with those purposes. In other words, any personal data collection should be collected for a clear and specific purpose.

Personal data breach: a breach of security leading to the accidental or unlawful destruction, loss, alteration, unauthorized disclosure of, or access to, personal data transmitted, stored or otherwise processed.

Special categories of data: data revealing racial or ethnic origin, political opinions, religious or philosophical beliefs, or trade union membership, genetic data and biometric data for the purpose of uniquely identifying a natural person, data concerning health or data concerning a natural person's sex life or sexual orientation. There is very strict limitation to the collection and processing of any special categories of data.

2.2.2. Impact of normatives for smart cities and city cards operators

The entry into force of the European General Data Protection Regulation (GDPR) and the ePrivacy Directive poses new challenges to the smart cities sector. The GDPR creates a complex legal framework that different actors have to master and apply. Such complexity needs to be communicated in simple terms, while ensuring an accurate level of compliance with security and personal data protection obligations.

In what refers specifically to smart cities, this legislation poses a series of new challenges. For example, data subject's control on personal data becomes more difficult due to the dispersed number of data sources and entities processing personal data; as the chain of providers of smart city's services stretches, allocation of responsibilities and enforcement of data protection law become more complex than before; and the same can be said with regards to compliance to the principles of purpose limitation and data minimization. Moreover, it is not easy to identify in each case what the viable legal ground for personal data processing is. The data subject's consent is not

always a reliable one; in some cases – especially in the Smart Cities domain – Union or Member State law may constitute the legal basis for personal data processing through IoT deployments. Such complexity needs – therefore – to be somehow simplified, while at the same time ensuring an adequate level of security and personal data protection. The standard rule is that anonymized citizen data can be shared between relevant stakeholders with the common goal of maximizing public value, subject to national and EU legislation. However, safeguards (e.g. synthetic data) must be identified and put in place to avoid, wherever possible, the risk of individuals or profiles being identified through use of new data analysis technologies (e.g. mining, use of artificial intelligence, aggregation of data sets or data linking).

There are a number of provisions that are specifically relevant for the public sector that are likely to result in changes. We highlight the most important ones in the context of smart cities.

Data Protection Officer: Government agencies that process personal data are always required to appoint a Data Protection Officer (DPO). This is different in the private sector, where a DPO is only required when certain criteria are met. It is possible to share a DPO with organisations or agencies, as long as the organisational structure and size are taken into account. Also, consult local legislation to determine if there are additional requirements, such as registration of the DPO in a government register.

Legitimate Interest as grounds for processing: The GDPR restricts the public authorities from using Legitimate Interest as a legal ground for processing personal data. This means that public authorities must find another legal ground if Legitimate Interest is currently relied upon. Review the processing activities and determine if it can be processed under a different lawful basis, is exempted, or if a derogation applies. If this is not possible, the personal data may not be processed.

Consent for data transfers: Consent is another legal ground for processing with restrictions for the public sector. The GDPR does allow a data transfer based on consent of the data subject, however, public sector organisations can hardly ever use this exemption. The rationale behind this is the relational imbalance between the government and its citizens, which is impeding with the requirement that consent must be 'freely given'.

Citizen data: Citizen data is personal and non-personal data, directly or indirectly generated in the digital public sphere, using digital technologies and collected through different infrastructures (IoT, telecom networks, payment systems, cameras, social networks, etc.) This data is traced, collected, measured, stored, used and managed both by public and private entities (according to the General Data Protection Regulation). Regarding handling of Citizen data, Eurocities has developed a set of principles on citizen data[1], which includes the following ten points:

1. Citizen data as a public asset: citizen data must be recognized as a public asset and shall be therefore solely used in the public interest.

2. Public value: local governments recognise, support and adhere to the principle that use of citizen data generate tangible benefits for citizens and society as a whole. There is untapped potential yet to be recognised and understood to use data-generated knowledge to improve our cities through scientific, civic, economic and institutional organizations.

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[1] http://nws.eurocities.eu/MediaShell/media/Citizen_data_principles_final_draft.pdf

3. Citizens as data custodians: governments have the responsibility and act to ensure citizens can have access to and manage their data, as well as influence how it is collected and used.

4. Protection and privacy: if citizen data contain personal data, the General Data Protection Regulation will apply. Storage, management and use of data that involve privacy or safety risks should be done in accordance with EU and national legislation.

5. Transparency and accountability: when generating data in public space, transparent, understandable and accountable measures on which, when, where and for what purpose data is sourced, collected and managed should be put in place; This includes both manual and automated methods, such as Artificial Intelligence and decision-making tools.

6. Citizen Data Sharing and Governance: anonymized data should be shared between relevant agents with the common goal of maximizing public value, subject to national and EU legislation. However, safeguards (e.g. synthetic data) must be identified and put in place to avoid, wherever possible, the risk of individuals or profiles being identified through use of new data analysis technologies (e.g. mining, use of AI, aggregation of data sets or data linking).

7. Quality: the quality of the data should be preserved. Those who use and share data have the responsibility to ensure the integrity, authenticity, consistency and accuracy of data.

8. Interoperability: the importance of data interoperability should be recognised and guaranteed through standardisation, open interfaces and protocols to facilitate data sharing and re-use.

9. Ethical and social responsibility: collecting and combining data may result in unforeseen insights to society or individuals. Parties collecting data in public spaces should have ongoing engagement with citizens to investigate, discuss and agree requirements for any ethical consequences of data collection and, if necessary, adjust their practices accordingly.

10. Citizen Data Connectors: city governments are especially suited to provide the connection between the quadruple helix innovation ecosystems and the public and private data silos. They should be given the means to means to develop and expand city data stores (or knowledge bases) to facilitate this.

2.3. MAIN PROCEDURES TO BE FOLLOWED

There are several challenges for the development of public services (as city cards), but the most challenging one is possibly to be able to establish trust with customers.

This establishment of a trust relation implies, nowadays that the EU General Data Protection Regulation, GDPR must be enforced; in particular the users must have the right to access, correct, erase, restrict, transfer and object to the use, of their data. Data must also be protected from abuse, e.g. from marketing operators. A clear Data Protection policy is a must and a specific Data Protection Officer at the city governance, may help to build trust within citizens.

The first task to complete, by each City implementing a city card, is to clarify who is in charge of what, and more specifically, who are the data controller(s) and the data processor(s). Be aware that a City Council may involve several Data Controllers and Several Data Processors. It is important to single out the operation linked with the implementation of the city card and This requires clarifying and defining the Privacy Organisational Scheme that is adaptable to the specific case of the city card implementation.

The Scheme should clarify: - What personal data are/will be collected: by listing the various data sets that will be collected and assessing their potential qualification as "personal data"; - Who are the various stakeholders / entities involved in data processing for the project, by making a detailed list and drawing a map of data flows among these entities. It is suggested to distinguish non-personal data flows from data flows that include personal data (Figure 1 provides a simple example of Data Flow Scheme in a smart city use case)

Figure 1: Data Flow Scheme in a Smart City Use Case
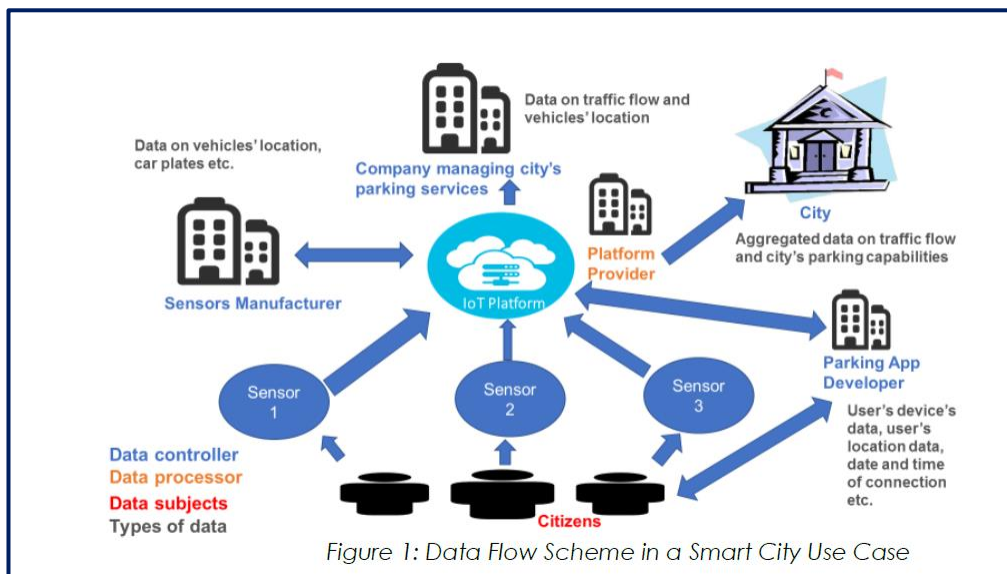
The Privacy Organisational Scheme should also clarify how data will be stored and how it will be secured. Data storage security involves protecting storage resources and the data stored on them – both on-premises and in external data centers and the cloud – from accidental or deliberate damage or destruction and from unauthorized users and uses. It's an area that is of critical importance to enterprises because the majority of data breaches are ultimately caused by a failure in data storage security.

Well-designed data storage security is also mandated by various compliance regulations such as PCI-DSS and the EU's General Data Protection Regulation (GDPR), thus adding legal weight to storage security demands. Increasingly, security companies are tailoring security solutions to help companies comply with those regulations, such as the growing market for GDPR solutions. In general, good data storage security minimizes the risk of an organization suffering data theft, unauthorized disclosure of data, data tampering, accidental corruption or destruction, and seeks to ensure accountability and authenticity of data as well as regulatory and legal compliance.

At the overall project level, each City Team in charge of the City Card should also appoint a Project DPO, which will be in charge of:

- Establishing common rules and requirements for the consortium data protection policy;

- Serving as an entry point to answer questions and complaints from third parties
- Providing guidance on how to implement the privacy by design and by default principles

The appointment of a DPO represents a valuable step towards a better protection for personal data within the projects and puts the City in line with the rules on data protection established by the GDPR. The DPO may be a staff member of the controller or processor or fulfill the tasks on the basis of a service contract.

Furthermore, each City should adopt an internal Data Protection Policy. Any person who is likely to have access to personal data should be contractually bound to respect and protect personal data. If the contractual clauses do not yet include specific and comprehensive clauses to protect personal data in line with the GDPR, these persons who have access to the data should sign a contractual agreement including a formal commitment to respect the project's Data Protection Policy and Rules before accessing the data. As part and parcel of the above-mentioned Privacy Policy each City should establish clear procedures for the management of the data subjects' requests, in order to smoothly let data subjects exercise their data protection rights and promptly reply to them. The users (data subjects) involved in the project should be informed on these procedures and should have an easy access to the Data Protection Officer(s), for instance through a website.

Finally, in addition to the principle of ensuring data privacy and protection, cities must also consider the possibilities open by a (smart) data governance. The potential applications of data governance in the smart city can be significant. Through data governance, cities can tailor data to the specific needs of the stakeholders in important areas such as urban decision- and policy-making, service development or management. They can also realise their sustainable development goals in urban sectors. Opening local government data to the public can empower stakeholders and provide for more effective data use for everyone. Giving access to open data that matters to citizens can also provide people with a citizen-specific and contextualised smart environment. The realisation of these potentials, however, poses questions about creating 'meaningful' data that account for the context and the objectives of the sustainable smart solutions. Even so, harnessing data to improve urban sustainability is a big step that cities are yet to take. As connectivity and collaboration are growing ever more, it seems important that smart cities and their citizens become more aware of the value and potentials that data governance has for sustainable urban development. Developing smart city projects that deliver services and infrastructure that meet sustainability objectives can help with studying this phenomenon.[1]

2.4. GOOD PRACTICES AND HINTS FOR FURTHER LEARNING

A good practice example of a clear data protection and privacy policy can be found e.g. in the website of the Canterbury city council in the UK:
https://www.canterbury.gov.uk/info/20032/transparency_and_open_data/240/privacy_notice

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[1] "Data Governance in the Sustainable Smart City", Informatics Magazine
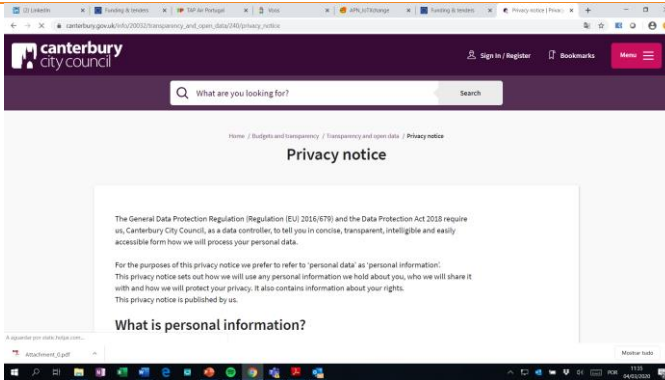
The website, in its privacy notice section (pictured next) clearly lists the council's data protection and privacy policy, with an indication of the appointed DPO and explaining the purpose of collecting and processing personal data.

Other cities such as Rijeka in Croatia have certified their Data Center activities, according to the ISO / IEC 27001: 2013 international standards in the scope of information and communication activities, having been granted the Certificate for the Information Security Management System, which confirms the efficiency of the city administration in data protection and passes a trust message to citizens. More info regarding this process can be found on: https://www.rijeka.hr/en/city-rijeka-awarded-certificate-information-security-management-system-thus-confirming-efficiency-city-administration-data-protection/

The subject of Data Protection and Privacy in Public Administration is at the core of some H2020 projects in the Internet of Things (IoT) area, including the U4IOT project (https://u4iot.eu/). One of the project partners, Archimède Solution (contact person: Ana Maria Pacheco), is specifically in charge of data protection issues and can be contacted for a Master Class on these topics or for further information.

Finally, on the topic of Smart Data Governance, there is a Urbact project addressing this theme, 'Smart Impact', which could be a source for exchange of information and good practice. More info on this project is available at: https://urbact.eu/smartimpact

3. INTEROPERABILITY

3.1. Introduction

Smart cities are characterized by a heterogeneous technology environment. In the Internet of Things ecosystem, home automation devices, security systems, power grids and anything else you can think of, should be connected to the Internet and have to talk to one another. However, today, there are many different types of devices, adapted for specific cities, with multiple platforms, which result in all sorts of interoperability challenges. The three largest use cases, currently representing nearly one quarter of global Smart Cities investments, are video surveillance and public safety, intelligent transportation and mobility, and smart outdoor lighting. Regardless of their dimensions, municipalities around the world are developing smart applications to improve other basic services such as energy distribution and solid waste collection, but also to favor inclusion and encourage people participation, as through the implementation of City Cards, facilitating the use of services and making Cities livelier and more attractive.

In the Internet of Things age, launching any smart solution to manage street lighting, parking facilities, security applications, power grids, WiFi hotspots, etc., requires the implementation of a network infrastructure to connect all related field objects, allow remote monitoring and control, and enable data-driven decisions. But deploying single-application platforms proved to be ineffective and very expensive in the long run. One of the most important challenges for Smart Cities is interoperability, that is the opportunity to develop a unique, performing and reliable network supporting any kind of urban application over the same infrastructure – the best option to improve City services and achieve concrete, measurable results, while investing for a sustainable future.

Interoperability is a big issue for city innovation. The siloed approach that still exists in many urban services management – including as regards City Cards implementation - leads to fragmentation, complexity and increased costs, as well as missed opportunities relating to efficiency, service optimization and quality improvement, good practice and data-sharing.

If cities endorse an open approach, applications can work together in a seamlessly integrated way – and increase their collective power. Data can be smoothly exchanged at any level of the urban infrastructure, and be correlated – for instance, to mitigate traffic congestion through better synchronised public transport or smarter management of car parks, or to facilitate emergency support and law enforcement through brightened street lighting in the case of a road accident or crime.

As Smart Cities and the volume of IoT devices and applications scales up, it's important to provide interoperability among different devices. Yet current simple standard protocols lack sufficient openness and interoperability. IoT for smart cities needs to guarantee the accessibility of open data and cloud services to allow industries and citizens to develop new services and applications.

By being involved from the beginning of the standardisation process, city authorities will be able to push for the creation of open standards, without hindering innovation, for a more fair and multi-vendor market which will drastically reduce both capital as well as operating costs[1].

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[1] EUROCITIES standards & interoperability management guide

3.2. THE CHALLENGES

As part of its drive to achieve smart city status, the city of Bordeaux has recently invited tenders to connect the infrastructure in one of its neighborhoods. A key requirement of the project was that the various services should be interoperable, should communicate with each other, and share data. However, only one of the eight consortiums that participated in the tender complied with the request. This story provides insights into the lack of dialogue that can exist in this area between local authorities and manufacturers. "*When businesses start losing several contracts because they refuse to support interoperability, then mentalities will change,*" says the smart city project leader at *Bordeaux Métropole*. To force this change, city authorities must understand the complexities at stake in their projects (such as City Cards projects) and enforce the adoption of open standards. Cities can address interoperability and enhance standartisation by being active or represented in the European standardisation bodies: ETSI, CEN and CENELEC.

3.2.1. UNDERSTANDING THE COMPLEXITIES OF IoT TECHNOLOGIES

How does an interoperable technology look like? First of all, it is based on open standards, thus it is brand-agnostic, allows seamless integration of third-party systems and custom applications, and grants the confidence of a continuity of supply over time. This must be ensured not just for a single technology, but for all types of technologies. Within the context of Smart Cities projects and IoT adoption in cities, there are three pillars of technology which bring their own complexities:

i. Devices: IoT sensors and devices come from a plethora of manufacturers that have their own approach to delivering a solution for use cases. These devices are made at different quality levels with different standards and protocols for delivering the data.

ii. Networks: Networks come in many shapes and sizes. They tend to exist in different locations with disparate owners with varying transmission technologies including Bluetooth, LoRaWAN and other LPWAN technologies, cellular, WiFi and fixed line.

iii. Platforms: Platforms come from multiple vendors with various ways for businesses and users to gain access to their data. Because data comes from multiple sources and transmissions with proprietary protocols, the platform providers are required to complete a large amount of 'heavy lifting' to simply ingest the data where the real focus should be on intelligent decision-making.

3.2.2. USING STANDARDS FOR SMART CITY DEVELOPMENT

The first step towards adopting interoperability is to stick to wide-adopted standards. Standards are a set of tools, each of them having a different purpose. Therefore, to decide which standards are needed, cities need to first consider what are they trying to achieve. For example, and during the different steps of City Card implementation, cities may want to:

Define something: when it is needed to define a smart city or use common terminology so that suppliers have a common understanding of something and are referring to common terminology standards (e.g. ITU-T Y4051 defines common vocabulary for smart cities).

Understand something: to understand what it means to be a smart city and refer to a guidance standard (e.g. PD8100 describes to city leaders what it means to be a smart city).

Design something: to design a smart city platform or other components of an ICT system and reference an ICT Reference Architecture standard (e.g. ISO/IEC 30141:2018).

Manage something: to set governance requirements for how data is managed (e.g. PAS183 provides a decision-making framework for sharing data in smart cities).

Measure something: to set KPIs or use common approaches for how to measure performance and use a measurement or indicator standard (e.g. ISO 37122 defines indicators for smart cities).

3.3.   THE COLLABORATIVE PATH TOWARDS INTEROPERABILITY

With all of the inherent complexity of smart cities, enabling interoperability within and between such a system of systems through defining minimal standards is essential, and it can only be successful is addressed through a full collaborative approach beyond the level of a single city.

A collaborative approach among technology vendors, City managers and operators is needed to successfully design and implement interoperable communications infrastructures and data models. Some programs in Europe are already going this way – think of the European Innovation Partnership on Smart Cities and Communities (EIP-SCC) – but there are also some promising industry initiatives such as the uCIFI Alliance.

But the most relevant example for EU cities addressing new smart city projects such as the implementation of City Cards, comes from The Open & Agile Smart Cities (OASC) network, which is a coalition of 124 cities from 24 countries. Cities in this network have formally adopted so-called Minimal Interoperability Mechanisms (MIMs) as universal tools for achieving interoperability of systems, data, and services between cities and global suppliers. The formal approval of the MIMs took place during a vote in January 2019 at the OASC Council of Cities, and have in the meantime been implemented in the cities of Ghent and Antwerp (Belgium), Manchester (UK), Helsinki (Finland), Santander (Spain), Milan (Italy), Eindhoven (Netherlands), Carouge (Switzerland), Porto (Portugal), Seongnam (South Korea), and Bordeaux (France).

The OASC MIMs are the key ingredient for cost-effective innovation and procurement for cities around the world as they allow companies to develop once and deploy many times. This can drive down cost dramatically. MIMs also allow cities to avoid vendor lock-in, a big problem in the market today.

Almost as important as the adoption of the MIMs by the OASC member cities, is the fact that cities are finally talking standards. They are finding out just how important standards are when procuring new digital services and reaching a new level of awareness which will only help cities and their citizens benefiting from the smart cities' advantages. The OASC coalition of cities was founded in December 2017 and is headquartered in Brussels, Belgium.

3.4.   GOOD PRACTICES AND HINTS FOR FURTHER LEARNING

The OASC has developed a guide for helping cities in developing, procuring and deploying IoT- and AI-enabled services within Smart Cities context ("A guide to SynchroniCity"), that can be found here: https://oascities.org/a-universal-guide-to-make-your-city-fit-for-the-digital-transformation/

As a way for cities to develop further knowledge on Interoperability and consider joining on-going collaborative efforts on this regard, a study visit to the Brussels area is recommended, including the possibility of meetings with the European Innovation Partnership on Smart Cities and Communities marketplace, the Open & Agile Smart Cities (OASC) network and visits to the cities of Ghent and/or Antwerp, to find out more about implementation of concrete measures. Useful contacts:

- EIP-SCC: C/o VITO/EnergyVille, Paulien Martens (Press and Communication), communication@energyville.be

- OASC: Open & Agile Smart Cities vzw, Brussels, info@oascities.org

- City of Ghent: Bart Rosseau, OASC Council of Cities Coordinator and Chief Data Officer of the City of Ghent, Bart.Rosseau@stad.gent

- For organization of meetings in the Brussels area: SERN – Startup Europe Regions Network, info@startupregions.org
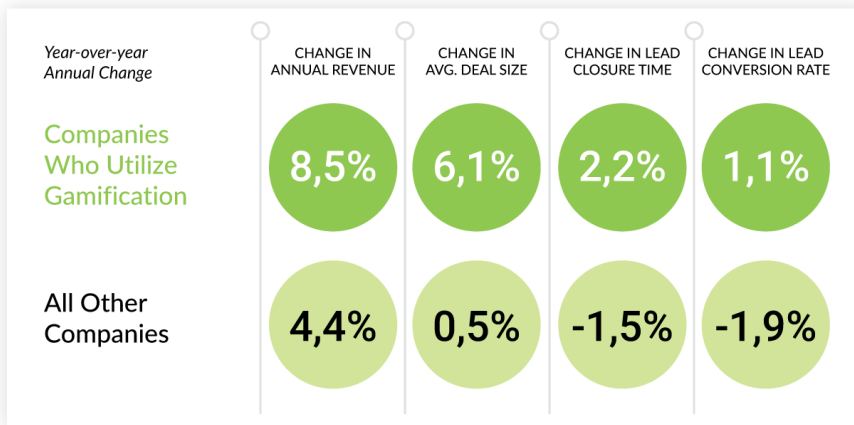
Finally, a good example of interoperability has been presented at the Card4All meeting of Clermont Ferrand: the AMC – Citizen Multiservice Application, a standard to manage services with a single device in the territories. This standard has been developed by ADCET. Contact:

- Philippe Rousselet, General Secretary ADCET, prousselet@adcet.org

4. GAMIFICATION & USE OF NEW TECHs

4.1. INTRODUCTION

Gamification is a term introduced in 2002 by [Nick Pelling](), but that became popular only in the following decade. Gamification represents the application of game principles and design elements in non-game contexts and is also referred to as 'serious gaming'. Gamification. Gamification is the concept of applying game mechanics and game design techniques to engage and motivate people to achieve their goals - through motivation, fun, rewards, competition and challenges. Gamification taps into the basic desires and needs of the users' impulses which revolve around the idea of Status and Achievement.

Year-over-year Annual Change	CHANGE IN ANNUAL REVENUE	CHANGE IN AVG. DEAL SIZE	CHANGE IN LEAD CLOSURE TIME	CHANGE IN LEAD CONVERSION RATE
Companies Who Utilize Gamification	8,5%	6,1%	2,2%	1,1%
All Other Companies	4,4%	0,5%	-1,5%	-1,9%

Source: tokarasolutions.com

The rewards in terms of user engagement from using gamification can be substantial, as shown in the results from the survey from '*Tokara solutions*' pictured next, and its use in the concept of 'smart cities' is tempting.

While the recent emergence of smart cities is highly supported by the development of IT and IoT technologies, a fundamental aspect for a smart city is still to meet the needs and requirements of its citizens. In order to build a smart city it is therefore necessary to understand the benefits of such a city. A smart city is, beyond technology, populated by people. A smart city can be raised by its citizens' contribution, and gamification is the means to motivate them. The concept of city cards, in particular, with access to multiple services and benefits, makes it ideal for 'behavioral changing' experiences and to gamification approaches, with instant rewards to 'good' or 'successful' behavior. City planners could take advantage of smart technologies to reduce operational cost at the same time improve service quality, using eID (Electronic Identification) to consolidate all the public/ municipal services such as filing federal tax return, federal registration (any kind), access of public transport, special care support for elderly and young citizen and public infrastructure like library, public parking, swimming pool, sport facilities, etc.

The key questions are how can games be used for engaging citizens in urban matters? How the addition of urban game-like programs, crowd sourced initiatives in real/digital spaces and temporary urbanism can improve the life in smart and connected cities?

4.2. THE CHALLENGES

The implementation of gamification proposals such as points or rewards in urban contexts *(traditionally, non-gaming environments),* either on-line or off-line, is starting to be used regarding for a vertical range of city matters, from planning processes to participatory events

and civic public initiatives, improving the rates of engagement, compromise and place identity of citizens, and fulfilling the user experience. Although the major gamification *wave* is still to come, some experiences prove that urban game-like actions can foster and stimulate changes in citizens' behavior, move and extend participation beyond the traditionally committed arenas and fulfill the potential of citizenry, especially when the gamification projects moves across both on-line and off-line layers in the cities.

So, If the city can create a game-like initiatives, move privates *(single and collectively)* into action, allow temporary interventions in public spaces and enable platforms for multi-sharing experiences and rewards with other citizen/players, such **gamification, crowd sourcing and tactical urbanism** are the proper tools to create engagement and sense of community among solution-minded neighbors as the urban realm improves.

But Smart Cities are complex, dynamic and open-bounded socio-technical systems and the challenges that a gamification solution needs to face are the following:

- A game action is potentially any action that a citizen performs in the real world. The gamification solution needs to support the integration of a great diversity of services, providers, and technological affordances.

- Game objectives are dynamic and require the collaboration of different stakeholders. Game logic needs to dynamically adapt to meet the new game objectives.

- Behavioral change needs to be sustained over time. There is the need to support for long-running games and appeal also late-comers.

4.3. POSSIBLE APPROACHES

Every citizen has his own point of view regarding the city he lives in, therefore each smart city and every smart urban application have to be designed so that each citizen can feel at home and at ease with them. Gamification offers the tools to encourage the citizens to be involved, even if they do not have access or IT knowledge. Gamification represents motivation techniques specific to games. Neither all games are electronic, nor does gamification mean only IT.

A possible methodology for the introduction of gamification into Smart Cities contexts, presented in the Paper "Gamification in the context of smart cities"[1] is based on Waterfall life cycles (typical on software development) and present specific elements of motivation based on gamification for the three typical stages of a project implementation (such as a City Card implementation): pre-use, during-use and post-use.

Project Implementation Lifecycles with gamification techniques

Project Phases	Methods	Gamification techniques	Technologies
Requirements Analysis System Design	Pre-use: • Input survey	At the beginning, surveys must be organized in order to establish the points of interest for the community. In order to have as many surveys	Big Data

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[1] M R Zica et al 2018 IOP Conf. Ser.: Mater. Sci. Eng. 294 012045

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		completed as possible, from various categories of population, people have to be motivated. At this stage, the motivation must be a reward. The reward can be a future application badge representing that this person is a founder of the 'City Card community' or points which can be exchanged to virtual money after the virtual city creation that can be used for accessing city services through the card (access to sport facilities, libraries, transportation…). For instance, Gijon is considering creating a virtual currency that could be used only in the local shops, in order to promote local economy, as a private-public partnership.	
• General survey • Think aloud exercise			
Implementation Verification (testing & deployment)	During-use: • Data logs • Staged usage situations • Experience sampling method	During implementation users should be rewarded for each improvement made to the services or card application. There should also exist competition with points, badges and leader boards between the users of the application. The application has to be fun, so mini-games of solving potential problems which appeared in the city can be implemented. The users that found the best solution will receive a badge and rewards. To avoid the sense of being controlled, the data can be used aggregated (for example the level of recycling can be measure taken into account buildings or neighborhoods instead of individuals).	Gaming technologies

Maintenance Evolution	Post-use: • Self-report data • Collection techniques • Data logs	In the post-use phase the key is to distinguish users than can enhance new versions of the application or of the services to which it provides access. A motivation must be found for users to come up with solutions for the city's problems that can be implemented into the real city. Those that propose feasible solutions can become an honorable citizen of the city, or receive other, more substantial, rewards.	Blockchain technologies

In terms of technological implementation, the first stage consist of registering the users, stage in which data about each user involved in the study is gathered, whether we are talking about data that the user can define or pre-existing data about the user (e.g. data gathered from social media websites). Based on big data algorithms, relevant information is extracted and used to complete the users profiles. These profiles represent the starting point for each Virtual World from the application.

After this, implementation starts and each user will be rewarded with points for the personal achievements and teamwork and he will be able to check his position in a leader board, using off-the-shelf gaming technologies.

In the last stage, each user's achievements will be integrated, the roles will become dynamic and the participants will be able to earn cofounder badges as well as change points for virtual currency. Here, use of state-of-the-art technologies such as blockchain can be an advantage to increase trust and robustness of the solutions, as they can the introduction of rewards and subsidies and submission of authenticated documents and applications.

4.4. GOOD PRACTICES AND HINTS FOR FURTHER LEARNING

Examples of incorporation of gamification into Smart Cities concepts are still scarce, and its use for implementation of City Cards is even rarer.

One of the best examples is the City of Amesterdam, and its initiative 'Games for Cities', from which more info is available at: https://amsterdamsmartcity.com/projects/games-for-cities

More knowledge from this topic can be obtained from gamification experts with experience of Urban Development, and from H2020 projects in this topic such as 'Gable – Gamification for better life' (https://projectgable.eu/) coordinated by Universitat Rovira i Virgili in Barcelona, Spain (Contact: Domenec Puig, domenec.puig@urv.cat).´

Private companies such as Miconex (www.mi-cnx.com) or Bits of Stocks (www. https://www.bitsofstock.com/nl) have also been developing gaming concepts as part of loyalty programmes that can be applied in different city contexts.

5. ABOUT THE AUTHOR

Eurico Neves, @ecneves, is the CEO and Founder of INOVA+ S.A. a leading firm in innovation studies in Europe. He directly created or participated in the creation of more than 10 new firms, in the services and information technologies field, since 1997. Before he has worked for the European Commission in Luxembourg at DG Enterprise between 1994 and 1997 and has participated in the team developing the European Green Paper on Innovation in 1995. In 2017 he was invited to become a member of the World Economic Forum's 'Digital Leaders of Europe' Community, that he joined in July of that year, having since contributed to the annual report "Innovate Europe - Competing for Global Innovation Leadership" presented in the Davos 2019 WEF forum. He cooperates with URBACT since 2005 and is the currently the Lead Expert of the IoTXchange APN since September 2019.~

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