IAFeS Edition

"Open Data and Big Data – The Impact on Digital Society and Smart Cities"

13th NETTIES Conference
(Network Entities)
Humboldt Cosmos Multiversity
Tenerife March 5th – 8th 2015

Volume 2

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Humboldt Cosmos Multiversity
and
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The association, whose activity is not directed towards profit, aims:

- to promote the development, education and research in the area of eScience:
  Information and communications technology (ICT), telecommunications, e-learning, emedia, e-commerce, e-government, e-democracy, e-culture, e-health, …
- promotion of young researchers in these areas
- offering an exchange platform for experts
- offering an international co-operation platform

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1. Preface

Each year the International Association for eScience (IAFeS) organises the Networking Entities conference (NETIES). NETIES 2015 was held in Tacoronte, Tenerife (Spain) in collaboration with the Humboldt Cosmos Multiversity. Previously, the conference has attracted a large attendance but in 2015 it was decided to hold a smaller, more intimate, conference with a mainly invited list of highly qualified and expert speakers and researchers.
The Humboldt Cosmos Multiversity hosted the conference in a refurbished, yet romantic and haimish, former monastery which provided the perfect environment and atmosphere to engender discussion and debate. The main focus of the conference was 'Big Data' and its impact and influence on people and society. 24 delegates and speakers from around the world contributed to interesting and often passionate debate on the positive, negative and even controversial issues surrounding big data.
The proceedings of NETIES 2015 are contained in this book. We hope that you, the reader, will find the content interesting and enjoyable and inspire you to contribute to future IAFeS research and events.

That the result of this conference is now available as book is thanks to our colleague Graham Orange. He made the lecturing of all the scripts and he braught the text of all foreighn speakers into a correct english.

Johann Günther
Organizer of the conference,
board member of IAFeS and
Professor at Jianghan University Wuhan, China

2. Words of the President of IAFeS.

Prof. Dr. Radu Vasiu
Professor Technical University Timisoara, Romania
President of IAFeS, Internationale Association for eScience

Each year the International Association For eScience (IAFeS) organises the Networking Entities (NETTIES) conference.
In the past the conference focus has been topical and relevant to the social and commercial environment at the time and the 2015 conference held on the island of Tenerife was no different in that it addressed the relationships between globalisation, the internet and big data. The location of the conference was specifically selected to reflect the island's ambition to become an information technology hub based on its situation with the potential to serve Europe and Africa and even further afield across the Atlantic.
The NETTIES conference this year attracted researchers and presenters from 15 countries including the United States, China and many European participants. NETTIES conferences are by tradition small and intimate concentrating on quality of presentation and facilitating informed discussion with the intention of enthusing delegates to take the research forward and play an active part in future IAFeS events and initiatives.
To this end this book contains the proceedings of the conference in the hope that readers will be inspired to follow up on the research and ideas within.
The IAFeS committee wish to extend their appreciation and thanks to the conference hosts, the Humboldt Multiversity (under the leadership of Professor Günter Koch) and the government and officials of Tenerife for making this conference possible.

3. Forword by the President of the Humboldt Cosmos Multiversity being NETTIES host in 2015

Prof. Dipl.Ing. Günter KOCH
Rector of Humboldt Cosmos Multiversity

The definition of a "Multiversity" was first formulated in 1963 on the occasion of a speech given at Harvard University by Clark Kerr, having been the long time president of all Californian State Universities. He explicated that "the idea of a university was a village with its priests", whereas "the idea of a 'modern university' was a town with an intellectual oligarchy". Instead, "the idea of a Multiversity is a city of infinite variety…This city is more like the totality of civilization as it has evolved…and movements to and from the surrounding society". In today's terminology we may speak of "citizens' science", and indeed, universities are no more considered to be ivory towers rather that they are open agoras to which citizens are invited to contribute to their own and the universities' advancement. In my experience, indeed, I would like to confirm that the intellectual capital hidden in society is a treasure still to be lifted, especially in human and social sciences.

I have deliberately chosen Alexander von Humboldt as the patron and eponym of our institute: Not only that he started his first scientific excursions, before he departed for his grand adventure to South America, in Tenerife, investigating every geological object and every plant which he found on his way when he climbed up mountain Teide in 1799, he also serves as one of the great role models of a universal scientist, today even more than at his time. He not only made hundreds of discoveries on his own, he also collected the (natural science) knowledge of his time gained by correspondences with all great brains of his period, and integrated and documented it first by giving public lectures, then subsequently, already in his sixties, he started to document his complete view on the world in his famous oeuvre with title "Cosmos". Thus he proved, that also in a late phase of life – he compiled his book until he was nearly ninety years old - a curious spirit can be highly productive independent from age.

Humboldt Cosmos Multiversity's (HCM) "philosophy" is that it shall serve as a think tank and workshop platform approaching important questions of our time and by different methods and by combining different disciplines, thus not only be devoted to multidisciplinarity, rather than also identifying transdisciplinary methods leading beyond the horizons which we could have seen so far (which may also be a metaphor for the geographic position of the Canary islands, from where world changing trips have had their beginning, as e.g. Columbus' excursion to discover a new world, or Humboldt's discoveries in the nature of this new continent).

The key method for making new discoveries which HCM tries to apply has been inspired by one of its founding patrons, The New Club of Paris, which also was parent founding an innovative "Campus for Societal innovation" installed at Aalto University in Helsinki, Finland, therefore its acronym is ACSI. This campus is based on the idea of applied diversity of its members: in age, profession, education, experience, cultural and ethnic background. HCM explicitly invites members from different communities to contribute to its discourses, believing that involving many different perspectives creates a better understanding of the subjects under discussion and thereby to better outcomes.

In this spirit the IAFeS, the International Association for eSciences, was most welcome when it decided to hold its 2015 NETTIES (Networking Entities) conference at HCM on questions of current technological and societal importance such as on Big Data and Smart Cities. Participants of more than 12 nations and of different ages assembled in the smallish and inspiring ambience of "La Casona", the convention house of the NCP, a refurbished and modernised historic building in Canary style located in the "wine town" of Tacoronte.
As these proceedings of the NETTIES conference demonstrate, both the scope of themes and
the diversity in discussing them conforms to the spirit laid out above. I am perfectly sure, that NETTIES 2015 will be followed by some consequences effectuating the development of the island. Some contributions in this book from authors with a strong affinity to Tenerife make evident, that there is an intense will to catalyze the emergency of the island's development gaining a profile also as a knowledge and education location.


Workshop & Seminare
2013
Humboldt
Cosmos
Multiversity
2012
2014
2015
Publikumsöffentliche Veranstaltungen
Konferenz
Humboldt
Cosmos
Multiversity
CABILDO DE TENERIFE

4. University of La Laguna

Eduardo Pintado Mascareño
Chancellor of Cabildo de Tenerife
Professor of University of La Laguna

Rodrigo Trujillo González, PhD
Ex-Vicechancellor of Research and Internationalization
Associate Professor of University of La Laguna

The celebration of the 13th International Conference on Networking Entities (NETTIES 2015) past March, 2015 at La Casona in the Village of Tacoronte, located at Tenerife, one of the main island of the Canary Islands, has become for the knowledge community of Tenerife one of the great event of 2015. Organized by the IAFeS - International Association for eScience (www.iafes.org) and the Humboldt Cosmos Multiversity (www.humboldt-cosmos-multiversity.org), with the support of the Universidad de La Laguna and the Cabildo de Tenerife.

This edition has been titled "Open Data and Big Data – The Impact on Digital Society and Smart Cities" and it has been devoted to the spirit of digital society and smart cities in the domain of eScience, information and communication technologies, eLearning, eMedia, eCommerce, eGovernment, eCulture. The conferences counted with speakers from more than ten countries, which impress at the opening to the Major of the Village of Tacoronte who didn't remember such concentration of nationalities in his village, mainly well know by its fine wines and not longer visited by tourist, the main economic activity of all Canary Islands.

The theme of the conferences is of the main interest of the government of the island, the Cabildo de Tenerife, for the future development of the island to a knowledge driven economy. Open and Big Data generated by the huge amount of tourists which visit the Canary Islands every year, more than 12 millions, near 6 times the resident population. Smart Cities as model of future for the residents, investors and tourists. And Digital Society as the way to connect the talent of the Canary Islands with the rest of the world, by using the powerful infrastructures of the region.

This opportunity to meet and share our experiences, with the high qualified specialist of all Europe who has attended these conferences, has become a milestone in the long road to overcome the economic crisis that has beaten all so dramatically.

We both, Eduardo Pintado as Chancellor of the Cabildo of Tenerife and Rodrigo Trujillo as Vice-Chancellor of Research and Internationalization of Universidad de La Laguna, would like to express our deepest gratitude to Prof. Radu Vasiu (Politehnica University of Timisoara, Romania and IAFeS President), Prof. Johann Guenther (Jianghan University, Wuhan, China and Saint Petersburg State University for Telecommunications, Saint Petersburg, Russia, and IAFeS General Secretary) and
Prof. Günter Koch (President of the Humboldt Cosmos Multiversity) by deciding to celebrate this conference in Tenerife, attract such amount of high level especialist and help us to open a new time for our firms, public administrations and young qualified workers, a promising comitmment with the knowledge of the Cabildo and the University with one of the most

biodiversity region of Europe, a paradise in the Atlantic Ocean where any visitors desire to back and stay.

We wish to meet all of you in the future again here in Tenerife, and please express to all your friends and colleague that our island is one of such places in the world which anybody could miss to visit.

5. Casona

José Luis Roda
ULL – Tenerife

Excelentísimo Señor Alcalde:

En marzo del año corriente usted tuvo la gran amabilidad de darle la bienvenida a los participantes de la conferencia "NETTIES" que se celebró en la Casona y de obsequiarlos con un surtido de vinos de la región.

Las distintas ponencias de esta conferencia se publicarán en un libro. Tenga a bien encontrar como anexo a la presente un primer borrador de esta publicación

Quisiera pedirle que tuviera a bien escribir un prólogo para este tomo de aproximadamente una página. Sería un gran honor poder contar con su contribución que por su puesto nos podría enviar en español. Esta publicación cuenta también con prólogos del Consejero Eduardo Pintado y del Vice-Rector de la ULL, Rodrigo Trujillo.

Ruego que me enviara su texto en cuanto antes le sea posible a la siguiente dirección de correos electrónico: koch@execupery.com

Agradeciendo de antemano su estimada cooperación, me despido
con muy cordiales saludos.

6. Welcome of Major

Álvaro Dávila González
Major of the Municipalitiy of Tacoronte

In the name of the citizens of Tacoronte, as well as from me as its Major, it is an honor to us that our municipality has been chosen as the location for holding the 13th International Conference on Networking Entities (NETTIES 2015) which was set up by the International Association for eScience (IAFeS) and organized by the Humboldt Cosmos Multiversity. I want to express for all of us my thanks and my most honest congratulations to all the different organisations and institutions which, in the one or other way, have contributed with the effect, that something real has been created, constituting a reality which has deeply touched us who are living in and loving our town.

Tacoronte is a municipality with 24.000 inhabitants, situated in the North of Tenerife, originally devoted to agriculture and retail trade, profiting little from the streams of tourists coming to the Canary Islands. It is a quiet place, cozy and hospitable, and the town feels very grateful towards the Government of Tenerife (Cabildo) that it has been offered the convention building known as "La Casona", which is located where the town was been founded 500 years ago.

This building in Tacoronte has been the place where, for a few days, prominent scientists from many universities of various continents have debated the impacts of the Digital Society, of Smart Cities and of Open versus Big Data. Such an event is an opportunity which we would like to be repeated in the future and to which we from the part of the town hall on disposition of the Tenerife

Government as well as of the Humboldt Cosmos Multiversity would like to offer our humble support. This support shall serve to convert “La Casona” into a meeting facility, where scientists from Europe as well as from all over the world would like to decide to meet, to share their thoughts and to debate future science. And all of this at a special location which is profiled by its charm and tranquility, one of the precious places which is hard to find in today’s society.

7. "Big Data – Introduction and Definition"

Prof. Dr. Johann Günther
Professor at: Danube University Krems, Austria, Bonch-Bruevich Saint Petersburg State University of Telecommunications, Russia, Jianghan University, Wuhan, China
Johann@johannguenther.at

In 2012 a 16 years old girl in the Netherlands had a birthday party invitation posted on Facebook. Mistakenly she did it „public". 3000 people turned up! She wanted just a dozen guests. At the end the father called police to rectify the situation. These are consequences of Big Data and wrong use of this powerful tool.

The digital data in the network are exploding. Also experts are not aware, how much it is already. I just give some figures, that the reader can get some feeling for this situation:

7.1. Data Worldwide[1]

- Beginning recorded history till 2003: 5 billion Gigabytes
* 2011: 5 billion Gigabytes every 2 days
- 2013: 5 billion Gigabytes every 10 minutes
- 2015: 5 billion Gigabytes every 10 seconds

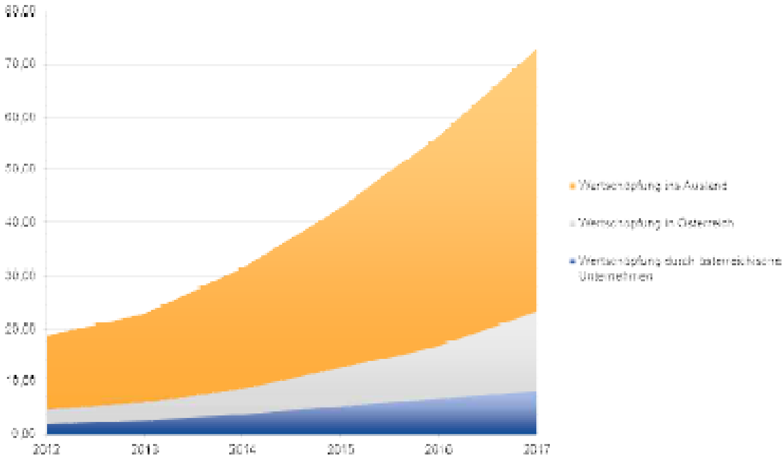
These are figures no human being has an imagination.

[1] Source: Smolan & Erwitt 2012

There is also business behind Big Data. In 2012 the international turnover was 9,8 billion $. In 2017 we expect four times more: 32,4 billion $.[2]

2012: 9,8 billion $

2017: 32,4 billion $



7.2. Definition

Big Data is a large collection of data. Big data is a broad term for data sets so large or complex that traditional data processing applications are inadequate. Challenges include analysis, capture, curation, search, sharing, storage, transfer, visualization, and information privacy. The term often refers simply to the use of predictive analytics or other certain advanced methods to extract

[2] Source: IDC

value from data, and seldom to a particular size of data set.“[3]

Big Data includes also data sets „with sizes beyond the ability of commonly used software tools to capture, curate, manage, and process data within a tolerable elapsed time.“ [4]

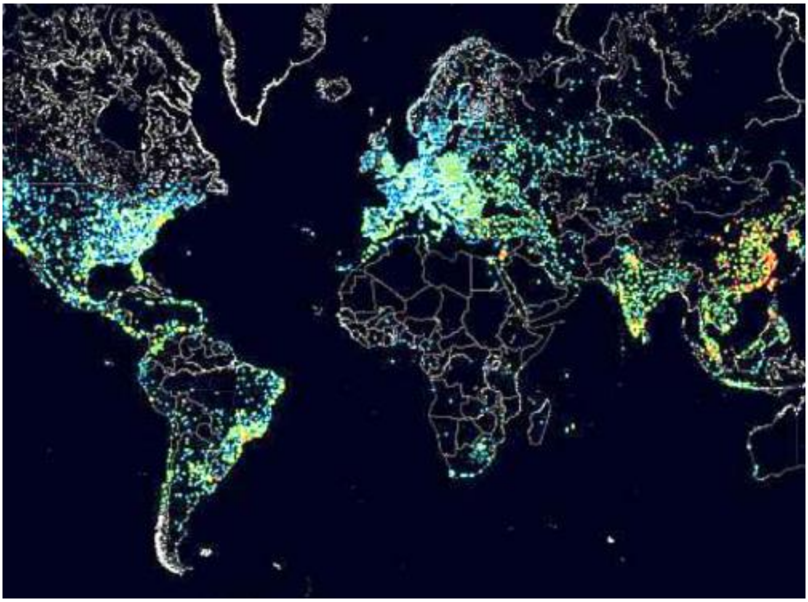
Data Set is the old term from Main Frame Computing. Today Data Sets can not be handled with traditional applications.

In the first impression the development in data processing went back from the centralized main frame computing to the centralized Cloud Computing. BUT: there is a development like in spiral stairs. When you go up, all stories look the same, but you get higher and higher. The same is and was in the devlopment of data processing.

[3] http://en.wikipedia.org/wiki/Big_data

[4] Snijders, C.; Matzat, U.; Reips, U.-D. (2012). "'Big Data': Big gaps of knowledge in the field of Internet". International Journal of Internet Science 7: 1–5.

- It started with centralized main frame computers.
- With Personal Computers it became a decentralized architecture. Every user stored his data by himself localy.
- With cloud computing the size of local CPU is not so important any more. Big Data is stored somewhere outside in the „Cloud". This is a server which stays in a place most users do not know. It looks like we are back at the stage of the beginning of Data Processing, but it is far more developed.



A very important impact to Big Data was globalization. The link between all countries of the world brought us the volume, which one country would not be able to produce. This also increases the quality of information. It can be said: „The world became a globale village".

7.3. Characteristics of Big data

- First criterion – which also gaves the name „Big Data" – is volume, the quantity of data.

- Second criterion is variety. When we ask in Google or another search engine a question, we get so many answers, that often we do not know what to do. In former times a teacher had to train his students with facts. Today he must train them to find the right information in the right place.

- Third criterion is velocity. Due to the big volume of data a high speed of processing is needed. To guarantee high speed in the network is a new challenge of governments. With the quality of the network the quality of the economy is defined. Countries that do not invest in a highspeed network will be the loosers in the long run.

- Fourth criterion is veracity. For one question we get so many answers, that it is not easy to find out which one is the correct one. Everybody can offer some information in the net. The quality of all these offers is very different. To define the quality of information is a new and big problem.

- Last but not least is complexity an important criterion. To manage the data with large volume and from different sources is a challenge and an important instrument.

7.4. Politics and Big Data

Law must be adapted to this new situation. Data from public cameras, different networks deliver information. Who is allowed to get which information. A regulation is needed. In the country and international. In a global network national legislation not enough. International regulations are needed. Information and Data became a power-tool. A power tool which is manly used by devoloped countries.

Politicians should make the regulation, but they see in Big Data also chance for their own career. United States of America are a leading country in this respect. Most data is stored in US. Most of spying is done from there. Obama´s administration announced in 2012 a Big Data research and development Initiative. Big data analysis was also an important fact for Obama's re-election in 2012. [5]

The US Federal Government owns six of the ten most

[5] Picture: http://blogs.reuters.com/great-debate/2013/07/25/obamas-plan-one-nation-under-government/

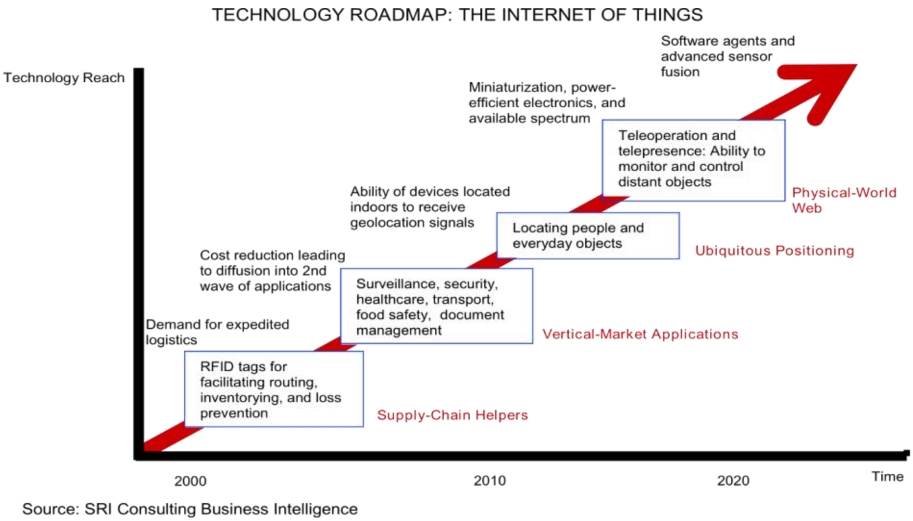
powerful supercomputers in the world. Another one – the so called „Utah Data Center“ – is under construction by „United States National Security Agency“. It will handle a large amount of information, which was collected by the NSA.

Nowadays the war and terror from small organisations and single persons needs new methods how to handle data and information. Innumerable cameras are watching the public world and are used against terrorists.
Information from airlines are used for suppression of terrosism. Individual rights and privacy are less important than public interests.

7.5. Internet and Things

In a next step „things“ will bring data to the networks. This will make a new jump in the development. Already today end users collect digital photos, they very often can not be stored localy. The need a cloud. They store the pictures in Drop Box or similar.
At the beginning of this century a new technolgy came for logistic and administration: RFID – Radio frequence Identification. The former BAR-code will be replaced by small computers, they are able to intentify in an automated way the characteristics of a good. These are the new supply chain helpers.
Vertical market applications came in the first decate of the 21st century in operation. Surveillance, security, health care, transportation, document management and many other fields produced data in big volume and started to select and interprete.

With the help of geometricals signs it was possible to locate things and
Ubiquitous positioning



Gartner expects, until 2020, 25 billion devices in the net. But also tradional things like computer and notbooks we register an enormous growthrate. Alone between 2010 and 2016 we will have 8% more notbooks and desktops – all in all 3 billion units – and 33% more tablets and smartphones (6 billion).
Since 2008 people have downloaded 200 billion Apps. Out of this 50% were done in 2013, which is 100 billion in one year.
This is possible, because we have more and more smartphones. In 2014 it were 2 billion smartphones and in 2020 experts expect, that 8 out of 10 mobilephones will be smartphones[6].

[6] Source: Gartner, IDC

The market for mobile phones is a heavy growing, but also very competitive market. In the last years we had several changes in the leading companies: from the american Motorola Nokia took over first place and after a technical lack in Finland Samsung became number one. But market leader never means technological leader. Apple is still the inovator, but others make the big business. In 2015 the ranking in the worldwide mobil phone market looks like this:
* Samsung
* Apple
* Lenovo with Motorola
* Huawei
* LG Electronics
* Xiaomi (Chinese "Apple"

The Far East became, after USA and Finland, the leading area for this technology. China started as producer and now they took over the technological leadership.

A 2 person household in Europe had in 2015 1 Desktop, 1 Notebook (+2 company Notebooks), 2 Tablets, 2 Smart Phones, 1 Music Player, 1 Media Box, 1 Blue Ray Player, 1 Camera, 1 SAT Receiver, 2 Printer, 1 NAS, 1 Switch, 1 Router and 1 Access Point. Every person had several IP adresses.

All this infrastructure makes it possible, that „BIG DATA" can be.
Big Data in a dual, interconnected manner:
- Targeting of consumers
- Data-capture

Big Data is a modern form of communication. It is driven by Social Media and leads to a hyper-networked

society in which individual acts are spread via the network.
The society is dependent from social media. To close an account at a social network is like a „Virtual Identity Suicide“. Social networks are very powerful. Their size is enormous. By end of February 2014 Facebook had 1,228 billion user. Out of this 282 million were in Europe, 27,38 million in Germany and 3,24 million in Austria.

The competion of Facebook is very much smaller, but still big volume of users:
* Instagram: 200 million user
* Twitter; 232 million active user
* Google+ 300 million
* Xing: 12,65 million

The list of Social Network alternatives is long:
* Facebook
* Instagram
* Twitter
* Google
* Xing
* Flickr
* Foursquare
* Last.fm
* Delicious
* Scribd
* Slideshare
* Covestor
* Pinterest
* tumblr
* Goodreads
* WhatsApp

7.6. Open Data

The volume of data, which is offered now is one aspect. The other one is the public availability. It is called „Open Data“.
Open Data are Data, which is

- freely available,
- can be used by everyone,
- can be republished and
- has no copyright.

Everyone can use these data for free and can use them also for republishing. There is no copyright on „Open Data“.

What is the difference between „Open Data“ versus „Closed Data“?

- The access is with open data for everyone and for closed data it is restricted to persons or organisations.
- To take data from „Open Data“ is free (no costs). Closed Data are allowed to take fees for the access.
- Open Data have legaly no licence fees. Closed Data can have usage rights.

For many applications we use today we need open data. Our world is observable and has a configurable infrastructure with

- Social Web
- Smart Phone
- Smart Home
- Smart City

The objective is efficiency. For example traffic control and traffic lights make the public traffic more flowing.

7.7. Users of Big Data

7.7.1. eBay.com

Has two data warehouses with 7.5 petabytes and 40PB. In addition 40PB Hadoop cluster for search, consumer recommendations and merchandising. Inside eBay a 90PB data warehouse is in use.

7.7.2. Amazon.com

Amazon handles millions of back-end operations every day. They have more than half a million third-party sellers.
Amazons IT is Linux-based. In 2005 it was the world's three largest Linux databases with 7.8 TB, 18.5 TB, and 24.7 TB.

7.7.3. Facebook

Facebook was descripte already before. In addition to this information they handle 50 billion photos.

7.8. The Future

Where all this will lead us?

Many changes. Teachers are not any more instructors, they are leaders. Normal consumer can not get the answer directly. A sentence like „Google will know

the answer to your question before you ask it“ sounds funny, but is realistically a problem.
The future with Big Data is open, but the past is past. Technology is neutral - they can both good and bad. It is, what human beings make with all this information. There can be still more progress and more data, but a way back to a "Digital Biedermeier“ seems is not possible any more.

8. „Development of Smart City Applications Based on Open Data“

Prof. Dr. Radu VASIU
Politehnica University of Timisoara, Romania
Director of the Multimedia Research Centre
radu.vasiu@cm.upt.ro

8.1. European Union policy regarding Smart Cities

According to the *Digital Agenda for Europe* [1] adopted by the European Commission, "A smart city is a place where the traditional networks and services are made more efficient with the use of digital and telecommunication technologies, for the benefit of its inhabitants and businesses." With this vision in mind, the European Union is investing in ICT research and innovation and developing policies to improve the quality of life of citizens and make cities more sustainable in view of Europe's 2020 targets.

To speed up the deployment of these solutions, the European Commission has initiated in July 2012 the *European Innovation Partnership (EIP) on Smart Cities and* Communities that intends to bring together European cities, industry leaders, and representatives of civil society to smarten up Europe's urban areas.

Fig. 1. EU Smart Cities and Communities Initiative (Source: https://eu-smartcities.eu)

So far, the European Innovation Partnership (EIP) on Smart Cities and Communities has received some 370 commitments to fund and develop smart solutions in the areas of energy, ICT and transport. These commitments involve more than 3,000 partners from across Europe and create a huge potential for making our cities more attractive, and create business opportunities.

The partners have been grouped in *Action Clusters*, based 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.

The 6 Action Clusters which have been set up so far are:

- Business Models, Finance and Procurement
- Citizen Focus
- Integrated Infrastructures & Processes across Energy, ICT and Transport (including Open Data)
- Policy & Regulations / Integrated Planning
- Sustainable Districts and Built Environment
- Sustainable Urban Mobility

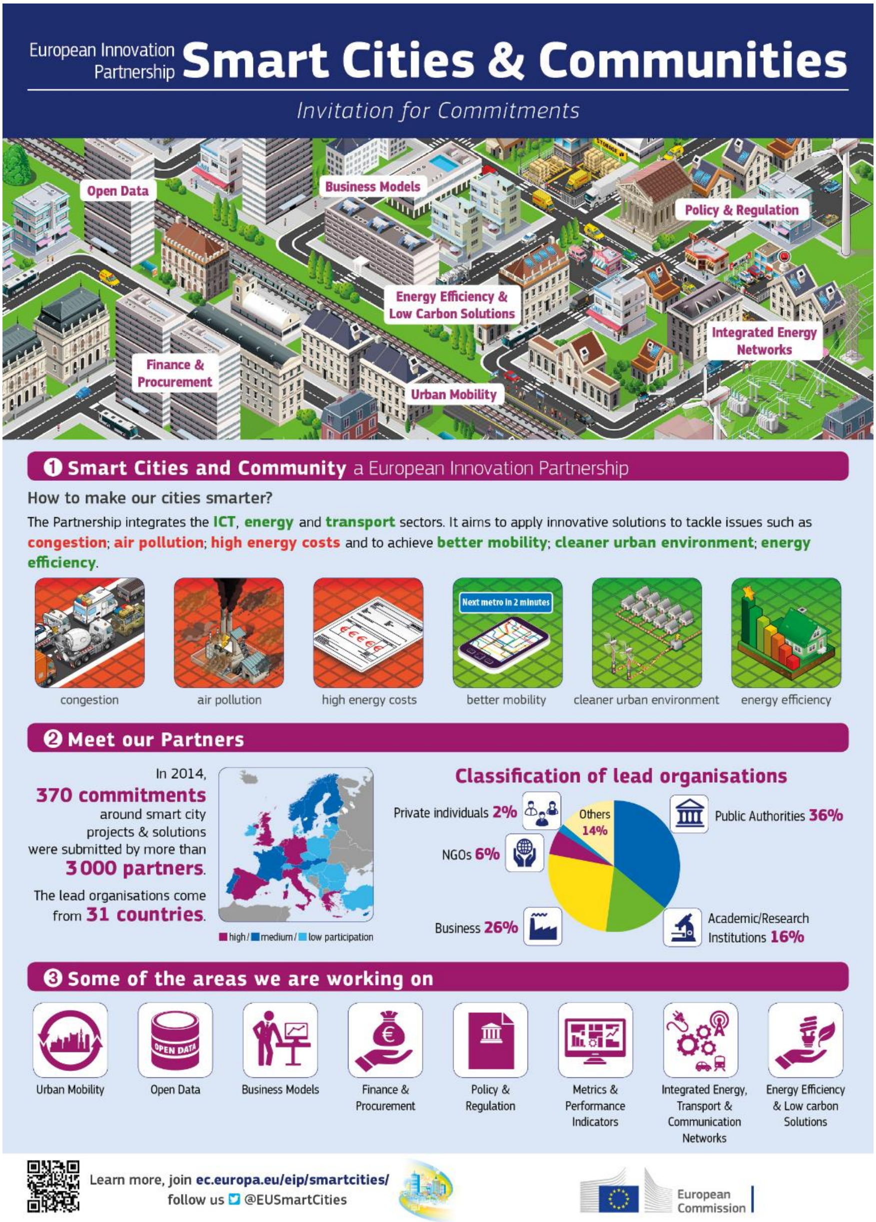


Fig. 2. Smart Cities and Communities Initiative. Invitation for Commitments

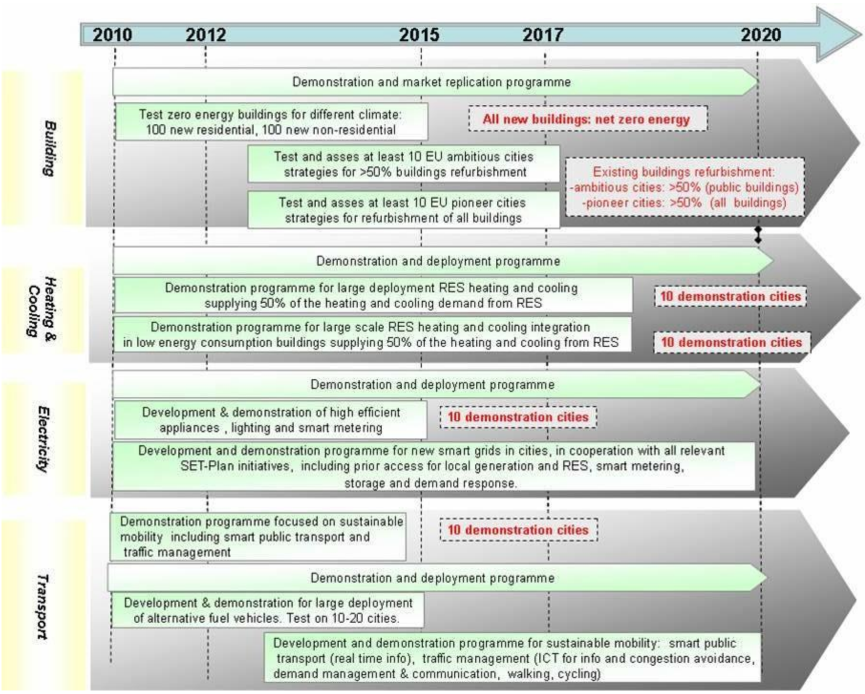


Fig. 3. Smart Cities Initiative Roadmap. EC SET Plan (Source: SETIS, 2011)

The *Action Clusters Kick-Off Conference* took place in Brussels, on October 9th, 2014. There were over 300 guests participating. The conference has been honoured by the presence of the key politicians pushing this initiative:

- EC Vice President for Energy Günther H. Oettinger
- EC Vice President for Digital Agenda, Neelie Kroes
- EC Vice President for Transport, Siim Kallas

8.2. Visions of Smart City in the ICT Era

The need for smarter cities is defined by the main challenges cities are facing today [3], [4] :

1. Growing population

In Europe alone, about 80% of the population lives in cities and urbanization is accelerating, while in China about 300-400 million people will move to cities in the next 15 years [5]. By 2030 it is estimated that the urban population will be around 5 billions people. In the 21st century, cities will account for 90% of population growth, 80% of global CO_2 emissions and 75% of energy use.

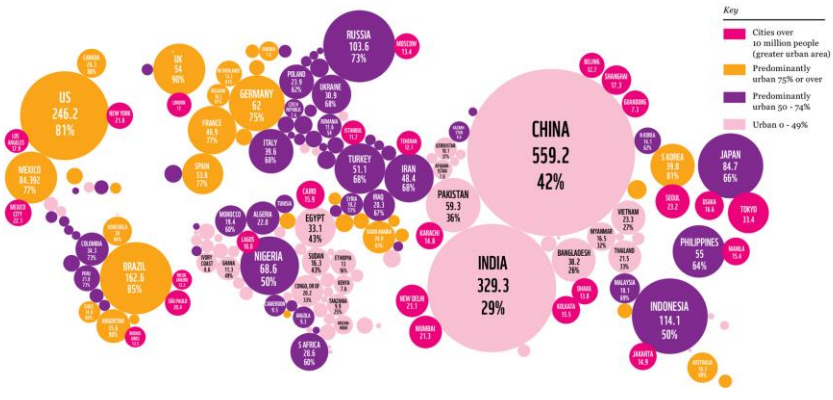


Fig. 4. Growing population (Source: http://awsassets.panda.org/downloads/1_lpr_2012_online_full_size_single_pages_final_120516.pdf)

2. Traffic congestion

More and more transport needs are increasing: goods, people, etc

3. **Space**

Increase of urban population and shift of working places into cities mean that there will be an increased need of spaces, both homes and public space.

4. **Resource management**

The increased need of resources requires a better management, especially for water and energy use.

5. **Climate changes**

The present situation means an increase of carbon emissions and global working.

6. **Tighter city budgets**

The financial resources will need to be more efficiently used, in terms of public expenditure and efficiency.

7. **Aging infrastructure**

In major cities, the infrastructure is aging quicker than the rate of renewal. This is why, smarter solutions need to be implemented in order to face the challenge.

8. **Aging population**

Live expectancy is increasing globally, while the birth rate is decreasing in the more developed countries. This means that the cities' population is aging, and smarter solutions need to be addressed in order to transform cities in *age friendly cities*.

With those challenges ahead, the vision of smarter cities should include several goals, all linked to the idea of sustainability:

- environmental sustainability and efficiency
- sustainable homes and buildings
- efficient use of resources

- efficient and sustainable transportation systems
- better urban planning – livable cities

The Smart City concept is therefore based on a six pillars model [6], with the corresponding indicators:

1. Smart Economy,
2. Smart Mobility,
3. Smart Environment,
4. Smart Governance,
5. Smart People,
6. Smart Living

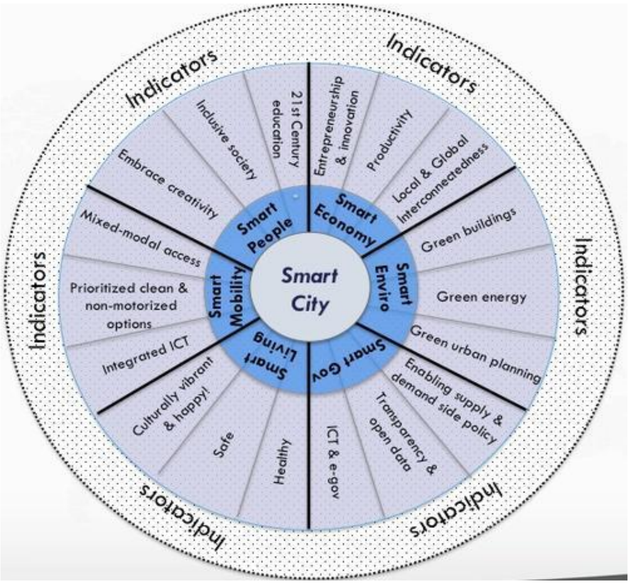


Fig. 5. The Smart Cities Wheel developed by Cohen

Smart Economy:

- Innovative spirit
- Entrepreneurship
- Economic image & trademarks
- Productivity
- Flexibility of labour market
- International embeddedness
- Ability to transform

Smart Mobility:

- Local accessibility
- (Inter-)national accessibility
- Availability of infrastructure
- Sustainable, innovative and safe transport systems

Smart Environment:

- Attractivity of natural condition
- Less pollution
- Environmental protection
- Sustainable resource management

Governance:

- Participation in decision-making
- Public and social services
- Transparent governance
- Political strategies & perspectives

People:

- Level of qualification
- Affinity to life long learning
- Social and ethnic plurality
- Flexibility
- Creativity
- Cosmopolitanism/open mindedness
- Participation in public life

Living:

- Cultural facilities
- Health conditions
- Individual safety
- Housing quality
- Education facilities
- Touristic attractivity
- Social cohesion

a. Open Data

Open data is data that can be freely used, re-used and redistributed by anyone - subject only, at most, to the requirement to attribute and sharealike [7].
The most important principles of Open Data are:

- *Availability and Access:* the data must be available as a whole and at no more than a reasonable reproduction cost, preferably by downloading over the internet. The data must also be available in a convenient and modifiable form.
- *Re-use and Redistribution:* the data must be provided under terms that permit re-use and redistribution including the intermixing with other datasets.
- *Universal Participation:* everyone must be able to use, re-use and redistribute - there should be no discrimination against fields of endeavour or against persons or groups. For example, 'non-commercial' restrictions that would prevent 'commercial' use, or restrictions of use for certain purposes (e.g. only in education), are not allowed.

The most important feature of Open Data is *interoperability*. Interoperability denotes the ability of diverse systems and organizations to work together (inter-operate). In this case, it is the ability to interoperate - or intermix - different datasets. Interoperability is important because it allows for different components to work together. This ability is essential to building large, complex systems.

Not all publicly made available data are open data. In order to be open, the data should be:

- published in an open format (such as CSV, JSON, XML, RDF etc.), that allows their automated processing
- described as rich metadata and classified according to standard vocabularies (DCAT, Eurovoc, ADMS etc.) in order to facilitate search and interoperability
- accessible as data transfer (massive data fluxes), as well as through API – Application Programming Interfaces, in order to facilitate their automatic processing
- accompanied by explicatory documents regarding used metadata and vocabulary, in order to facilitate data bases interoperability
- periodically updated by re-users, in order to mentain data quality

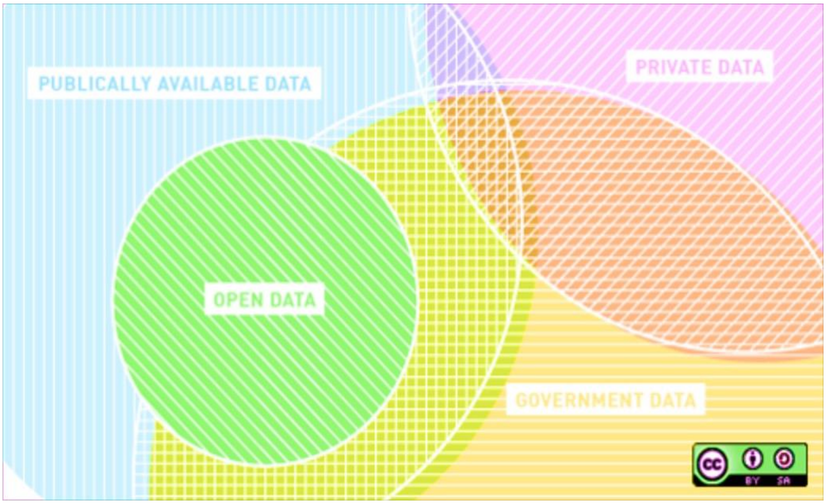


Fig. 6. Open Data vs. Publically Available Data (Source: opensource.com)

b. Open Data Applications

Open Data are used by a large variety of IT experts in order to develop application of interest for the public. Generally, those applications are online application and most of them are accessible from a mobile device (smartphone, tablet etc.).

Some of the most known and used applications based on open data (that probably everybody used) are:

- *weather applications*, based on data provided by the meteorologists
- *exchange rate applications*, based on data provided by central banks
- *transport planning applications*, based on data provided by municipalities, underground – bus – train transport companies

Many of those applications, more and more sophisticated, are able to provide a better access to information for population, better governance services or better social services for different groups of people. This is the reason why they are at the core of developing Smart Cities applications on all pillars defining a Smart City.

5. Study Case: Smart City and Open Data in Romania

In Smart Cities, digital technologies translate into better public services for citizens, better use of resources and less impact on the environment.

Efforts in the realization of Smart Cities projects are just at the beginning in some areas of Romania. However, the IT industry is quite developed and some enthusiast IT experts have started working in the field, more or less on a voluntary base. This is how a number of associations have been established:

- Open Data Coalition (http://datedeschise.fundatia.ro/)
- Smart City Association (http://mysmartcity.ro)
- Association for Technology and Internet (www.apti.ro)
- Open Knowledge Romania (https://okfn.org/network/romania/ and http://ro.okfn.org/)

After signing the Open Government Partnership international agreement [8], in December 2012 the Romanian Government established a Department for Online Services and Design. One of its main tasks was to establish a governmental portal for central access to open data sets made available by public authorities, on the aim to help people to find, to save and to use all information generated and owned by administrative structures. The portal can be found at http://data.gov.ro/.

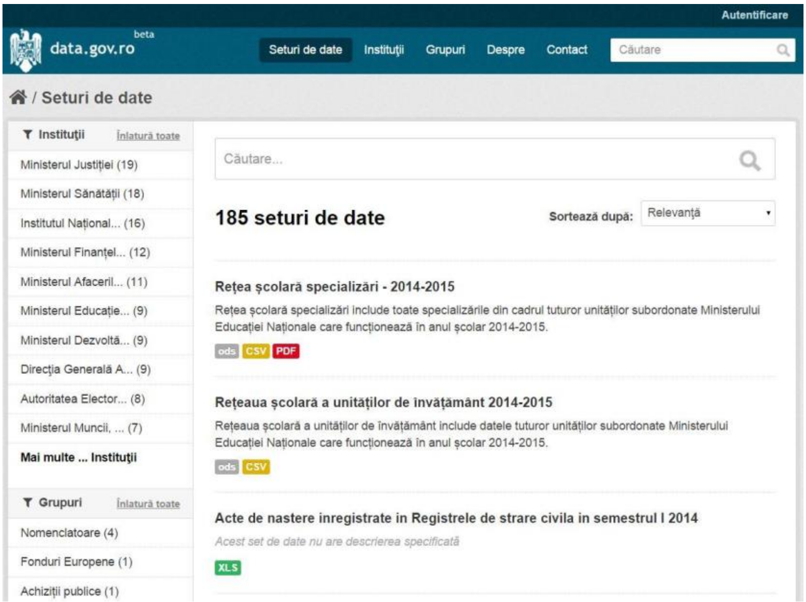


Fig. 7. Sample from the Romanian Governmental Portal of Open Data

In reply to the call for expressions of interest launched as part of the European Innovation Partnership on Smart Cities and Communities initiative (https://eu-smartcities.eu/), a partnership formed by Politehnica University of Timisoara, Timisoara City Hall and the Smart City Association submitted the Commitment 7711, related to the use of Open Data Sets for creating smart applications to the benefit of citizens.

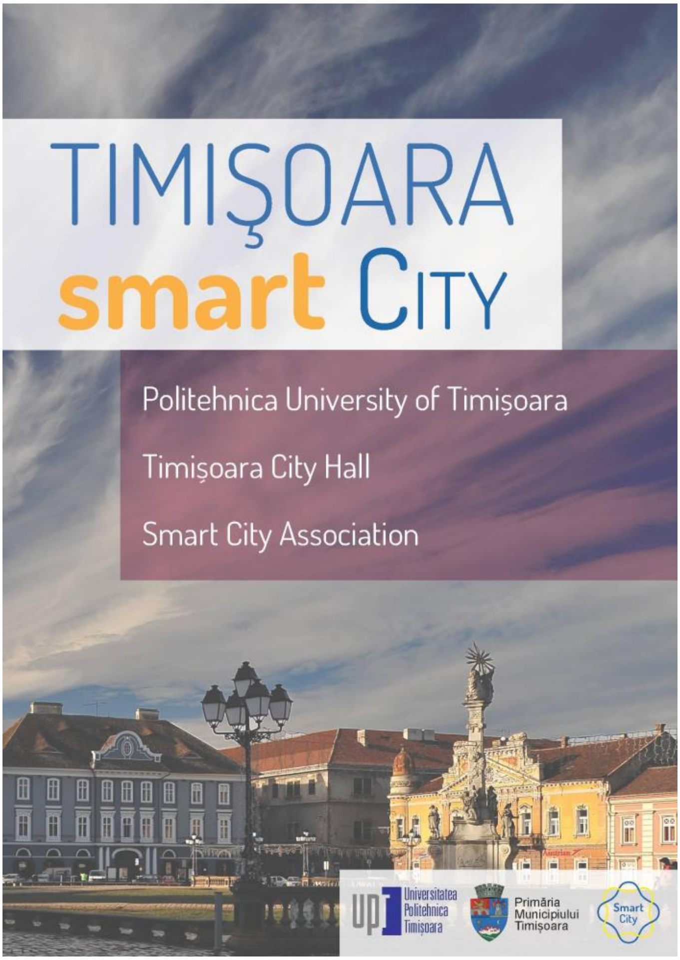


Fig. 8. Timisoara Commitment for the EIP on Smart Cities

One of the first results was the increased number of data sets made available by Timisoara City Hall on the governmental portal, that located it on the first place in Romania.

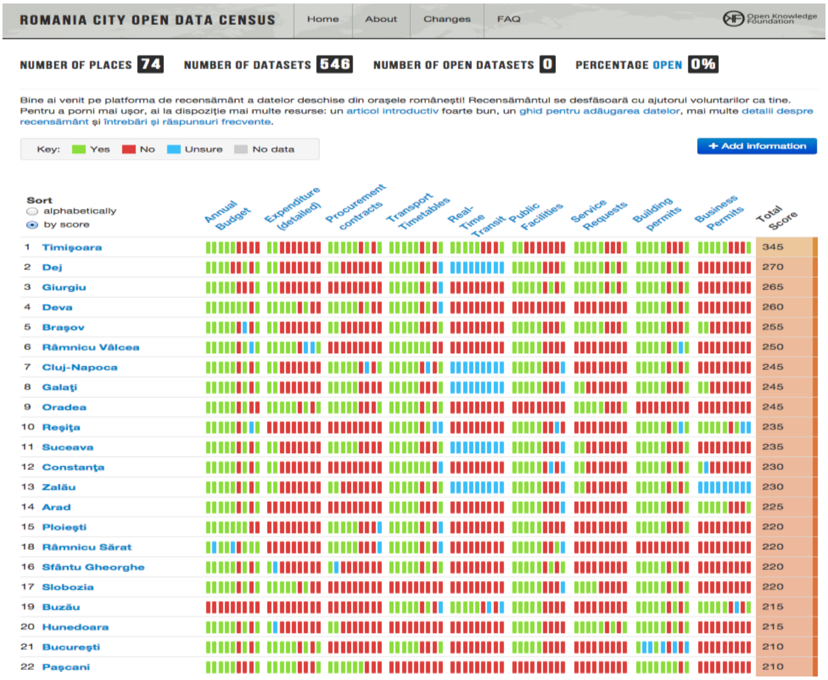


Fig. 9. Open Data Sets uploaded by Timisoara City Hall

Fig. 10. Timisoara – first place in Romania in Open Data

c. Smart City Applications based on Open Data developed in Timisoara

Once a significant number of data-sets being made available by the Timisoara City Hall, the local IT community, centered on the group of initiative from the Politehnica University, started developing various applications.

i. Timisoara Street History

Timisoara Street History is a map-based web application that displays the current and past street names in Timisoara using an intuitive, usable map that displays well on desktops and smartphones.

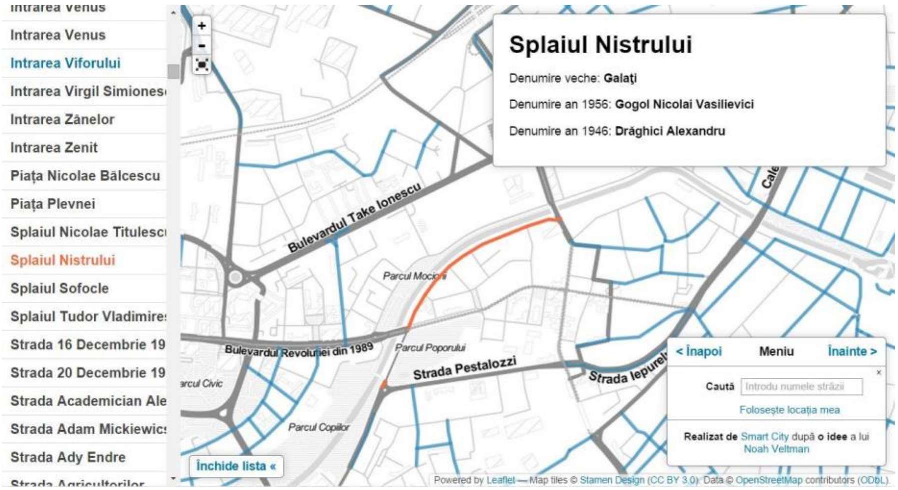


Fig. 11. Screenshot from Timişoara Street History: apps.mysmartcity.ro/Street-History

The project aimed to prove the usefulness of a dataset published on the Government's Open Data Portal by the Timisoara City Hall. The dataset is a comprehensive list of the current and past street names in the city. As such, citizens are now able to browse through the streets in Timisoara and learn how they were called and how the name changed during the previous century. The application can be found online at http://apps.mysmartcity.ro/Street-History/.

ii. City Alerts

The application has been developed by a team of students from the Politehnica University of Timisoara, with the aim to gather open government data related to incidents and planned changes that happen in the city.

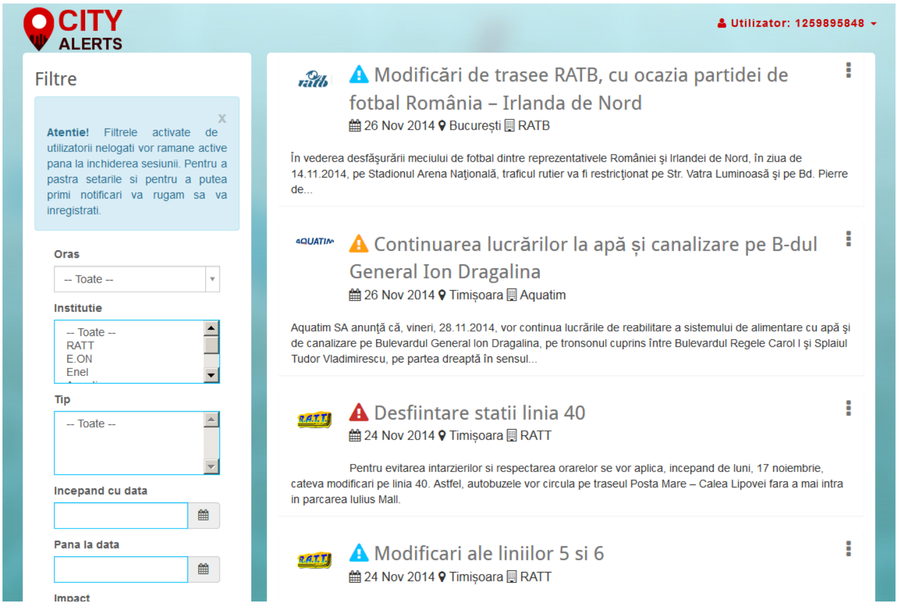


Fig. 12. Screenshot from City Alerts: www.cityalerts.info

Citizens can register themselves on the platform, stating the area of the city in which they are interested in, and they will receive notifications about electricity or gas shut-offs on their street, changes in the route of the buses, improvements on certain streets and so on.

For that, all open data provided by the agencies and local companies belonging to the public administration, that might provide works in the city are interrogated in real time, in order to provide the alerts for the population. The sets of open data are provided in different formats that are transformed by the application.
The application is accesible online from a smartphone or from the computer. The user can also select to receive notifications via email or SMS.

iii. Augmented Reality Tourism Application

This mobile augmented reality application helps tourists to get a sense of the unfamiliar surroundings based on popular linked open data content sources that are integrated for this purpose. The current version is available online.

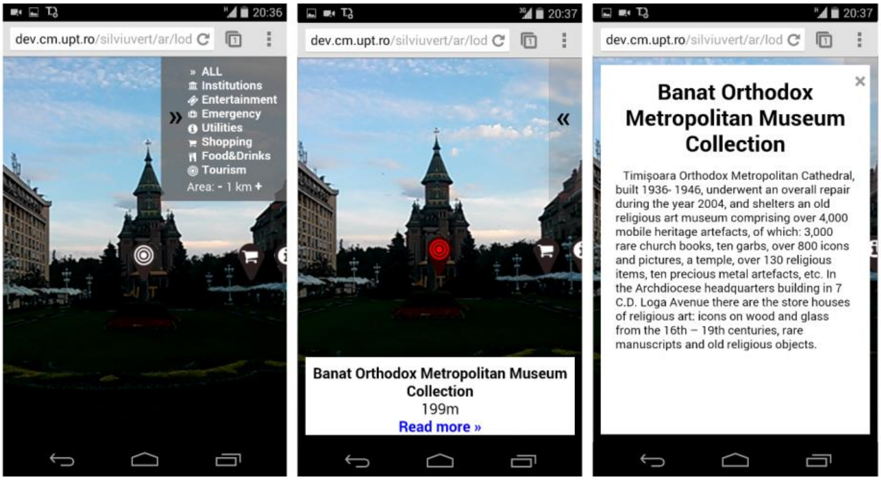
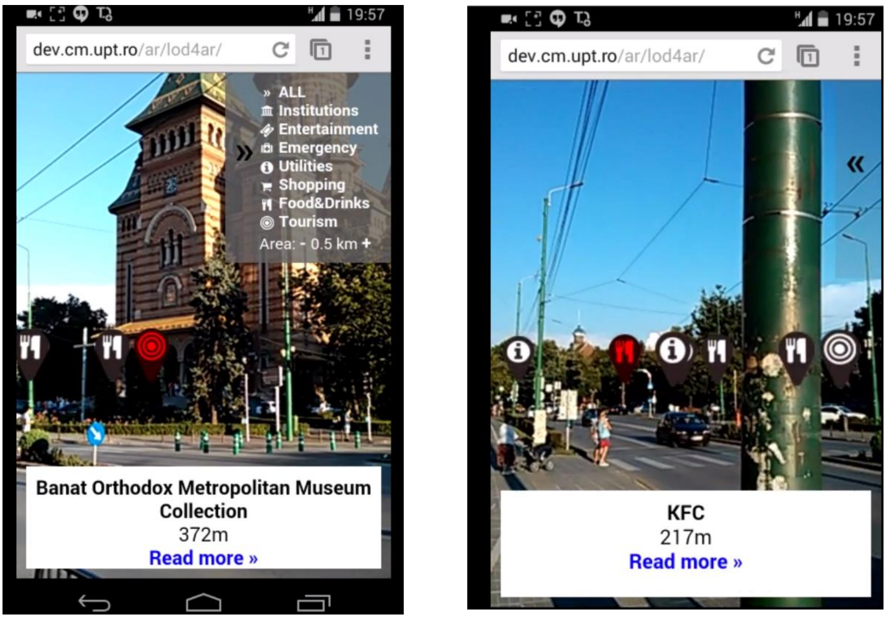


Fig. 13. Screenshots of the mobile browser application: dev.cm.upt.ro/ar



iv. CityArtTM

Timisoara City Art is a project developed during the Timisoara Open Culture Hackathon that was organized in Timisoara in 2015. The hackathon was the first event in Romania to facilitate the reuse of open cultural data. Hackers, graphic designers, artists and representatives of national cultural institutions were invited to develop applications and design platforms that can reinvent the relationship between the public and the cultural works. Cultural data refers to collections, art works, books and other types of publications, audio visual materials, photographs, archived documents, monuments (content), as well as to descriptive information about these (metadata), such as title, creator, year, dimension, technology used etc.

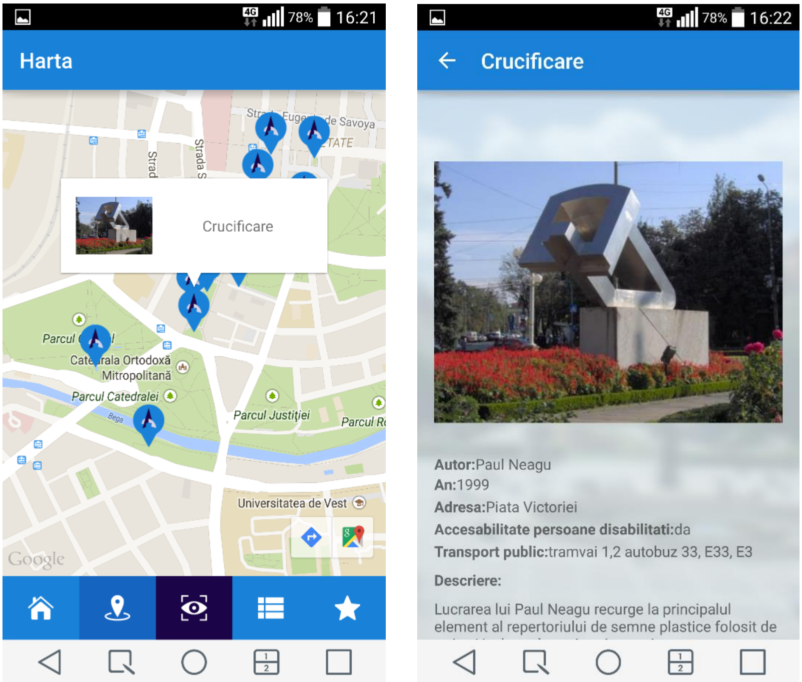


Fig. 14. Screenshots of the City Art application

v. How to develop Open Data Applications

As stated for the Timisoara City Art application, many of the open data based created applications are developed by groups of students guided by a mentor, that is usually a university professor or an IT expert from a company.

Usually, those events are organized by the afore mentioned associations working with open data, such as: Romanian Coalition for Open Data, Multimedia Center of the Politehnica University Timisoara, West University Timisoara, Smart City Association, Kosson Community, Open Knowledge Romania and authorities representatives such as the Department for Online

Services and Design of the Romanian Government and Timisoara City Hall.

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9. Urban Mobility and Smart Cities = a survey from a European R&D perspective

Prof. DI Günter KOCH
Humboldt Cosmos Multiversity, Tenerife

a. Abstract

Several members of the "European Research Consortium for Informatics and Mathematics" (ERCIM), an association combining major European Research Centers, engage in projects in building systems in support for Transport Mobility and Smart Cities.
Extracted from ERCIM's rich pool of knowledge and from current R&D projects being concentrated and available at different international ERCIM R&D sites, some of their concepts are discussed. The attempt is to demonstrate in a survey style the complexity and multi-dimensionality of the problems to be approached when building integrated and user friendly mobility systems – as much as technology can contribute to urban and regional mobility.

In order and for orientation to stay on a bird's view level, the discussion in this presentation opens with some references to charts and pictures, in conclusion providing the motivation for moving from today's silo approaches to more integrated and consolidated systems in support of urban mobility, not denying that the systems to be constituted are technically highly complex and by far not yet homogeneously integrated. The key message is, that it is not enough to combine different

sources of information, the real challenge is to integrate information by semantic integration.
Finally, coping with the complexity of building such integrated systems, politicians, administrators, engineers, IT specialists and project managers too often forget to (re-)start from and to serve users' or customers' interests and needs. An example from Vienna is given. The conclusiving plea therefore is to include the user in the planning process not only for legal or formal reasons, but to make use of his/her competence by applying methods and tools well known and practiced in knowledge management. Such methods can ideally be applied for getting citizens involved and participating in mobility system and smart cities construction. To exploit such competence also applies to questions of data protection, data safety and security and privacy.

b. Keywords:

Urban Mobility, Smart City, IT Architecture, Knowledge Management, User Involvement
JEL: R – Urban and Regional Economics ; O – Economic Development, Technological Change, and Growth; M – Business Administration.

c. Resources for research on smart city development: The ERCIM network

ERCIM, the European Research Consortium in Informatics and Mathematics (www.ercim.eu) is a group of more than 20 leading and relevant European research institutions committed to information technology and to applied mathematics, by…
… building a European-wide, open network of "centres of excellence" in ICT,
… excelling in research and by acting as a bridge to applications,
… being internationally recognized as a major representative organisation in its field. Its portal gives access to all relevant ICT research groups in Europe,
…acting as an interface also for the non-EU member institutions within the European Community and other international organisations
In addition to its key function of bringing European ICT research together, the legal body of ERCIM, being a so called EEIG , in January 2003 became the European host of W3C. Quote: "With the move to ERCIM, there is the potential for considerable growth and synergies of Web technologies across Europe" (Tim Berners-Lee, W3C director and inventor of the Web).
The current fields of basic or semi basic research disciplines in which ERCIM member institutes engage are:

- Computational and Methodological Statistics
- Constraint based algorithms
- Dependable Software-Intensive Embedded Systems
- E-Mobility
- Environmental Modelling

- Formal Methods for Industrial Critical Systems
- 

Grids, P2P and Services
- Image and Video Understanding
- IT and Mathematics applied to Interventional Medicine
- Media Technology and Edutainment
- Models and Logics for Quantitative Analysis
- Security and Trust Management
- Sensor Web
- Software Evolution
- Software Engineering for Resilient Systems

ERCIM publishes regularly its ERCIM News, each edition under a key theme. The one issue in relation to the subject of this paper has been published under the title “Smart Cities” in July 2014.

d. Research projects in mobility and smart cities reported from the ERCIM community

The contributions to the subject of “Smart Cities” in this special ERCIM News issue are as numerous as indicated by the following list of ERCIM members' projects indicated in the following list (quotation from the table of contents) which gives the impression that

- “Smart City” must be a hype subject in our decade,
- the definition of what a smart city is evidently is extraordinarily broad,
- the number of projects in this field, not only in research, must be uncountable,
- aspects of smart cities range over all disciplines, i.e. IT technology, environmental, political, sociological, geographical / geolocation, cartography… - in other words: it is a true multidisciplinary if not even a transdisciplinary challenge.

o Urban Future Outline - A Roadmap on Research for Livable Cities
o Urban Civics - Democratizing Urban Data for Healthy Smart Cities
o AppCivist - A Service-oriented Software Platform for Social Activism
o CityLab@Inria - A Lab on Smart Cities fostering Environmental and Social Sustainability
o A Framework for Improving the Multi-Device User Experience in Smart Cities
o Moving Towards Interoperable Internet-of-Things Deployments in Smart Cities

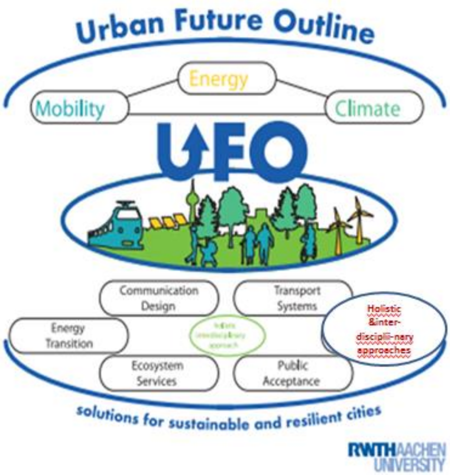
- Realizing Smart City Scenarios with the ALMANAC and DIMMER Platforms
- Internet of Things Applications for Neighbourhood Embedded Devices
- Internet of Things: A Challenge for Software Engineering
- Semantic Management of Moving Objects in Smart Cities
- Flexible Access to Services in Smart Cities: Let SHERLOCK Advise Modern Citizens
- Quantifying the Benefits of Taxi Trips in New York through Shareability Networks
- Integrated Electric Vehicles Sharing and Pooling Mobility Solutions for Smart Cities
- A Carpooling Recommendation System in the Smartphone Age
- A Smart Parking Campus: An Example of Integrating Different Parking Sensing Solutions into a Single Scalable System
- Stochastic Travel Planning for Unreliable Public Transportation Systems
- A Quantitative Approach to the Design and Analysis of Collective Adaptive Systems for Smart Cities
- Query-Driven Smart Grid City Management
- 'U-Sense', A Cooperative Sensing System for Monitoring Air Quality in Urban Areas
- Monitoring and Controlling Energy-positive Public Lighting: The E+grid System
- Demand-Side Management in Smart Micro-Grids: An Optimization Perspective
- Cyber Physical Systems give Life to the Internet of Energy
- When Smart Cities meet Big Data

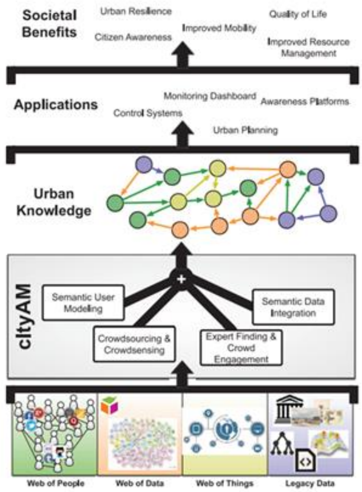
- cItyAM: Managing Big Urban Data for Analyzing and Modelling Cities
- Urban-Scale Quantitative Visual Analysis
- Mobile Augmented Reality Applications for Smart Cities
- Monitoring People's Behaviour using Video Analysis and Trajectory Clustering
- Trusted Cells: Ensuring Privacy for the Citizens of Smart Cities
- Smart City Operation Center: A Platform to Optimize Urban Service Rendering
- Building Smarter Cities through ICT-driven Co-Innovation

From these 30 contributions the following key insights can be abstracted:

i. A larger framework needs to be taken for reference

The model of a smart city and its mobility infrastructure needs to be mapped into a framework which is wider than that only defined by technology. The two following charts draft the overall framework of a future urban environment as well as define the "benefit architecture" of a smart city based on its collective knowledge and its transformation into benefits instantiated by "apps" to be offered to and used by the citizens.





UFO: matthias.jarke@fit.fraunhofer.de TU Delft: direct.tudelft.nl/ahine-117.html

ii. Mobility as a matter of optimal routing and transport

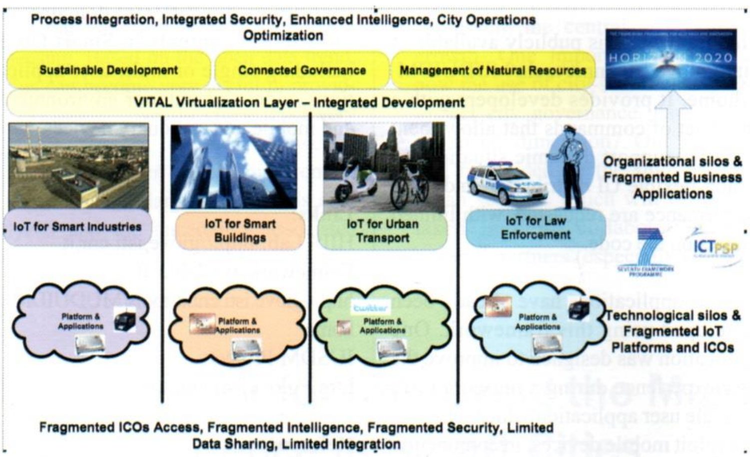
As for mobility, the simple question, hard to answer in practice is: What is the optimal transport connection from where I want to start and to where I want to go?

Optimisation criteria are manifold: cost, time, modality, comfort, minimal changes + walking distances, transport capacity, environmental stress, energy consumption, com-/ entertainment-facilities in carriers, …
Providing a routing solution based on a well specified individual "profile" may end up in a highly complex

combination of data drawn from different sources, especially if the data sources are not compatible. Broker services as available in air transport based on common databases such as Amadeus do not yet exist over all modes of transport, although integration of information of public transport services and its timetables have been extended stepwise in larger municipality areas during the last decade.

iii. Today's smart infrastructures are not (yet) smart – they are aggregations of mutually disjunctive function domains

There is no question that today's series of seemingly intelligent services in supporting our transport and mobility needs are in place, but eith respect to. to their level of interoperability they are still fragmented – as is presented in the EU FP7 project VITAL (www.vital-iot.com) – see :



iv. The number of types of "web objects" being in place is increasing with the venue of every new technology

Part of the fragmentation problem is that the "objects" existing in structures for the support of services provided for the mobility of users moving around are manifold, as demonstrated by the following chart. It also gives an insight,of how many different references for any moving subject need to be maintained in order to identify the location of a user, to build connection to the device/s he or she is using, what preferences and what rights in a local context he/she has and what services he/she is requesting and using.

Mobile device object	*Makes use of multiple sensors (GPS, NFC, Accelerometer, etc.) to measure physical quantities. It is used to identify the user in other systems and to access the user's profile. It supports the user with GNSS (Global Navigation Satellite System) capability.*
NFC Door object	*Operates an NFC-tagged electromechanical door lock using a mobile device (equipped with an NFC sensor).*
User Profile object	*Stores users' preferences to query about them.*
GNSS Location object	*Represents the user's location.*
Location Rules object	*Represents the rules concerning location sensor-based services in order to trigger the corresponding requests to the home automation platform.*
Request object	*Stores the URI and Payload corresponding to the request performed by the mobile device.*
Home Automation Platform object	*Handles the mobile device requests, and also monitors and manages the home automation appliances.*

(© web-of-objects.com, Prodevelop, Spain)

e. Complexity of smart city development

The real challenge with respect to the design of a smart city and its mobility structure is to master the complexity of systems contributing to a smart city and their integration. But what generates complexity?

The interrelationships and dependencies in ICT systems providing the services for smart city mobility have developed towards a size, a level of opacity and multi-dimensionality which can only be characterized as complex – not just complicated. Being complicated is not being complex; it means that a certain effort is needed to solve a problem, but it is manageable anyway. Not so a complex problem.
There does not exist one common definition of complexity: A mathematician aims to find formulas describing phenomena that have proven hard to capture, such as changes in weather or financial markets. The interest of a technician is to learn how to master huge and virtually impossible to understand machinery or facilities. A medical doctor is hardly in a position to consider all factors which are relevant in a disease which is new or not yet curable. A psychologist or a cognition scientist may wonder how people take decisions in situations in which they do not have all data and facts needed and may be irritated. Such a scenario would be a human definition of complexity. At the "lower end" of obfuscations, computer scientists do research on the complexity of algorithms, and, at the "upper end" they are confronted in understanding the complexity of large systems, the largest being the Internet. And finally, sociologists seem to have surrendered in interpreting how society in its rapid development can be explained.
(There is no question that in such a situation, where large parts of society no longer understand in logic terms what is happening in reality tend to adopt esoteric models of explanations communicated by some self nominated Messiahs, most often consultants who want to make us believe that complexity can be reduced, as though factual complexity could be spirited away).

There exist options in terms of research institutes and researchers on a world scale who take up the challenge to study and to resolve complexity, as such, are the Santa Fé Institute in New Mexico, the IIASA Institute near Vienna, Austria, the COSY research group of Stefan Thurner in Vienna or the department for foresight research at the Austrian Institute of Technology. These experts are quite engaged; however, within the large community of scientists they are represented in subcritical numbers only.

"Complexity research" and the resulting knowledge body about complexity and its mastering still has not yet been introduced in education plans of universities, given that everybody perceives that the problems at hand as e.g. are smart cities, by their nature are complex and would need competence in mastering them. This holds for all the different grand challenge aspects of securing citizens' future living conditions, e.g. climate, demography, diseases, finance, etc.

Citizens are becoming aware that those who are members of parliaments and governments are not as much in the know as is conceded. Polls made e.g. in the Austrian Parliament finding out about competences of the MPs in the field of financial politics disclosed concussive results showing that the number was lower than 10%. This is a typical, but in no way a singular case.

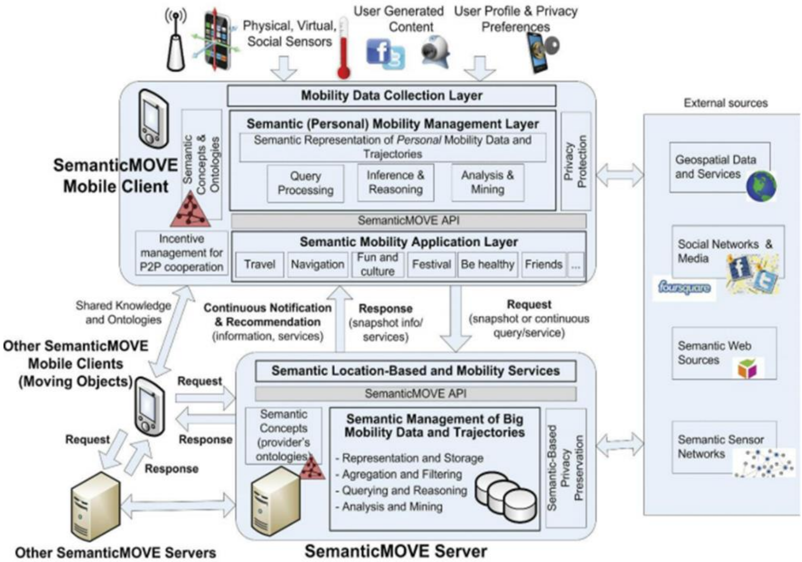
Albert Einstein, who himself was convinced of the rational, calculable and logical foundations of the world, was intelligent enough to state that (complex) problems cannot be solved with the methods which have generated them. In a metaphoric (!) sense, this conforms to Kurt Goedel's discovery, which tells us that within a formal system of mathematics there may exist mathematical problems which cannot be decided if they can be solved within that system. Thus, the paradigm

which limits the potential of humans in understanding complexity still results from the enlightenment of 250 years ago. So far its “laws” were helpful and produced the whole body of knowledge on which our modern society and technologies relies. However, the example of not understanding complexity demonstrates that we need new foundations of thinking. This is being achieved in science – an excellent example is quantum physics – but certainly not yet in everyday life.
We can identify new directions in founding a new paradigmatic basis that is helpful in dealing with complexity. One of the “ideological” preconditions, which makes us humble in our expectations, emerges from the discussion on constructivism. It tells us that in the end one only can master what one can understand, i.e. what we as humans are able to explain, being founded on scientifically sound insights. Beyond our own competences and capacities there do not exist absolute and objective truths. The silver bullet to cope with and to “master” complexity is to behave in a competent and educated way versus complex situations. The future, which is always a complex animal, cannot be foreseen, but what can be done is to participate actively in the design of the future, and that is mainly what constructivism tells us.

f. Semantic integration as the key challenge

In a formal sense the real complexity of a smart city system does not result from the aggregation and combination of components and functions which constitute the ICT foundations, much more it is the sensible and meaningful integration of the diverse

information stemming from different sources as already has been pointed out above in 2. (3).
If we consider a full scope ICT architecture of a "smart city system" as the following one, it is evident that such system is not only complex, but its concern is to integrate all information so that the user will receive coherent information:



©webdiis.unizar.es/~silarri/SemanticMOVE/

Semantics, by definition, is the study of meaning.
It focuses on the relation between signifiers, like words, phrases, signs and symbols and what they stand for, their denotation. Forms of semantics include the semantics of programming languages, formal logics, and semiotics.
In computer science the term semantics refers to the meaning of languages, as opposed to their form (syntax). Semantics provides the rules for interpreting the syntax which do not provide the meaning directly but

constrains the possible interpretations of what is declared. In other words, semantics is about interpretation of an expression. Additionally, the term semantics is applied to certain types of data structures specifically designed and used for representing information content.

A semantic network is a network which represents semantic relations between concepts. This is often used as a form of knowledge representation. It is a directed or undirected graph consisting of vertices, which represent concepts, and edges combining them.

In summary: Any real integration of information forming a "complete" information body delivering sensible information to its users needs mechanisms of semantic integration, which is more than just interfacing data formats, which, in the worst but practical case are incompatible.

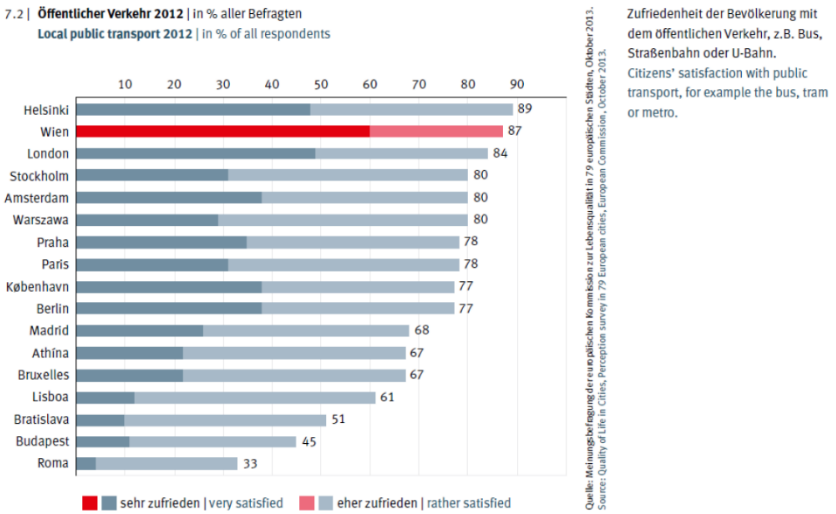
g. The case of Vienna: an example for participative development

Complementary to the discussion on how to construct ICT systems underlying a smart city, the question is who specifies what the services of a smart city to its citizens are or shall be. Or, with other words, how do citizens participate in the development of "their" city.

A showcase on how and to what intensity citizens are involved can be studied in Vienna.
Already in the 1st decade of our century the city administration started a public consultative project what should be understood as a smart city Vienna – see copy of report here:

This initial workshop was the starting point of a process finally leading to the self definition of the city to be a smart city. Today, the smart city logo is displayed on large posters welcoming visitors arriving by car to the city on motorways, as well on brochures, posters, and in cinema ads..

The city continuously aims to involve its citizens by means of so called "Smart City Forums" explicitly declared as events for citizens' participation. (When this



article wa written, an announcement was made for such a forum in May 2015, also announcing that methods of knowledge management will be applied in order to stimulate and to structure contributions).

As a result, a recent study authorized by the city displays the satisfaction of the Vienna citizens with "their" public transport infrastructure which, in Europe, ranks 2nd after Helsinki:

h. A plead for using knowledge management methodologies

Citizens' participation, especially when larger numbers of citizens are invited to constructively contribute, needs a professional and goal oriented moderation.
Knowledge management has grown towards a mature practical discipline to manage such kind of collective or individual or institutional generation of ideas and contributions.
The "tools- and methods box" of today's knowledge management – as shown in the figure below listing some 80 methods - is well filled and ready to be applied for all kinds of meetings. I.e. managing processes in developing smart cities, if not technical in nature but defining the objectives of city development following the informal needs and wishes of the inhabitants, can be captured best by applying the methods indicated.
Going one level beyond, i.e. defining a long term development strategy from the perspective of responsible persons in government and administration, methods of intellectual capital analysis / design / reporting might be applied, as has been exercised by several municipalities in Europe. Not only the city of Vienna, but Austria as a whole has committed to apply methodologies for finding a strategy towards becoming an "knowledge country" by publishing a report on "Austria's Transformation to the Knowledge Society" – see bibliography below.

After Action Review, Analogie-Modell, Balanced Scorecards, Best Practices, Bibliothek, Bildung von selbststeuernden, interdisziplinären Teams Brainpool, Brainstorming, Business TV, Coaching, Cognitive Mapping, Computer/Web-based Training (W/CBT), Corporate Universities, Data Warehouse Datenbanken, Debriefing, Diskussionsforen, Dokumenten Managementsystem, Elektronisches Who-is-who, Erfahrungsaustausch, Erfahrungsdatenbank, Experteninterview, Expertensysteme, Externe Partner, Externes Benchmarking, Fachliteratur, „Graue" Beraterstäbe, Handbücher,	Hotline, Info-Center, Informationsreisen, Interner Wissensmarkt, Internes Benchmarking, Internet, Intranet, Intranet-Portal, Job Rotation, "Kaffeeecken", Know-how-Bilanzen, Knowledge Communities, KnowledgeLinks, Kommunikationsforen, Kommunikationstraining, Kooperation, Lernlabor, Lernmodule, Lessons Learned, Management by Knowledge Objectives, Mentoring, Mergers& Akquisitions, Methode 4+1, Methode 635, Mitarbeiterzeitung, Morphologie, Newsgroups, Open Space, Patenschaftsmodelle, Patentbewertung, PE-Matrizen, Personalgespräch, Planspiele, Protokolle, Rundschreiben,	Schwarzes Brett, Selbstreflexion, Seminare, Senior-Junior-Pools, Stakeholdernetzwerke, Success stories, Synektik, Szenariotechnik, Szenenetzwerke Technologiescouts, Telefonkonferenzen, Teleworking, Think Tanks, Videokonferenzen, Vorschlagswesen, WI Data Mining, Wissensbewertung, Wissensbilanzen, Wissensbroker, Wissenslandkarten, Wissensmatrizen, Wissensmessen, Wissensportfolios, Wissenszirkel, Workflowoptimierung, Work-Out-Sitzungen, Workshops, Yellow Pages, etc.

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10. „Big Data in Education“

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a. Abstract

Big data has arrived in education. Reformers and data scientists see student data as the key to the future of education. In contrast, critical pedagogues advise against dehumanization through decision making by statistics and data security officials warn of privacy, legal and ethical issues inherent to learning data. Pros and cons of big learning data are exposed.

b. Introduction

According to business intelligence analysts big data means big impact. The obvious current excitement surrounding big data has been generated primarily from the web and those leading e-commerce vendors with their product recommender systems. Likewise many areas of science and technology are exploiting the data of a multitude of sensors from any kind of activities and events whether detected from machines, nature, or living beings, whether stemming from the micro or the macro cosmos. The Internet of Things and mobile devices are transforming our society with their impact on business, entertainment, healthcare and politics. But what about education? Did big data arrive at schools and at universities? According to a quick check with Google Trends using the keywords <big data

education> big data popped up in education only recently in October 2012, for whatever reason, and is continuing to gain in importance (see Fig. 1).

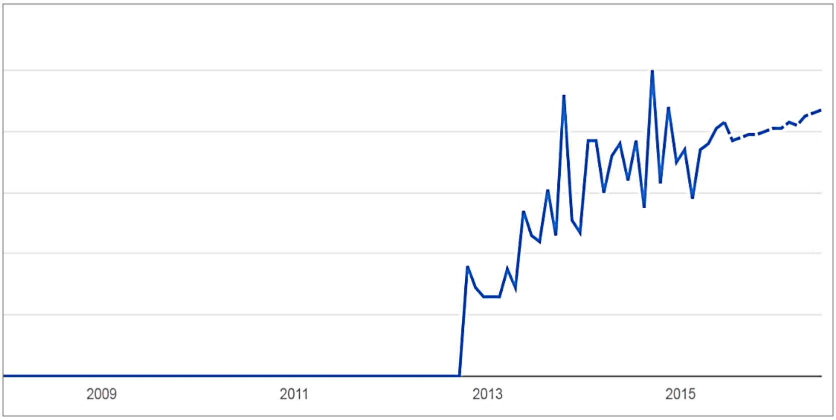

Fig 1: Google Trends result on the keywords <big data education>
Source: https://www.google.com/trends, [30.06.2015]

It seems worth taking a closer look at what big data in education is about. Digging deep into computerized statistical data on learners to make decisions regarding their performance is a trend that excites some and worries others.

c. Big Learning Data

Without doubt ICT became increasingly embedded in the educational domain. E-learning has become a cornerstone in higher education, in schools and in the work place. The number of online courses is steadily increasing worldwide. Learners and employees leave tracks while they are interacting with lecturers, trainers and any kind of content material, data about their successes and failures can be captured even in real time. Big data in education is created when learners enroll and engage in learning activities with content which is mainly provided through a learning management system (LMS). Those LMSs generate data from logins, courses, modules, files, assignments, exams, quizzes, grades, learning paths, and different kinds of interactions with peers, tutors, and lecturers. Thanks to a newly introduced e-learning specification, the Experience API (xAPI), even more data is created blowing the limitations of browser-based LMSs. xAPI allows for recording learning experiences from real-world activities, experiential learning, social learning, offline learning, or collaborative learning. Those activity streams contribute considerably to the increase of data records.

Ferreira (2015) divides educational data into five types, one on student identity and four on student activities, in order of how difficult they are to attain: (1) *Identity Data* - who are you? what is your role? (2)*User Interaction Data* - engagement metrics like click rate, page views, (3)*Inferred Content Data* - efficacy data on instructional materials, (4)*System-Wide Data* - attendance, grades. (5)*Inferred Student Data* - exactly what concepts does a student know and need? For building recommendation systems *User Interaction Data* and simple rules are not enough. According to Ferreira *Inferred Content* and *Inferred Student Data*, though difficult to obtain, are key to successfully build such adaptive systems.

An increasing number of companies is keen on datafying the learning process claiming to satisfy the needs of learners by improving comprehension and performance as well as the needs of administrators by improving nothing less than the whole education system. Feinlab (2015) posted a list of innovative education analytics applications which helps to illustrate the current market situation and product features. Here are a few examples: *CourseSmart* embeds analytics directly into digital textbooks measuring how students are interacting with their books allegedly allowing for accurately predicting student outcomes. *Declara* developed a dynamic map of how people learn based on years of research across hundreds of subjects taking every interaction an individual has over the network to deliver the right content. *Knewton* personalizes digital courses figuring out what each student knows and how that student learns best, then recommends what to study next.

While companies are pushing for the aggregation of student data into analytics tools to improve their algorithms concerns arise over who should have access to what data, for what purposes. The achievements of data scientists in developing algorithms seem to proceed faster than the competences of other stakeholders on what to do with the outcomes. Certainly the debate over the use of data in educational contexts is only at its beginning.

d. Benefits and Challenges

The vast availability of user interaction data is setting the course for unlocking the potential of learning analytics. So the expectations are high. According to Alacron (2014) education reformers see the merging of student data, predictive analytics, processing tools, and technology-based instruction as the key to the future of education and a means to further opportunity and equity in education. Education researchers and companies promise that personalization will bring about a more adaptive, responsive, and efficient school system and ameliorate inequalities in the educational system.

Proponents advocate data-driven instruction and educational reform as a low-cost and more effective means to deliver better content to a wider variety of students, which, in turn, is seen as a means to encourage social and economic mobility.
From an institutional point of view the promises point at facilitating both global and community development, help marketing study programs, can improve graduation rate, facilitate early warning systems and at least can optimize the enrollment process. From a learner´s point of view big data can personalize the learning process, can measure performance beyond test scores, can increase interaction via mechanics, can monitor a student´s level of engagement, and can produce adaptive learning plans. “Personalized learning” adjusts instructional content, pace, and complexity to meet an individual learner's needs and objectives.

So much for the benefits. What about the downside? As mentioned above data-driven educational policy is a polarizing topic. Concerns about privacy and security of personal data, and legal and ethical issues are raised unmistakably. Disclosures about global surveillance have raised public interest and consequently gathering data is no longer a niche service. Privacy and security issues have to be treated by transparent policies with increased urgency, however, such policies are not around yet. Legal and ethical questions have to be answered but discordant stakeholders – critical pedagogues, teachers, learners, parents, learning analytic evangelists, administrators, developers, and data security officials get in on the act. Data ownership is a very sensitive issue in learning contexts and this issue isn´t solved yet.

Similarly disturbing is the potentially dehumanizing impact of statistics and probabilistic. Profiling substitutes calculation for human judgment on what should be very sensitive human issues, and thus treats those profiled as objects, as collections of facts, rather than as persons. Relying just on algorithms and numbers when it comes to decisions on personal careers is frightening. The more frightening it is when we forget to keep in mind that the relevance of data is not always to be taken as granted, correlation does not prove causation. The risk of spurious correlations - associations that are statistically robust but happen only by chance - increases with more data. Big data analysis needs to stand on solid ground thus proper skills must be developed. Research in this domain requires increased attention. In short on could say: big data without big analysis is big mistake and without big care is big brother.

Viktor Mayer-Schönberger, Professor of Internet Governance and Regulation at Oxford University and Kenneth Cukier, a prominent commentator on developments in big data elaborately deal with the pros and cons in their publication on learning with big data (Mayer-Schönberger & Cukier, 2014). Among other things they come to a far-reaching socio-critical conclusion as a possible result of the big data impact on education: “As these changes unfold, we´ll find that many of the tools and institutions we rely on must themselves change. […] This will lead to an unbundling of the educational experience. The monopoly that schools hold today is starting to resemble the monopolies once held by monarchy and Church. It is poised to crumble, as did those other seemingly impregnable institutions when the currents of an earlier

information revolution – printing – washed over them."
Will education change – after all?

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11. “Smart Cities in the UK?”

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The phrase 'smart cities' has been adopted over the past decade by a number of large companies that understand technology - Cisco, IBM, Siemens - for the application of complex information systems to running urban infrastructure and services such as transportation, utilities, waste management and public safety. Indeed, IBM has copyrighted the variation, 'smarter cities'. The term is also used by politicians and their publicists to describe things they don’t understand, but which sound suitably futuristic and technical. It’s been used alongside, and confused with many similar terms. Some of these terms are a bit more specific - sustainable, for example leans towards the ecological; networked implies connections between the specific cities involved. And as Komninios (2006) notes, “All intelligent cities are digital cities, but all digital cities are not intelligent.”

In this presentation, I plan to look critically at the smartness claims of a few cities in the UK, and also at the notion of smart cities itself, and highlight some of the reasons for the question mark. In summary, I don’t think many cities in the UK are that smart, or that people would really want them to be “smart” in the sense that the term usually implies. They might however be happier with different kinds of smartness.

Some of the first cities involved in current EU projects were long term twins, under arrangements that begun in the middle of the last century. Birmingham, for example, was a founder member of the Eurocities network with twin partners Frankfurt and Lyon in 1986, with the aim simply of putting the issue of cities and their economic, political and social development onto the European agenda. This network now includes 135 European cities from 34 different countries. EUROCITIES works along three complementary strands of activities - networking, to develop contacts with colleagues in other European cities; influencing, strengthening the role of cities in European decision-making, and visibility, providing a European platform to city politicians.

Eurocities has now been joined by many other groupings - some of them long term, and some established simply for the duration of a particular project. The UK government, coming somewhat late to the party established a Future Cities grouping in 2013 group under the Department for Business which set up a bizarrely named Future Cities Catapult, to provide funding, spread best practice and support cities in their efforts to implement various pilot projects. The bulk of this funding (£33m) was awarded to Glasgow, although other projects are underway in Bristol, Milton Keynes and Peterborough. The Department of Culture Media and Sport is also committed to providing superfast broadband to twenty or so Super Connected Cities, and the Department of Transport plans to establish open standards for Intelligent Transport Systems.

The UK is not generally regarded internationally as a leader in Smart Cities. For example, a recent league table of Top Smart Cities had London at number 2, but no other UK cities in the Top 10. Other European countries are probably further ahead, with Spain, France, Germany and Italy all making steady progress with greater public backing. Looking further afield, the US, Japan, Singapore, Australia and South Korea are all promoting and investing in Smarter Cities with encouraging results.

In a recent presentation about New York’s PIans, Mayor Bloomberg stated that his team drew on the experiences of Berlin for renewable energy and green-roof policies: from Hong Kong, Shanghai and Delhi for rail systems; from Copenhagen for pedestrian and cycling upgrades: from Bogota for buses; and from Los Angeles and Chicago for plans to plant a million trees. Nothing from the UK.

To understand why, it's probably useful to have a brief look back at the history of city governance in the UK, and to highlight some of the significant differences with other parts of Europe.

19th century urban expansion, especially in the North of England was accomplished largely through the foresight of wealthy local industrialists – men like Joseph Chamberlain in Birmingham. As mayor, Chamberlain forcibly purchased Birmingham's squabbling utilities companies on behalf of the borough declaring that, “we have not the slightest intention of making profit - we shall get our profit indirectly in the comfort of the town and in the health of the inhabitants”. Partly inspired by Haussmann’s work in Paris, Chamberlain also built new streets and rehoused the poor, and directed both public and private money was to the development of libraries, municipal swimming pools and schools. Chamberlain was also responsible for the creation of Birmingham University, and the clock tower in the centre is named after him

However, control of new functions was in the hands of a plethora of different bodies - school boards, boards of guardians, local boards of health, and antiquated posts such as sheriffs and lord lieutenants alongside more contemporary creations such as town clerks. The 1888 Local Government Act created a slightly more coherent system based on the old counties, many of which had existed in various forms for hundreds of years, although towns of over 75,000 were designated county boroughs, with certain functions devolved. As newer towns grew while older ones declined, this became increasingly unworkable through the 20th century. A series of reforms in the 1970s led to new tiers and layers, many of which proved worse than what had gone before, and others which were abolished or merged for ideological reasons - most notably the Greater London Council, dissolved by Thatcher in 1984. More importantly, their powers to raise and spend money independently of central government were severely curtailed. The key point arising from this is that at a time when cities in the UK were supposed to be becoming smarter, many had no base on which to do so. The mantra of the 1980s was always that civic government was backward, based on restrictive practices, prone to wasteful profligacy and in hock to trade unions. Both nationally and locally, many of the functions that now form part of smart city initiatives - transport, utilities, power, telephony - were removed from any kind of local democratic control, and such local planning control as remained was starved of the resources it needed.

A New York mayor has discretion over seven local revenue streams (including income tax). Central grants cover just 33% of local spending in New York, 25%

Berlin and a mere 17% in Paris. The equivalent figure for English cities is a humiliating 95%. The Council Tax, the main source of local revenue is based on house price valuations which have remained unchanged for over 20 years, while prices have increased by over 500%. Local government can only increase revenue in minor areas like car parking charges and speed cameras. It surprises many people to realise that few UK cities actually have executive Mayors – currently just London, Bristol and Doncaster, although there are plans for one in Greater Manchester. Many more have Lord Mayors. London has both. Some have Dukes or Earls, which are not quite the same thing, although the Duke of Westminster, one of the richest men in the country, owns a substantial part of the centre of London.

Local public transport is a prime example of regulatory and financial impotence. Transport laws in the 1980s completely deregulated all local bus services except London. Since 1986 anyone has been able to operate a bus service, with no restrictions on timetables and fares, and minimal technical requirements. There is not even an obligation to inform local authorities or local users of the timetable or the fares. Local authorities were expressively forbidden to introduce any integrated ticketing scheme without consent of all private operators, and any such scheme had to be operated largely in the interest of the private operators.

As Thatcher put it, "Any man who rides a bus to work after the age of thirty can count himself a failure in life". In Tyne and Wear, around Newcastle, the light rail-tram system, which was held up as a model for Britain in the early 1980s with cross-ticketing between buses and trams was broken up and privatised. It is now cheaper to use the bus than the metro so the services are forced into pointless competition. This same approach is reflected in ticket pricing and availability - simple flat rate fares which are common in many European cities are rare in the UK, with its obsession with stages and fares measured by distance.

During the 1990s, the problem of local transportation was complemented by rail privatisation, where the national operator, British Rail was broken up into one company that managed the tracks, and others that provided the services. The resulting chaos has led to the most expensive fares in Europe and a patchwork of provision which varies wildly across the country. Anyone who has travelled through New St Station in Birmingham at the heart of the network will have experienced announcements such as "passengers waiting for the train on platform 2 are advised that this service is now ready to depart from platform 11". The comparison with the seamlessly integrated services in cities like Berlin is depressing.

With this background in mind, what have UK cities achieved in the way of smartness, and what more can they hope to achieve over the next few years?

London, the capital, claims to be a smart city but its remit seems narrowly focussed on IT specific projects which, while important, do not approach the breadth of some of the definitions of what a smart city is supposed to be about. There is some superficially impressive work with open data, and social media enabled traffic management, but no real evidence that this is more than a gimmick. On transport, one of the first acts of the current Mayor was to reduce the restrictions on private cars and create so-called cycle superhighways which fizzled out in areas of densest traffic. That is now being replaced by proposals for the kind of segregated cycle lanes that exist in the Netherlands and many other European cities, but to fierce protests from many business interests. And the lack of any control over the price or availability of housing, the increasing number of empty buildings owned by Russian and Middle Eastern oligarchs and the skyline resembling "a bizarre set of sex toys poking gormlessly into the air" suggests anything but smartness. A reminder - just 5% of the taxes paid by Londoners is spent by locally elected bodies. The rest goes straight to the Treasury.

Birmingham was one of the first cities in the UK to get its own Act of Parliament (in 1854) to allow the Authority permission to acquire land to create public parks, and today it has ambitions to deliver a 60% reduction in carbon emission over the next ten years. The Birmingham Smart City Commission and Digital Birmingham which include key players from Birmingham's economic and academic community and third sector leaders aim to share as much data as possible in three areas – technology and place (connectivity, infrastructure, embedding digital principles into city planning); people (digital inclusion, skills, employment, building smart communities); and economy (health and wellbeing, energy efficiency, smart payments). However, lack of funding means that the new city library, opened to great acclaim last year is now reduced to nine to five opening on weekdays only. There is talk of a £8 million a citywide Wi-Fi network allowing more efficient traffic management. Transport spending in London at £644 per head is more than four times that in the West Midlands, and local public transport in the Birmingham area is woefully unintegrated. Plans to link the main Birmingham railway stations by tram are only now beginning to take shape – but Birmingham still seems like one of Richard Weller's cities that the cars built when we weren't looking (2013).

Manchester is undertaking a number of initiatives to encourage its development as a "smart city" and is a partner in a number of European projects with other significantly smarter cities such as Helsinki, Barcelona, Amsterdam, Ghent, Bologna and Cologne. The Manchester Digital Development Agency is involved in number of European projects and supports a "Go ON Manchester" campaign to develop "digital champions" - and again, there are plans for an open public Wi-Fi network to enable better connectivity.

More importantly however in the light of the UK's record on local governance, Manchester has just received a sudden and unprecedented derogation of power from Whitehall under a scheme known as devoManc. The surprise offer from the government last year, stung by worries around the Scottish referendum was open to "any city that wants to move to a new model of city government – and have an elected mayor". The new mayor will not be accountable to an elected assembly, like in London – instead, he or she would answer to the ten leaders of neighbouring authorities directly, sitting as a cabinet, and health care has now also been added to the mix. The Department for Transport however flatly opposed Manchester's desire to regulate local bus companies, having only recently deregulated them.

Of all the UK's putative smart cities however, Bristol perhaps comes closest to the European model. Bristol City Council owns and manages a £9 million city fibre network, 'Gigabit Bristol', created by the University of Bristol from an old cable television network – which the council bought for small change and which, thanks to the addition of new superfast fibre, can support colossal data speeds of terabits per second. The project likes to compare itself to the work of the great Victorian engineer Joseph Bazalgette - when he replaced the drains and sewers in London, he built far more capacity than a city of that size needed at that point, on the basis that it was the over-specification that allowed London to grow. The city's new fibre optic network is intended to form the basis of a giant open source operating system that can learn from its citizens, while they, in turn, can use it to "customise their environment." For example, Sphere (Sensor Platform for Healthcare in a Residential Environment) will see some homes fitted with sophisticated monitors that can work out how effectively people prepare meals, whether they eat in front of their TV, and how quickly they walk upstairs.

The elected Mayor of Bristol, George Ferguson is a one of very few UK urban leaders who really understand and promotes technology, with aspirations for Bristol to become the UK's most creative, smart, green and connected city. It is currently the only place in the UK to be funded both as a Super Connected City and a Future City Demonstrator, and in 2015 Bristol is European Green Capital.

However, standing back a bit from these utopian visions, it's instructive to look back a few years to where did the idea of the Smart City in its current form actually came from. Quite apart from its other effects on economic and political life, the banking crisis that began with the collapse of Lehmann Brothers in September 2008 led to a dramatic drop in corporate IT spending, prompting companies such as IBM, Cisco and Siemens to repurpose the technology designed to run multinational corporations and try to sell it to local government (Townsend 2014). At the same time, Apple launched the iPhone.

The American urban writer Adam Greenfield (2011) criticises the belief that "the smart city" can simply be a turnkey installation – a collection of technologies that can provide accurate knowledge of all the needs of its citizens and be able to meet them perfectly. The rhetoric, vision, and reality of these corporate schemes is based on an alarming disregard for both history and actual knowledge about how cities really function. It leads to bizarre notions like defensive architecture, and in the UK, the omnipresence of CCTV. Indeed, part of the reason of London's surprisingly high positions in some smart city league tables is probably due to the quantity of big data that CCTV produces. Conversely, cities from Berlin eastwards are far more wary of constant and omnipresent surveillance, remembering only too well how these technologies were used by the Stasi or the Securitate in the comparatively recent past. (MacGregor 2014)
A city consists of real people moving through real environments, using everything from their feet to bicycles to cars and trains. As the sociologist Richard Sennett says, "We are very odd snooker balls whose colour and shape change constantly in contact with other balls." (Sennett, 2015). Is a student updating her Facebook status on her iPhone in the street, a tourist checking a restaurant on TripAdvisor, or a traveller ordering a taxi through Uber part of the smart city

infrastructure? The sales pitch of smart city solutions salespeople assumes that everything people do, " whether in public or in spaces and settings formerly thought of as private — can be sensed accurately, raised to the network without loss, and submitted to the consideration of some system capable of interpreting it appropriately. And furthermore, that all of these efforts can somehow, by means unspecified, avoid being skewed by the entropy, error and contingency that mark everything else that transpires inside history." (Greenfield, 2011).

According to Sennett, part of the problem is because too many urban forms are designed for single functions and can't be easily adapted when they outlive their original purpose. High streets are abandoned in favour of shopping malls, which are in turn abandoned for even larger out of town malls – which in turn are now falling into disrepair. But while speaking the language of freedom, political and economic elites effectively manipulate closed bureaucratic systems for maximum private gain. Those who complain most about zoning restrictions are those who stand to gain the most, and almost certainly do not live in the areas they are proposing to change. Against this kind of over determination inspired by the early twentieth century French architect Le Corbusier, the approach of town planners such as Jane Jacobs suggested that urban life should be dense, diverse and dissonant. Sennett proposes three ways the open city should develop - ambiguous edges (porous membranes rather than solid walls), incomplete forms (to allow people themselves to determine the functions of urban space) and unresolved narrative, as real life rarely follows a script. As the American poet William Empson wrote in a throwaway

line, "the arts result from overcrowding" - people mix at the margins, they collude, gossip and innovate.
So what should a really smart city look like? We need to hear more about examples of public sector innovation, as Western culture is immured in propaganda suggesting that public sector is slow, big, cumbersome and entirely devoid of innovation. An employee from a 19th century city council would recognise much of what they saw in a 2015 city council office, although they might wonder about the flickering screens on everyone's desks. But bureaucracies have rarely managed to scale empathy and engagement, and often seem unable to turn strategy into a real civic culture.
In Helsinki, Ravintolapäivä (Restaurant Day – http://www.restaurantday.org) started in 2011 with hundreds of diverse popup restaurants peppering the streets, effortlessly circumventing the city government by exploiting legal grey areas and simply relying on common sense, and clear public support. Created in response to overly repressive, cumbersome and outdated legislation, the festival was originally devised by a small group of friends coordinated via Facebook and Twitter. Ravintolapäivä was essentially code, a set of instruction – and as such, difficult to arrest or abolish. It's part of a growing movement towards Happy Cities, rather than Smart Cities.
In the UK, the School of Life established by the philosopher Alain de Boton has proposed six things real people look for in a city – order, visible life, compactness, orientation and mystery, scale, and uniqueness. Even today it seems, the planners have not recovered the simple art at which their predecessors were supreme, that of the lively, coherent urban street.

“The shape of a city changes more quickly, alas, than the heart of a mortal” (Charles Baudelaire - Les Fleurs du Mal).

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12. "E-Government Principles and Implementation of these in a Higher Education Institute in Greece"

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M. Sigala PhD candidate of National Kapodistrian University of Athens, Greece

12.1. Abstract:
A general description of the e-government system of the Public domain in Greece is presented in this paper in brief. An analysis on the progress of e-government principles applications in Piraeus University of Applied Sciences gives us details about services that any student could get from the MIS of the Institute. Results about the satisfaction of the students concerning overall educational aspects, ensure that the system's implementation attracts them to give a positive feedback or to participate more efficiently.

12.2. Key words:
education, e-government, e-services, ECTS, ENQA

12.3. Introduction

The EU organization declares that e-government is the use of information technologies and communication in Public Management in combination with the appropriate changes and abilities of personnel, in purpose of better services to the public, the encouragement of democracy and the support of public data. In the education area e-government constitutes of all the appropriate taken actions in order for all the educational institutes to have a strategic management with declared points and standards of quality for their curriculum and their degrees.

12.4. E-Gov in Greece

In Greece e-government has a delay on implementations of 72% of the digital scoreboards 2012. This fact shows that we have low grades in implementation of e-payments, e-exchanges, e- procurements, and broadband although the fact that we have succeeded the high level for the 7 of the 20 e-services, which are declared from EU as model of implementation of E-government principles.
Currently, in Europe we can observe a transformation of a citizen's needs and satisfactions. As a result of this we have an entrepreneurial governance where citizens are transformed into clients and the Public sector and especially the citizen becomes a businessman of himself , who cares about the cost / benefit and the value of money in relation with measurable and realistic targets . This trends to promote responsibility of citizen who declares that keep citizen rights and obligations in society .
The six dimensions of Governance , which Greece has to implement to its Public Management, as the other EU countries have already done, are

- Voice and Accountability of the citizens
- Political Stability and Absence of Violence
- Government Effectiveness
- Regulatory Quality

- Rule of Law
- Control of Corruption

In the following chart we see the level of e-government implementation of some European model services in Greece.

Services for citizens	% of e-government services	Authority
Vat and tax services	100%	Taxis Office (Ministry of Economy)
Finding a job	100%	Ministry of Labor
Insurance services (e.g. unemployment allowance)	45%	Ministry of Labor
Passport and driving license	50%	Greek Police
Building Permit	50%	Environment Ministry and Urban Offices
Public libraries	80%	Ministry of education
Birth certification and certification of the event of life (such as death, birth, residence change)	75%	KEP
Change of residence	100%	KEP
Health services (appointment with doctors,	50%	Ministry of Health

Services for enterprises	% of e-government services	Authority
Insurance services	100%	Ministry of Labor
Vat and tax services	100%	Taxis Office (Ministry of Economy)
Public Procurements	50%	Trade Department
Business Start up	50%	Trade Department
Environmental Permit	40%	Environment Ministry and Urban Offices

According to the latest research of European Commission e-Government performance across policy priorities in Greece comparing to average of the other European countries is as follow:

According to the latest research of European Commission e-Government performance across policy priorities in Greece comparing to average of the other European countries is as follow:

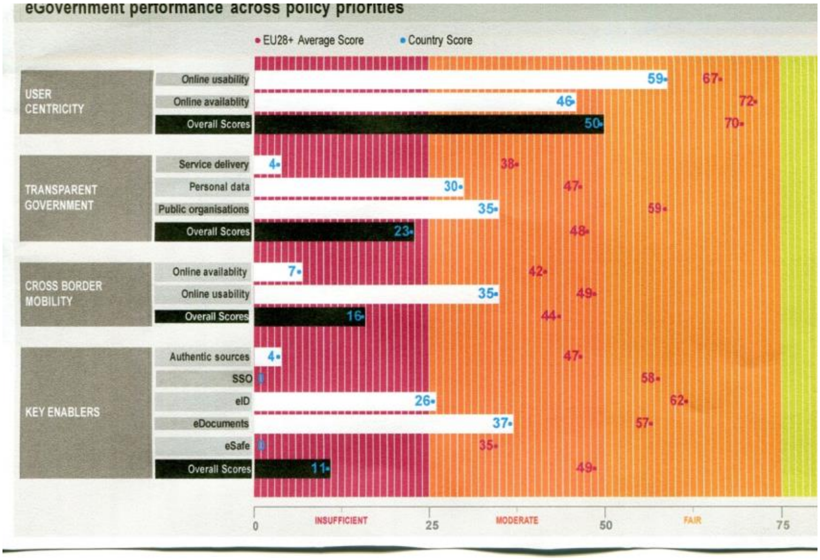


Figure 1. E-Government Performance across policy priorities

- The user centricity indicates to what extent (information about) a service is provided online and how this is perceived by the citizen so, includes the online usability and the online availability.

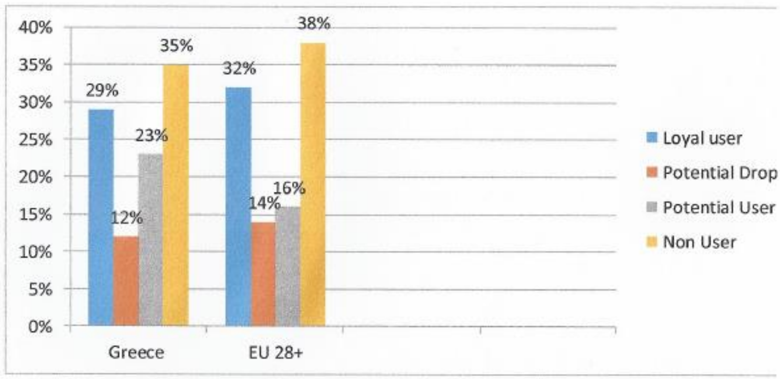
- The transparent government evaluates the transparency of Government authorities' operations and service delivery procedures and the accessibility of personal data to users. This indicator includes: transparency of service delivery, transparency of personal data and of public organizations which mean, controlled assesses of whom and which public organizations manage the citizens' e-file.

- The cross border mobility which includes the online availability and the usability. Online availability and usability determine to what extent information and services are fully online, with the relevant feedback available.

- The key enablers includes the authentic sources which are base registries used by Public authorities in order to automatically validate or fetch data relating to citizens or businesses, the single sign on (SSO): which is a functionality that allows users to get access to multiple websites without the need to re log in multiple times, the electronic identification (e-ID), is an electronic identification which declares if the user is who he claims to be, the electronic documents, which includes all the document which are used, delivered and sent by Internet and the electronic safe (e Safe): which is a virtual secure repository for storing, administering and sharing personal electronic data and documents.

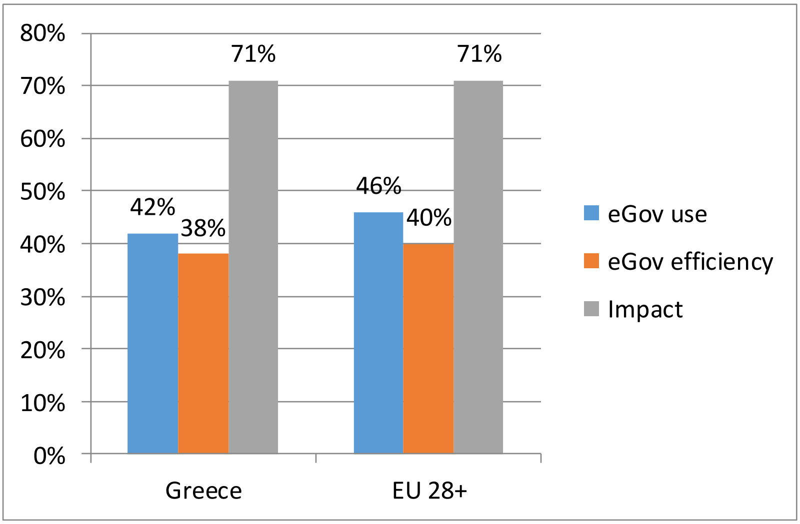
Figure 2. About the E-Government Users according to the latest EU research (2014)

Figure 2. About the E-Government Users according to the latest EU research (2014)



The benchmark of Effective Government indicates the extent to which government succeed in satisfying their online users and achieve re-use and fulfilled expectations and includes the indicators e-Gov use.

Figure 3. Effective Government



So, total we have :
Completion rate of e-Government services

% Completion rate of e-Government services	Greece (2010)	Average of EU 27 (2010)
Services for citizens	65%	87%
Services for enterprises	78%	94%
Total of existing 20 model e-services	70%	90%
Indicators of Fully e- accessibility	48%	82%

Since 2012, there have been many efforts in order to be raised these percentages of e-government services, to increase the citizen satisfaction and to minimize bureaucracy, delays and disorders in Public sector.

Greek Public Management is trying to adopt the use of information technologies in it's services. The operation of ERMIS portal in where the citizen could make the basic exchanges with public authorities through internet as long as they have been identified by the authorities, for using this services, the implementation of diaygeia project, which includes the transparency of any administrative or financial public decision, the taxis net services, are some significant actions, which are implemented by the Greek authorities for the e-government plan in Greece.

The issues that has to be enforced and encouraged by the next era 2014-2020 are the accessibility of all citizen especially for the vulnerable groups, the interoperability of all data systems for the public sector, the open data, the simplicity of administrative procedures, are some action which have targeted in reducing of cost and time for those procedures and reducing of beaurocracy. One significant area in which the Government in Greece has to be focused is the creation of the unique citizen data entry points in order to be one reference point for all public sector and for everyone to be able to access the data, with the appropriate security and transparency as Eu laws declares, a long term strategic plan for information technologies implementation in public sector. Also simplifying the regulatory and institutional framework is important, so that citizens and the markets feel that Greece is a safe and valid environment for business and life also.

12.5. E-Gov in Education

Order to Greece to make implementation of new management models and the Target Models also, in higher education, as it tries to happen in Public Administration in Greece, will be made:

- Recording cost
- Recording objectives and strategic planning of each department and institution under at least five years
- Recording processes occurring both at administrative and educational level
- Measurement of effectiveness - efficiency, ie. Internal assessment - self-assessment and evaluation, with continuous improvement movements and measurements.
- These parameters should be considered and done through internal and external evaluations of departments and institutions in general, actions which are also provided, law enforcement databases and international quality frameworks such as the organization ENQA, the principle of quality assurance in educational institutions and implemented through the Quality Assurance Agency in Education in Greece (ADIP authority in Greece). ADIP is an umbrella independent organization in Greece which is responsible for the quality assurance in education institution in higher education.

"The European Credit Transfer and Accumulation System (ECTS) is a tool that helps to design, describe, and deliver study programmes and award higher education qualifications. The use of ECTS, in conjunction with outcomes-based qualifications frameworks, makes study programmes and qualifications more transparent and facilitates the recognition of qualifications.” The European Credit Transfer System (ECTS), which is already applied in many European higher education institutions is a useful credit granting and transfer tool, which was originally developed and experimentally been applied widely in the Member States of the European Community, from 1992 to 1993 and we can say that is an element of el-government in education, since it contributes to facilitating academic recognition processes between the collaborating institutions in Europe through the use of real and generally applicable mechanisms. ECTS hides an organized management system, continuous self-assessment and evaluation of the education system, competitive and comparable to encourage mobility of students, and staff of institutions, since it requires constant vigilance and reform, both the educational process, but also offered services, infrastructure, personnel, etc. Our institution implements ECTS with success since 2011.

We could declare that the European Credit Transfer System (ECTS), is a system of e-governance of higher education institutions, since it provides a code of good practice for optimizing the organization of academic recognition and enhances transparency, comparability and equal weight between the respective object of study programs in European countries and raises the need for a single European Qualifications Framework. But how the e-government brought changes in higher education in Greece;

12.6. Case Study: PUAS

The case study applied in PUAS has given some distiguitive results but let present our Institute.
Synopsis of the profile of PUAS

Piraeus University of Applied Sciences (Technological Education Institute of Piraeus) is an independent and self-governed Institute of higher education. The operation of the Institute is based on the Greek laws 4009/2011, 4076/2012, 3549/2007, 2916/2001. The degrees offered are recognized by the Greek state and EU and are fully evaluated. The studies in the Departments of Piraeus University of Applied Sciences (Technological Education Institute of Piraeus) for the first level degrees are lasting four years typically and are equivalent to 240 ECTS, according to the Bologna Process Guidelines.
After graduation, the new scientists may continue their studies in the second level (MSc) programs that last one to two years weighted 90-120 ECTS. Then, a third level course is possible for PhD studies in collaboration with several Universities in Greece or in European region.
The campus is extended on an area of about 100.000 m2 in the middle of an olive grove, which includes some of the very same olive trees that used to shade Plato's Academy. The campus is near the center of Athens and the port of Piraeus and includes several buildings with the equivalent of 50.000 m2 space. Among them the Conference Center and the library are encountered. There are facilities that cover all students' needs and support academic activities.
Nine (9) Departments exist in Piraeus University of Applied Sciences (Technological Education Institute of Piraeus) , grouped in two schools:

12.6.1. Engineering School:

- Automation Engineering Department
- Civil Engineering Department
- Computer Systems Engineering Department
- Electrical Engineering Department
- Electronic Engineering Department
- Mechanical Engineering Department
- Textile Engineering Department

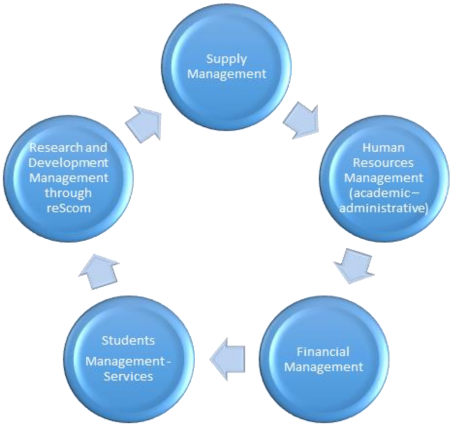
12.6.2. School of Business and Economics:

- Accounting and Finance Department
- Business and Administration Department

PUAS has awarded a DS label for the system of Higher Education alignment procedures. There are also about (19) Postgraduate Programs at the second level (Master). Some of them are autonomous and are governed by the TEI of Piraeus rules. There are also programs that are organized in collaboration with several Universities in the European area and the United States.
Educational institutions in Greece, often focus only on the purely educational function, regardless of the other services offered to the students themselves, having the excuse especially in Greece, that the Central Government as long as the education in Greece is a free privilege, is responsible for the targeted institutions and the wider course are provided the finances and decide that for most of their actions, but this is not entirely correct, since it is simultaneously self-administered and some actions may be performed by them.

The Information System of PUAS is based on ERP Guidelines.

Figure 5. ERP Guidelines implemented in PUAS



Our Information Technology System includes the following subsystems:

- Data Management undergraduate and Graduate studies and curriculum
- Internet via student services
- Service Teachers online
- Report Manager
- Management Statistics
- Student Services for the Food and Care services
- Data Management academic and administrative personnel
- Data Management Procurement and Supplies
- Download Documents from external file
- Data Management of Business register for training and employment of our students

Also in our next step will be:

- the creation of a data base for the research activity for all academic personnel,

- the Textbooks management and Scheduling Galleries through IT

The Research and Development Department which has annual budget about 2 million Euros manages all the EU and non EU programmes and has a separated Information System reScom, which offers an integrated project management of all research project (timesheets, economic managements, management of work packages, etc).

In the following chart we can see the comparative data for the provided services for students before 2009 and after 2009 in PUAS:

Administrative support of the department in our Institute	Before 2009	After 2009
Students registration (not for the new ones)	100% physical presence	100% electronically with the use of unique password for each students
Various applications (as for marks, etc)	physical presence 90% through one stop shop KEP 5% phone services through KEP (1502) 5%	physical presence 30 % through one stop shop 10 % E-MAIL 10% e services 50%
Administrative procedures and communication with other parties	physical presence	E-MAIL : 55% FAX:25% physical presence: 20%
Diploma and calculation of the score	manual	e-system 95% manual 5% (old students)
Student card	manual	e-systems with the collaboration of institute, ministry of education and private party who has this authority

Figure 6. Provided Services for students in PUAS before 2009 and after 2009

So, we realize that e-government in the higher education institutions, enables the simplification and transparency of procedures, such as recording the scores and the degree grade calculation, in order to directly serve the student with quality and safety (limiting fraud in assessment process), but also affects the educational process itself, with introduction of open academic courses, with the existence of e- course and e-lectures provide (with e-additional information materials and simulations for the laboratories courses and the existence of an ambient cloud (cloud) for each course) but also encourages the existing of platform for sharing of ideas and techniques between the involved parties overcoming distance and accessibility. Furthermore, social media already become prominent in educational procedures initially by the students themselves, as a means of communication and exchange of views, but may be used by the institutions themselves for hanging emergency communications, etc.

The objective of open academic courses, is the completion of the project to provide as many courses online, the corresponding digital material available with creative commons licenses both stakeholders (students, students) and the general public through asynchronous learning platform but generally available material through video-conferences or general multimedia podcast type material and other interactive educational materials that will help to encourage the student to learning through creative learning channels.

At our institution, here is how they are applied;

Regarding the educational process and the services available to students:

In recent years we have implemented ECTS system since 2011 in full, which facilitates the movement or transfer of credits for students in other European countries and

the implementation of a quality system record of ongoing procedures, questionnaires to students who respond to the provided services and process them with a view to continuous improvement and monitoring of performance indicators and the educational process.
Also, e- secretariat services have been implemented so many services provided to students are made electronically through identification of students. These services are offered to all existing students rather than to newcomers required in the first stage of their physical presence with the documents required for enrollment in section and receipt codes for electronic services through the information system. Then the scores, statements that may be needed by students from the department, is something provided electronically through the information system and greatly reduce the service time student, ensure transparency of the process and reduce costs, since fewer required people in physical presence to serve the students in person.
Already implemented at our institution the "Open Academic Courses", through the platform moodle, with the aim of strengthening and time to multiply, so some courses in all departments, can be fully electronically offered. Through the program of Open Academic Course, provided knowledge and given aid and Professors and students to have access to the communication platform and develop digital lectures, digital tutorial material for students who need it, etc., thus reducing the cost of education and the notes or educational books too.

12.7. Conclusion

In conclusion, we can say that in Greece despite the economic crisis, we are encouraged to implement e-government of public services, while in the area of public administration as well as in education, but we should note that higher education institutions in Greece have no other financial resources outside of state funding, leading to absolute dependence on it, in terms of both their staff and the services provided to students, so this fact makes all the effort more complicated.

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13. “Enhancing Smart Cities: 3D Printing for Higher Education Research and Innovation”

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a. ABSTRACT:

Smart cities and 3D printing technologies are attracting unprecedented attention with signs that they will be key drivers of societal and economic change. Yet, the connection in how 3D printing can enhance smart cities remains understudied. To this end, this paper argues that 3D printing has widespread applications across higher education and smart city settings through the opening and democratizing of innovation. Accordingly, several examples of recent 3D printing developments and smart city advancements are presented. However, higher education institutions (HEIs) must also be mindful of the social, ethical, and legal challenges involved with 3D printing research, integration, and democratization. Reflecting on the Triple Helix Model of university-industry-government relationships, this paper concludes that HEIs should take the lead for 3D printing and smart city

collaborations. It is only through this leadership that 3D printing's positive uses will prevail over the potential pitfalls that this disruptive technology is capable of.

b. Introduction

i. Smart Cities Basics: The What?, Why?, and Why Now?

Discussions about smart cities are gaining momentum around the world. Integral aspects and/or parallels of smart cities such as sustainability, integration, and resilience are now taking center stage in public policy discourse and agenda (Moir, 2014). Accordingly, grand research projects are carried out to tackle the challenges of future cities (e.g. the City of the Future Initiative, 2015). Against the background of such developments, this part briefly discusses the different conceptualizations of a smart city along with an explanation of why it is receiving unprecedented attention from a widening group of stakeholders.

Based on a study conducted by Moir (2014) that surveyed various communities of interest (e.g. citizens, government, and academic institutions) to describe their ideal future city, the most recurrent depiction given was 'smart city'. However, when it comes to what this term entails, there is no consensus among the respondents. Correspondingly, there also is no agreement among scholars with some narrowly equating it to the extensive use of information and communication technology (ICT), while others expand the definition to incorporate additional characteristics like sustainable socioeconomic development (Gamero, 2012; European Union, 2014). Moreover, the fact that several terms ('Intelligent City', 'Knowledge City' 'Sustainable City', 'Talented City', 'Wired City', 'Digital City', 'Eco-City') are employed by different scholars to refer to smart cities also adds to the confusion surrounding the concept (European Union, 2014, p. 21). Considering these complexities, and in the absence of an internationally accepted definition, this paper follows the European Commission's (2015) characterization of smart cities because of its comprehensiveness:

A smart city is a place where the traditional networks and services are made more efficient with the use of digital and telecommunication technologies, for the benefit of its inhabitants and businesses. It means smarter urban transport networks, upgraded water supply and waste disposal facilities, more efficient ways to light and heat buildings, more interactive and responsive city administration and safer public space.

Hence, the term smart city encapsulates Smart People, Smart Living, Smart Governance, Smart Mobility, Smart Economy and Smart Environment (European Union, 2014; Komninos, 2014, p. 29).

Cities have been absolutely pivotal to human civilization for numerous reasons of practical importance. In addition to being places where sizable populations of people and most business organizations reside, cities are the building blocks of a country and the engines of socioeconomic development (Gamero, 2012; Moir, 2014). What is more, cities account for 80% of global energy consumption (The Guardian, 2012). Nonetheless, considering that the above mentioned facts have been true for centuries, it makes one wonder, why are more energies being focused on urban planning now compared to the past?

A series of interrelated developments could be cited in this regard. First is the rapid advancement of ICT and its impact on the balance of power. In particular, the unprecedented growth in data, (often called "big data") and, more importantly, efforts to make it accessible to the community at large (often called "open data") has increasingly empowered various stakeholders (Gurin, 2013). Nowadays, citizens are more conscious about city initiatives and demand greater transparency and accountability (Institute for Technology, 2015). The media is also more powerful than ever before and philanthropic organization can make their voices heard by mobilizing greater support for their causes through various channels including the internet. Such developments are piling more pressure on governing bodies.

Second is the accelerating pace of urbanization. According to an estimate by World Health Organization (WHO), in approximately three decades more than half of the world's population will reside in cities (as cited in The Guardian, 2012). This has its own economic, demographic, social, and environmental implications. Third is the advent of indexes that evaluate different qualities of cities. As noted by Vienna University (2007), for more than two decades city rankings have become an appealing indicator to a wider audience (e.g. the Quality of Living Worldwide City Rankings – Mercer Study) (Mercer, 2015). This has also added to the internal and external demands being placed on government officials to improve local conditions. Fourthly, the growing awareness of important issues that are plaguing overcrowded cities such as air pollution caused by escalating emissions and traffic congestion from more cars on the road. Moir (2014) contends that many urban challenges are the products of decisions made several years ago. In the same fashion, decisions made now will shape the composition of cities in the years to come. This line of argument is described in economic and social science circles as 'path-dependency'. It is based on the logic that governing bodies, feeling the impact of their predecessors' actions, become more cautious about the sustainability of their own decisions, to avoid the so-called negative lock-in. This has also given impetus to the smart cities discourse.

To sum up, all the aforementioned developments point in the direction that smart cities will continue to be at the center of national and international public policy discussions for the foreseeable future.

c. 3D Printing: An Overview

We live in the Knowledge Age where a nation's wealth and prosperity is contingent on the stock of knowledge at their disposal. This is particularly intertwined with the issue of technological innovation that is frequently transforming human life as we know it. Thus, today's economic developments are rooted in the creativity of citizens and their ability to convert their inventive ideas into reality (Rosenberg, 2004; Divining Reality, 2014; Organization of Economic, 2012; Cohen, 2011).

Although as apparent as it might seem, it took economists a while to identify the innovation-economic development nexus. Particularly, Russian scholar Kondratieff first identified the role of a disruptive innovation for the revival of the economy. He justified his argument by providing several 19th and 20th century examples from the steam engine, railways and electrical engineering to petrochemicals, the automobile and information technology with each innovation reviving the global economy at different points in time (van Lambalgen, 2014). The Austrian scholar, Joseph Schumpeter, building upon the work of Kondratieff also reaffirmed the importance of innovation, which he framed as "creative destruction." (Divining Reality, 2014). In light of this, various stakeholders are making a concerted effort globally towards fostering innovation.

Among these innovative endeavors, 3D printing is one that has caught the attentions of business practitioners, academics and technology enthusiasts. 3D printing, or additive manufacturing as it is professionally called, involves "the process of creating an object using a machine that puts down material layer by layer in three dimensions until the desired object is formed" (EDUCAUSE, 2012, p. 1). Several file formats using computer-aided designs can now be 3D printed. (Z Corporation, 2009). With respect to raw materials, different inputs can also be utilized to create three dimensional objects. However, the most common techniques include plastic filament extruded through a nozzle (Fused Deposition Modeling), liquid resin hardened by a laser beam (stereolithography), or powder sintered by a laser (Selective Laser Sintering) (Sauramo, 2014).

Additive manufacturing began surfacing in the 1980s. American engineering physicist Charles Hill is attributed with making the first 3D printer in 1983 (Wohlers & Gornet, 2012). Since then, 3D printing has gone through several changes. A notable breakthrough is Massachusetts Institute of Technology (MIT) advanced 3D printer that they named "Darwin". It is considered a landmark in the 3D printing field as the first machine that was capable of fabricating its own replacement parts (McLellan, 2014). Similarly, the industrial reach of 3D printing has seen significant improvement. According to a research and consulting firm Canalys (2015), the market of 3D printing is now estimated to be over 3 billion USD with this figure expected to grow fivefold in the next half decade.

Despite 3D printing's achievements, a number of scholars are still skeptical about whether or not additive manufacturing will transform the global economy. This is understandable with the vast majority of technological innovations being unable to survive in the marketplace even for a short while, let alone bring about significant economic development. In response, there are advocates like the Computer Science Corporation ([CSC], 2012) who defend that 3D printing will live up to the hype. Referencing the conceptual framework developed by Dr. Clayton Christensen at Harvard Business School in 1997, CSC contends that 3D printing satisfies the criteria of a disruptive innovation. More specifically, they point to the fact that this emergent technology is getting simpler, cheaper, and more convenient when compared to the conventional manufacturing methods (Sauramo, 2014).

From the literature, other research also reinforces pro 3D printing claims such as those made by CSC. Additional supporting arguments include: (1) the remarkable technological improvements 3D printing has undergone; (2) the drastic decline in the cost of production; (3) the rapid expansion of the technology to different industries and; (4) increased attention and commitment from various governmental and intergovernmental entities (see Diriba, Fraumann, & Maes, 2014).

To recapitulate, the main premise of this subsection is that 3D printing is here to stay. This begs the next question. How can 3D printing, through higher education research and innovation, support the enhancement of smart cities?

d. 3D Printing for Smarter Cities

There are two frontiers in particular where 3D printing is showing potential for playing a significant role in the growth of smarter cities. They are open innovation and democratization of innovation. Open innovation is a concept popularized by Henry Chesbrough, adjunct professor at University of California Berkeley’s Haas School of Business. In his pioneering book, Open Innovation: Researching a New Paradigm he defines

the theory as “the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively” (Chesbrough, 2006, p. 2). This is in contrast to closed innovation models where firms maintain strict control over their intellectual property from the research and development phase to production, marketing, distribution, and after-service. In addition, special care is taken in closed innovation systems for security of a firm’s intellectual property rights against violations of use without permission and/or compensation. Meanwhile, open innovation allows for the free flow of ideas to externalities outside the firm including consumers, but also academic institutions, government agencies, and even rival companies.
Similarly, Eric von Hippel, professor at the MIT Sloan School of Management, is renowned for his contributions to the democratization of innovation. This perspective promotes users and consumers as the innovators of new products as opposed to the long held view that focuses on companies and suppliers (von Hippel, 2006). As Björgvinsson (2010) states “innovation has been democratized through easy access to production tools and lead-users as the new experts driving innovation” (p. 1). The effect is a more inclusive approach to innovation that empowers individuals as pioneers of their own original ideas, designs, and services without having to rely solely on manufacturers as the source of all breakthroughs.

3D printing, by its very nature, is a testament to open and democratized innovation. It is “the fabrication of almost anything by anyone, anywhere in the world" (Leblanc, 2014). This is to say that additive manufacturing puts the power of creation in the hands of lead-users to construct the products that they themselves have envisioned. MacDonald (2012) describes this movement as grass-roots manufacturing with some experts even heralding that a digital fabrication revolution is on the horizon (Bass 2014; Federal Ministry, et al., 2013, p. 10 & 85; Universität Liechtenstein, 2014; University of Cambridge, 2014; Ranaldi, 2014, p. 1).

All in all, 3D printing's major contributions to smart cities is not simply the products that this technology is capable of fabricating. Even more profound is the environment that additive manufacturing creates for giving everyday users greater opportunities to actively engage in the innovation process. As the examples in the next section will show, it is this form of democratization and opening of the knowledge-based society that will make cities even smarter.

e. Examples of Research and Innovation for 3D Printing and Smart Cities

Current research and innovation is developing both 3D printing technologies and the growth of smarter cities in various ways. Considering the above mentioned concept of user-based approaches to additive manufacturing, some HEIs are making 3D printing facilities more available to the campus community. Academic libraries are one example where 3D printers are being installed for people to experiment with outside of laboratories (Nicholls, 2014). Tod Colegrove (2014), Director of the DeLaMare Science and Engineering Library, states that 3D printers are fundamentally changing the common understanding of libraries from purely knowledge archives to places taking part in knowledge production and innovation (also cited in Murphy & Leigh, 2014, p. 3).

Another example is the establishment of so-called "Fab Labs" i.e. Fabrication Laboratories (The International Fab, 2014). These Fab Labs are open to the public and offer production space, equipment, and volunteer staff for helping people to bring their innovations to life. Universities also initiate comparable initiatives such as MOVEFAB at the University of La Laguna, Tenerife, Spain. The MOVEFAB project encourages students to engage in the innovation process by providing the necessary background in digital fabrication as well as the 3D printing equipment (Fundación General, 2015).Cooperative efforts such as these go far beyond the original expectations that Tenerife had for 3D printing when the technology was first introduced to the island (Trujillo, 2014).

Similar to Fab Labs is the field of cloud-based design and manufacturing (CBDM). CBDM is a collective means of managing ICT where several users work together online to design, and in the end manufacture a product (Leblanc 2014, p. 3). For 3D printing specifically, FabHub (2015) is a global online network where anyone can locate a qualified fabricator, submit their design, and collaborate for creating a distributable commodity. There are also open source 3D blueprint websites with Thingiverse (www.thingiverse.com) by MakerBot Industries being one of the largest communities of this kind. HEIs have also joined the open source cause for 3D printing with a notable example being Michigan Technology University who have made their schematics for building a 3D printer from commercially available parts (McLeod, 2013).

3D printing is showing potential to create a zero waste society. This may seem like a utopian view, but organizations like the Zero Waste Advocacy ([ZWA], 2015) group argue that this future is attainable. As the leading consultancy organization for zero waste community plans in the United States, ZWA is building on their concept of resource recovery parks to incorporate additive manufacturing that fabricates with the salvaged materials brought to these facilities. ZWA also promotes giving access to the waste streams and 3D printing technology not just for industrial use, but for community members and local businesses as well. If this sustainability strategy spreads, it will have a tremendous impact on the smartening of cities.

On the topic of sustainability, HEIs are also connecting additive manufacturing to green technologies. Returning again to the University of La Laguna, scientists are exploring methods for 3D printing advanced fuel cells for sustainable energy uses (Hernández-Rodríguez et al. 2014, p. 1-2). There is also LuminoCity, an interactive map from MIT's (2015) that fabricate 3D replicas of geographic locations as a means of visually highlighting trouble spots in need of improvement like areas of heavy air pollution or traffic congestion mentioned in section 1.

To a greater extent, there are even the emergence of sustainable and smart campuses. For instance, the International Sustainable Campus Network (2015), an association made up of several universities around the world, hosts an annual conference where topics are discussed on how smart campuses can be achieved and managed. An individual example is the Harvard Office for Sustainability whose function is to aid in the university's teaching and research mission by connecting initiatives and facilitating campus-wide collaboration for sustainability (Harvard University, 2015). There are even HEIs like Universidad Carlos III de Madrid (http://www.uc3m.es) and Universitat Jaume I (http://ujiapps.uji.es/) that have made grand efforts to reach the status of being a smart campus. Collectively, these examples emphasize how not only higher education research and innovation, but HEIs themselves can serve as a model for smart cities, which is a topic that will be explained further in section 3.

f. The Future of 3D Printing, Higher Education, and Smart Cities

In Fabricated: The New World of 3D Printing, Lipson and Kurman (2013) provide a glimpse into the next chapter of additive manufacturing technology. By tracing the history of 3D printing developments to cutting-edge research being conducted today, the authors map what they call "the three episodes of 3D printing" (2013, p. 265). Presently, the first and second episode involve mastering command over physical matter and manipulating its internal structures. This has led to the expansion of available materials that can be used for printed in going beyond plastics to incorporate heavy metals and glass, even food and living cells. 3D printing machines are also now experimenting with blending multiple materials at the nanoscale to create new microcomposites that have extraordinary properties. For instance, scientists at the Karlsruhe Institute of Technology (KIT) have created a ceramic-based material that "has a higher strength-to-weight ratio than the toughest known engineering materials and boasts a density lower than that of water" (Halterman, 2014).

For the third episode, Lipson and Kurman envision that 3D printing will soon control the behavior of fabricated objects. In other words, humans will have the ability to program how products function on their own after they are manufactured. One example they give is automobile bumpers made of compounds that absorb and redirect energy upon impact while then remolding to the original shape with no signs of damage (Lipson & Kurman, 2006). Others include running shoes that use synthetic biological materials called Protocells that self-repair themselves like new overnight (Curtis, 2013). There is also what has been hailed as "reactive blueprints" that adjust to the environment in real time, which allows for variations that could not be anticipated during the initial printing (Lipson & Kurman, 2013, p. 257). This includes post-design adjustments based on the specific circumstances surrounding the print job. To illustrate, "a house that needs to adapt to a yet unknown terrain, a bridge that needs to adapt to wind conditions, or a lampshade that needs to compensate for particular ambient lighting conditions" (2013, p. 258).

Combined with other disruptive technologies like robotics and artificial intelligence, the future of additive manufacturing is boundless. Some experts predict that 3D printers will eventually be encoded with competencies that not only sense malformations before they develop, but that can interact with the human operator to assist in brainstorming solutions. Also, that society is not too far from having machines that design, print, repair and recycle other machines in addition to their own ability to self-replicate. As advancements in 3D printing of multimaterial integrated systems improve, it is only a matter of time before internally wired electronic parts will literally "stroll out of the printer" (Lipson & Kurman, 2013, p. 266).

After all, the range of prospects for 3D printing and its contribution to the enhancement of smart cities is only limited by humans' ability to express their imaginations. Greater possibilities are unlocked with every new lead-user that additive manufacturing technologies reach. Engineers and researchers are also hard at work to develop enhanced design tools and machine interfaces that are more intuitive and responsive for printing complex designs with better precision, which will inspire generations of products that have not even been thought of yet.

i. Challenges to 3D Printing Research and Innovation

The transition from mass manufacturing to mass customization is not without potential drawbacks. There are ethical, legal, and feasibility issues that must be considered. It is especially imperative in regards to the adverse consequences that additive manufacturing could cause if left unchecked. This section will look at some of the main arguments against 3D printing.

Ethics. Government and the media are raising concerns about 3D printing on the grounds of dual-use dilemma. This perspective emphasizes that scientific discoveries are capable of not only making positive impacts, but also causing severe harm. Much like atomic energy, jet propulsion, and other disruptive technologies, additive manufacturing can also be detrimental to society. A particular concern is the printing of plastic guns and other non-metallic weapons that can go concealed through metal detectors. Firearms that are 3D printed by individual consumers also have no serial numbers so they exist outside of national tracking systems.

There is also the highly controversial topic involving living cells also known as bioprinting. The technology is now capable of not only building prosthetic limbs, but customized anatomical organs and tissues. This medical accomplishment is praised as lifesaving by some, but condemned by others that fear it will be taken to the God-like extreme of designing humans. It is also resurfacing other ethical debates on subjects such as genetic engineering, the use of embryonic stem cells, and animal testing.

Legalities. At the moment, laws and regulations governing additive manufacturing are almost nonexistent on national and international levels. This situation is compounded by the fact that the future impact of the 3D printing is also difficult to predict accurately. However, there are two legal realms that will inevitably be involved. The first is tort law in determining liability for 3D printed products that inflict personal injury or property damage. To explain this point, imagine a consumer printing a mechanical part for their automobile from a free blueprint online. The mechanical part malfunctions causing the automobile to get into an accident. Who is to blame? The consumer, the blueprint designer, or the automobile company? There is a case that could be made for either of the three parties based on more detailed investigation of the circumstances. In this regard, liability issues such as these are of particular importance for public safety.

Then, there is the matter again of intellectual property. For 3D printing, this legal realm can actually have a bidirectional effect. Companies defend their intellectual property citing their right to receive payment for the 3D printed products that they created, which also risks protectionism and price fixing. On the other hand, small businesses and individual inventors could have their ideas taken by large corporations, modified just enough, and then sold for cheaper. Either way, additive manufacturing inevitably involves discussions about copyrights, trademarks, and patents when consumers have the ability to print anything from the privacy of their own home.

Feasibility. Even considering positive speculations from reputable sources such as Gartner's 2014 Hype Cycle Chart and New Media Consortium's annual Horizon Report, 3D printing is still an emerging technology in its early stages of development. Currently, enterprise-class 3D printers still costing around USD $2000 or more with high-end models priced between USD $100,000 and $1 million (Gartner, 2013; Mearian, 2014). This begs the question, is 3D printing practical outside of experimental labs? Financial consideration are important for HEIs when making decisions about budget allocations and system changes, especially in countries like the UK and the US that are experiencing reductions in public funds while operating costs continue to increase. In these conditions, why should colleges or universities invest in 3D printing technologies when resources are already strained as it is?

Ultimately, there is no question that these ethical, legal, and feasibility concerns must be taken seriously. However, they also should not be reasons to impede the positive applications of additive manufacturing. To an even greater degree, the potentially harmful impacts of 3D printing are justification for why HEIs must be proactive in steering the positive use of this technology for the enhancement of smart cities and the public good. The next section will elaborate on these points.

ii. The Role of 3D Printing Research and Innovation in Higher Education for Enhancing Smart Cities

A number of experts have offered explanations and recommendations for how to organize innovation systems. One of the first theories in this field is Sabato's Triangle, which defends that countries should adopt top-down, government-led approaches for coordinating science and technology developments (Sabato & Botana, 1968). There are also Lundvall (1992), and Nelson (1993) who propose national frameworks for harmonizing complex sets of actors across higher education, private enterprise, and government sectors. Even more recently is the work of Swanson and Leitner (2014) that extends considerations of innovation engagements to the regional level.

Perhaps the most influential theory for describing innovation systems in the past decade is Etzkowitz's (2003) Triple Helix model. Specifically, Etzkowitz recognizes that HEIs do not merely hold supporting positions within innovation systems, but they hold a central place. Namely, as "natural incubators" for innovation with greater "flow-through" of fresh knowledge and young talent than public research institutes or corporate laboratories (2003, p. 324-325). Other benefits from universities that business and government agencies rely on include student laborers, consultations from faculty, and access to physical resources. This is the principal function that HEIs must play as an integral partner in university-industry-government relations.

Additionally, Torres-López et al. (2014) make the observation that HEIs are suitable test beds for the adoption of innovations to cities by and large. In fact, there are HEIs that can be considered cities, in and of themselves, because of their sheer size and vast network of campuses (e.g. the University of California and California State University systems). As mentioned in section 2, there are already smart campuses providing models that cities can follow such as the Universidad Carlos III de Madrid and Universitat Jaume I. There is also the International Sustainable Campus Network and universities like Harvard that offer sound practices. These vanguards are yet another reason why HEIs are pivotal in being an example of 3D printing innovation for other institutions, organizations, and entire cities.

Furthermore, HEIs as a cornerstone of knowledge economies can enhance smart cities via 3D printing research and innovation through their social engagement missions. For one, continuing education and lifelong learning programs could find creative ways to bring aspects of 3D printing into their courses or even offer standalone 3D printing courses. As shown in section two, establishing Fab Labs and setting up 3D printer stations in libraries are also effective methods for offering 3D printing to the community towards democratizing the base of lead-users. Meanwhile, HEIs must find ways to make 3D printing research and innovation more open. This could be accomplished in various ways like contributing to open-source 3D printing blueprint databases or "educate to innovate" projects that give 3D printing expertise and resources to local primary and secondary schools (The White House, 2015).

On the topic of 3D printing's destructive uses, this is an area that HEIs are vital in providing scholarship and policy advisement. Philosophers, political scientists, medical doctors and even engineers can help in expanding the knowledge-base about the ethical and legal complications of additive manufacturing. In the end, like smart cities, 3D printing technology is here to stay. Therefore, it is imperative that HEIs expand awareness about 3D printing through lectures, publications, conferences, workshops, and other academic avenues.

Questions also persist about the practicality and feasibility of 3D printing for higher education and smart city settings. First, additive manufacturing technologies are still commonly viewed as a luxury, especially in terms of their cost and the extent of their capabilities. However, research firms like Gartner (2014) predict that 3D printing for consumer use is on its way to the plateau of productivity within the next decade and even sooner for enterprise-class 3D printers. Referring again to history, disruptive technologies only get exponentially cheaper and more functional with time. Consequently, concerns revolving around 3D printing's practicality and feasibility will eventually wane with early adopters placing themselves in an advantageous position (Gartner, 2013). As the global higher education landscape continues pressuring universities to become more entrepreneurial, it may not be optimistic to say that more funding for 3D printing research and innovation will become available.

Lastly, there is the issue of implementation. How should HEIs approach 3D printing research and innovation for the enhancement of smart cities? There are no simple answers to this question nor are there one-size-fits-all solutions. Every HEI and city should consider good practices and good models, although they must devise their own course of action for integrating 3D printing into their infrastructures. At the same time, HEIs would be wise to follow strategic planning and strategic management guided by institutional research before embarking on any major, system-wide changes (Dooris, M. & Rackoff, 2012). That being said, a case can be made regarding comprehensive efforts for utilizing 3D printing at all corners of the campus. This is a bold suggestion that requires instilling and sustaining a culture of innovation for motivating buy-in from all stakeholders including students, the professoriate, administrators, governing boards, and external partners. Otherwise 3D printing will remain locked away in science and engineering laboratories to be used only in isolated instances.

g. Conclusion

Beginning with an overview of the underlying principles behind smart cities and the progress that additive manufacturing has made since it's invention in the 1980s, this paper showed how 3D printing and smart cities are connected by the paradigms of open innovation and democratization of innovation. Second, examples of recent 3D printing research and development were given to emphasize that this industry is thriving and already having an impact on society. This is especially true in the areas of self-sustainable communities and increasing lead-user participation in the innovation process. Third, this paper concluded that higher education should play a central role in 3D printing research and innovation for the enhancement of smart cities. Specifically, foresight predications about additive manufacturing's disruptive nature emphasize that HEIs are essential to the acceleration of 3D printing's positive contributions while serving as guide for the prevention of harmful applications. Lastly, there are research limitations that are important of noting. As mentioned previously, 3D printing and smart cities are emerging areas of study that are gaining scholarly interest. However, more research is needed about the various manners that additive manufacturing can contribute to smart cities and vice versa. If the scenarios presented in this paper serve as any indication, one could audaciously say that the future depends on it.

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14. “Knowledge Intensive Entrepreneurship Fostering Digital Society”

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14.1. Abstract

The history of active digitalisation started roughly from the invention of transistor. After microprocessors the digitalisation has followed the Moore´s law. Earlier digitalisation was clearly focused on technology sciences e.g. robotics, mobile phones, automation, intelligent vision, neural networks, 3D printing. Slowly also service and client based applications are in a more and more active role. Intelligent construction, intelligent clothes, clean tech, logistics, intelligent healthcare and whole social media. These topics among other things e.g. car tire with it´s own internet address, deal more and more with big data and step by step the whole society is under digital control and guidance and also the intelligent innovation and development procedures are run by complicated digitalised algorithms.
The above development gives us huge challenges and a great part of them are developed, activated and used and the most potential results are run as profited business. On the other hand how many challenges are lost, destroyed, never found or have not got correct push or start-up actions? Anyway the main thing is that to

run and mutually develop this digitalised society is knowledge intensive entrepreneurship. It includes two principles. The first one is that the new enterprises are based on higher education to guarantee the updated knowledge in the young brains. The second one is the role of higher education which is integrated also in the succession procedures of enterprises because that just the point to evaluate present business ideas and take into account business challenges of digital society.

Finnish universities of applied sciences (UAS) have developed several successful activities for promoting entrepreneurship. In this presentation the possibilities of knowledge intensive entrepreneurship are discussed. The discussion is based on the progressive results and the models which are developed during the last years.

Great demands are also set for universities (Entrepreneurial University) where knowledge intensive entrepreneurship is successfully moving ahead. The strong strategic and operational commitment is one of the main things.

Discussion is based on authors' diverse and active experiences, research activities and observations in promoting entrepreneurship in UASes and Universities.

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14.2. Introduction

14.2.1. Big data and digitalisation

In the following we are simply following discussions in Finnish professional media about big data and digitalisation. In car production processies via industrial internet new sofware, new services are produced. At the same time risk of information security are increased (Juha-Matti Mäntylä, Talouselämä 13, 2.4.2015).
Tekes - the Finnish Funding Agency for Innovation has activated new programs for the digitalised future of Finland:

14.2.2. 5th Gear 2014–2019

The 5thGear programme aims to solve challenges related to the next generation wireless data communications, the creation of new business, and rocketing Finland as the leading target for international investments.(Tekes.fi/5g)

14.2.3. Industrial Internet – Business Revolution 2014–2019

The programme aims to renew the business operations of companies through the Industrial Internet and encourage companies from different fields to engage in new kinds of cooperation.(Tekes.fi/ti)

14.2.4. Bits of Health 2014–2018

The programme is mainly intended for companies that utilise digitalisation and strive for international growth and that develop products and services promoting health, the early diagnosis of illnesses, health monitoring and personalized treatment.(Tekes.fi/terveyttabiteista)
Study about the fishermen of big data is telling that most of the bidies in Finland are keeping silent about their project of big data. (Ari Saarelainen, tivi, January 2015, tivi.fi)
Government and cities and pioneers are also very active with digitalisation and e.g. fresh publication of Ministry of Employment and the Economy of Finland is studying how digitalisation is changing the service sector as strongly as in industry creating new business possibilities and new type of entrepreneurship. (Ministry of Employment and the Economy Publications 12/2015, tem.fi)
The above cases are very faraway from the first step of active digitalisation which started roughly from the invention of the transistor. After microprocessors the digitalisation has followed the Moore´s law. Earlier digitalisation was clearly focused on technology sciences e.g. robotics, mobile phones, automation, intelligent vision, neural networks, 3D printing. Slowly also service and client based applications are in a more and more active role. Intelligent construction, intelligent clothes, clean tech, logistics, intelligent healthcare and whole social media. These topics among other things e.g. car tire with it´s own internet address, deal more and more with big data and step by step the whole society is under digital control and guidance and also the intelligent innovation and development procedures are run by complicated digitalised algorithms.

14.3. What does our society look like?

When we are discussing the huge possibilities of digitalisation in business and society it is also worth thinking about how our society looks and how progress coincides with digital success?

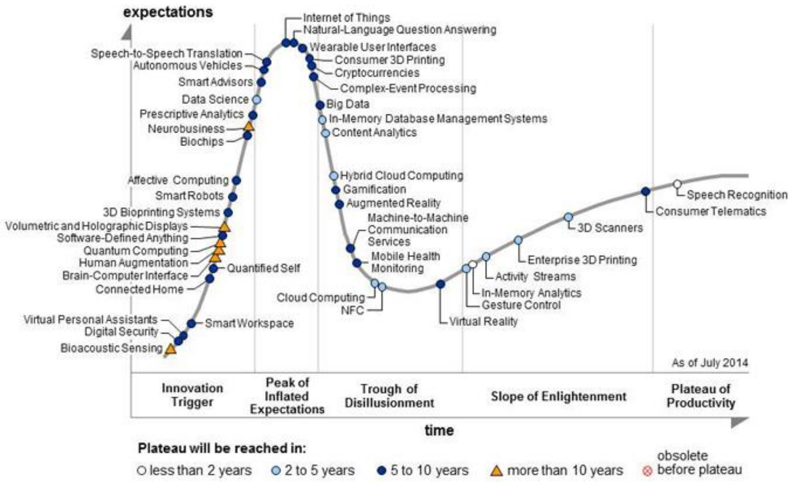
The global population and net productivity have roughly doubled during the last 50 years. Additionally living standards in western economies including Japan has tripled during the last 50 years and now also China and others are increasing their living standard with the same rate as western economies. Although the rate of western economies is slowing down (www.ggdc.net/MADDISON/oriindex.htm, esa.un.org/undp/wpp).

Technology is the main element in Finland when the reasons of the work productivity are discussed. Additional elements are education and investments. Knowledge intensive entrepreneurship is an important element of future growth and it is also necessary when we are discussing the real use of big data.

Planetary boundaries could have drastic effects on the progress of digital society e.g. climate change, nitrogen cycle, rate of biodiversity loss (Rockström et al 2009, Planetary Boundaries: Exploring the safe Operating Space for Humanity). This also connects the aspects of decoupling that the environmental impacts decouples economic activity (gci.org.uk/Decoupling_Report_English.pdf).

14.4. Snapshots of digital society

In the following we will give some examples of digital business/products for the background of the chapter "Entrepreneurial university".
Freely available operating systems are good examples about free distribution just like games, you are getting something free but you pay for additional or professional features. The earning logic based on that distributed volumes are thousands normally millions. One basic feature is also that you can distribute but you can still keep it also yourself. Digital distribution of music is also the same but it´s nature has already felt changes in digital downloads and physical shipments. Net e-business is still only using digital routing instead of conventional logistic. We have different free distibuion models from history e.g. Maxwell equations where you didn´t get any earnings about the equations itself and real winnings were coming if you was engaged with application product.
E-health is one of very active field of digital information but still we are in the situation that digitalisation is used for data storage picking up data and storing the data and essential intelligent applications are lacking to minimize the conventional work not only adding the work load of health professionals.
Gartners hype curve (Gartner Research May 2003) is also important to keep in mind because there are so many inventions which takes too long to get tomarket or never reach the level of profitable business.



14.5. Entrepreneurial university

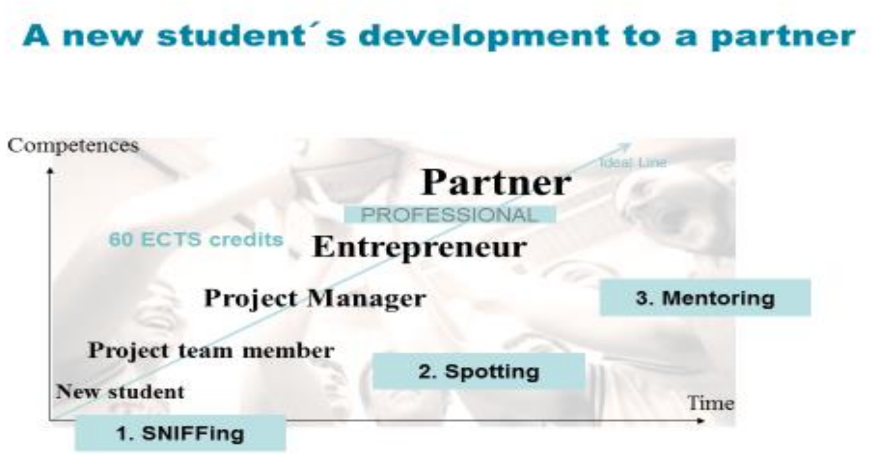
Entrepreneurship in Finnish universities of applied sciences (FUAS) has increased tremendously during the last decade. Entrepreneurship has taken a position as a part of educational processes and educational programs including also real start-ups of enterprises during studies and also as a result normal incubating processes. Also special succession schools are organized in some universities as a part of degree studies for special group of multi-discipline students. Additionally entrepreneurship is active process in master programs, which are focused into management, entrepreneurship and social and health care.

The above great progress in FUAS is partially or totally followed by the strategic decisions just like Turku University of Applied Sciences (TUAS) and Satakunta University of Applied Sciences (SUAS). In both universities entrepreneurship was stated in the strategy as one of the primary goals. Moreover the full commitment of higher management is given which is one of the main criteria to guarantee the progress of entrepreneurship in the university and also the activity of staff who were interested to develop entrepreneur in education and in action. Following our experiences we do argue that these two points are the most essential ones to start to develop entrepreneurship in higher education, but it is also necessary to have support and order from surrounding society (Mertanen, O., Lähdeniemi, M.and Neuvonen-Rauhala, M-L. 2008. Entrepreneurship in action as a result of university's strategic choice. Promoting Entrepreneurship by Universities. The Proceedings of the 2nd Internetional FINPIN 2008 Conference Hämeenlinna, April 20-22, 2008).

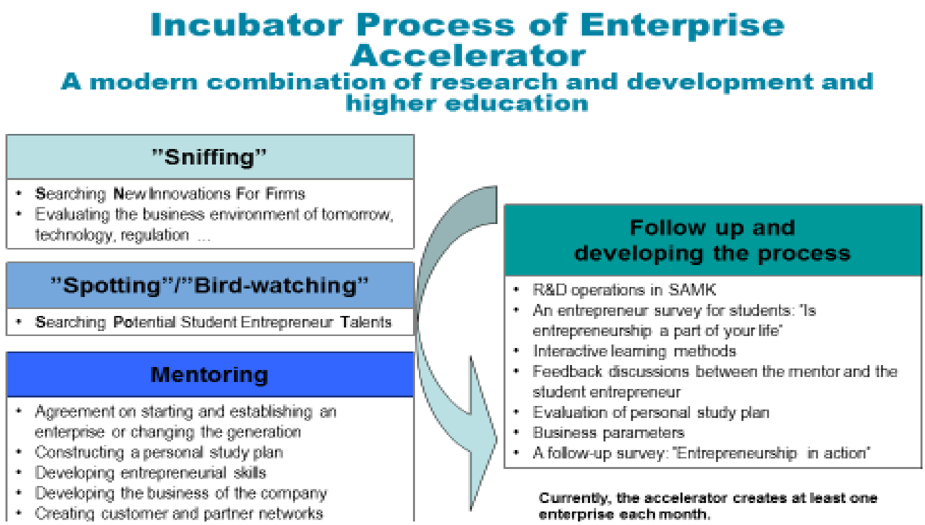
14.6. Enterprise Accelerator

Enterprise accelerator in Satakunta University of Applied Sciences is a combination of knowledge intensive studies and entrepreneurship. It creates student opportunities to become entrepreneurs during their studies. The students have the possibility to establish an enterprise or to continue existing business by succession or business transfer. Students' collaboration with industry during the studies and the R&D -projects as part of studies are creating business ideas and help to find the first clients or partners for students own business. Accelerator's mentoring process helps create needed competences, offers technology and know how backup, ensures basic business skills, and helps in building networks and partnerships. Mentors support the students and the process encourages also growing international.

The model what we also offer as an activation method for businesses of digital society is following the figere underneath.



Incubation process consists of following steps:



It also fits to generational re-placement process and is giving a good tool to refresh conventional business to the direction of digital business.

14.7. Business succession school

The Business Succession School deepens entrepreneurship education from the point of view that in the future there will be changes in the ownership, either because of corporate acquisitions, or because the ownership is passed on between generations in a family business. In Finland there will be about 70 000 enterprises in front of this problem in the near future and the number has been estimated to be over 650 000 in EU.

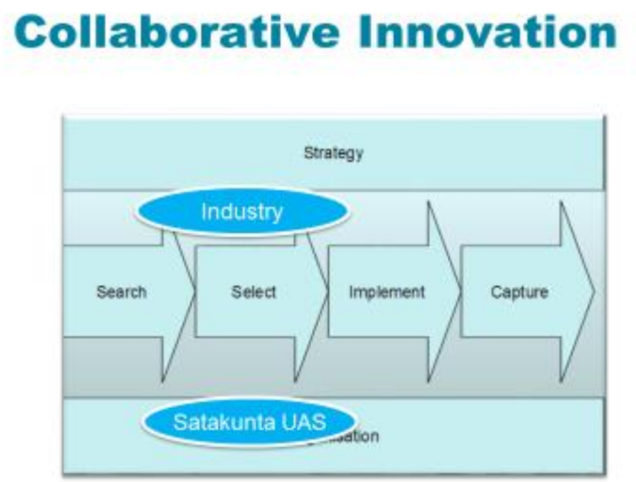
The BSS in Turku University of Applied Sciences is a training program integrated into the university degree, which provides skills to plan and run controlled transmission of the enterprise to the student, who will be able to continue the profitable business and ensure business regeneration. Economically it´s sensible to protect the future of active enterprises compared to the alternative that enterprises finish their operations because of the lack of a successor and somewhere else somebody starts a new business with all the challenges and costs. The SME`s need a program like Succession School to maintain entrepreneurship, their competitiveness and growth.

In the Succession School the network of higher education institutions provide a training programwhich starts with the entrepreneurial potential tests for the students and their personal successor curricula. The training program contains theoretical and practical items about business analyses and business improvement. Pedagogically we use e.g. project work, team work and working in an enterprise, in addition to the traditional lesson methods to activate the innovativeness of the students.

If a student has a family business background, the enterprise and the owner are involved from the beginning. If a student is willing to buy a business but he/she doesn`t have one, the institution searches it with the help of public business organizations and the enterprise is involved, when the program is realized. It`s very important that during the succession process the renouncing enterprise and the entrepreneur accept the process and work together. The transfer can take 3-5 years.

As a result the BSS will ensure the success of an enterprise, which is facing ownership change
When the Succession School is realized internationally, the network of institutions, enterprises and students all benefit from exchange of information, developing the

program and creating business contacts. The project produces economical disquisitions, training packages, a study module and a final report as a concrete outcome. It provides a basis for training to changes of ownership and promotes entrepreneurship.
The above models fit also very well into the process of collaborative innovation.



General and simplified model for innovation process based on Tidd and Bessant 2009, p. 44

14.8. Conclusions

Digital society is moving us from conventional industry to service business where also environmental and lifecycle parameters are being accounted for. Digital business is giving reason for economic growth.
Private sector is doing business but in the case of digital society it is giving a reason to ask do we need also govermental information plans and/or is policy of information also necessary?

Tailored university studies just like enterprise accelerators and business succession schools are necessary because digital business entrepreneurs have mainly university studies and even updated ones.
Digitalisation is giving also for several enterprises in conventional field to go on with profitable business by refreshing up their business ideas with adding value from digitalisation.
The future of digitalised business society based on two principles which set great demands for universities (Entrepreneurial University) where knowledge intensive entrepreneurship is successfully moving ahead.
The first one is that the new enterprises are based on higher education to guarantee the updated knowledge in the young brains.
The second one is the role of universities (universities and universities of applied sciences) which is integrated also in the succession procedures of enterprises because that just the point to evaluate present business ideas and take into account business challenges of digital society.
Finally the main thing is to run and mutually develop our digitalised society with knowledge intensive entrepreneurship.

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15. “Demola Oulu – Ecosystem for Need-Driven Value-Creation Process

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In a strong ecosystem, innovation is based on a fusion of ideas, skills, and perspectives. Demola is the base for such an ecosystem by promoting and developing efficient co-creation methods, driving a cultural change towards open innovation, and enhancing innovation competences both on individual and organizational levels. Demola concept is strengthened by a global network that combines the talent of the students with company R&D activities and university research.

Innovation is in focus which makes Demola clearly different from more practice oriented work based projects. Students have a unique possibility to receive real world project practice, industry contacts, and increase their value of being employable. The great potential is also in the fact that Demola may serve as a basis for international student projects

Demola is a common open platform for where students and universities develop new products and services and together with companies create real solutions to existing problems and challenges. This challenge together with desires for similar ecosystems have inspired also other European regions to adopt Demola.

Focus is on students, and innovative multi-disciplinary projects. Students get contacts with possible future employers, and generally improve their values of being employable. Demola provides an ecosystem with several winners and has produced real-world outcomes and ongoing engagement among participants.

Demola, originating from Tampere, Finland, is a collaboration platform with focus on industry supported innovative product developments. Here industry partners contribute with low risk with product ideas, where multidisciplinary student teams meet those ideas in projects, with their own innovative proposals and prototyping

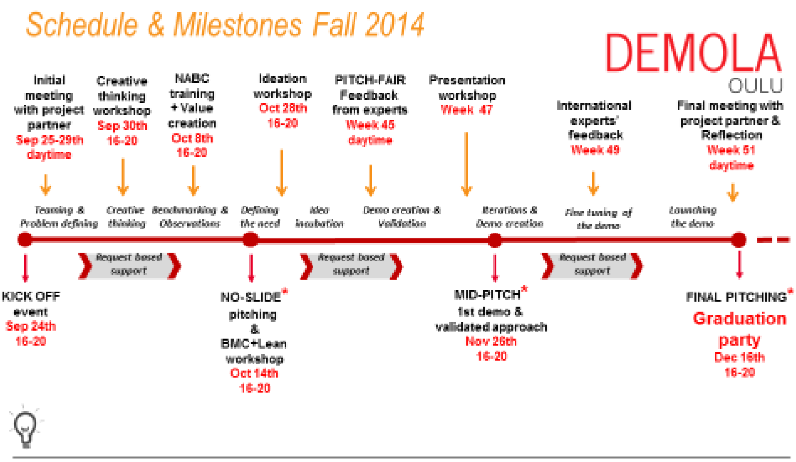
Working on multidisciplinary teams equips students with valuable skills for working life. In addition, they learn cross-discipline collaboration. One multidisciplinary team could have students from several universities (currently from Oulu University of Applied Sciences and Oulu University), Finnish and exchange/double-degree students and even post-graduate students. Team members come from different study programs representing different skills. Currently about 60% of the students are international students.

The projects are real, as they have been handed to the teams by companies or public sector organizations, which motivates the students. We strongly believe that participation in Demola work based (co-creation) learning projects improves their employment opportunities.

Demola Oulu has currently (spring 2015) seven projects and 39 students. Five projects and project partners are from Oulu region and two from northern Norway.

At the starting phase each project is seen as a great opportunity for new business concept for the students or/and employment. Demola is also a great opportunity for the students to show what they can and without any doubts the companies are also using Demola to find and recruit the best talents to work for them.

Demola is not providing sub-contracting type of projects. Demola is a learning environment based on co-creation of the demo/prototype.



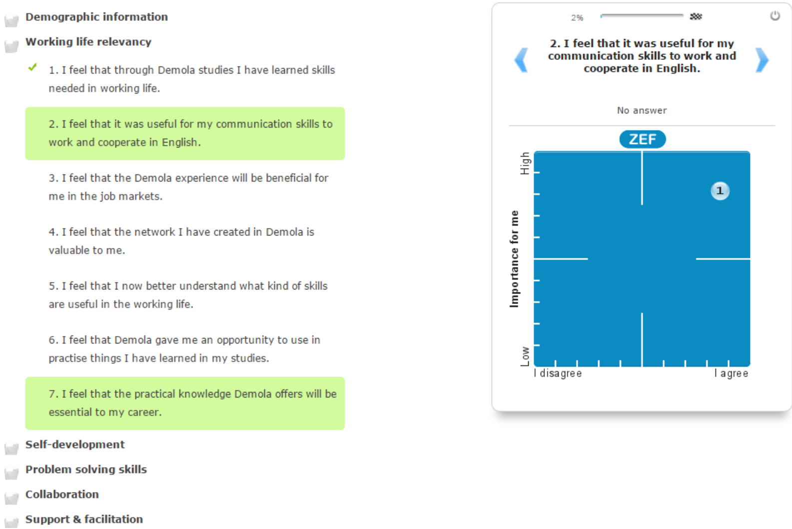
Picture: Demola schedule and milestones (fall 2014).

15.1. Example of the Demola case by the Building Supervision Office of Oulu

The brief:
To further improve the maintenance and usage of buildings, the Oulu Building Supervision Office (BSO) is looking for a project group to develop building measurement and monitoring services. A new product concept is to be created around measurement and monitoring system demo to further improve the quality of new buildings and living.
The housing builders and occupants need a tool to better understand the potential in energy savings as well as the

importance of healthy indoor air quality involved to the usage and maintenance of buildings. How could building measurements and monitoring serve as a tool to educate, inform and help the builders and occupants to use and maintain building correctly? What kind of economic savings could be achieved with certain operations? What kind of user friendly service could be a solution? How would you incorporate both energy measurements with monitoring and building physical measurements with monitoring to the service? During the project the group will develop a demo version of the desired service. The group should pay attention to the user friendliness of the service, finding the right platform and the best ways to utilize the service. The demo service should include both energy and building technical measurement and monitoring elements. For example, the end solution could be a social media service or an application for the building occupant utilizing cloud services. The demo service should include at least one building located in the Hiukkavaara pilot area. For more information, please see www.tulevaisuudentalot.fi. The project requires the use of data processing and monitoring tools and methods as well as simulation skills. The project can include also a 3D-model created in previous Demola-project to visualize the solution.

The learning outcomes and expectations of the co-creation skills and self-development are currently under evaluation in Oulu and other Demola network sites globally.



Picture: Example of the feedback survey for the Demola students.

Previous surveys has shown that meeting students from other disciplines and meeting companies have had the greatest value for the students. Both criteria have a direct connections to employment in the short and long perspective.
Demola network: http://www.demola.net
"Case Oulu ICT-Cluster – Short History, Current Era and Future"
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Oulu is the leading information and communications technology cluster in Northern Europe. We want to be continuously the leading and most agile ecosystem in Europe. Our expertise will cover the whole value chain from the design of components and devices to producing end products and services.

A city can be called a “Smart City” when investments in the human and social capital and traditional and ICT-based infrastructure fuel a sustainable economic growth and a high quality of life, with a wise management of natural resources, through a participatory government (Rantakokko 2012, Caregliu et al 2009). So far, Oulu has been selected twice among the 7 smartest cities in the world. The main reason for this seems to be the strong influence of early use of digitalization in the local ICT-ecosystem.

Big changes have happened in the Oulu region during the last five years due to the Nokia – Microsoft business and the company closing some part of its R&D operations in Oulu.

15.2. Oulu before the year 1990

In the 1980’s Oulu was a typical Finnish average sized city with a regional average sized university and some tertiary educational institutions. Pulp industry, chemical and cable factories powered the local economy.

During the 1980’s radio technology for mobile telecommunication was one of the key topics at the University of Oulu and in the Technical Research Centre of Finland (VTT). A group of researchers had fresh and advanced ideas on how to make new kinds of phones, but nobody knew what kind of a success story was waiting. A lot of international standardization was needed before the first NMT and later GSM phones came out from the laboratories.

A very important innovation outside the technology research was the total change in the education system from the old subsequent to the new parallel model. All levels of labour were educated and trained simultaneously so that the fast implementation of new technology in R&D and manufacturing was possible when the rapid growth started. This kind of implementation was not typical for the industry in earlier decades. The University of Oulu and Oulu Institute of technology transformed electrical engineering studies to electronics, computer science and radio technology. All these new programmes were successful.

Another enabler for rapid business growth was intensive networking and openness between individuals, which was typical in the Oulu region. Most of the people in business knew each other and they had typically studied at the University of Oulu or in institutions now called Oulu University of Applied Sciences. This human networking and trust between individuals was the main difference between Oulu and the rest of Finland and in some cases the rest of the world.

15.3. Is it possible for Finnish people or companies to become the best of the world?

The Finns very seldom thought so except for some individual sportsmen, rally drivers or those in the F1 business. This perception had to be changed before the Miracle of Oulu was possible. How this was made is written in the history of Nokia, a company known in the 1970´s for its rubber boots, car tires and toilet paper. This old industrial company tried several strategic changes during the 1980´s. For example, it took over one of the biggest TV manufacturers in Europe, Schaub Lorenz, and was very active in the first years of PC computer business (Mikro Mikko). The financial situation of Nokia at that time was very weak. None of its industrial divisions was successful.

Nokia changed its strategy and decided to be one of the big players in the ICT world. All other divisions were sold. Now Nokia had two main business areas: Mobile Phones and Mobile Phones Base Stations. Both sectors were located in Oulu, where they found enough trained labour and possibilities to do research and testing. Oulu had also agile companies, which were able to create and produce automatic manufacturing and product testing needed in mass manufacturing of mobile phones in a large scale.

Parallel to Nokia's success story, the self-confidence of the people in Finland and in Oulu grew to a totally new level. The European Silicon Valley was de facto located here. The rest of the world asked: "How is it done?" At that time we did not give exact answers, because we did not fully understand what had happened. Now, after several years it seems to be more evident.

15.4. Oulu in a new millennium

During the 10-year period from 1991 to 2000 the economy grew very fast in Finland. Big R&D investments were made. A big part of those investments was made by Nokia. With regards to R&D investments in Finland, Oulu was in the lead. The share of R&D investments in Oulu compared to the GNP was the highest in the EU and amongst the highest in the whole world.

In education, these were interesting times. Nothing was enough. For example, Oulu University of Applied Sciences educated more than half of all engineers for the

ICT-sector. They got plenty of project and thesis topics from Nokia and its subcontractors. Work opportunities for new engineers were excellent and salaries and share options were high. At the same time, they lost some of their best teachers to ICT-companies. As a public university the salaries were not flexible enough. From time to time the situation in university education was really critical. More engineers were required, but this requirement could not be fulfilled – luckily, because the first ICT-bubble.

15.5. Regional activities and Nokia's influence to the City of Oulu

The capital growth of Oulu from 1990 to 2008 was the strongest in whole of Finland. Companies and labour paid every year more and more taxes. The costs of unemployment were minor. Some of the money was used to build open test platforms and to create open networks, where new mobile technologies and services were tested before they were commercially published. These platforms were designed, owned and run by open organizations where, both Universities, the Technical Research Centre of Finland (VTT), some companies and the City of Oulu were working together in close co-operation. I have had the possibility to be involved in the administration of these organizations.

Two main enablers should be mentioned. The Octopus network (2002) made it possible to test the newest GSM solutions especially in the Oulu area and also worldwide. The widest free WIFI network at its time called Pan-Oulu (2003) gave the opportunity to see how

it influenced users and what kind of business might be created.
When all payers in a certain area put their strategies to the same direction and the timing of both economy and technology is right, a big technological and economical impact is possible. However, not all impacts are positive. The risk level is high. "Do not put all eggs one basket", says an old proverb. This was not done even though this was demanded repeatedly. During the first years of the new millennium many companies in the Oulu region were sold to stock markets. This led to several new rich ex-entrepreneurs, who were ready to put their money to the new SME's in the area. ICTeducation in Universities reached its highest volume in 2002 – one or two years after the top of the ICTbusiness. Suddenly, new engineers could not find work after graduation. The situation was totally new. This shows how difficult it is to regulate education, the length of which is four or five years. It is like trying to change the course of a huge oil tanker.
The welfare of the region still continued to rise. Business went well, even though the growth had slowed down. One of the main indicators, the number of flight passengers at the Oulu airport, grew all the time until the dramatic year 2008. Regional enabler platforms worked well and international co-operation was lively. The City of Oulu did well and was able to make new investments for the welfare of citizens and industrial activities. Nokia and other companies in the ICT-business knew how important it is to create ecosystems and how important it is to put effort to developing new mobile solutions for everyday use. All players did their best, but were not agile enough compared to global development. The economic decline after the year 2008 and some strategic mistakes in Nokia's part made big

changes also in Oulu. Some smaller sections of Nokia product development were sold to international companies, and finally Microsoft bought Nokia in its entirety. The new CEO Steven Elop made dramatic changes in Nokia's strategy, which caused the mobile phone R&D in Oulu to be closed down soon afterwards. In a short period of time, there were about 2,500 unemployed R&D engineers, who had big capacity to work in world-class product development. Was it a problem or a huge opportunity? Probably it was both. If those specialists are unemployed, it will cost Finnish society a huge amount of money. If they are able to do what they do best, there is huge potential for entrepreneurship and are able to attract more and more companies to the Oulu region. The later prognosis seems to be the future. Luckily, Nokia Base Station R&D is still staying in Oulu, and its growth will be a part of the next success story of Oulu. The 5th generation of mobile technology is already waiting in laboratories. The new Nokia grows rapidly also in Oulu.

For years, big changes had been predicted in the ICT industry. Worst case predictions were made on the background. In 2009, a new co-operational network, TERWA was founded. The head of this co-operation was the mayor of Oulu. The universities, research centre, labour officials and other key organizations were also represented. Several plans for future operations were ready for future use. This group got all the information in a very early stage and often even faster than people within the companies. The new strategy of Oulu was formed so that potential was directed in such a way that the impact for economy and business was the biggest possible. One of the first things was to start a new, city-owned organization, Business Oulu, where all separate business support activities were collected.

The development of ICT and its usage has continued after the year 2008 so that by today, Oulu has been selected twice among the world´s 7 most intelligent cities. During the last years, new technologies have been studied and implemented using those methods, which accelerated the growth of the mobile phone industry during the 1990's. The most promising new technology seems to be printed technology, which is mostly used in electronics and sensors. In printed technology, Oulu is the number one in world just now. Printing technology is done roll-to-roll like newspapers. Both the Technical Research Centre of Finland (VTT) and Oulu University of Applied Sciences have their own printing laboratories. This technology and its use is strongly supported by the government. International co-operation is worldwide.

15.6. Oulu in 2015

Many large corporations in Europe are going through a time of transformation. Nokia is a typical example of a company, which owns a lot of patents and innovations that they are not going to use in their core business. Economic circumstances drive corporations to reduce non-core activities and seek for a more dynamic R&D network to meet the future needs of the markets.

This new model of making new business is called Innovation Mill. This type of funding can be used, for example, for integrating new intellectual property into the existing technologies, marketing research, pilot projects, and the development of business operations. Funding is provided by Tekes – the Finnish Funding Agency for Innovation.

Innovation Mill is nowadays driven by a company named Spiverse. It helps corporations to streamline and effectively manage the spin off process to support the core business, and to increase the R&D activities outside the corporation. Clients get help in finding external funding to spin offs from public and private sources and maximizing their probability to successful growth.
The situation in Oulu has been very fruitful for the Innovation Mill procedure due to the large number of well-trained and nowadays free specialists, who want to be more independent entrepreneurs.
Maybe the best bridge between education and companies is the model called Business Kitchen born in Oulu – naturally! Business Kitchen is the first place in Oulu, which truly brings together different actors from entrepreneurial fields under the same roof, presenting a new way for making things happen.
In Business Kitchen, the public sector meets the private sector and the students meet the serial entrepreneurs. They work across organizational boundaries and have found that these crossroads are often the best contexts for creating and trying new ideas. This collaboration does not happen by itself; to engage in the interaction requires a lot of explanation and patience. Their activities are based on co-creation and learning, because what was true yesterday, is not necessarily true tomorrow. The business environment, as well as life itself, is constantly changing.
Today entrepreneurship exists everywhere. Not everyone has to start a company to engage in an entrepreneurial mindset or a feeling of responsibility, these are keys to success in any area of life, whether an employee or a student.

15.7. Conclusion

The development of ICT and its implementation has happened so fast that there has not always been experience enough to handle it. Most agile organizations have earned huge amounts of money. The ICT world has changed very much. There have been bubbles and hype, but also at same time there has been advancement for human welfare and everyday life. During the first years of the ICT boom, R&D and manufacturing was done in very same districts. Later, manufacturing was moved to countries, where labour costs are essentially lower than, for example, in Finland.
Oulu has been and still is the centre of R&D in the field of ICT. There weren't large-scale mobile phone factories so the first phase of change had little impact. The next phase was more serious, because companies in the Oulu region, except Nokia, had not enough own products. Many SME's served Nokia and other similar companies and they were extremely dependent to this very strict business-model. After the crisis of 2008, the situation has now changed very much. The Oulu region gives now birth to more new product and service-oriented companies than any other region in Finland. Support mechanisms for these small companies have been created. Regional and global networking and business support is efficient. New technologies, that is printed technology and 5G will create new business. Many international companies have opened new offices in Oulu. Education is deeply involved in new kind of challenges.

Oulu is and will be among hottest hot spots in future technology!

16. “Digital Signage – Cloud driven Smart Display Solutions”

Ing. Felix EDELMANN MSc
Helix, Austria

Digital Signage has now evolved to a well adopted and mature technology and reached the plateau of productivity in the technology life time circle. Five years ago, the trend for dynamic information at the point of sale (POS), point of information (POI) or in the corporate environment had just started to gain traction. Today, professional displays directly connected to the cloud are everywhere and a must have for most retailers, the traffic and transportation sector, leisure time, recreation areas and sports. We see a clear trend moving most out of home (ooH) information away from paper and bill boards toward digital out of home information (DooH) means Digital Signage. The range goes from small electronic price tags for shelf-label to the world’s biggest video wall, the Suntec Singapore consisting of 664 pieces 55 inch full HD screens.

In the past Digital Signage displays were usually retrofitted to an existing shop design. The majority of displays were standalone wall or ceiling mounted. Today, Digital Signage is an integral part of shop design and usually integrated in furniture and shelf concepts.

Today and in the future professional displays will more and more integrated with various touch and sensor capabilities recognizing people, gender and age to enable customers a barrier-free and interactive user experience.

More and more of the professional displays are becoming smarter in multiple forms. LG and Samsung provide integrated System-on-Chip (SoC) solutions.

These screens connect to the internet by LAN or WLAN and that's it. No external components like PC´s or media player are needed.
In February 2015 the "Integrated Systems Europe ISE", in Amsterdam was the leading Digital Signage exhibition in EMEA. From 1049 exhibitors 406 where dealing with Digital Signage.
On the software side, browser based Digital Signage Content Management Systems (CMS) are becoming platform agnostic. This enables users to plan, manage and monitor Digital Signage screens not only on traditional PC´s and MAC´s but on platforms as iOS, Android, and others from anywhere anytime.
In a live demo on an iPad, the cloud driven and browser based Digital Signage CMS System Sklera www.sklera.at was shown. You can get your free trial account at https://my.sklera.at/register

17. “Open Data and their Impact on Smart Cities”

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17.1. Abstract

As an intelligent being human never ceased seeking for the means that could improve his wellbeing. To this aim his powerful companion was the technology of each era and especially after the industrial revolution, the technological factors were rapidly and endlessly growing. Through the recent years of the economic crisis the term of a smart city became again to the surface as a constant source of improvement of wellbeing. Major contributor in the expansion role of the smart city project is the citizen who is actively engaged via the open data. Therefore the purpose of this paper is to identify the need of this active involvement by gazing upon the characteristics of the smart city and some possible actions that can lead to its development. Furthermore some characteristic examples of applications as well as some cases of successful implementation strategies are going to be examined.

17.2. Introduction

This digital era we live in, is beyond doubt characterized by the excessive use of the available technology in our everyday activities. Especially Information and

Communication Technologies, hence ICTs, are the leaders in this field. Main purpose of this paper is to identify the role of ICTs in the development of smart cities while analyzing the most crucial characteristics of such initiatives.

The term smart city is not a new one and in fact there are a lot of theories contributing their knowledge within this context. No matter how different one definition can be from the other they all tend to recognize that a smart city is one that uses effectively its digital technologies so as to enhance performance and wellbeing of its citizens, while reducing costs and resource consumption. Furthermore they stress that it is considered important for the development of a smart city the active engagement of the citizens.

This involvement can be maintained by sharing necessary information about the project of the smart city development and clarifying their role in the whole process. And here comes the term of open data, the second important terminology of this paper. So open data is considered a certain type of data that is freely available to anyone, in order to use and republish as they wish, without any copyright restrictions or any other mechanisms of control.

It becomes clear that the citizens must be among the recipients of the content of the open data, in order to be actively involved in the process of the smart city development. After examining the major characteristics of the smart cities and mentioning some possible actions that can be taken, we are going to analyze a strategic example of such an initiative, identifying at the end the success factors of such projects. Then some aiding applications are going to be studied and a small classification of the smartest European capital cities is going to be presented. Finally the overall impact and the benefits to the society are going to be presented.

17.3. Smart city characteristics

Many efforts have been done by the researchers of smart city projects in identifying the general attributes that define the term smart city. As it is was obvious a great number of these attributes occurred making difficult the shorting process. Therefore all these attributes were classified into basic groups forming this way the six general categories of the characteristics of smart city initiatives. These categories are smart economy, smart people, smart governance, smart mobility, smart environment and smart living and they all interact with each other as shows the figure below.

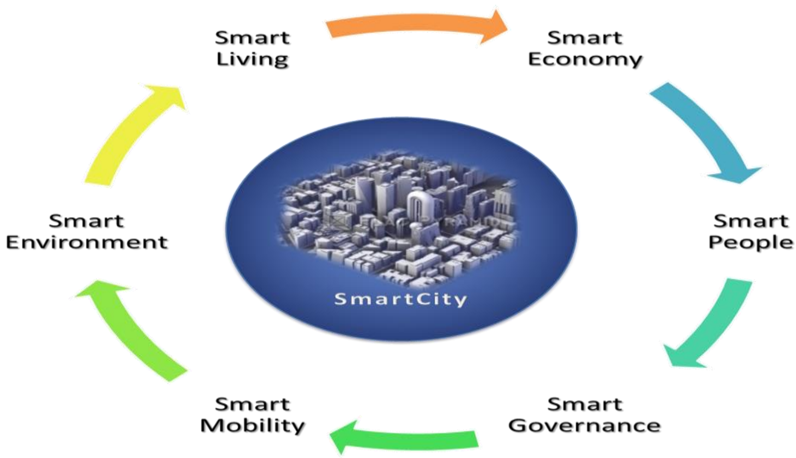

Figure 1: Smart City Characteristics

A smart economy is one with a constant appearance of innovative spirit and entrepreneurship, which leads to the establishment of a strong economic image and trademarks that increase the productivity level.

Furthermore the flexibility of the labor market as well as the international embeddedness offer to the city the ability to transform so as to cope with the challenges of the demanding environment.
Smart people are not only characterized by their qualification level, but also by their affinity to lifelong learning without setting any barriers to social and ethnical plurality. Such people are flexible, creative and open minded to any new and innovative ideas, while at the same time they are willing to practice these ideas through their participation in public life.
Smart governance is actually formulated by the level of participation in the smart city development and especially participation in decision-making and the organizing of public and social services. The most important thing is that the governance must be transparent and with clear political strategies and perspectives.
Well planned transport and ICT define the level of smart mobility. The sure thing is that the city must be accessible both locally and internationally and the availability of proper forms of ICT infrastructure will lead to the formation of sustainable, innovative and safe transport systems.
An environment with attractive natural conditions and minimized pollution factors is characterized as a smart environment. Cities that have such kind of an environment contribute a lot to the environmental protection policies through a proper sustainable resource management system.
Finally well-established cultural facilities and proper housing quality that enhance health conditions and individual safety are the major components of smart living. In additional suitable education and touristic

facilities together with social cohesion lead to increased touristic attractivity.

Analyzing a bit more the above-mentioned characteristics someone can easily identify possible actions that can promote the smart identity of a city.

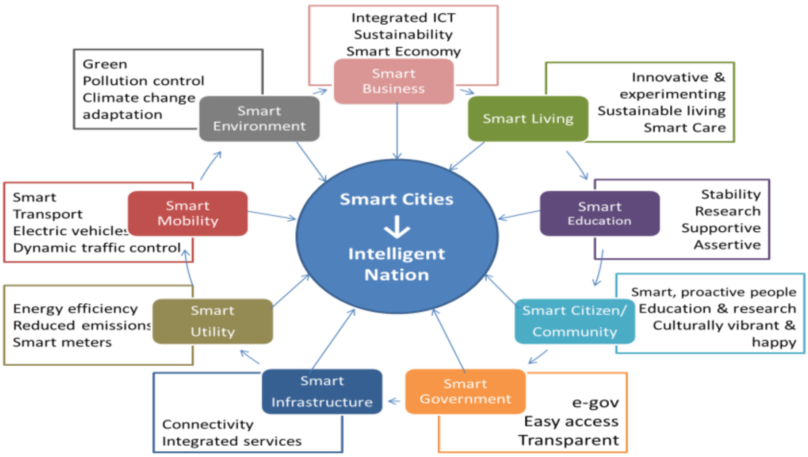

Figure 2: Possible actions that promote the smart identity

For example a city that cares for its citizens and their wellbeing can promote its smart environment by growing the spaces of green and taking measures in order to control pollution as well as being adaptive to the climate change.

17.4. Smart city strategy (Intelligent Thessaloniki)

Smart city initiatives need to increase public awareness in order to be successful. This role has been undertaken by the existing ICTs of the cities. An example of such implementation comes from Thessaloniki in Northern

Greece, where a remarkable effort is taking place. The project is called “Intelligent Thessaloniki” and it involves the implementation of ICTs in five major districts of innovation and entrepreneurship. Through these digital points there is a continuous exchange of information and ideas that promote more improvements in the field of entrepreneurship and innovation. For instance wireless broadband networks are being installed within intelligent environments that combined with sensors for real-time information processing and alerts enhance the participation of both businesses and individuals to the network communities. More specifically the implemented ICTs in the harbor area assist to the competitiveness enhancement of various port operations. The establishments of such technologies within the central business district facilitate accessibility and mobility matters. At the University Campus these environments offer opportunities for further research as well as facilitating the collaboration of academic and private sector. Finally the existence of smart environments within Eastern technology district aid to the broadening of provision of online technology services for any kind of business activity.

17.5. Success factors of smart city initiatives

Smart city initiatives can sometimes increase the jealousness of some cities and therefore promote the competition among them for the more successful strategy. However, conceiving the essence of such projects as means of competition and not as ways of improving wellbeing, guarantees the unsuccessful effort in carrying out such project. Comparing the smart city project to a business will help us understand better the factors that affect the success of this kind of initiatives. So the factors that consist the criteria of a successful smart city implementation are:

- Management and organization: It is considered the spine of the project that takes care to ensure that the ICTs are going to be efficiently and effectively for the improvement of citizens' wellbeing
- Technology: ICTs are considered the key component of such projects and if all the parameters are taken under consideration, like resource availability, capacity and institutional willingness, the route to success is obtained
- Governance: It involves the well-established cooperation of the various stakeholders of the smart city project, an action that is enhanced by the proper use of the ICTs
- Policy context: It is actually a set of rules and directions for the proper use of ICTs in order to assist to the development of the smart character of the city
- People and communities: A critical point of understanding how projects like these should work is not only the individual citizen with his needs, but also the organized community they participate in
- Economy: The better the economy of a city is organized, the best way it will serve to the purpose of development of the smart character of the city
- Built infrastructure: The availability of proper network infrastructure is considered crucial to the

successful implementation of ICTs and thus the successful way of the smart city initiative

- Natural environment: The better exploitation of the natural resources of the city as well as their sustainability ensure the improvement of wellbeing and therefore the success of the project.

17.6. European initiative on smart cities

There is a European initiative that supports the development of smart cities and its duration limit is the year 2020 when it will cease to count. The purpose of the initiative is to support cities and regions that wish to apply smart city projects in an effort to decrease greenhouse gas emissions by 40%, through the use of renewable forms of energy. Technology plays a crucial part with the means of lowering the level of carbon outcomes both in building premises as well as traffic network. The initiative includes possible actions in three major fields, buildings, energy networks and transport.
To accompany and reinforce this initiative the European Commission draw a directorate that supports the development of smart city initiatives within the European Union. The directorate is entitled “Mapping Smart Cities in the EU” and it covers aspects from the fields of economic and monetary affairs, employment and social affairs, environment, public health and food safety, industry, research and energy and finally internal market and consumer protection. Within this context it offers a series of possible solutions to any aspect of the European countries, so as to encourage any initiative with purpose to promote the smart character of the cities.

In addition it outlines a number of recommendations that assist such initiatives as the above mentioned ones. The list of recommendations includes five thematic categories related to:

- Understanding Smart Cities: research and evaluation
- Designing smart city initiatives and strategies
- Smart City governance
- Supporting the development of Smart Cities
- From Smart Cities to a Smarter Europe: replication, scaling and ecosystem seeding

All the recommendations that are included in the five above mentioned pathways are considered of equal importance to the formulation and growth of smart city projects around Europe. However, the ones that really motivate cities to engage to the chase of the smart character, are these described in the section "supporting the development of smart cities", where initially public authorities at all levels are instructed to use demand-side measures to stimulate demand for city-based smart solutions and also regulatory and procurement authorities are directed to encourage Smart City initiatives by selective use of regulatory forbearance.

17.7. Smart City platforms

Synchronized with the directorate of the European initiative on smart cities the European Agenda contains a digital platform able to support any initiative that is generated within European Union. It is actually an application that offers policies and projects for the proper utilization of ICTs for the environment, mobility, health, public services, trust and reliance. In reality it works as an aiding tool for smart cities initiatives around Europe.

Another characteristic application of a European city, which actually is providing the open data to its stakeholders, is “Amsterdam Smart City” that operates as an innovation platform and it motivates businesses, residents, the municipality and knowledge institutions to suggest and apply innovative ideas and solutions for urban issues.

Also from the other side of the Atlantic Ocean a leading company in the computing technology sector IBM has introduced a series of applications that can be used as guiding tools for various actions that enhance the smart character of a city, with the most characteristic ones being IBM water management center, energy optimization and IBM transportation management center.

All these applications aim to transform the attributes that promote the smartness of a city to open data, in order to be shared among the major stakeholders of such initiatives, so as for the project of smart city development to be successful. In this way public awareness is achieved and makes the citizens main contributors and components of this development process, something that makes these applications a constant source of ideas and innovation.

17.8. Smart European cities classification

Before we proceed with any form of shortage of smart city initiatives we should note that there is no ultimate classification list for the smart city projects. And this is happening because cities can be characterized as smart if only they fulfill some of the criteria, as criteria being the smart city characteristics, with the cases fulfilling the full list of criteria containing only some exceptional few examples. For instance some cities may have constructed an extensive network of bicycle routes, so as to cope with the mobility section, others may have exploited in the best way the renewable forms of energy, while others may have developed a combination of these criteria. Within this context a kind of classification list edited by Boyd Cohen, which consists mainly of European capital cities, is analyzed below:

1. Copenhagen:

The capital of Denmark has been awarded as European Green Capital for the year 2014, due to its lowest carbon footprint per capita achieved through energy efficiency and renewable sources projects combined with the impressive cycling rates at the approximate percentage of 40%

2. Amsterdam:

This city does not only have amazing cycling rates with more than 10.000 bicycles moving daily around the city, but it also has developed the Amsterdam Smart City collaboration that has supported more than 40 smart city projects until now

3. Vienna:

Vienna is well known as a provider of high quality of life for many years mainly through some innovative projects as the "Citizen Solar Power Plant", as well as the testing of a range of electric mobility solutions and the forbiddance of residents of specific areas to own a personal vehicle. But the most impressive project is the renovation of a former slaughterhouse district into an innovation district focused on media science and technology

4. Barcelona:

Barcelona is a respectively newly-constructed city which combines modern architecture with lively streets and it is supporting not only its own initiatives but also international ones, like the Smart Cities Expo World Congress held in its premises. Furthermore it was the first city exploiting e-mobility in a huge innovation district consisting a mixture of smart urban planning and entrepreneurial innovation

5. Paris:

The city has invested a lot on shared mobility with the Velib bikesharing network that extends throughout the whole city leading to a 5% decrease of vehicle congestion. In addition the Autolib carsharing project is an example to be followed by other cities as well. Also Paris's entrepreneurial ecosystem was characterized as the 11th best in the world

6. Stockholm:

With the 40% of its land mass dedicated to green space, Stockholm was rated second in Siemens Green City Index and it was awarded in 2010 as EU Green Capital. The city's extensive metro network figures the highest per capita users leading to air pollution decrease and meeting the viable levels of air quality being set by the World Health Organization.

7. London:

The British capital holds the 7th best position in the world in entrepreneurial ecosystems, while with its congestion zone gains income and less traffic. Also the Olympic Games was the perfect opportunity for London to dedicate more to the greener character, with the characteristic example of the Royal Docks one of the greenest and smartest buildings in Europe

8. Hamburg:
Besides the award as a European Green Capital in 2011 the city has undertaken the largest urban regeneration project of Europe HafenCity

9. Berlin:
The city attracts and retains the creative class leading to urban renewal and economic growth through innovation and entrepreneurship and by supporting a vibrant cultural scene.

10. Helsinki:
An exceptional position among the cities thriving in the Smart Government arena is Helsinki with its more than 1.000 open datasets enabling active citizens' engagement through hackathons. Besides hosting Open Knowledge Festival in 2012, the city also employs its own smart city project Forum Virium Smart City Project hopping to improve quality of life.

17.9. Expected impacts

All the initiatives on smart cities as projects are supposed to have a number of outcomes, where in this as an outcome is considered the impact that this project will have.
Generally three are the sectors who are affected the most, science, technology and competitiveness as well as society. In the matter of science a whole new field is generated with the best exploitation of the digital means,

while applying urban simulation leads to the evolution of smart city models.
And especially through the developments in data mining techniques new approaches to mobility and communication are discovered. Through research cities have the chance to evolve their technological skills and therefore become more competitive and desire to achieve a better position in the smartness scale.
And of course all of the above appeal to the society making it stronger with the feedback that it receives and able to cope with actions that promote the smart character of the city.

17.10. Conclusion

It is important for the smart city projects to engage actively their citizens, who are among the major stakeholders of the smart city development process, in order to be considered successful. And this active engagement involves the sharing of information through open data. In this way citizens feel that they truly contribute to the development process of the smart city and they are able to enjoy the benefits deriving from this. Some of the most characteristic benefits are:

- Increase of energy efficiency and acceptance of renewable forms of energy
- Smart police services generate a crime decrease rate by 25%
- Smart environment systems provide better natural resource management
- Implementation of smart traffic systems improve air quality, reduce traffic jams and increase the use of public transport

- Availability of smart governance and smart living services improve residents' community participation and quality of life.

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18. “Evaluation on reverse logistics system of city waste based on Circular Economy”

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18.1. Abstract

With the rapid development of the city, it generates large amounts of waste. More and more city waste seriously damage city environment. Therefore, how to effectively deal with city waste is urgent issues. Taking reverse logistics system of city waste as studying object, this paper constructs a set of reverse logistics system of city waste and comprehensive evaluation index system based on circular economy. And then give the fuzzy comprehensive evaluation method to evaluate reverse logistics system of city waste. This paper can provide a theoretical reference for the construction of city waste reverse system and evaluation.

Keywords: City waste; reverse logistics; circular economy; fuzzy comprehensive evaluation method

18.2. Introduction

Management of city waste is a priority for urban communities. Actually, the city waste management system can be considered as reverse logistics problem in supply chain management. In supply chain management, the main concerns of reverse logistics are waste management, material recovery (recycling), parts recovery or product recovery (through remanufacturing). Therefore, we can use circular economy theory to deal with city waste. It can solve the problem of environmental pollution very well.

Previous studies of city waste mainly focus on an optimization model of industry waste (i.e. electronic and material waste) and hazardous waste (i.e. nuclear waste). In the area of hazardous waste, an optimization model was formulated to manage problems of transportation routing among transfer stations, disposal facilities, and long-term storage impoundments (Peirce and Davidson, 1982). A regionally hazardous waste management system was developed involving selection of treatment and disposal facilities, allocation of hazardous waste or residues from generator to disposal plants, and selection of the transportation routes(Nema and Gupta, 1999).

A coordinated reverse logistics management system was presented in a high-technology manufacturing zone for the treatment of multi-source hazardous waste (Sheu, 2007). A Risk Assessment Model and multi-objective reverse logistics model was proposed to design a hazardous waste management system for selecting an optimum configuration of management facilities and allocation of hazardous waste to these facilities (Fengjiao Wan. 2013). In the area of industry waste, a reverse logistics system was advanced for recovery of discarded products (Krikke et al., 1999). An inexact reverse logistics model for municipal solid waste management systems was proposed. The application of the model was illustrated through a classical municipal solid waste management case. With different cost parameters for landfill and the WTE, two scenarios were analyzed (Yi, Guo and Li, 2011). A functional model of waste management was proposed that represented supply chains in terms of processes, their interconnections, material flows, waste streams and cumulative costs (Hicks et al., 2004).

Generally, seldom research focused on evaluation of city waste logistics system under circular economy. Therefore, the objective of this study is to develop a reverse logistics evaluation system for city waste management. Waste collection system, transportation system and processing system will be considered in evaluation system.

According to construction and evaluation of city waste reverse logistics system, this paper can provide the theoretical basis for the management of city waste and find out the bottleneck which have influenced city waste disposal system efficiency, then give suggestion for the optimization of management process improvement.

18.3. Reverse logistics system of city waste based on Circular Economy

A reverse logistics management system of city waste involves a number of processes with socio-economic and environmental implications, such as waste generation, transportation, treatment, and disposal and so on. In general, the traditional processing method of waste is incineration, landfill and composting. However, these methods can cause serious adverse effects. For example, incineration needs large investment and will produce a lot of waste gas to pollute the environment.

Nowadays, resource depletion and environmental degradation has restrained economic sustainable development. So, all the countries have adopted the strategy of sustainable development, the idea of circular economy is rising. The nature of the circular economy is a kind of ecological economy. It needs to transfer the traditional model “resources --products -- waste" into a new economic development model "resources -- products -- renewable resources".
This involves the reverse logistics. Reverse logistics is defined by the council of Logistics Management as: the process of planning, implementing, and controlling the efficient, cost-effective flow of raw materials, in-process inventory, finished goods and related information from the point of origin to the point of consumption for the purpose of conforming to customer requirements. Based on that, the reverse logistics management system of city waste under circular economy that we proposed can comprise of three levels of organization (see fig.1):

(1) Waste collection stations which receive all generated waste from each distinct, and separate and transport some recyclable/reusable waste to remanufacturers.

There are two kinds of collection method: mixed collection and sorting collection. Advantages and disadvantages of the two methods listed in Table 1.

Table 1 Advantages and Disadvantages of the two methods

Collection method	Advantage	Disadvantage
Mixed collection	Simple , low cost of operation	Reduce the purity of useful substances and recycling value, increase the difficulty to deal with waste
Sorting collection	Resource, reduction, reduce the cost of treatment	Complex, difficult (need economic strength, legislation and so on)

(2) Waste distribution centers which store and transfer the waste from city collection station to disposal facilities.
With the rapid expanding of city, waste disposal facilities is often far from the city, so many cities built waste distribution center to store waste. Then use large trailer to transfer waste.
(3) Waste disposal/treatment facilities such as landfill, incinerator and composting plant.
In China, we often use the following three kinds of city waste treatment method: landfill, incineration, composting. Their advantage and disadvantage are shown in table 2.
According to the advantages and disadvantages of collection and treatment method, and then combined with the characteristics of city waste reverse logistics system and circular economy; we construct process of

city waste reverse logistics based on circular economy. (See fig.1)

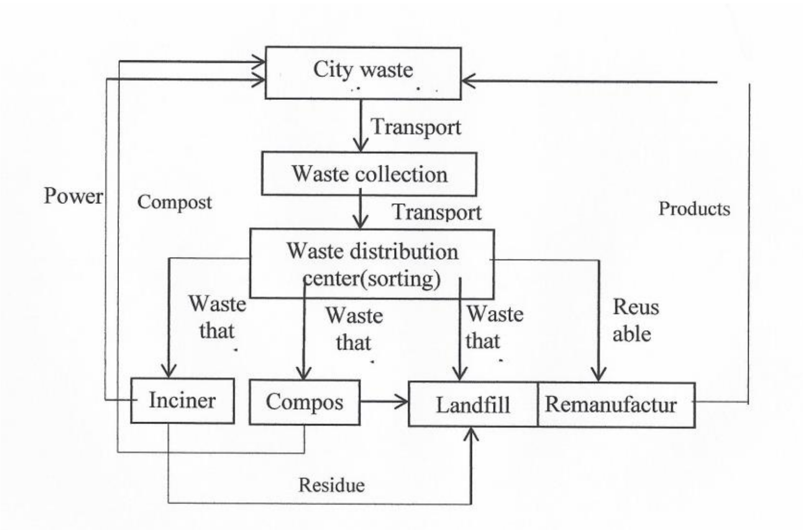

Fig.1 City waste management system

Table 2 Advantage and Disadvantage of city waste treatment method

Treatment method	Advantage	Disadvantage
Landfill	Simple and easy operation, large treatment capacity, low cost	occupy large land, difficult site, hazardous substances in the waste can cause ground water pollution, buried in the field of odor will cause secondary pollution.
Incineration	Incineration treatment thoroughly, make full use of waste heat value	The investment and operation cost is high, the gas generated will cause secondary pollution
Composting	organic components separated from waste can be used as fertilizer	It is difficult to completely decompose organic matter, composting time is long, it may cover an large area

18.4. Evaluation on reverse logistics system of city waste based on Circular Economy

18.4.1. The construction of index system

Based on the process of city waste reverse logistics system (see fig.1), and then combined with the relevant regulations of environmental pollution, we construct the comprehensive evaluation index system of city waste reverse logistics system. The index system is shown in table 3.

Table 3 The comprehensive evaluation index system of city waste reverse logistics system

	One class indicator (criterion layer)	Two class indicator (sub criteria layer)	Three class indicator (index layer)
The comprehensive evaluation index system of city waste reverse logistics system(u)	Waste collection system(u_1)	Collection method(u_{11})	
		Collection way(u_{12})	
		Collection facilities(u_{13})	
	Transportation system(u_2)	Equipment compatibility(u_{21})	
		The total cost of transportation(u_{22})	
		Environment(u_{23})	
	Treatment system(u_3)	Economy(u_{31})	The project total investment(u_{311})
			The unit operation cost(u_{312})
			Investment utilization rate(u_{313})
			The payback period of investment(u_{314})
			Land occupancy(u_{315})
		Suitability(u_{32})	
		Systematic(u_{33})	Reliability(u_{331})
			Safety(u_{332})
			Advanced technology(u_{333})
		treatment effect($_{34}$)	Resource(u_{341})
			Reduction(u_{342})
			Harmless(u_{343})
		social effect(u_{35})	public satisfaction(u_{351})

18.4.2. Fuzzy comprehensive evaluation method

The comprehensive evaluation index of city waste reverse logistics is non-quantitative, and unable to use the general method to compare directly. The fuzzy comprehensive evaluation method is in fuzzy environment, it can consider the influence of various factors. It also can make comprehensive judgment or decision under some purpose, and can deal with fuzzy information which cannot be treated by other methods. Therefore, this paper adopts the fuzzy comprehensive evaluation method to make comprehensive evaluation on city waste reverse logistics comprehensive benefit.

18.4.2.1. Determine the evaluation factor set

According to the analysis of 20.4.1, evaluation set is divided into 3 layers, first layers of the total target factor set is $u = \{u_1, u_2, u_3\}$; second level target factor set is

$$u_1 = \{u_{11}, u_{12}, u_{13}\}; u_2 = \{u_{21}, u_{22}, u_{23}\}; u_3 = \{u_{31}, u_{32}, u_{33}, u_{34}, u_{35}\};$$

third level target factor set is

$$u_{31} = \{u_{311}, u_{312}, u_{313}, u_{314}, u_{315}\}; u_{33} = \{u_{331}, u_{332}, u_{333}\}; u_{34} = \{u_{341}, u_{342}, u_{343}\};$$

18.4.2.2 Determine the evaluation set

The evaluation set is a kind of language to descript evaluation indexes of each level; it is the evaluation set that reviewers give. For different evaluation goal, the evaluation level has different meanings. According to the characteristics of city waste reverse logistics, given evaluation set $v = \{v_i\}$, a total of 5 evaluation class $v = \{v_1, v_2, v_3, v_4, v_5\}$, Wherein

$v_1 = \{very\ good\}, v_2 = \{good\}, v_3 = \{general\}, v_4 = \{poor\}, v_5 = \{very\ poor\},$

The evaluation set is

$v = \{very\ good, good, general, poor, verypoor\},$

18.4.2.3 Determine the weight of each index in the evaluation system

In the fuzzy comprehensive evaluation, the weight can impact the final evaluation results; Different weights will produce different results, thus affecting the decision-making. Therefore, it is crucial to determine the weights. There are many ways to determine the weights, such as analytic hierarchy process (AHP), experts' estimation method, entropy method. According to the index system and city characteristics of reverse logistics, AHP may be applied to determine the weight of each index. In order to obtain scientific index weight, we set up a total of 20 people university expert jury which is composed by the management personnel, technical personnel, expert of university. They evaluate the weight of the index, $u_i (i = 1, 2, 3), u_{ij} (i = 1, 2, 3;\ j = 1, ..., 5), u_{3jk} (j = 1, ..., 5;\ k = 1, ..., 5)$ and then we determine the comparison judgment matrix, the weight of each index by AHP method is shown in table 4.

Table 4 The weight of each index

Target layer(u)	One class indicator	weight	Two class indicator	weight	Three class indicator	weight
The evaluation index system of city waste reverse logistics system(u)	Waste collection system(u_1)	0.6483	Collection method(u_{11})	0.63		
			Collection way(u_{12})	0.1515		
			Collection facilities(u_{13})	0.2184		
	Transportation system(u_2)	0.2297	Equipment compatibility(u_{21})	0.1047		
			The total cost of transportation(u_{22})	0.2583		
			Environment(u_{23})	0.637		
	Treatment system(u_3)	0.122	Economy(u_{31})	0.0503	The project total investment(u_{311})	0.0815
					The unit operation cost(u_{312})	0.0815
					Investment utilization rate(u_{313})	0.1485
					The payback period of investment(u_{314})	0.2499
					Land occupancy(u_{315})	0.4386
			Suitability(u_{32})	0.0979		
			Systematic(u_{33})	0.1062	Reliability(u_{331})	0.1576
					Safety(u_{332})	0.7608
					Advanced technology(u_{333})	0.0816
			treatment effect($_{34}$)	0.273	Resource(u_{341})	0.1047
					Reduction(u_{342})	0.2583
					Harmless(u_{343})	0.637
			social effect(u_{35})	0.4727	public satisfaction(u_{351})	1

18.4.2.4 Determine the fuzzy evaluation matrix

We invited 20 experts and apply the questionnaire survey method to collect data. All experts have evaluated three class indicators and two class indicators in table 3 according to the evaluation set respectively.

The factors of their upper level indicators can calculated through their evaluation results and the corresponding weights. Then we analyze the results of the investigation and obtain the degree of membership of each factor which is shown in table 5 and table 6.

Table 5 The fuzzy evaluation matrix of two class indicator

One class indicator	Two class indicator	Very good	Good	General	poor	Very poor
Waste collection system(u_1)	Collection method(u_{11})	0	0.4	0.4	0.2	0
	Collection way(u_{12})	0	0.3	0.4	0.2	0.1
	Collection facilities(u_{13})	0.05	0.4	0.3	0.2	0.05
Transportation system(u_2)	Equipment compatibility(u_{21})	0.1	0.3	0.5	0.1	0
	The total cost of transportation(u_{22})	0.2	0.4	0.3	0.1	0
	Environment(u_{23})	0	0.05	0.4	0.4	0.15
Treatment system(u_3)	Economy(u_{31})	0.1	0.5	0.4	0.1	0
	Suitability(u_{32})	0.2	0.4	0.3	0.1	0
	Systematic(u_{33})	0.05	0.2	0.4	0.25	0.1
	treatment effect($_{34}$)	0.1	0.3	0.3	0.2	0.1
	social effect(u_{35})	0	0.2	0.2	0.4	0.2

Table 6 The fuzzy evaluation matrix of three class indicator

One class indicator	Two class indicator	Three class indicator	Very good	Good	General	poor	Very poor
Treatment system(u_3)	Economy(u_{31})	The project total investment(u_{311})	0.2	0.4	0.3	0.1	0
		The unit operation cost(u_{312})	0.1	0.5	0.4	0	0
		Investment utilization rate(u_{313})	0.3	0.4	0.3	0	0
		The payback period of investment(u_{314})	0.2	0.6	0.2	0	0
		Land occupancy(u_{315})	0	0.4	0.5	0.1	0
	Suitability(u_{32})						
	Systematic(u_{33})	Reliability(u_{331})	0	0.2	0.6	0.1	0.1
		Safety(u_{332})	0.05	0.15	0.4	0.3	0.1
		Advanced technology(u_{333})	0.1	0.2	0.4	0.2	0.1
	treatment effect(u_{34})	Resource(u_{341})	0.1	0.4	0.4	0.1	0
		Reduction(u_{342})	0.2	0.6	0.1	0.1	0
		Harmless(u_{343})	0.1	0.2	0.4	0.2	0.1
	social effect(u_{35})	public satisfaction(u_{351})	0	0.2	0.2	0.4	0.2

18.4.2.5 Comprehensive evaluation

We evaluate from the bottom, the evaluation algorithm is based on comprehensive evaluation model $B = A \circ R$, B represent a fuzzy comprehensive evaluation result, A represent the weight of each index and R represent the membership degree of fuzzy subset in each level.
According to the weight of the two indicators: $A_1 = (0.63,0.1515,0.2184)$;
$A_2 = (0.1047,0.2583,0.637)$; $A_3 = (0.0503,0.0979,0.1062,0.273,0.4727)$;

Obtain fuzzy comprehensive evaluation result of a class index: $B_1 = A_1 \circ R_1 = (0.011,0.385,0.378,0.2,0.026)$;
From the results, it can be seen that the evaluation of waste collection system is 'good', the membership degree is 38.5%.
$B_2 = A_2 \circ R_2 = (0.062,0.167,0.385,0.291,0.096)$; From the results, it can be seen that the evaluation of waste

transportation system is 'general', the membership degree is 38.5%. $B_3 = A_3 \circ R_3 = (0.057, 0.26, 0.268, 0.285, 0.13)$; From the results, it can be seen that the evaluation of waste transportation system is 'poor', the membership degree is 26.8%.

According to the weight of the first level index $A = (0.6483, 0.2297, 0.122)$; the fuzzy comprehensive evaluation index result of city waste reverse logistics system is $B = A \circ R = A \circ \begin{bmatrix} B_1 \\ B_2 \\ B_3 \end{bmatrix} = (0.028, 0.32, 0.366, 0.231, 0.055)$ .The result has shown that the china city waste reverse logistics system is general, its membership degree is 36.6%.

18.5. Conclusions

At present, China city waste reverse logistics is still in the initial stage, the social haven't fully realized its influences. At the same time, although China has established some related policies and regulations to implement waste reverse logistics, because management facilities is backward, it is very difficult to develop reverse logistics and cannot solve the environmental pollution of the city waste. This paper evaluates the city waste reverse logistics system; it can help government timely to find out the bottleneck that has impact the development of waste reverse logistics. It also make social to understand the waste reverse logistics comprehensively and give some suggestions to improve the optimization of management process, and then ultimately improve the overall effect.

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19.0 „Smart Cities, the Future of Innovation and Creativity“

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Social and economic globalization is making the world 'more uniform', and cities are being seen as centres of economic attraction, that disseminate knowledge and culture and where talent and creativity can be cultivated and developed. Proof of this is that in 2008, for the first time in history, half of the world's population was living in urban areas, and predictions raise the percentage to 70% in 2050.

Therefore the paradigm of the city must be changed. According to several authors like Caragliu and Nijkamp 2009: "A city can be defined as 'smart' when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic development and a high quality of life, with a wise management of natural resources, through participatory action and engagement."

Department for Business, Innovation and Skills,UK 2013: "The concept is not static, there is no absolute definition of a smart city, no end point, but rather a process, or series of steps, by which cities become more 'livable' and resilient and, hence, able to respond quicker to new challenges."

Other key factors in a "smart" economy include retaining and attracting talent and fostering creativity. Cities are increasingly aware of the need to have well educated, creative and entrepreneurial citizens in order to be more competitive.

Today it is hard to imagine our life without the Internet. Proof of this is the fact that the percentage of Internet users in most cities (41%) is very high, ranging between 76% and 100%.
The use of ICT can contribute to preservation and promotion of the culture heritage in the widest possible terms. A knowledge society must make special efforts to transform its peculiarities and diversities into information and disseminate it by making use of the revolution in information and communications technology.

The rise of new Internet technologies promoting cloud-based services, the Internet of Things (IoT), real-world user interfaces, use of smart phones and, networks of sensors, and more accurate communication based on the semantic web, open new ways to collective action and collaborative problem solving.

Large IT and telecommunication companies such as CISCO, IBM, MS have developed new solutions and initiatives for intelligent cities as well. CISCO, launched the Global Intelligent Urbanization initiative to help cities around the world using the network as the fourth utility for integrated city management, better quality of life for citizens, and economic development. IBM announced its SmarterCities to stimulate economic growth and quality of life in cities and metropolitan areas with the activation of new approaches of thinking and acting in the urban ecosystem.

This paperfocuses on the role that all these new technologies can play to protect, preserve and promote

cultural heritage. Indeed a Smart cultural heritage, can be conceived as the identity of places through the implementation of smart technologies, knowledge and social inclusion, for total participation in the promotion of this so important aspect of our collective life.
The city's relationship with its past and with emergencies that occupy space should be seen in different temporalities and strata of the urban space, as an element of understanding of the dynamics, but also of the formation processes over time of the city's identities.

For example some Italian projects intend to define and develop an open platform for smart services for the cultural offer, that is very relevant for the dissemination of this information and the easier access to it. Specifically these projects aim to develop tools for enhancement and capitalization of cultural and environmental resources in a territory and the promotion and marketing of tourism.

These lines of action share a technological platform and social paradigm to create an ecosystem where companies, public administration, citizens and tourists and services are created involving all the stakeholders in social and cultural innovation.

The focus of these projects is to define and build an open platform for intelligent services for the cultural offering: knowledge about cultural heritage to offer to users, its fruition, conservation and preservation.
In Barcelona, the first city in the top of the smart cities 2015, the Local Digital Agenda model, continues to be an extremely useful tool to advance the goal of digital, competitive and collaborative cities in a structured and

planned manner, while also advancing the Smart City Agenda.

But all this must be done with the people, must involve the communities and their participation, only this way we can have human smart cities where innovation and creativity are the essential contribution to the evolution of human civilization.
Cultural heritage and cultural entrepreneurship needs care and promotion to express their best potentiality which is that to be the most effective ambassador of peace and the right path for the social inclusion and a healthy society.
Technological and social innovation can make an invaluable contribution in that direction, if urban policies adequately consider citizens and their innovation and creativity capacity the most valuable resource, because they are the main actors of urban "smartness". This paper continues to use this expression Human Smart City as this concept is totally adapted to the structural idea of this paper and also in line with the concept of creating services that are born from people's real needs and have been co-designed through interactive, dialogic, and collaborative processes.

Co-creation initiatives should be the core of human smart cities stimulating local development, creating new business models and new apps, products, services and solutions and making use of the creativity of the human resources.

Indeed, the solutions for the big challenges of our time require not only innovative technologies but, above all, mass behaviour transformation of the kind that can only be achieved through the involvement of people and the sharing of common visions and learn from each other to find the right path towards social and urban innovation.

In Portugal companies, clusters, universities, R&D centres, municipalities and other economic and social players acting in the smart cities market joined forces to create the **Smart Cities Portugal** collaborative platform leaded by INTELI.

The priorities for Smart Cities Portugal portal are "partnership opportunities" and "cities profiles and needs" were the top priorities according to the opinion of the partners and the application areas for Smart Cities solutions are: governance, mobility, energy, buildings, environment, quality of life, others.
In Portugal Smart cities market is not yet in a mature stage.
To accelerate the transition to a renovated urban development paradigm, it will be needed to strengthen enablers and removing market barriers. Overcoming these barriers will enhance the adoption of innovations, the deployment of smart city solutions and the enlargement of the market
Horizon 2020 will be one of the most relevant funding sources for smart city solutions deployment.

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20. “Tenerife: a Knowledge Hub at the Atlantic”

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Canary Islands is one of the main touristic destination of Europe, with more than 12 millions of visitors per year, stressing a territory of 7446,95 km2 with only 2,1 millions of residents. This scenario has developed a societal estructure highly drived to the service sector, real state and low qualifications jobs.

The economical crisis in the last years has generated a great social breakdown, driving to all the region to become one of the highest rate of unemployments of the EU. As you probably know, this long term crisis has produced great proportions of population closer to poverty and an enormeous desperation concernig to the perspectives to get a job, mainly to young people.

However, this dramatic situation has reactivated the idea to convert all the region and, in our case of studie, the island of Tenerife in a knowledge hub which could connect Europa, Africa and Iberoamérica, by similar status (Europe), by proximity (Africa) and by cultural and historial linkages (Iberoamerica).

In this article we resumen some of the main facts which we assume that would help to get this goal by attracting investors, support entrepreunerships and promote innovative business, highly based on knowledge, taking the maximum benefit from the Intellectual Capital of the region and generating a more promise future for the young generations.

20.1. Tax benefits

The network of companies based in the archipelago benefits from a stable legal and tax system that also has direct access to bilateral agreements with different countries in Africa.
Businesses that decide to operate from Tenerife will immediately benefit from privileged conditions under the protection of the islands’ status as an ultra-peripheral region of the European Union. It should be added that the Canary Islands channel part of Europe’s support programme in the north-west of Africa.
All of this provides opportunities for companies that operate from the Canary Islands to access the support, cooperation, arbitrage and institutions of the European Union and chiefly the Canary Islands Tax and Economic System (REF). All of this translates into investment opportunities, and tax and customs advantages.

20.2. Singular infraestructures

Tenerife enjoys modern infrastructures across all sectors. Two ports and two international airports, advanced telecommunications infrastructures, as well as large industrial areas.
There has been a high level of development in recent years with over seven million tourists visiting the island

in 2012 and an active population of over 800,000 residents.

- Modern hospitals and health centres. These are a national benchmark, mainly in specialised areas such as kidney or liver transplants.
- Public and private education establishments. The University of La Laguna currently has over 23,000 active students who can choose from a long list of specialities to train for their future in complete confidence.
- Tenerife hosts a campus of the renowned Universidad Europea. Connected with universities around the world with an education system with a strong international focus.
- Transport and communications. The island has two international airports and two commercial ports. This means there are wide business opportunities since they are the main arrival points for tourists and entrepreneurs.
- Environmental infrastructures. Tenerife has a modern solid waste infrastructure. One of the island's main values is its commitment to sustainability and respect for the environment.

ITC Facilities

The ALiX project is a proposal from Tenerife Island Council, headed by the Technology and Renewable Energies Institute (ITER) and aimed at promoting competitiveness on the island with regard to the global ITC market, eliminating the structural shortcomings in the Canary Islands for the Information and Communication Technology sector.

Thanks to ALiX, the Canary Islands are twenty years ahead of other European ultra peripheral regions. It is

the most strategic plan in the Canaries in the last fifty years.
The main aim of ALiX is to improve competitiveness in the Information and Communication Technology (ITC) sector in Tenerife and, by extension, in the Canary Islands. The Council has thus committed to making Tenerife and the Canary Islands a real information technology platform for Africa, America and Europe, having quantitative and qualitative broadband capacity at a competitive price in addition to offering free access for all operators to the neutral ALiX infrastructures.
The three pillars of the project
In order to carry out the project, ALiX comprises three main pillars:

- The Telecommunications Technology Institute of Tenerife (IT3)
  This public operator was created by the Tenerife Island Council for the ALiX project and is responsible for rolling out a land-based island ring of fibre optic cable around the entire island (running alongside the motorway).
- CanaLink
  CanaLink has laid and implemented a system of neutral submarine cables between Rota (Cadiz) and Granadilla de Abona, Tenerife, where the ALiX project data centre is located, in addition to an offshoot towards north Africa (Morocco). The aim is to liberate the sector and provide new alternatives to current operators (or with expansion plans in the Canary Islands) since the only cable before between the mainland and the Canaries belonged to Telefónica. CanaLink has rolled out two further cables: Tenerife – Gran Canaria and Tenerife – La Palma.

Furthermore, thanks to the new CanaLink infrastructures, coverage of the Spanish academic and research network (RedIRIS) has been extended, offering three points in the Canaries: the first two at the University of La Laguna and the main headquarters of the Astrophysical Institute of the Canary Islands on the island of Tenerife and the third at the Roque de los Muchachos Observatory on the island of La Palma.

- Datacenter ALiX (D-ALiX)

  The implementation of the ALiX project data centre represents a neutral three-continent aggregation and distribution point, as well as the southern European gateway in terms of telecommunications. The management equipment for the communications trunk network is located at D-ALiX, housing the IT services of the Island Council, RedIRIS and most town councils on the island of Tenerife, as well as equipment from CanaLink and IT3. In addition, the data centre provides installation space to provide services to businesses and operators, benefiting from the ability to house their technology platforms at a neutral high-availability infrastructure (TIER III+).

  The proximity to the coast of D-ALiX means it can be a landing station for the ALiX project submarine cable system, with businesses housed at the data centre being able to reach the European and African continents and, in the future, America. D-ALiX is located at the facilities of the Technology and Renewable Energies Institute (ITER) on the Granadilla de Abona

Industrial Park – a completely renewable and sustainable setting.

20.3. Scientific and Technological Park

The Tenerife Science and Technology Park (PCTT) aims to efficiently, effectively and sustainably foment the creation and develop of innovative technology companies in Tenerife through creating different innovative settings where land and spaces, infrastructures and appropriate services are on offer.
The PCTT is the right-hand of Tenerife Council with regard to business innovation and support for Research and Development (R&D).

- It has two business incubators for innovative and technology projects located at the Santa Cruz de Tenerife Exhibition Site (Innovaparq) and the Main Campus of the University of La Laguna (Scientific-University Node). The first is practically full with only one free office remaining, whilst the second has the whole of floor five available in the building, with a surface area of 549 m2. The incubator has a total surface area of 1,647 m2.
- The tender process for the planning project of the future Science and Technology Park in Cuevas Blancas is currently underway, where over 260,000 m2 will be available for setting up technology businesses and organisations to carry out research, development and innovation projects mainly in Information and Communication Technology and Innovation in Tourism. In all, both the planning for the area and the construction of the main building are expected to be ready for February 2016.

- The third pole will be a university related area, devoted to three main areas of specialization, all strongly related with the Key Enabling Technologies (KET): Astrophysics, Nanotechnology and Advance Materials, Biotechnology and Biomedicine, and Sustainability. This facilities will be finished at the end of 2016.

20.4. Conectivity

Tenerife is an excellent commercial, logistical, business, and service and technology transfer platform between continents

The Canary Islands are a European Union territory located between three continents. Their excellent airport and telecommunications infrastructures turn their geographical location into an opportunity, whilst also having European legislation, regulations and standards.

It is the ideal location to operate in the three continents: Europe, America and Africa.

The main resources are the folllowing:

- Connection with 147 international airports by the performance of more than 79 airlines working in our airports
- Connection with 278 ports
- 6 international cable systems connecting Europe, America and Africa

20.5. University Campus of Excelence

The University of La Laguna, together with the another public university of the Canary Islands located at Gran canaria island, have joined forces to develop the Tri-

Continental Atlantic Campus, a space of excellence that, by this 2015, must be an Atlantic Benchmark in Europe as an axis that receives and catalyzes talent in teaching research, innovation and transfer projects with Africa and Latin America in Marine and Maritime Science and Technology, Biomedicine and Astrophysics, under the common denominator of a development model of integral sustainability.
The Campus will be an indispensable element in the development towards the new economic, production and social structure of the Canary Islands. Improved competitiveness is based on a sustainable, global approach that will consolidate key sectors, promote new sectors linked to the fields of specialization of the Campus and help to create employment.

The Canary Islands Atlantic Tri-continental Campus will act with particular attention in the areas of specialization that are unique, given the characteristics of the Canary Islands Archipelago and the geostrategic situation closet he Africa and bridge to Latin-America:

- Sea-related fields: Marine (Marine Science and Technology), Maritime (Tourism, Economics of the Sea-Mobility-Logistics)
- Astrophysics
- Biomedicine applied to Development Cooperation

These three areas will function under one common denominator: Integral Sustainability. In this sense, teaching and research will be closely linked to sustainability. The integral nature of the concept lies in its relationship with the environment, with the economic development of the Islands and Development Cooperation with Africa and Latin-America, as well as with the urbanistic elements for transforming the

campus–some of which are environmental. A global sustainable economy within the framework of the Tri-continental Atlantic Campus means working for the conservation and good use of environmental resources, new personal mobility models (tourism and immigration) and merchandise (Logistics).
After three international evaluations, the project has been graded with A, showing the enormeous potential of the universities as engine of the change in the region.

21. "Open Data Canarias"

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21.1. Summary:

The Canaries Open Data Project is the first open data initiative in the Canary Islands developed during the last three years. Its main objective is to promote, support and provide an open data web portal to citizens, developers and to public administration. This work presents the benefits of open data usages in different scopes with special remark in the tourism sector. This work presents an open data project to validate and to publish such data across multiple administrations. The main benefits for the public sector are the improvement of the data quality and the interoperability between different administrations.

21.2. Keywords:
Open Data, Open Government Data, Interoperability, Tourism.

21.3. Introduction

In 2012, an agreement between the Department of Education, Youth and Equality of the Cabildo de Tenerife and University of La Laguna for the promotion and development of Open Data strategy was

established. The main goal was to open data sources related to mobility, training and employment in the context of University of La Laguna. During early stages of the project, it was extended to include other scopes (tourism, transport and culture) and new stakeholders (councils, public organizations).
The initial step of the project was to convince the public administration participants of the convenience of providing citizens with the information they had collected or generated. The first meetings focused on spreading the Open Data principles [1], the European regulations and related national legislation. Specifically, in our case, the legal framework is the Spanish Law 37/2007, a state law on Re-use of Public Sector Information. The Royal Decree 1495/2011 extends the previous law and establishes mandatory regulations for the general government administration for the publication of data from different areas in open format. The latter provides an element that we found very interesting for the implementation of this project: the Re-use of Public Sector Information Plan, the main objective of which was to promote, help and develop open data strategy.
This contribution presents the Canaries Open Data Project and some current cases of open data use by different administrations in the island.

21.4. Canaries Open Data Project

The Canaries Open Data project is the first open data initiative in the Canary Islands. Its main objective is to promote, support and provide an open data web portal to citizens, developers and to public administration (http://www.opendatacanarias.es). The Canaries Open

Data Project is led by the University of La Laguna (ULL) with funding from the Cabildo de Tenerife. The fact that the project is coordinated by the ULL permits greater independence and the ability to combine efforts between different administrations. Another key element in the ULL leading the project is the proximity to computer engineering students and researchers, which allows direct use of data through the development of web and mobile applications.

The following tasks were established:

- Identification of data providers, their data sets and formats.
- Requirement, development and loading data into the Canaries Open Data platform.
- Development of Web and Mobile prototypes and apps.
- Dissemination (i.e. competitions, media and conferences).

Once data providers were identified, we focused on the data quality that each organization was going to contribute in the first phase. On the one hand, we had the island administration of the Cabildo de Tenerife, with broad responsibilities in the island, which provided data related to tourism in the island: accommodation, restaurants and shops. Three municipal councils participated by providing data that complemented the information from the Cabildo de Tenerife. Also, public corporations such as Turismo de Tenerife or Museos de Tenerife participated by providing valuable information about their activities.

This task involved multiple meetings with each of the organizations. Each department described the structure of its organization and its responsibilities. Secondly, they presented us with the candidate data sets to publish on the Canaries Open Data platform. This was the point where coordination by the ULL played an

important role. Each stakeholder worked with the ULL to provide useful data. The ULL had a global view of the data sets and detected duplicated, complementary and overlapping information between the providers. Each administration focused on their competencies but many details were of interest to two or more organizations. After reviewing the data in depth, errors, inconsistencies and duplications were detected. We informed the data providers, and in a second phase, they corrected their data sets. Finally, with the publication of the data on the Canaries Open Data platform, the different organizations could validate, compare and contrast the data sets between several administrations.
Each of the organizational units or institutions involved in the project was instructed in the need for the creation of the Re-use of Public Sector Information Plan. This Plan was proposed in the Royal Decree 1495/2011 which allows the general government administration one year to adapt to this law and to determine the four data sets that they are going to publish in the following six months. A Plan template has been published in [2]. We have adapted this document to the goals of our project. The Plan contains the following items that each administration should describe and implement: a) Introduction of the Document, b) Background of the Administration, c) Definition of the Working Group, d) Identification and Selection of Reusable Information, e) Data Set Preparation Process, f) Conditions for Reuse, g) Designing and Management of Web Portal, h) Publication and Maintenance of Reusable Data, i) Measures for Assessment and Quality Improvement, j) Timeframe to Publish New Data Sets.
The ULL team again offered help and dedication to the development of the Re-use Plans for different administrations. Our support placed special emphasis

on having well defined time limits, what data sets were going to be published, opening procedures and the state of their own data.
The Canaries Open Data platform was developed during 2013 based on customizing Drupal and CKAN platforms [3]. The catalogue was composed by almost forty datasets. Several transformations of data set formats (csv, xml, rdf) and best practices documents for governments (e.g. data opening process, and how to develop APIs) were developed.
In June 2014, a public presentation of the new platform was made to improve visibility. The idea was to encourage more administrations to take an interest in the project. In July 2014, a competition was held where several web applications and apps were developed using the platform data sets. The results were very exciting because on one side the project got great visibility, and on the other, the public sector employees of the participating administrations could see the huge potential of the open data initiative (http://www.opendatacanarias.es/apps). Nowadays we continue working to improve data quality, to increase the number of datasets, to federate with other institutions and to develop new apps related to smart cities. The catalogue contains 90 datasets and soon we will federate with other institutions of the Canary Islands. Canaries' Open Data Project should become the node where anyone can search for open datasets in our region.

21.5. Case Studies: Tourism

The tourism industry accounts for over 70% of the economy of the Canary Islands. The Cabildo de Tenerife

pays special attention to providing high quality tourist information. In the tourist information that we have opened on the platform, we highlight Tourist Information Offices, Accommodation, Bars and Restaurants, Shops, and Museum Events. There are other data sets on the platform not related to this work.
The following practical cases show the benefit of opening data for public administrations.

a) Accommodation Data Set

Both the public corporation Turismo de Tenerife [4] and thirty-one municipalities are collecting data for different types of accommodation. This represents about 500 hotels, apartments, rural hotels and houses, etc. The information that each municipality collects should be similar to the information held by Turismo de Tenerife which has island-wide accountabilities. The opening of data in this case allows the establishment and integration of information from various sources. The most advanced case is the Municipality of Arona which has also developed a CKAN based open data platform [5] with data in different formats including RDF. Therefore, Turismo de Tenerife and the Municipality of Arona can now access each other's data and enrich their data sources with information that was not previously available.

b) Restaurants Data Set

This case is very similar to that above but in the field of bars, restaurants and cafés, etc. Around 10,000 of these businesses exist at this moment. We, again, have very similar data at both island administration department and municipality level. This is a clear case where integration of data sets would enrich each administration. Administrative information of the businesses is complemented with customer information, from different points of view.

c) Shops Data Set

The Data Bank Department of the Cabildo de Tenerife, collects information from all retail stores that exist across the island. Municipalities also have to collect this data for their own administrative purposes (e.g. taxes, refuse collection, etc.). Although there is communication between the island departments and the municipalities, data updating is not very frequent (once a year, or less). With the publication of both data sets in our open data portal, all providers involved can efficiently share and update the information required. In this case, the municipalities of Arona and Tegueste have already offered their retail stores data, and the process of updating and improving it is now real time.

d) Museum Events Data Set

Museos de Tenerife [6] is a decentralized administrative entity which was created by the Cabildo de Tenerife with the main mission of studying, cataloguing and preserving the island's cultural heritage. The different museums that make up the network comprise important cultural spaces in the island that are visited not only by tourists but also by the citizens of Tenerife. In this case, we studied two data sets. On the one hand, the basic information held by the museums (address, location, timetables, web, email, phone) and on the other hand, the events held every day at the six museums (museum, event title, description, timetable, price). The first resource consists of a text file in csv format. The second one is a syndicated rss source already publicly available with the events of all the museums.

Another benefit of releasing this data set is related to the case of Turismo de Tenerife mentioned above. Turismo de Tenerife could automate their manual events updating process to integrate museum data into their database. Any other local council or island administration could, of course, also read events online from the Canaries Open Data platform and give to the tourists and citizens more reliable information.

Three weeks after publishing these data in Canaries Open Data portal, two computer engineering students developed an app with all the information of the Museums of Tenerife. Its users not only include citizens and tourists, but museum staff that can also use the app to confirm the correct publishing of their events.

Currently, we are continuing to work on the project to offer new data sets related to transportation, environment, sports facilities, other events, etc. In every case, the government is the first to benefit from sharing their data sets and promoting new services and companies can develop web portals and apps.

21.6. Benefits of the Canaries Open Data Strategy

The three year project experience has reported the following benefits for the community:

a) Opening public sector data is beneficial for citizens (transparency) and software developers (innovation) but also for administrations, as they can share data.

b) Using open data formats, public administrations can easily share and update data from various sources. At present, different administrative services of the Cabildo de Tenerife often require data from other services. Due to the Canaries Open Data Project different administrative services are exploiting the potential of open data to share information with other administrations.

c) Greater inter-operability can be achieved when the same open data standards are used by different public administrations. We have collaborated with the Cabildo of Tenerife and municipalities to show that information interoperability can be achieved with open data. In this case we have worked with two specific examples: accommodation and restaurants.

d) Customer service improvements. Data sets combined from several sources enrich the information shared and permit the development of new services for citizens. For example, the Canaries Open Data portal offers transportation data sets: bus and tram. In both cases, the companies responsible for these services (Metropolitan and TITSA) have developed the API to access routes, timetables and stops information. It is easy to relate this data to data about accommodation, restaurants and/or events, to offer alternatives for tourists to get around the island.

e) Open data strategy will create multiple business opportunities if the public sector continues to open their vast amounts of information. Within the Canaries Open Data portal we have promoted through competitions the development of apps using museum events, accommodation and restaurants datasets.

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22. “Profiling Regions as Knowledge Regions – Model Cases for Tenerife”

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22.1. Abstract

With the venue of the Knowledge Society subsequent instantiations such as Knowledge… Economy, … Economics, … Management, …Worker, … Capital, … Nation, … Region, …City etc. entered a broader discussion, mainly conducted by philosophers, sociologists, economists and computer scientists. Today, knowledge became the prefix characterizing that the subject under discussion is based on more than just data or information: the aggregation, interrelation and correlation of information items in a larger semantic construct is perceived to be the formalized representation of what we may call knowledge.

A Knowledge Region therefore is formed by its well defined institutions, as well as persons making up the regional constitution, but it goes beyond the nomination of its elements. The challenge is to identify models which combine the different aspects of a “knowledge body” as e.g. once have been introduced through “Intellectual Capital Reporting” models as e.g. are presented in [1]. Such models applicable to municipalities have been invented and applied for different locations, some of which are addressed in this article as model cases. The question addressed especially in this paper is if and how such methodology may be applied to the Canary Island of Tenerife as a model case for a “Knowledge Island”.

22.2. What is a Knowledge Region / City / Island…?

In a prospective publication A. Bounfour and L. Edvinson in 2005 with the title "Intellectual Capital for Communities Nations, Regions, and Cities" [2] collected a community of authors who argued on what may be understood as a knowledge region. In accordance to an existing award on the "Most Admired Knowledge Company" [3], F.J. Carrillo in his World Capital Institute (http://www.worldcapitalinstitute.org/) lauchend the "Most Admired Knowledge City Award" (MAKCi). The identification and evaluation of a "Knowledge City" was based on a model, which was introduced by F. Javier Carrillo and Blanca Garcia – see Fig. 1.

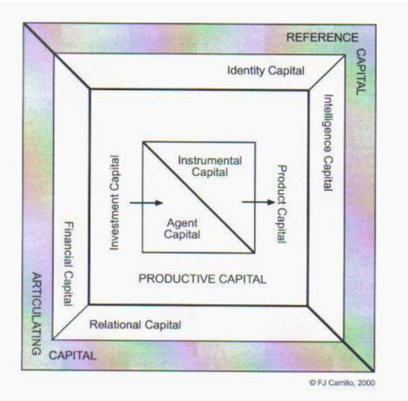

Fig.1 Model for MAKCi Award candidate evaluation

In the same course and around the same period, whole countries were considering to present themselves as "Knowledge Nations" describing this of their nature by means of Intellectual Capital Reports (ICR). One

example is the IC Report of the State of Israel [4]. The "model" in most cases of these reports was given by the outline structure of the respective report. It was a narrative and discussion along different aspects of what can be considered to be constitutional for a knowledge municipality.
One driver in this discussion was and is the World Bank which not only created a sophisticated method and associated with it a ranking of what the "knowledge value" of a country is [5], thus providing arguments to nations on their strengths and weaknesses in their knowledge societal constitution.
In Europe at the beginning of this movement mainly two regional players engaged in the definition and identification of knowledge: Scandinavia and the Danube Region with Austria as a pioneer country. The today so called Austrian Institute of Technology (AIT) in 1999 headed by the author published its first ICR, which was communicated in public first time at an OECD conference in 2001 [6]. The model and method described there was picked up by a community in Germany [7] refining the "Austrian method" and applying it to both German companies, but also for profiling regions as knowledge regions. One example was exercised in the so called Ortenau region, which is a German municipality located in the triangle between Karlsruhe, Strasbourg and Freiburg [8].
The major set of reports on knowledge municipalities, however, was produced in the framework of the MAKCi Award
(http://www.worldcapitalinstitute.org/makci/makci-awards-most-admired-knowledge-city).

22.3. A few cases of European Knowledge Regions / Knowledge Metropoles: Ortenau, Vienna, Romania, Kosice, Danube Region

The author of this paper was involved in a series of projects profiling regions as knowledge regions which, for the sake of this paper, may serve as references for identifying and constructing one specific approach to be taken for the special case of the island of Tenerife – and further islands as well.

22.3.1. The Ortenau Case [8]

Ortenau is a regional district in the German Federal State of Baden-Württemberg reaching close to France / Alsace, adjunct to the City of Strasbourg, and situated between the wider municipality of Karlsruhe in its North, one of the leading "high tech regions" of Germany with the Karlsruhe Institute of Technology (KIT) in its center, and , in the South, the area of the City of Freiburg, a historic township with a university more than 550 years old. The capital of the Ortenau region is a town called Offenburg with some 60.000 inhabitants.

Being "squeezed" between three heavy knowledge regions, the Ortenau region by its economic policy bodies decided to find a profile as a knowledge region situated "in between". The approach taken was to apply the German version of the Austrian IC reporting model, which is denoted as "Wissensbilanz – Made in Germany".

The IC report constitutes a meta model which can be used for different topics and questions, as are:

- What are the advantages in IC of the region, what are the immaterial advantages of the region?
- With given goals what are the most important impact factors to reach this goals?
- If we improve some elements of the intellectual capital of a region, what are possible improvements ?
- What is the intellectual capital profile of a region?
- In the cross impact matrix which will be developed in an IC reporting project: what are the best actions to take in order to improve the intellectual capital?
- There exist many approaches for regional development. Why is intellectual capital reporting an appropriate and good approach for regional development?

As in the Ortenau project the chosen method was "Wissensbilanz – Made in Germany", the above questions find their answers as follows:

- The generated IC report provides an insight and intrinsic view of the region profiled.
- The IC report helps the participants from the regional institutions who engage in the development of such report to understand the complex cross-impact relationships (represented in a so called Vester matrix) and reveals the elements which have the most influence in this system of regional interdependencies.
- Intellectual capital reporting (ICR) - as discussed - is a method requiring participation of officials, citizens and representatives of interest groups. To create an intellectual capital report for regions according to the chosen method requires relevant insider knowledge from local experts and interest

groups. This is one guarantee for the later broader acceptance of the results.

- The intellectual capital (IC) report for regions is also a method for integrating divergent views. In addition, the IC report allows to integrate different complementary aspects in regional development. The recommendation resuming from the Ortenau case was to combine the IC report with information such as

- regional statistical data
- regional development plan/s and/or regional development program/s
- ongoing regional activities intended to improve the wealth of the region

Intellectual Capital (IC) reporting for regions also allows to reflect the implicit complexity when dealing with regional development. Many concepts / models / methods of ICR may be well founded in a scientific sense, but most of them ignore the inherent complexity which often leads to questionable results and recommendations. By using and discussing the so called cross-impact matrix as one part of the applied method exposing cause-effect chains, participants of the workshops working out the IC report acquire a deep understanding of the dependencies of regional development and its impact elements.

Compared to other methods in regional development, the IC report for regions as was applied in the Ortenau project requires less time to end up with some profound and well arguable results. Depending on the availability of qualified participants in the workshops, an IC report can be completed within a period of two or three months.

A second argument for applying the "Wissensbilanz" reporting methodology to regions is that it includes cause-impact analysis and thereby offers the possibility to construct and analyze cause-effect chains. Applying this specific part of the method allows to generate useful predictions of potential outcomes of any proposed action which is effectively put into practice.
In summary and after the practical experience made by the Ortenau project team, IC reporting demonstrated a superior approach namely that its results can be perfectly used in order to manage the regional strategy planning processes.

The process of establishing an Intellectual capital report for regions

Intellectual Capital Reporting (ICR) according to the model of "Wissensbilanz - Made in Germany" is a process-based methodology. The core process is implemented through a series of workshops each with a specific, well selected variety of participants. These teams make use of the available collection of regional data (e.g. from the office of statistics) and identify the best indicators, many of them also being quantifiable.

Participants of an intellectual capital report for regions

As mentioned at the beginning of this section, the success of an intellectual capital reporting project for regions heavily relies on well planned workshops.
For practical reasons, in the initial phase a series of workshops with each up to 20 participants needs to be conceived. If there is sufficient time available or in case there are more participants interested in taking part, recommendation is to run different workshop series at

the end of each the results of the different workshop groups shall be compared and converged.
The selection of possible participants depends on criteria such as:

- What shall be the key question / topic of the intellectual capital report?
- Who are the "customers" of the IC report or who are possible promoters?
- Who, for sure, will be available during the workshop period?
- Who has a solid and sustainable interest in participating in the workshop?

It is helpful and contributes to the validity of the results to have different perspectives represented in a regional IC report. Typical participants therefore would be:

- Members of regional development organizations
- Politicians which are responsible for the regional development
- Members of social and different political parties
- Participants from different education organizations (schools, universities, ...)
- Representatives from the economy of the main branches of the region
- Representatives from the church
- Representatives from tourism
- Representatives who deal with environmental issues

Associated with the invitation to the workshops a short introduction explaining the goal of the respective workshop must be given. In a best case an introductory event is recommended to take place in order to present the methodology and the purpose of the intellectual capital report in a condense and motivating way.

Such participative approach of developing a "picture of the future" for the Ortenau region lead to the effect that the results were well accepted not only by the participants, but also by external recipients of the findings. It goes without saying that the quality of the results depends on the competence of the participants in the workshops knowing about details w.r.t. their region. By experience, the outputs are of much higher quality and credibility than produced by many alternative methods.
Thus the results of the intellectual capital report allowed to derive a precise and concrete action plan the aim of which is to contribute to the future wealth development of the region – in economic and non-economic terms of intangible nature (such as satisfaction, happiness etc.).
An additional important side effect of intellectual capital reporting as was applied for the Ortenau region, which, at the beginning did not yet have had a vision or strategic plan of its own; through the working-out of an IC report they compiled a strategy for their regional development. The conclusion is, that an IC report therefore can be well used as a tool for building a regional development strategy.
Matching the results from the workshop series with indicators from third sources in the Ortenau case allowed to combine soft factors as identified in the group sessions with hard statistical quantitative data.

22.4. The Vienna case [9]

Vienna follows knowledge-based strategies already for decades, not having explicitly named it that way. The current two basic strategies for profiling the Vienna

Knowledge City are its “smart city strategy” and the “Research, Technology and Innovation Strategy”. In 2105, 650 years after the foundation of the Vienna University, Vienna redefines itself explicitly as a Knowledge City (“Wissensstadt”), substantiated by publications and specific ambitions.

The capability to enact this aim is demonstrated by the results achieved so far: Vienna has an excellent international ranking, such as by today:

- "Smart Cities": Rank 1 world-wide (followed by Toronto, Paris and New York); Source: Boyd Cohen, 2012, http://www.fastcoexist.com/1679127/the-top-10-smart-cities-on-the-planet
- The World's Most Reputable Cities: Rank 1 world-wide; Source: Reputation Institute / CityRepTrak, 2014, www.reputationinstitute.com
- Quality of living: Rank 1 world-wide (followed by Zürich and Auckland); Source: Mercer, Quality of Living Survey 2015, London, März 29015, http://www.mercer.com/qualityofliving
- Most prosperous city: Rank 1; UN-HABITAT report "State Of The World’s Cities Report 2012/2013" ranks Vienna as the most prosperous city among 70 metropolies of the world. This ranking observes factors such as productivity, sustainability, quality of life, and infrastructure. Vienna has got top rankings in all categories and has therefore outperformed cities with an equally high quality of life such as Zurich, Toronto, and Brussels.
- Best Cities for young people to live in: Rank 1 worldwide (followed New York and Malta)

Source: Best Cities for young people to live in, 2013, www.list25.com

- International Congress and Conventions: Rank 3 world-wide in 2013, (preceded by Paris und Madrid); before 2013, Vienna had Rank 1 for seven years! Source: ICCA (International Congress and Convention Association), http://www.iccaworld.com
- European Green City Index 2009: Rank 4 in Europe (after Copenhagen, Stockholm and Oslo). Analysed Categories: CO2 Emissions, Energy supply, Buildings, Transport, Water, Air Quality, Waste, Agriculture, environmental management. Source: European Green City Index 2009, Economist Intelligence Unit, http://www.eiu.com
- The Travel & Tourism Competitiveness Index 2013: Austria ranks No. 3 world-wide with Vienna as the main touristic attraction. Source: World Economic Forum, http://www3.weforum.org/docs/TTCR/2013/TTCR_OverallRankings_2013.pdf
- Business Friendliness: Rank 5 worldwide (after Dublin, Manchester, Wroclaw und San Jose). Source: Global Cities of the future 2014/15
- Innovation Cities Index: Rank 6 worldwide (after San Francisco, New York, London, Boston and Paris); Source: Innovation Cities Global Index 2014
- Online Cities: Rank 5 worldwide; Vienna after Berlin, Seoul, Barcelona and New York. Source: A Case Study of 31 informational World Cities - University of Düsseldorf, Germany.
- Startup-Cities where entrepreneurs want to meet-up: Rank 6 worldwide; Vienna after Copenhangen, San Francisco, London, Berlin and New York; Source: Startuptravels, 2014

- Global Power Cities: Rank 10 worldwide. Source: Global Power City Index 2014, The Mori Memorial Foundation.

The lately published statement on the Knowledge City Vienna published by the city government in 2015 demonstrates, that Knowledge is regarded as an ecosystem including a broad range of institutions, relations, assets, responsibilities, infrastructures and more, that all have to cooperate an co-develop well. Therefore platforms for knowledge offerings and exchanges, science, business, culture and politics are key elements for the Viennese Knowledge Identity as proclaimed by the city administration.

The password of Vienna is „Co-Creativity". This means, that companies, science institutions and many complementary knowledge partners work together and co-create their future with the clearly stated goal, to develop new products, technologies and their applications. This commitment is symbolized by qualified and well identifiable urban quarters such as the "Vienna Tech Gate", the "Campus Vienna Biocenter", the "Science Park Techbase"; the "Business and Research Centre" and the "Media Quarter Marx" are best examples of knowledge areas within Vienna.

The Vienna City Administration is following a strict participatory approach to co-create the future together with tenth of stakeholders and citizens. The process "Wien denkt Zukunft" ("Vienna Thinks Future") is aimed at implementing the vision of a Smart City combined with a Knowledge City.

Independent from the public administration, the so called "Knowledge Partnership" was founded in Vienna in 2009 with strong participation of the New Club of Paris (NCP - www.new-club-of-paris.org) in the context of one of the several famous national NCP Round

Tables, aiming to set the agenda for a national knowledge policy strategy. The "Knowledge Partnership" serves as a platform to connect the Knowledge City Stakeholders, to develop strategies and innovative actions, to innovate together and to recognize outstanding achievements.

Already in 2001, the Knowledge Management Academy (KMA) was founded in Vienna, a world-leading education and training organization with an international faculty (constituted by many members of the NCP), offering certification courses, trainings, in-house programs and conferences in Knowledge Management and Knowledge Policies in Vienna and in several countries of the globe. KMA supported the City of Vienna as well as the Federal Administration, plus the largest companies on spot, NGOs, Scientific Organisations as well as International Organisations like UN bodies such as IAEA and UNIDO in the build-up of their Knowledge Management . KMA as an individual player is the main catalyst and facilitator for the management of the Knowledge Partnership in Vienna.

Last but not least, the world-leading think-tank on the Knowledge Society, the New Club of Paris (NCP), has its formal headquarter in Vienna. Quite a number of university lecturers affiliated with this international think tank organisation have their professional roots in Vienna, where some of them started their academic career e.g. at the Vienna University of Business and Economics.

Social cohesion and inclusiveness in Vienna are key objectives and achievements of the last 70 years of political work after World War 2. The uninterrupted social-democratic government of Vienna today provides comprehensive services for all stakeholders and groups in society, promoting equal rights and professional opportunities for all citizens. The city offers free access to education from kindergarten to university and supports students who cannot afford to study by their financial means. Free access to libraries, a broad spectrum of lectures, pedagogic offerings in museums, a tremendous diversity of courses and seminars make Vienna a paradise for everyone who is curious to learn. And, as a coronary: equal opportunities for women and men and special support and reduced prices for public services for children and retirees. Active integration of and collaboration with immigrants and creation of offers consisting of a growing number of services in numerous languages. The diversity of the public services provides to all talents an opportunity to develop and to find their appropriate spaces to grow.

Very important: every citizen has unrestrained access to the Health System.

The tax-system in Austria and Vienna is highly correlated to the individual income, i.e. people with low income pay a small to reasonable minor amount of tax.

Since 2009 the City implements an ambitious and comprehensive diversity program.

It is seen as a key achievement, that all (!) public services such as transportations and a wide range of media, etc. can be accessed or be used by people with disabilities.

Inclusiveness also means, that all the data, information and knowledge of the city administration are openly accessible (“Open Data”). In cooperation with other cities in Austria and with the Federal Prime Ministry, Vienna initiated “Open Government Data Austria”, which won the United Nations Public Service Award 2014 in the category „Improving the Delivery of Public Services“. (Remark: The Public Services Award was initiated in 2003 to recognize outstanding innovations and achievements in delivering public services. It is the most recognized international award for the public sector!).

22.5. The case of Romania

Studies on the special case of Romania have been sponsored by Romanian R&D Agency uefiscdi and resulted in two reports, one applying IC analysis to universities (already published in 2014 [10]) and one draft report co-authored by the author of this paper, so far existing as an internal document devoted to the identification of intellectual capital on regional level [11].

The report [11] is the result of a series of workshops having taken place in Bucharest headlined “Mutual Learning Workshop” on Intellectual Capital Reporting – International Practicew.r.t Universities, regions and nations and was arranged and organized by uefiscdi. The philosophy of this report is represented in Fig. 2. Its authors claim, that their contributions cover both the historic and the current discussion in IC Reporting. They also elaborate that there exists not yet a consolidate “theory” as a foundation of “ Intellectual Capital”, first hand understood as a complement to traditional capital theories as exist in economy and economics.

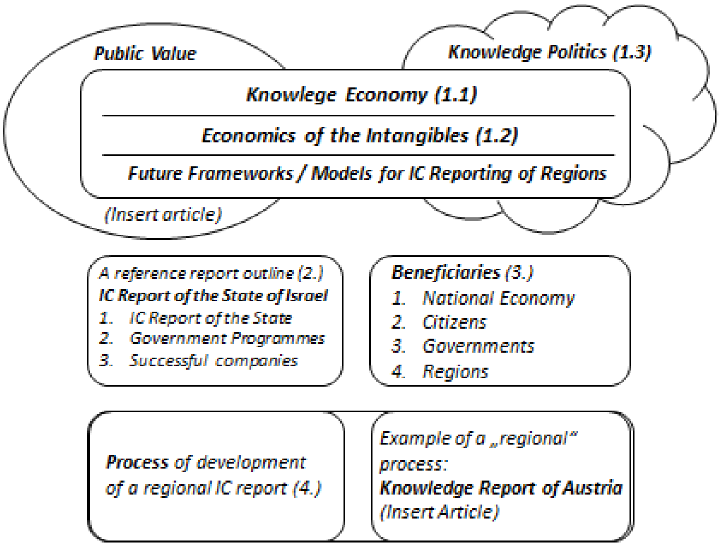

Fig 2.. Structure of this Blue Print report as emerged during work (Ref. numbers refer to chapters in the report [11])

This insight is confirmed by the fact, that the authors discuss several options of framework models for IC reporting, trying to reflect the latest development in national IC reporting and mapping them into compound new framework models. This discussion is not concluded in suggesting one specific model for a future Romanian IC Report, but provides sufficient background to take such decision once Romania would go for an own national and/or regional IC Report and with this decision to design an adapted model of its own.

In order to give a concrete example what the format, structure and content of an IC report on national level can be, the authors of the report [11] suggest to adapt the model of the IC Report which was developed by and for the State of Israel as a reference report. The rough structure derived from this model report for a Romanian IC Report would be

1. An IC analysis, i.e. an identification of the "state of knowledge" and the competitive knowledge advantages of Rumania, mainly using data from trusted sources as World Bank, OECD, World Economic Forum, IMD's Yearbook or NIC data (as was published by C. Lin, P. Stahle and L. Edvinsson). On national level, as much as available data as e.g. form the office of statistics or from research results as published by the uefiscdi members C. Holeab and A. Curaj in 2013.
2. A survey on government programmes, usually in support of R&D, technology development, funding of science and in support of universities, which contribute to an IC / knowledge (political) strategy of the country. In the case of Romania, this would be fed by the uefscdi agency and ministries in charge of science, research and education.
3. Presentations of examples of successful companies and company clusters, thus demonstrating, how a national knowledge policy potentially resumes in concrete instantiations of competitive advantage. This presumes that knowledge politics transformed into knowledge policy decisions then is translated into a concrete IC strategy and into subsequent actions implementing such strategy.

The author wants to point out, that in IC reporting the underlying, abstract framework models may be independent form the size and level of the subject and scope to be IC-analyzed, but in practice no "one size (i.e. one concrete model) fits it all".

22.5.1. Conclusion for Romania

A national IC report as conceived for Romania has a different structure, size and data basis than a regional IC report. Its construction and production will be a combination of "top down analysis" and compilations from "bottom up" - analyzed results.
In contrast, a regional IC Report as was the case in the Ortenau project (see 2.1) is a bottom-up compilation resulting in or soliciting a regional development strategy, worked out in a participatory process, involving citizens, interest groups and members of the regional innovation networks and clusters, knowledgeable in regional specialties and foundations, thus representing the "genetics" of the region to be IC analyzed.
This division between top-down for the national report and bottom-up for regional instantiations motivated the authors of the report [11] to explain how such bottom-up development of an IC report on regional level works in practice. By experience, the main benefit of organizing a process bottom-up - structured in workshops and well defined steps - is that the respective region (or city) going through this process will convergently find its "strategic picture" plus the subsequent implementation steps directed for the further beneficial development of the region (or municipality).
The reference framework model which is used in all contributions referring to practical application of IC reporting is the quasi "standard model", as was "invented" in the late 1990ies in Austria for its largest R&D organization (then called Austrian Research Centeres – today Austrian Institute of Technology (AIT)) and then further applied in larger numbers of cases in

Germany ("Wissensbilanz – Made in Germany" [7]). This model suggests to structure an IC analysis and IC report along four dimensions:

1. Vision, mission and strategy
2. The potential and resources to turn strategy into results, i.e. the intangible capital structured into human, relational and structural capital
3. The key processes to be implemented and to be managed for achieving strategic goals.
4. Outputs, outcomes and impacts.

In (strategic) knowledge management and IC reporting a multitude of methods have been introduced in the discussion. The authors of [11] do not favor apodictically one model only, however, over many years of working with such methods in practice, they came to the insight, that the basic scheme of four dimensions of the framework provides a meta model which has the potential to integrate several complementary methods and aspects known from theories and models in management since long, as already described in [1].

22.6. The Kosice case: Key concern is to convince companies to embark on IC methodologies

When this paper is written, the "Kosice Case" is still under development under the direction of the European Leonardo da Vinci project LEGEND [12], carried out by four partners, a Slovakian coordinating consultancy firm , an expert company in Intellectual Capital (IC) Analysis

from Germany, a University of Applied Science in Austria with deep experience in applying IC Reporting and a team in charge for the economic development in the Kosice region. Kosice is the second largest city in Slovakia and the capital of the Slovakian “IT Valley”. The major target groups in the LEGEND project are small and medium-sized companies (SMEs) and their educational counterparts, so called Higher Educational Institutions (HEIs) in first instance universities.
LEGEND is the acronym for "Leveraging knowledge for sustainable innovation and growth" and, as its main objective proclaims, aims at contributing to the increased use of knowledge by Slovak and Kosice IT Valley based SMEs in order to enhance their sustainable growth and potential and generation of innovation. One of the key concerns of the project specifically is to transfer Intellectual Capital (IC) methodologies to SMEs and their partners, especially to the corresponding Higher Education Institutions (HEIs). Results of LEGEND will be used as specific training and reporting tools in the local context, with the aim to contribute to increased competitiveness of SMEs and their partners mainly involved in research and development. The project also aims to overcome the weak interrelations between the labor market and the system of Vocational Education and Training (VET) for Slovak SMEs.
In order to convince the Slovakian SMEs to adopt IC methodologies, experience made in Germany and Austria serve as key arguments as follows:

An IC report on an organisation´s Intellectual Capital combines indicator based numbers with narratives and visualizations, which, in practice, can have two major functions:

• complement management information (internal management function);
• complement the financial statement (external reporting function).

The main idea behind IC Reporting for companies is the differentiation that financial information informs about the past performance of the enterprise but tells little to nothing about its future potential. The future potential of an enterprise lies not only within its financial capital, but at more than 50% - some experts from the auditing community claim up to 75% - in its Intellectual Capital. Creating transparency about the enterprise´s IC will enable it to manage its intangible resources better than before, to increase its staff´s confidence and motivation as well as imparting greater certainty to investors and other stakeholders about its future earning potential.

An IC Report particularly helps to overcome the differences in knowledge of entrepreneurs on the one side and financiers on the other side (constituting "information asymmetries") by providing key points and associated narratives which demonstrate that an SME looking for financial support…

- … understands its technologies and areas of expertise – its skills, competencies and capabilities;
- … understands its areas of competitive advantage, its intellectual property (IP) and the technical standards related to its products, processes and markets;
- … understands its customer´s needs, wants, aspirations and the value that its products and services are able to deliver to them;

- … understands its markets and how to access them;
- … has a credible strategy for getting its products and services to market, profitably, despite local or even global competition;
- … has a credible strategy for managing the overall sequence of activities needed to succeed (e.g. value chain positioning and operation management);
- … is able to substantiate the assumptions used in the preparation of financial projections and is able to provide a flow of information to lenders and investors to keep them informed on how the business is progressing.

Although Intellectual Capital Reporting has been applied first hand in around thousand cases in German-speaking SMEs by the method called "Wissensbilanz – Made in Germany" [7], it has remained an exclusive method in comparison to others, e.g. the Balanced Scorecard (BSC) approach. The reason after the author´s experience is simple: BSC translates the different (in total: four major) dimensions of a company´s strategy into concrete and quantitative forecast objectives given to each responsible manager as a scorecard to be fulfilled, whereas IC reporting and conduct requires a more self-responsible intelligent interpretation in the following dimensions:

- market-environmental and competition influential factors,
- the classic, self-conducted trialogue w.r.t. vision – mission – strategy of a company,
- the potential in human, relational and structural capital which a company has at hand,

- the key processes and their optimization – a business which is so common today, that large parts of processes are delegated into software running the company in its clerical dimensions, however, the strategic steering still remains with the managers,
- finally and as an integral part, the presentation of financial results, however, as an equivalent in completion of the non-financial outcomes and impacts which also define the future-proneness of a company.

For large companies of > 1.000 employees, studies say that the time investment required to produce an IC report is less than 0,001% of the total work time. Although there is no empiric or scientific proof to allow extrapolation to smaller scales, reducing the number of employees of a company as low as down to 10, i.e. by a factor of 100, this should keep the reporting effort lower than 1%, which conforms to practical experience made in ICR projects. The gain on the other side of the balance sheet is argued to be 5% in cost reduction, which is made by factors such as

- easier and more effective communication because of better understanding of responsibilities and decision processes,
- less time spent searching and finding, mainly because employees amongst themselves know better who knows what or who has best access to information needed,
- avoiding redundancies mainly w.r.t. meetings, also better preparation, better allocations of responsibilities and better control of follow-ups,
- reducing “underground communication” and gossip, because everybody has a clear picture of

the company´s strategy, policies and rationale of decisions.

Of course, the disclosure of previously hidden “secrets” in an organization in the course of an IC Reporting project may raise tensions and even cause “explosions” between certain people with problematic relationships. The experience which the consultants and moderators in IC Reporting projects have gained so far is that in such cases the ICR-project serves as a catalyst for necessary changes. These changes would otherwise be initiated by other triggers usually becoming effective too late to prevent conflicts or with even destructive effects. The rational methodological approach given by IC Reporting can avoid or at least smooth such issues.
To introduce IC Reporting a company needs some extra motivation (just as if one wants to start a “diet” or to exercise a new regime etc.). Compared to other methods for improving competitiveness it requires a deep understanding of the concept of values beyond material values. Due to this abstract condition, this method is more “luxurious” than “hand-crafted” methods such as Balanced Scorecard.
The Kosice project as its main result produced a series of educational material for mainly SMEs which can be accessed via LEGEND’s home page
(http://project-legend.eu/category/publications/project-outcomes/)

22.7. The Danube Region [13]

The area covered by the EU Strategy for the Danube Region (EUSDR) stretches from the Black Forest (Germany / Baden-Württemberg) to the Black Sea

(Romania-Ukraine-Moldova) and is home to some 115 million inhabitants. “Official” Member States in this group therefore are: Germany, Austria, Hungary, Czech Republic, Slovak Republic, Slovenia, Bulgaria, Romania and Croatia (as of 1.7. 2013). So called Accession Countries belonging to this group are: Serbia, Bosnia and Herzegovina and Montenegro. Finally, neighboring countries being included in the considerations and consultations are: Moldova and Ukraine.
The Danube Region Strategy which is a top-down strategy addresses a wide range of issues; these are divided among 4 pillars and 11 priority areas (see chart). Each priority area is managed by 2 Priority Area Coordinators (PACs).

The Priority Area Coordinators (PACs) ensure the implementation of the Action Plan by agreeing on planning, with targets, indicators and timetables, and by making sure there is effective cooperation between project promoters, programmes and funding sources. They also provide technical assistance and advice. The coordinators work in consultation with the Commission, and relevant EU agencies and national/regional bodies.
In the pillar “Building Prosperity” one of three priorities besides “Competitiveness” and “People and Skills” is “Knowledge Society”, which is the domain the author addresses with the project on “National IC for Romania” [11]- see 2.3.
Priority Area 07 "To develop the Knowledge Society (research, education and ICT)" which for our project is of

major importance is coordinated by Slovakia and Serbia, with the involvement of a wide network of key players. The EUSDR strategy, as has been documented from its beginning, made a series of suggestions on how develop the profile of a Knowledge (Society) Region. One typical action which demonstrates such commitment is “To strengthen cooperation among universities and research facilities and to upgrade research and education outcomes by focusing on unique selling points”. This means that universities and research institutes in the Danube Region are motivated to engage in stronger cooperation in various fields, such as analyzing existing education and research programmes in the Region and developing joint programmes of common interest, mobility schemes for students and researchers, common research projects, exchange of best practices (e.g. in implementing the Bologna process), or developing innovative education programmes for target groups new to universities (e.g. life long learning programmes for older citizens). Future cooperation should build on existing programmes, such as the EU programmes Erasmus and Erasmus Mundus, Leonardo da Vinci or the Jean Monnet Programme and make best use of existing structures like the Danube Rector's Conference.

Thus, on an action level, a series of initiatives have been triggered since 2011, however, no definition of what a “Knowledge Region” is or shall be so far has been given. The New Club of Paris (www.new-club-of-paris.org) as a competence body in the development of knowledge economy (and Knowledge Society) has taken a series of attempts in order to find and apply methods of characterizing regions and nations as “knowledge regions”; and, this paper aims to contribute to this discussion

The author considers the approaches taken by the Romanian uefscdi agency as well as by the LEGEND project to initiate the development of a National Intellectual Capital Report as two ideal approaches combining top-down and bottom-up strategies for finding the one important identity dimension also for the whole Danube Region i.e. for a large scale knowledge region. Romania and the Slovak Republic – besides Austria and maybe Serbia – are candidates to act as the pioneering regions for developing such extended profile.

22.8. The Potential of Tenerife as a model case for a Knowledge Island

The Humboldt Cosmos Multiversity (HCM) as a Think Tank located in the Canary Island of Tenerife on several occasions addressed the question, if and how this island could be a model region, a kind of a "study lab", to give it the profile of a "Knowledge Island". Several studies on the geopolitical role of the island have been made and reported [14], however, so far, no IC profile has been developed. This chapter of this paper is conceived as a suggestion how to approach such analysis.

The starting point for Tenerife is to first analyze its structural capital as one dimension of an IC Report. A first attempt in this direction was given in a presentation on occasion of the opening of a HCM conference [15]. The aspects of interest are

- The geopolitical positioning of the Canary Islands and Tenerife in specific

- The institutions being existing nodes in the innovation system of the island on which its further development as a knowledge island can be built.

The geopolitical positioning is illustrated in Fig. 3.

This positioning shows a specialty which makes the Canary Islands (and Tenerife) very specific. Their definitional dimensions are

- geographical: close to the African continent (~ 180 km +)
- political: belonging to the European Union, being part of the Kingdom of Spain. In European Commission's terminology, the Canary Islands are denoted as an "Ultraperipheral Region" of the EU.
- Ethnical and cultural: strong bindings to South / Latin America. Symbolically the famous research voyage of A. v. Humboldt to South America started from Tenerife, where he started his first research excursions. Historically, more emigrants of the Canary Islands went to South America than to the Spanish mainland. Some of them founded their own settlements (e.g. "Little Tenerife"). Today many descendants form those emigrants e.g. from Venezuela re-immigrate back to the islands.

Fig 3: The geopolitical positioning of the Canary Islands and Tenerife in specific

Concentrating on Tenerife the key institutions forming the key structural elements of the knowledge infrastructure are presented in Fig. 4.

Fig. 4 Institutions being nodes in the innovation system forming the IC structure of Tenerife

As in other regions, the cooperation between these institutions is still in its infancy. This observation is quite common in places, where the question on best positioning and competitive advantage (if this term ever may be applied to scientific institutions) is not yet sorted out.

By evidence (not formally proven), the island of Tenerife concentrates its intellectual capital in the following competence domains:

- medical and biomedical research (e.g. through its CIBICAN institute being part of the local university ULL)

- astrophysical research and research services as through its international "Institutp de Astrofíscia de Canarias" (IAC) which also is the platform organization of a large telescope field situated on a high geographical level, covering a broad series of astrophysical projects of highest quality (each managed and largely financed by the home nations of the telescopes),
- oceanography which, due to the geographical position of the island in the mid of the Atlantic, is a natural opportunity for marine research. The Spanish Oceanography Institute (IEO) associated with the Canary Islands Oceanographic Centre has its lab facilities on the island. Their field of activity is the study of the sea and its resources.
- Energy farming, which results from the natural advantage of the "island of eternal spring" receiving a lot of sun, as well as being served with constant winds as an effect from its geographical position within the sea.

Since an island has the characteristics of being a well delimited territory with a structure and an infrastructure in itself, it is an ideal subject to become an experimental platform as a whole system. For this reason, profiling such island by means of an IC analysis (and report) is a natural and thrilling challenge.

22.9. One further future perspective: A network of Knowledge Islands

Islands, especially smaller islands, have their own natural profile given by their geography, their position and thereby logistical challenges and economic as well as their special climatic conditions.

The idea of looking at islands as knowledge islands in a first instance was invented in a project conducted by members of the New Club of Paris (mentioned in several instances of this paper) when they studied the history of Dubrovnik (in former times called Ragusa) in the South of Croatia, reported amongst several sources in [16]. Since the coast of Croatia, the Adria, is crowded with hundreds of islands, one of those participants attending the Ragusa workshops declared one of the islands where he was furbishing a hotel with an advanced technical ICT infrastructure to be a "knowledge island" (which, at best case, it was by the fact that the technological foundations existed at that time in the early years of our century).

The conceptual idea to look at an island as a kind of "living lab" – as was mentioned for the case of Tenerife before - generated the idea to perceive such island as an ideal case study for a "knowledge community". In fiction literature – think of Daniel Defoes Robinson's island, Thomas Morus' Utopia, Atlantis sunk in the sea or the tales about Caribean or Pacific treasure islands etc. – islands preferably play frequently the role of a mysterious projection of human fantasies. In the case of Utopia, such island was designed by its author for an idealized society being different from the real existing ones with all their deficits. Why not to conceive islands prototypes for hosting a Knowledge Society?

In the course of several intellectual events taking place under the auspices of the Humboldt Cosmos Multiversity, communication was built between representatives of islands such as Malta, Puerto Rico, Hawaii, Tenerife, … demonstrating interest in creating communication between their islands under the brand title of "Knowledge Islands".

This paper closes by putting this concept in the picture of a worldwide knowledge society as a framework for future work on the subjects discussed, likely hosted by the Humboldt Cosmos Multiversity, which, in itself, is an emerging node in a network of knowledge communities.

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Teacher

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- 1980-1985 – Guide in the Portuguese port wine cellars "Ferreirinha" in the summer campaigns.

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- 2006-2008 - Master in Contemporary Social and Economic History with a thesis entitled "Maria de Lourdes Pintasilgo - Years of Youth Catholic University Women - 1952-1956", published by Editora Almedina in April 2009.
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- Participation in various seminars, conferences, training courses, both in Portugal and abroad, related to the academic and professional field.
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- 1990-92 - Specialization in the Course of Documentary Sciences, Faculty of Letters, University of Coimbra.
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- 1986 - Scholarship awarded by the Goethe-Institut of Coimbra for an intensive course in German in Rothenburg ob der Tauber (Germany).
- 1985-86 - Attended the 1st Semester of the Course of History and German at the University of Hannover, Germany.
- 1980-84 - BA in History (Archaeology) by the Faculty of Letters, University of Porto.

Others

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University Assistant at Vienna University of Technology, Dpmt of Electronics Engineering
Research & Teaching Research and teaching activities in the area of technology enhanced learning and Internet based applications.
Other relevant activities Organizing international conferences on technology enhanced teaching and learning. Chairman of the ecoMEDIAeurope conference series, chairman of the Austrian eLearning conference series and co-chair of the eLearning Summit Tour Germany-Austria-Switzerland. Founding member of the International Association of eSciences.

Serving as an external expert for higher education accreditations for Kosovo Accreditation Agency and for Public Agency for Accreditation of Higher Education Albania.
Selected Publications
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1997 Master degree at the Danube University Krems and the Alaska Pacific University USA.
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José Luis Roda García was born in La Orotava, Tenerife, on 10 November, 1966. He is married and has two children. He finished his bachelor degree in Computer Science at the University of Las Palmas de Gran Canaria in1991 and got his Ph.D. in Computer Science in 1998, at the University of La Laguna. Since 2000, he has been anAssociate Professor at the University of La Laguna.
He has been teaching for twenty-four years at the University of La Laguna, principally in the main topics of SoftwareEngineering, Programming, Project Management, Software Architecture, and Law Relating to Information Technology. He has supervised more that forty final projects in Computer Engineering.
His main research topics are Software Engineering, Model-Driven Engineering, Open Data, Linked Data, Big Data and Bioinformatics. He was a visiting professor at McMaster University, in Hamilton, Canada, in 2010. He has published in journals and at conferences and has been the director of research projects for several different Spanish schemes (PROFIT, PETRI, AVANZA).

He has collaborated with IT companies over the last fifteen years.
For the last three years he has been Director of the Canaries' Open Data Project (www.opendatacanarias.es) (2012-2015), developing Open Data strategy to publish open and linked data in the Canary Islands.

23.7. Rodrigo Trujillo GONZÁLEZ

Professor at Universidad de La Laguna

Rodrigo Trujillo González was born in Gran Canaria, on June 9th, 1966, he is married and has two children. He finishes his bachelor in Mathematics in 1989 and got his PhD in Mathematics in 1996, both at Universidad de La Laguna. Since 2002 he has been Associate Professor at Universidad de La Laguna.

He has been visiting professor at Indiana University – Bloomington in the 90's and at Kansas University in the middle of the last decade. He has been also invited to the Universsity of Edinburgh, Universidad de Sevilla, Universidad del País Vasco, Universidad de Málaga and Universidad Autónoma de Barcelona.

He has more than twenty scientific publications and his work accumulate more than five hundred cites. His specialization area is the Harmonic Analysis, with special interest in singular integral operators and theory of weights.

In the last twelve years he has developed an intensive administrative activity at the government of his university: as Vice-Dean of the School of Mathematics (2003-2006), Chairman of the Open Source Office (2007-

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He is co-funder of the Humboltd Cosmos Multiversity association together with Prof. Güenter Köch, one of the best specialist on Intellectual Capital in the world. This organization wants to promote the knowledge and attract the best talent personalities to Tenerife.

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- 1986 professor of the State University of Telecommunication in St. Petersburg
- 1988 - 1996 several duties with Alcatel: sales director of Austria, export director for Central- and Eastern Europe and Latin America.
- Headquarters in Paris with the responsibility for Latin America and Europe, development of the distribution network of Alcatel in Eastern Europe, foundation of 12 companies with nearly 100 subsidiaries (Kazachstan to Hungary)
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23.10. Günter KOCH

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Günter Koch as a professor is guest at Technical Universities in specific in Austria and at the "Danube University", and permanent Adjunct Professor in Informatics at the IICM-Institute of the Technical

University of Graz. He works as a consultant to governments, banks, industries, in specific software dependant or software producing industries.
Professor Koch unites several and even divergent qualifications in his person: entrepreneur, manager and scientist. His last appointment as a manager of a big organisation was until the 1st half of the 1st decade of this century as the CEO of the Austrian Research Centers (ARC), Seibersdorf, today called Austrian Institute of Technology (AIT) , Austria's largest applied research organisation, employing some 1200 people in many different disciplines, including material sciences, life sciences, information technologies, system research, medical technology, energy and environment etc.
In his role as CEO in cooperation with a colleague from Graz University he developed the now widely used model ad method of an Intellectual Capital Report (ICR). This model served as the basis for even a law after which all Austrian universities must report their annual progress in respect to the development of their "intellectual capital". In 2012 he built-up the Humboldt Cosmos Multiversity, a university complementary think tank in Tenerife, Spain, which became legal in 2014. Since then G. Koch ist its President. His first appointment in Austria was in the early 90ies, when he was invited to become a guest professor in systems analysis and systems architectures at the computer science faculty of Graz Technical University. During this period he was also a member of the university board of the Sévenan branch of the French University of Compiègne. From 1993 to1997 he was the Founding and General Director of the European Software Institute (ESI) in Bilbao, Spain, at its time a most prominent foundation by the European industry and the European Commission, which later served as the model case for

the European Institute of Technology (EIT) with its head office in Budapest. In 1997 he joined SUN Microsystems in their Geneva offices as a chief consultant in Software Engineering and Management.
After having been assistant professor at Karlsruhe University's computer science faculty from on 1975, he became the founder managing director of a systems company specializing first in medical informatics in 1981 and later in automation and in software technology. He served in this function until 1993. In an extra appointment he was initiating and heading a Technology Center in the city of Freiburg / Germany.
Günter Koch since 1998 lives in Vienna and acts as the Vice President of the Austrian Association for Research in IT and managed (part time) as General Secretary of 'The New Club of Paris' from 2005 to 20014. He is a member of the Board of the Fraunhofer Institute FIRST in Berlin, and he is affiliated with the Vienna-based Knowledge Management Associates/ Academy / Association (KM-A) and its cooperation partner www.execupery.com , where he can also be contacted. An extensive CV can be found via
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1990 – 1998
Head and member in several international and national committees and boards
i.e. EATA and IAFeS.
Several lectures, articles and books
Special topics: District heating, energy and flow measurement, university administration, engineering education.

23.12. Matti LÄHDENIEMI

Tampere University of Technology, Finland

Adj. Prof. Matti Lähdeniemi gained a Ph.D from the University of Turku, and is presently an Adjunct Professor at Tampere University of Technology and at the University of Turku. His special fields are automation, image processing, entrepreneurship, knowledge transfer, quality and impact evaluation and RDI processes. He is/has been the director and consulting tutor of numerous industrial projects, and a member of several groups evaluating the impact of RDI and quality at universities on a national level and RDI measures on a national and European level. He has prepared and analysed the international evaluation of RDI activities at Finnish Universities of Applied Sciences. He has written about 190 articles on the above-mentioned topics. Previous positions include Research and Innovation Director, Vice president and Dean (Satakunta University of Applied Sciences), professorships (Computer Science/Tampere University of Technology, Materials Science/University of Turku, Surface Physics/Humboldt-Foundation), project manager in different research and industrial projects in Finland, Sweden, Germany and Japan, and chairman or board member of several organisations and foundations.

23.13. Jon MAES

Master Student of the Master Program "Research and Innovation in Higher Education" (Joint Degree Danube University Krems/Austria, University Tampere/Finland, Pedagogic University Beijing/China)
Maes.Jon.X@student.uta.fi

Education:

- Master (expected graduation Jun 2016): Master in Research and Innovation in Higher Education (MARIHE), ERASMUS+ Joint Master Degree, University of Tampere, Finland; Danube University Krems, Austria; Beijing Normal University, China, Osnabrück University of Applied Sciences, Germany
- Master (expected graduation Dec 2016): Master of Science in Higher Education, Concentration in Global & International Education, Drexel University, USA

- Bachelor (graduated Jun 2004): Bachelor of Arts in Religious Studies, Minors in Political Science and Philosophy, Gonzaga University, USA

Professional Experience

- Jan 2015 – Present: MARIHE eBook series editorial team
- Nov 2014 – Present: WPHES eJournal peer reviewer and social media marketing team
- Aug 2014 – Present: MARIHE Quality Board Student Representative
- April 2013 – Present: Assistant Director of International Recruitment & Admissions / Outreach Specialist, Tacoma Community College, USA
- Nov 2008 – Oct 2014: Project Manager & Curriculum Developer, Language Cradle Consulting, Canada
- Aug 2010 – Dec 2013: Senior Academic Manager for South East Asia and South Korea, ACT Education Solutions, Limited, Indonesia
- Jul 2006 – Jul 2010: Director of Studies for South Korea, STEPEDU Company Ltd., South Korea

Publications: Author/coauthor for two articles in MARIHE publications; Contributing writer for over 30 books in 10 Academic English/ESL textbook series.

Presentations: 12 public speaking appearances at conferences, seminars, and workshops in six countries.

23.14. Don Eduardo Pintado MASCAREÑO

Minister of the Government of Tenerife

Eduardo Pintado Mascareño was born in Santa Cruz de Tenerife, on May 3th, 1951, he is married and has two

children. He holds a degree in Political Science and Sociology from the Universidad Complutense de Madrid and began his career practicing various management positions in business associations in Tenerife as Cepyme, Cetepyme and Fedeco.
He later served as head of the Spanish Institute for Foreign Trade (ICEX) in the province of Santa Cruz de Tenerife and the Canary Islands Economic Development Company SA (Proexca) sector.
Since 1994, he is professor of Political Science and Public Administration at the Faculty of Economics and Business at the University of La Laguna. He is currently director of Institutional Relations of the Chamber of Commerce, Industry and Navigation of Santa Cruz de Tenerife. In the 80s, he was president of the Automobile Federation Interinsular Santa Cruz de Tenerife. He speaks several languages.
In his first time at the Cabildo de Tenerife (1995-2003), he developed the positions of Minister of Trade and insular counselor Land Protection. This year he has concluded his third legislative period at the Cabildo, by assuming the Special Delegation Counselor postion on Trade and Development Projects.

23.15. Olli Mertanen

Executive Director at Federation of S-W Finland UAS (CoastAL), former Vice President of Turku University of Applied Sciences

He has long background as well in industry in the field of communications technology as in engineering education in the field of information technology. He received B.Eng in automation technology (1976) in Kotka Institute of Technology, M.Sc. in digital and computer technology (1979) in Tampere University of Technology where he also received Lic.Sc. in computer science and telecommunications (1985) and D.Sc. in computer communication (1992). His industrial background includes positions in Philips Data Systems and Ericksson telecommunications. During his university career he was mentioned among 100 finnish avantgardists in the field of industry and business and awarded the recognition of EIS / excellent educator in electronics. 2012 he got an Achievement Award by INEER organization for his excellent work in the field of education and for his contribution to the creation of entrepreneurial spirit among future engineers. At the moment he is active in the field of enhancing creation of innovations as a result of co-operation between industry and University and furthermore leading to entrepreneurship.

23.16. Marisa Sigala

Marisa Sigala is a candidate PhD with a thesis for e-government in Greece.

Her first diploma is as a Civil Engineer by TEI Piraeus Greece and her master's degree is in Education and Computing by the University of Athens. She has been working for the TEI of Piraeus for15 years and also had working as a secretariat member for the Open University – TEI Piraeus collaboration in 1998 – 2002. Mrs. Sigala has participated in a several Projects (as Project Manager in Tempus Project) and conferences such as: Era 7, conference by the University of Athens and has also worked as a lab assistant in the civil engineering department of TEI Piraeus from 1999 – 2009.

23.17. Pekka SILVEN

Demola Oulu, Finland

Pekka Silvén, Head of Demola at Oulu University of Applied Sciences. Pekka Silvén has several years of experience in international education as a lecturer and course director. He has been project manager and expert in several remarkable international and national projects. He is leading Zef expert in evaluation, quality, feedback and development processes. He has been invited key-note speaker in international conferences and expert member in several international committees.

email: pekka.silven@oamk.fi

Education

1989 Master of Education, University of Oulu

Work experience

2014 - Head of Demola Oulu, Oulu University of Applied Sciences

2013-2014 Oulu University of Applied Sciences

Providing professional services for the local regional, national and international partners in public and private sector

2011 -2013 Head of Continuing Education (former Professional Development Services) at Oulu University of Applied Sciences

2009 - Director of Professional Development Services at Oulu University of Applied Sciences

2000 - Strategy, Evaluation, Feedback and Development Expert

Wide experience and expertise in consulting large variety of public and private organisatios

2000-2009 Oulu University of Applied Sciences (Polytechnic, Institute of Technology), lecturer for IT-subjects
Director of international IT-course (Digital Media and Multibroadcasting)
1997-2000 Oulu University of Applied Sciences (Oulu Polytechnic, Institute of Technology) and the school management of Oulu: Developer of information technology in teaching
1993-1997 Elementary school teacher, Pöllönkangas school, Oulu, Finland
1990-1993 Heinätori school, Oulu, Finland, special education-teacher
1989-1990 Elementary school teacher in Eskilstuna, Sweden

Part-time
1989-2009 Freelance radio journalist:
- SR (Swedish Broadcasting Corporation)
- YLE (Finnish Radio Broadcasting Company)

1998-2000 Private owned company:
- internet consulting
- web-design
- photography

2001- Zef Solutions Ltd.
Co-founder and Board member (2001-2013)

Languages

Finnish	mothertongue
Swedish	fluent
English	fluent
German	basics

23.18. Rodrigo TRUJILLO

Rodrigo Trujillo González was born in Gran Canaria, on June 9th, 1966, he is married and has two children. He finishes his bachelor in Mathematics in 1989 and got his PhD in Mathematics in 1996, both at Universidad de La Laguna. Since 2002 he has been Associate Professor at Universidad de La Laguna.

He has been visiting professor at Indiana University – Bloomington in the 90's and at Kansas University in the middle of the last decade. He has been also invited to the Universsity of Edinburgh, Universidad de Sevilla, Universidad del País Vasco, Universidad de Málaga and Universidad Autónoma de Barcelona.

He has more than twenty scientific publications and his work accumulate more than five hundred cites. His specialization area is the Harmonic Analysis, with special interest in singular integral operators and theory of weights.

In the last twelve years he has developed an intensive administrative activity at the government of his university: as Vice-Dean of the School of Mathematics (2003-2006), Chairman of the Open Source Office (2007-2010), Chairman of the Technology Transfer Office (2010-2011), Vice-Chancellor of Internationalization and Excellence (2011-2014), Vice-Chancellor of Research (2011-2014) and Internationalization (2014-2015) and Coordinator of the Campus of Excellence CEI CANARIAS (2011-2105).

He is co-founder of the Humboltd Cosmos Multiversity association together with Prof. Günter Koch, one of the best specialist on Intellectual Capital in the world. This organization wants to promote the knowledge and attract the best talent personalities to Tenerife.

23.19. Dimitris TSELES

Technological Education Institute (T.E.I.) of Piraeus School of Engineering Department of Automation Engineering

Professor of Automation Engineering Department of T.E.I. Piraeus, Deputy President of T.E.I. Piraeus, Vice-President of Hellenic NARIC. BSc in physics, MSc in Electronics and Communications, MSc and PhD in Electronic control.
2003 – 2010: Dean of Engineering School of Technological Education Institute of Piraeus, 1995 – 2000: Head of Department of Automation of T.E.I. of Piraeus, 2003 – 2006: Vice – President of Research Committee of T.E.I. of Piraeus, 2002-2010: Member of the Council of the Center for Technological Research of Piraeus and Islands, Director of many research projects, concerning new technology applications in various fields and especially in agriculture in previous years, directing a special program for young farmers funded by General Secretariat for Youth. Chair (and founder) of eRA Conferences. Over 130 objects of publications.

23.20. Radu VASIU

President IAFeS
President of the Research Committee of the Politehnica University of Timisoara Senate, Director of Multimedia Research Center, Politehnica" University of Timisoara
Bul. V. Parvan No.2, 300223 Timisoara, Romania

Radu Vasiu received the M.Sc. and Ph.D. degrees in Electronics and Telecommunications Engineering from the Politehnica University of Timisoara, Romania in 1982 and 1997, respectively. He is currently a professor at the Faculty of Electronics and Telecommunications Engineering of the Politehnica University of Timisoara. His research interests in the last years are in the area of smart city, open data, e-learning, multimedia and web technologies. Since 1993 he was involved in many international projects (Tempus, Phare, Socrates, Leonardo da Vinci, Life Long Learning, FP6, etc), especially in the field of multimedia and e-learning, both as coordinator or as contractor. He is now the President of the Research Committee of the Politehnica University Senate and the Director of the Multimedia Research Centre.

He acted as invited professor in different universities from UK, Finland, France, Austria, Greece and Netherlands. He has initiated and further developed 5 new degree specialisations at undergraduate and postgraduate level in Multimedia, Digital Media and e-Activities.

The publication list includes 12 books and more than 100 papers presented at different international conferences. He was involved in 28 research or international cooperation projects. He has initiated in 2013 the Timisoara Smart City Commitment as part of the EU Smart Cities and Communities Initiative

Currently, prof. Vasiu acts as President of the International Association for e-Science (IAFeS), that promotes at international level the use of ICT in science and technology.

He is also a member of IEEE Computer Society and IEEE Communications Society, European Association for Telematics Applications (EATA), European Distance and E-learning Network (EDEN), International Association of Science and Technology Engineers for

Development (IASTED), European Portal for Advanced Collaboration in E-learning (EuroPACE) and of the Commission for European Integration of the Romanian Academy, Timisoara branch.

23.21. Fangio WAN

Jianghan University, Wuhan, China
wfjwhut@163.com

Doctor: Wuhan University of Technology (China) 2007-2010
Major: Logistics management
Master:Wuhan University of Technology (China) 2003-2006
Major: Transportation Planning and Management
Undergraduate:Wuhan University of Technology (China) 1999-2003
Major: Transportation Management
Working experience: Associate Professor at Jianghan University (China) 2010-current
Achievements: In recent years, my main research is the analysis and optimization of logistics system and supply chain management, focuses on the reverse logistics system optimization, supply chain design and optimization fields. I have published 17 papers in journal, 1 monograph and 2 textbooks. I have undertaken 10 projects, including “on the location - routing problems of city hazardous waste reverse logistics”, “research on the evaluation system of fresh agricultural products in Wuhan city”, etc.

Humboldt Cosmos Multiversity (HCM) *)
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1060 Vienna, AUSTRIA
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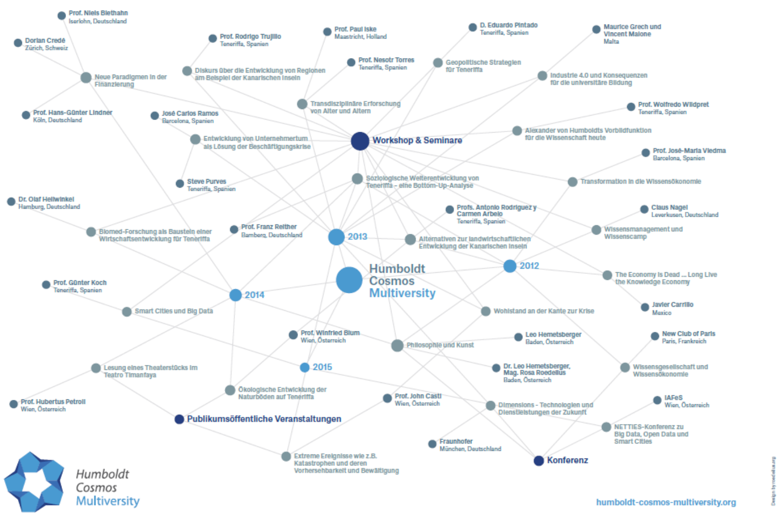
*) Humboldt Cosmos Multiversity is a registered association under Spanish law.
See: www.humboldt-cosmos-multiversity.org

Humboldt
Cosmos
Multiversity



CABILDO DE TENERIFE

TAGORO

ULL | Universidad de La Laguna

The 'Idea of a University' was a village with its priests.

The 'Idea of a Modern University' was a town with intellectual oligarchy.

The 'Idea of a Multiversity' is a city of infinite variety...
This city is more like the totality of civilization as it has evolved...
and movement to and from the surrounding society...

Multiversity introduced by Clark Kerr in 1963
President of the Universities of California

The HCM is open to anyone interested in its subjects and who is ready to actively contribute. Working languages are **English**, German and Spanish. Please inform yourself under *humboldt-cosmos-multiversity.org*

Die HCM ist offen für jede Person, die an ihren Themen interes-siert und bereit ist, aktiv beizutragen. Arbeitssprachen sind Englisch, **Deutsch** und Spanisch. Bitte infor-mieren Sie sich selbst: *humboldt-cosmos-multiversity.org*

La HCM está abierta a todo el mundo que estuviera interesado en sus temas y dispuesto a contribuir. Los idiomas de trabajo son el alemán, **español** e inglés. Mas informa-ciones tenga a bien encontrar: *humboldt-cosmos-multiversity.org*

Inauguration in February 2012

Achievements from 2012 to now

- Every year in spring and autumn a conference took / takes place; so far, in total, more than 30 events on different high-level subjects.
- More than 200 selected participants engaged in high-level workshops, seminars and think tank events.
- Range of subjects are covering current “Grand Challenge” questions such as the ecological development of regions, sociological changes in society, industry 4.0, future education, informatics, big data, smart cities, healthy living, knowledge regions, demography, philosophy, art … and much more.
- In cooperation with Tenerife-based institutions such as its government, the university ULL and the museum for contemporary art (TEA) remarkable events, amongst them exhibitions and cultural performances, have been realized.

The mission and future program

- The Humboldt Cosmos Multiversity (HCM) – following the convictions of its namesake A. v. Humboldt – offers a **multi- and trans-disciplinary discourse space** within which grand questions needing urgent solutions are put on stage.

- The preferred way of furthering the discussions are **round tables, think tanks, workshops, "camps"**, and, as less preferred formats, classical seminars, lectures or presentations. In other words interaction and involvement of participants have priority.
- Subjects therefore are the **big questions of our time**, however related to local and concrete challenges, such as conflicts of cultures and religions, radical changes in society such as in employment, safeguarding integration and coherence in developing a united Europe based on its strong regional roots, finding intelligent concepts to solve the demographic problem, etc., etc.
- HCM aims to **take benefit from diversity** in age – elder thinkers and young contributors are most welcome! – cultural backgrounds, professions, life experiences, disciplinary affinities. HCM is neutral with respect to religious or philosophical mindsets and expects open and tolerant respect between its participants.
- The setting of the HCM is also given by its main **convention facility**, which is a historic building in local style, a former village court house called **La Casona**, located in the picturesque "wine municipality" Tacoronte – a place with a garden for relaxed contemplations, discussions and social gathering.

IAFeS Edition

Volume 1:
„Challenges of Industrial Clustering in the 21st Century“
ISBN 978-3-9503983-0-4

Volume 2:
"Open Data and Big Data – The Impact on Digital Society and Smart Cities"
13th NETTIES Conference (Network Entities), Humboldt Cosmos Multiversity
Tenerife March 5th – 8th 2015
ISBN 978-3-9503983-1-1

Volume 3:
„Supply Chain Concepts for Steel Industry - Implementing new concpets for Improved Profitability and Competitive Advantage“ by Daniel JUNG
ISBN 978-3-9503983-2-8

Publisher: IAFeS – International Association for eScience
The association, whose activity is not directed towards profit, aims:

- to promote the development, education and research in the area of eScience:
  Information and communications technology (ICT), telecommunications, e-learning, emedia, e-commerce, e-government, e-democracy, e-culture, e-health, …
- promotion of young researchers in these areas
- offering an exchange platform for experts
- offering an international co-operation platform

IAFeS
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A 1010 Vienna
Austria

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