D2.1 – Production of a position paper including contents for each of the 7 HUBS

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1. Executive summary

The InCITIES project aims to achieve the transformations of HEIs (Higher Education Institutions) and their surrounding ecosystem both centred on cities' needs of inclusion, sustainability and resilience. Its specific focus on widening countries (Portugal and Slovakia) will allow overcoming structural, sociocultural, economic, political and institutional barriers. The InCITIES WP2, in a step-by-step pathway, plans incrementally HUBs implementation to co-create research strengths starting from knowledge co-creation around small groups of multidisciplinary researchers of each HEI partner.

A step-by-step approach has been proposed to set the basis of the knowledge HUBs on research and innovation; a survey has been launched in each HEI partner to collect current "hot" research topic and relevant research topic for the next 5 years for each one of the 7-thematic areas chosen to structure the InCITIES project.

The contributions received have been processed and aggregated when relevant in a co-construction process using email exchange and consolidation workshops.

The approach was successful with more than 230 contributions received coming from 60 researchers working in the 5 HEI partners. Another point is that most of the contributions received have been aggregated in relevant subtopic and involved at least two project members; this will be a good basis for developing collaborative work in the follow up of this task (work to be done in task 2.2).

Finally, during the survey, a huge collection of scientific references and relevant projects has been gathered and will be shared between the partners to extend their cross knowledge.

In the next task of WP2, the research contributions identified will be consolidated by a second round of discussion between researchers; in parallel, the present document will be shared with some stakeholders identified in the project proposal by online meeting or taking opportunities of conferences.

2. History of changes

Title of the document	Version number	Changes	Who	Date
D2.1 – InCITIES Knowledge Hubs building-15-may-2023-draft-version-0.1	0.1	Initial version	C Marin-Lamellet (Uni Eiffel)	15/05/2023
D2.1 – InCITIES Knowledge Hubs building-25-may-2023-draft-version-0.3	0.3	Peer reviewed version	Several reviewers from all HEI partners	25/05/2023
InCITIES Deliverable D2.1 – Production of a position paper including contents for each of the 7 HUBS-31-May-2023-version-1.0-Final	1	Version following peer review	C Marin-Lamellet (Uni Eiffel)	31/05/2023
InCITIES Deliverable D2.1 – Production of a position paper including contents for each of the 7 HUBS-02-April-2024-version-2	2	Add a summary on the steps followed; add in annex 2 the shorted version	C Marin-Lamellet (Uni Eiffel)	02/04/2024

Table of contents

Table of tables

Table of figures

3. Introduction

The InCITIES project aims to achieve the transformations of HEIs (Higher Education Institutions) and their surrounding ecosystem both centred on cities' needs of inclusion, sustainability and resilience. Its specific focus on widening countries (Portugal and Slovakia) will allow overcoming structural, sociocultural, economic, political and institutional barriers.

During the discussions between the partners concerning the best way to connect researchers, the consortium decided to define scientific topics that would enable us to base the cooperation on widely addressed scientific topics. In addition, these topics were also determined considering the European thematic areas covered by the Horizon Europe work programmes and priorities.

The InCITIES WP2, in a step-by-step pathway, plans incrementally HUBs implementation to co-create research strengths starting from knowledge co-creation around small groups of multidisciplinary researchers (public policies sciences, social sciences, engineering, and informatics) of each HEI partner (internal involvement) and progressively engaging more researchers, students, and partner organisations from the surrounding ecosystems (external involvement).

Within WP2 this deliverable concerns the Work Package 2 "Research and Innovation InCITIES thematic HUBs", and more particularly the task 2.1 "Knowledge HUB building". **The global focus of this task** (and of the task 2.2) is **to implement co-creation methods for the development of a Common Research Roadmap.**

The deliverable content gives the results of our step-by-step approach.

4. Origin of topics to build the InCITIES project research HUBs

In accordance with the abovementioned approach to cities' needs, the EU Green Deal priorities were investigated. Then considering actions to reduce emissions, create jobs and growth, address energy poverty, reduce external energy dependency, improve our health and well-being, applied to the needs of future cities and the Regional Research and Innovation Strategies for Smart Specialisation (RIS3) concerning the regions of the partners HEIs of the InCITIES project (5 countries) as well as the 2030 Agenda for Sustainable Development goals defined by the United Nations enabled the partners to set 7 broad topics:

1-Questioning urban transition;
2-Nature in the city;

3-Energy in the city;

4- Vulnerability, inclusion, and health in the city;

5- Mobility;

6- Digital transition;

7-Sustainable and resilient cities.

These topics hence potentially brought complementary and interdisciplinary knowledge and competencies for a sustained collaboration embedded in the European policy needs and research programs.

5. State of the art on cities needs

Background approach on sustainability of cities

A literature search was first performed to frame international analysis on cities needs which cover sustainability, inclusion and resilience in the spirit of cities sustainable development. The sustainability approach found in the literature may be driven by the author's academic disciplines (i.e., figure 1 the description is focused on organisational issues). **Then we focused on key findings from this literature review that make sense to set common bases for our multidisciplinary research HUB construction.**
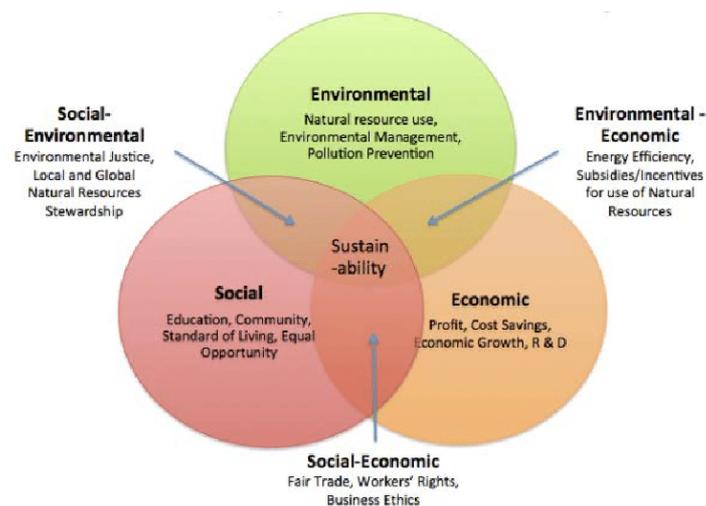
Figure 1 - Sustainable development issues and spheres interactions described with a disciplinary point of view (source: Manuela Ingaldi Czestochowa University of Technology · Faculty of Management, web consultation April 2023).

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Providing / sharing cities definition around the world and associated boundaries

Alberti et al (2017) propose an article focused on lifecycle sustainability assessment of cities and provide a review of background knowledge. This article analyses whether existing Life Cycle Assessment (LCA) and sustainability methods can be used in the assessment of a city or an urban region.

They have described the various scales considered in the cities as follows.
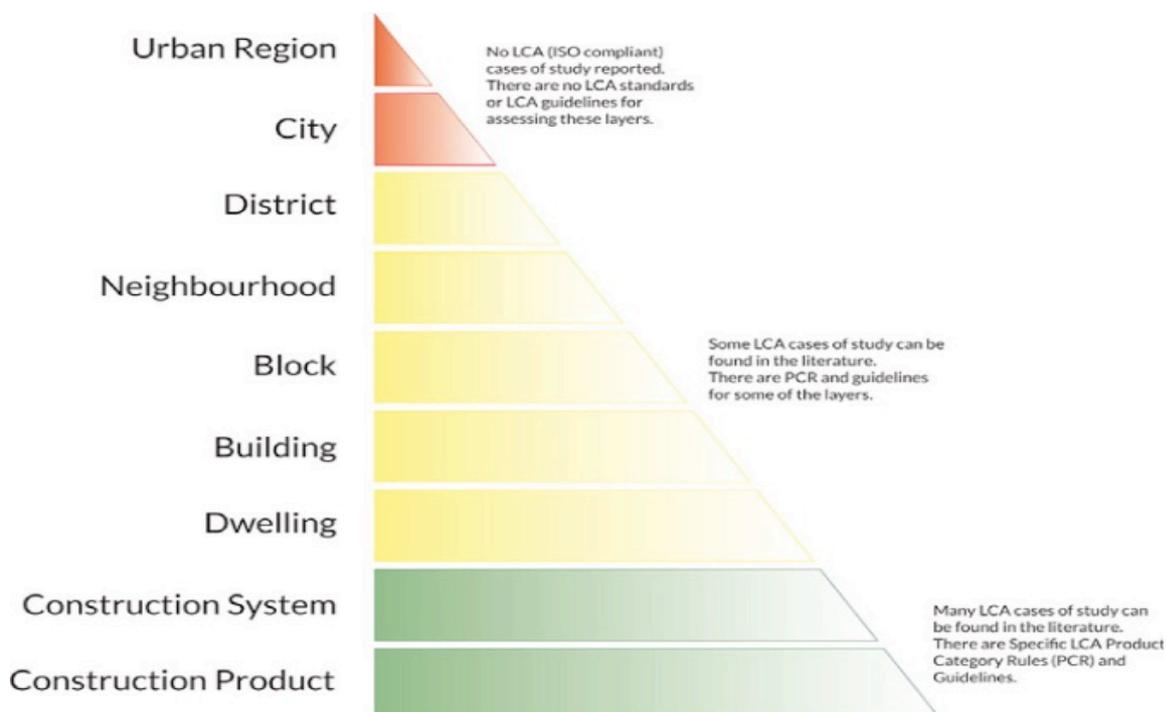
Figure 2 - Scales for cities environmental analysis with LCA methods (source Alberti et al (2017)).

The authors provide an analysis of the city definition examining "cities" and "urban settlement" in literature. From this survey they extract 8 categories among which 7 help to differentiate urban settlement around the world:

1) Population living within the boundaries, 2) population density, 3) area, 4) administrative boundaries defined by organisation or by law, 5) centre that cover land use or historic centres or urban consolidated areas, 6) services provided, 7) economic aspects considered or economic main sector and 8) geographical morphology which is found not significant for differentiation.

The highlights proposed by these authors concerns the LCA available in the literature for assessing cities and are that:

• Life Cycle Assessment (LCA) has been widely used in the construction sector.

• LCA beyond buildings are seldom studied and occasionally performed.

• LCA can and should be used for cities' Sustainability Assessments (SA).

• LCSA (Life Cycle Sustainability Assessment) of cities do not use the same functions or scope to frame the study.

• LCA standards are a good starting point for LCSA standardisation of cities. One can point out that these methods have been applied to the different scales of the figure up to the one of the neighbourhood and district.

Besides, sustainability approaches for cities and urban regions were also investigated. A few studies consider indices or indicators. The reviewed existing methods are not prepared to perform comparative assertions among cities or regions; however, they may allow self-comparison over time. The authors consider that "not a single methodology or standard has been found to include all the following aspects: (i) holistic point of view, (ii) multi-criterial environmental impact assessment, (iii) analysis from a Life Cycle perspective, and (iv) the adequacy for comparison among different cities or urban regions".

Identifying proper methodologies and scales to determine CO2 environmental degradation linked to energy demand

Urbanisation is extensively used as a determinant of environmental degradation in the literature according to Danish and Wang (2019). Theses authors investigated the best methods available to assess the environmental degradation in various countries around the world, considering their level of development and the relations with the economy and financial income. They conducted a wide literature survey to check whether it is sound to assess the CO_2 impacts or the ecological footprint. Hence, they explain why the more recent methodology of ecological footprint is more relevant to highlight environmental degradation. They report that "several studies have investigated various determinants of the ecological footprint, including tourism, energy consumption, stochastic behaviour, financial development, globalisation, use of natural resources, and social-political factors". The authors investigated the driving factors of the ecological footprint in emerging economies.

This paper led us to think that our topics may present interlinked phenomena and that this should be accounted for in our approach of HUBs. This also points out that our approach of cities and urbanisation development should be considered at the world level, considering the interactions with people: "As income increases, people demand higher standards of living, better education, and better health facilities and move toward cities, increasing the rate of urbanisation and the ecological footprint increases."

Understanding the energy demand to adapt the construction is investigated by Javanroodi et al (2019). They notice that "the share of urban areas in the world final energy consumption (70% in 2014) is expected to increase, especially due to the demand from building sector (IPCC, 2014)"; and also "studies have predicted that the portion of energy consumption for commercial buildings will increase notably while tend to decrease in residential buildings during the next two decades (Ruparathna, Hewage & Sadiq, 2016)".

Heating and cooling are accounted for more than 48% of the annual energy demand to achieve indoor thermal comfort in office buildings.

Considering the political level

In its article O'Connor (2019) concludes that "In the Four Spheres model the principles of which are shown in table1, a deliberative political process is very fundamentally necessary as the process of exploring and building a future together".

Table 1 - The 4th spheres and their interface by O'Connor (2019).

	SOCIAL	ECONOMIC	ENVIRONMENTAL	POLITICAL
SOCIAL	Forms of Collective Identity and Community: THE SOCIAL SPHERE			
ECONOMIC	OPPORTUNITIES & IMPACTS: "The economy versus the community"	Performance, Products and Output: THE ECONOMIC SPHERE		
ENVIRONMENTAL	LIVING WITH (IN) NATURE Meanings, Values & Risks: sustaining what & for whom?	ENVIRONMENTAL FUNCTIONS: Pressures on & services of the environment	Energy, Matter, Natural Cycles & Biodiversity: THE ENVIRONMENTAL SPHERE	
POLITICAL	SOCIAL POLICY: (Capacity of communities; citizen/public participation)	ECONOMIC POLICY: (Shaping the rules and limits of markets)	ENVIRONMENTAL POLICY: (Regulation of what counts as an environmental value)	Coordination, Power, & Governance: THE POLITICAL SPHERE

For this purpose, the science for policy handbook edited by Sucha and Sienkiewicz from the JRC (2020) and co-written by several dozens of authors, provides 19 chapters that will guide our code of practice while building the InCITIES research Hub and the next WP2 deliverables.

References

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6. Building the research HUBs

To build the knowledge research HUBs, a step-by-step approach was proposed to connect the academic staff of HEIs:

1- rethink and attach their research activities to be shared within the project to thematic R&I areas setup in the following 7 thematic HUBs: 1) Questioning urban transitions, 2) Nature in the city, 3) Energy in the city, 4) Vulnerability, inclusion and health in the city, 5) Mobility, 6) Digital transition, and 7) Sustainable and Resilient cities.

2- collect among the InCITIES researchers' information on their research hot topics and their literature references/publications to gather them, this phase is based on 2 questions targeting the identification of hot topics attached to each thematic hub with both a short term and a long-term perspective.

3- gather the answers provided in a short description of each hot topic and share the answers among the HEIs researchers.

4- cluster the researchers answers by organising for each topic an online workshop discussion to set the basis of cooperation on common hot clusters.

5- disseminate the output of the workshops with the hot clusters' description, contact details of researchers and their publication references.

6.1 First step: collecting research topics

A template has been designed by Uni Eiffel and discussed with the partners; the final template was sent to researchers December 20th of 2022 with a deadline at the end of January 2023 for completion. The collection process continues up to the end of February because many researchers asked for more time to complete the template.
The template was composed of different parts:
- Two Questions:
  - **Question 1:** please indicate three "hot topics" that are considered currently in your organisation-research department-laboratory in relation with the Hub topic
  - **Question 2:** please indicate three "hot topics" that should be considered in a five years period by your organisation-research department-laboratory in relation with the Hub topic

- Publications (not only academic papers, all categories of publications are welcome, but in English):
- Current projects related to the topic (please indicate if it is a local, national or European project):

Each partner contacted some researchers, without any limitation regarding the number; the name of the contributor has to be given.

6.2 Second step: preparing a file with all the collected answers, key words and filters

The answers to the template were gathered in an excel file containing the researchers' names, affiliation and answers to question 1 and 2.

Then, regarding **question 1** some key words were defined from the answers collected. Then came the idea to classify the hot topics also by the key words provided by the answers which would provide topical transversal connexions.
For question 2, the main key issues addressed in the answers collected has been identified.

6.3 Third step: connecting people through key words defined from their hot topic description and providing cluster description

After the consolidation of the answers collected, a first analysis was done by Uni Eiffel to try to identify in a given topic, contribution addressing the same issue or contributions which can be considered as closed to each other; the contributors of these issues were then contacted to validate this organisation or to suggest alternative choice. The final stage was the organisation of an online meeting per thematic HUB in order to reach the final consensus on the organisation of the contributions, to define title for sub-topics and classify the answers to question2. Forty-five (45) researchers have been involved in these workshops.

6.4 Fourth step: dissemination of the materials collected

The deliverable 2.1 is sent to all the contributors for final check and the summary of the research topics collected will be put on the web site of the project.
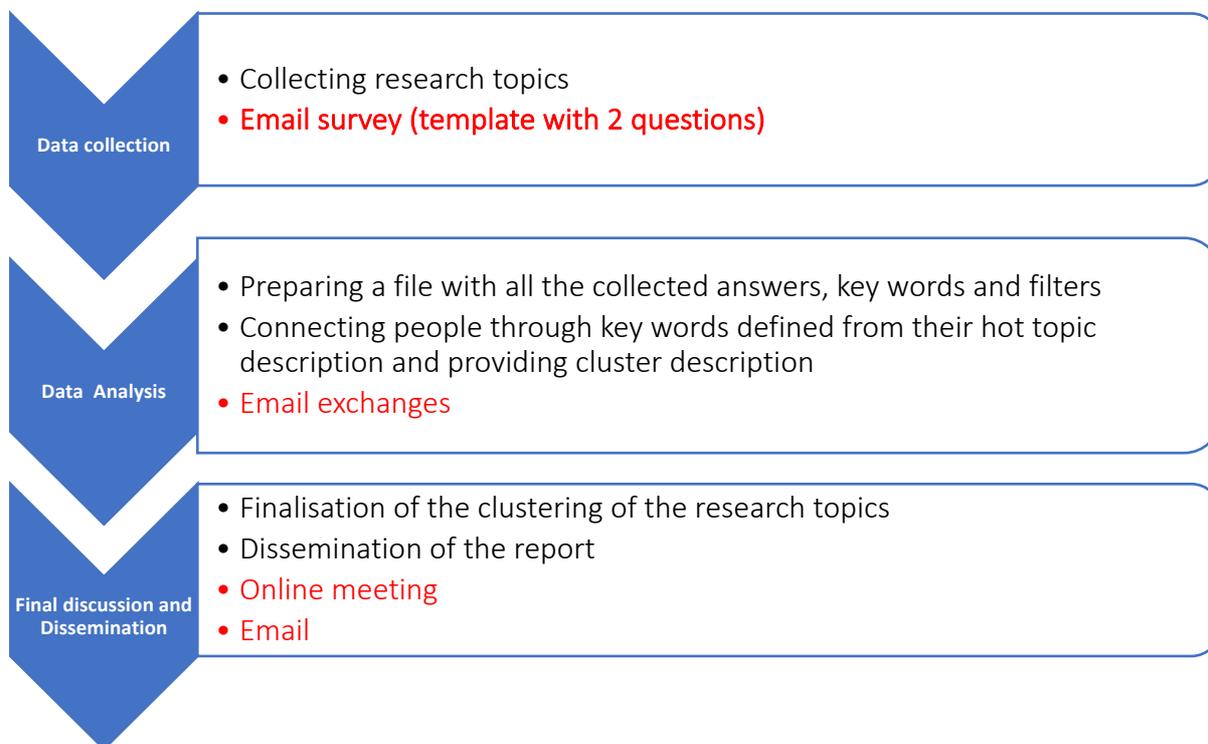
Figure 3 - Summary of the process used.

7. Output of the research hub on scientific hot topics

7.1 Contributions/contributors and hot topics proposal (covering question 1)

The **Question 1**: please indicate three "hot topics" that are considered currently in your organization-research department-laboratory in relation with the Hub topic
Nb: for each "hot topic", please develop in 5-10 lines, and indicate the approach used; if publications are available, please put the more significant one at the end of the paper.

Table 2 - Number of contributors for each topic.

Questioning urban transitions	Nature	Energy	Vulnerability, inclusion, health	Mobility	Digital transitions	Sustainable resilient cities	TOTAL
8	11	13	13	14	22	11	92

However, it has to be noted that researchers contribute to more than one topic and some contributions have been made by several researchers; so, the number of contributors is sixty (60) from all the HEI.

As described in table 3, one hundred and thirty-six (136) contributions have been proposed.

Table 3 - The number of contributions for each topic.

Questioning urban transitions	Nature	Energy	Vulnerability, inclusion, health	Mobility	Digital transitions	Sustainable resilient cities	TOTAL
16	15	17	17	27	29	15	136

7.2 Key word identification from the answers on question 1

The key words obtained are as follows (Table 4), for each topic a minimum number of key words was defined and allowed to gather the researchers working on similar hot topics.

Table 4 - Keywords identified from contributions for question 1.

Key words from HUB 1 - Questioning urban transitions	Key words from HUB 2 – Nature in the city
- changing mobility demand - city optimisation - digital society /needs of people - heritage - living labs - people needs - people needs/architecture - people participation - people participation/living labs - tools for people - transition feedback	- environmental impact mitigation - food security - food security/food supply - green engineering solutions - green engineering solutions/models/GIS - green walls - nature as a central element
Key words from HUB 3- Energy in the city	**Key words from HUB 4 - Vulnerability, inclusion, and health in the city**
- battery lifetime/energy supply sustainability - digital for energy savings - energy demand mitigation - energy content - energy content/ supply sustainability - battery lifetime/energy supply sustainability - environmental impact mitigation - modelling /building energy	- digital for people - digital for vulnerable people - emission to air /health - emission to air /health/people perception - health - inequalities characterisation and risk - mobility inequalities - people needs - people perception
Key words from HUB 5 - Mobility	**Key words from HUB 6 - Digital transition**
- city optimisation - digital for people - environmental impact mitigation - industry/services/products transformation - people needs	- city optimisation - co-creation methods - digital for energy saving - digital infrastructures - impact on people

• people Needs/ageing people • modelling/transport system • service /products transformation • solutions for goods • systemic assessment • vulnerable people	• Inclusive digital transition • industry/services/products transformation • methods for security • modelling/digital twins • sensors and IoT for environmental impact mitigation • gas and pollutant MEMS based sensors • micro devices to harvest ambient energy for autonomous sensors • radio propagation in urban and indoor environments • sensing RFID, Structure health monitoring of roads and buildings
Key words from HUB 7 - Sustainable and resilient cities	
• co-creation methods • complex systems/food systems • emission to air /health/people • environmental impact mitigation • industry/services/products transformation • model/GIS • sensors for air pollution • solutions to crisis	

7.3 Contributions/contributors and hot topics proposal (covering question 2)

Question 2: please indicate three "hot topics" that should be considered in a 5 five years period by your organization-research department-laboratory in relation with the Hub topic
Nb: for each "hot topic", please develop in 5-10 lines, and indicate the approach that could be used and the potential needs for partnership with cities, local authorities or other stakeholders

Table 5 - The number of contributors for each topic.

Questioning urban transitions	Nature	Energy	Vulnerability, inclusion, health	Mobility	Digital transitions	Sustainable resilient cities	TOTAL
7	12	12	13	6	17	12	79

However, it has to be noted that some researchers contribute to more than one topic and some contributions have been made by several researchers; so, the number of contributors is forty-three (43) from all HEI.

As described in table 6, ninety-nine (99) contributions have been proposed.

Table 6- The number of contributions for each topic.

Questioning urban transitions	Nature	Energy	Vulnerability, inclusion, health	Mobility	Digital transitions	Sustainable resilient cities	TOTAL
12	15	17	15	9	19	12	99

7.4 Key words identification from the answers on question 2

Then as regards **question 2** some key issues were defined from the answers collected (table 7).

Table 7 - Keywords identification for contributions to question 2.

Key words from HUB 1 - Questioning urban transitions	Key words from HUB 2 – Nature in the city
• coherent reliable digital information • ethic healthcare • proximity practices • psychology and environment preservation • co-creation of the built environment • coherent reliable security actions • keep the city democratic • value creation behind circular economy	• nature as policy baseline • food security policies • biomonitoring • biomonitoring • people co-development of green blue infrastructures • food policies • bio efficiency • nature as policy baseline • nature as policy baseline/biomonitoring • urban farming perception • food tractability • model to naturalize habitat • nature as policy baseline • people co-development of green blue infrastructure
Key words from HUB 3- Energy in the city	**Key words from HUB 4 - Vulnerability, inclusion, and health in the city**
• energy policies impacts • energy (in)dependency/supply • energy impacts/methods of assessment • energy policies impacts • energy needs in various territories/methods of assessment • availability of energy data • energy policies impacts/data • energy equity • energy and people data • adaptation to new energy demand • energy dependency • energy needs in various territories	• sharing space between road-users • health vs environment dimensions • co-creation to fight against inequalities • co-creation with people for crisis situations • real time information apps on pollution • air pollution PM • methods of disability assessment • vulnerability assessment of services • health-oriented planning • digital assistance for vulnerable people • ethical issues implementation • digital solutions for ageing people • facing transport inequalities • urban accessibility
Key words from HUB 5 - Mobility	**Key words from HUB 6 - Digital transition**

• multimodality implementation last mile • freight and greener modes • transition implementation • multimodality implementation last mile • tourism mobility optimisation • manage people decision for more sustainable transport demand • impacts of mobility services • data collection for transport optimisation	• solutions for vulnerable people not based on digital • AI support to creation/ innovation • ethical technology • technology to change people behaviour • technology to change services • data reliability for decision makers • technologies for the transition success • digital for life improvement • lats mile transport optimisation • business model for digital services • sensors for citizens living labs • security panoply deployment • acceptability of digital • accounting for data uncertainty • data collection for city optimisation • performing digital infrastructures • data to understand user behaviour • safe city data management • securing data
Key words from HUB 7 - Sustainable and resilient cities	
• circular management in the city • data sharing to enhance democracy • air quality monitoring for decision makers • systemic management of the city • city development multidisciplinary assessment • tourism optimisation • digital for city management • cities governance impact • risk management in the city	

8. State of the art of research topics

In this part of the deliverable, the structured research contributions received will be presented per topic.

8.1 Thematic HUB 1 - Questioning urban transition

The subtopic titles were consensually found during the workshops done in task 2.1. As mentioned above, one workshop was organised per thematic HUB, where all contributors of the corresponding thematic HUB were invited.

Table 8 - Subtopics and topics identified for the Thematic HUB 1 - Questioning urban transition.

Subtopic	Hot Research topic	Research topic in 5 years
Welfare futures	• Welfare Infrastructures • Versatile and sustainable healthcare research	• Community-Wellbeing • Future topics for Sustainable and Versatile social and healthcare
Democracy enhancement	• Housing, Neighbourhoods and Public Spaces • Citizen Participation • Pan-European Living Labs / Democracy interventions • Self-organisation • Coherent Security research	• The Digital City • Citizen participation in the design of the built environment • The Democratic City
Justice and inclusion by spatial design	• Just and Inclusive city • New Perspectives for an inclusive future of roças in São Tomé and Príncipe • Land Use and Transport Integration (LUTI)	
Citizen's behaviour, needs and expectations	• Mobility and Transports • Psychology & Sustainability &narratives to support behavioural change	
Enablers of change		• Transition management • Psychology & Sustainability • Rapid / radical change • Divided cities and communities • Insider Activism in Organisations and communities

8.1.1 State of the art of current "hot" research topics (Question 1)

This section presents all the proposals provided by all HEI members of the InCITIES project while answering to question 1 regarding the "hot" research topics for the thematic of HUB 1.

Welfare futures

- **Welfare Infrastructures**

Due to the "social acceleration" that many citizens are suffering, partially explained by the digital society and more intensive work, work-life balance and the need to support families with welfare infrastructures is a pressing issue. For this reason, planning and consequent execution, is crucial in terms of providing the best services, namely related with childcare and elderly care, among other public services. Scientific research could help solve this problem by creating the most appropriate tools for planning and evaluation of current conditions, supported on a very profound knowledge of everyday needs of people (through local surveys and other research instruments), co-creating with municipalities, citizens, companies, associations and the state the more appropriate solving-solutions.

- **Versatile and sustainable healthcare research**

Hot research topics for the programme focus on 1) supporting wellbeing and health of the citizens. This area has varied projects that study and develop areas such as virtual health and wellbeing living labs (Vitalise project) and possibilities for elderly people continue to live at home (Shapes project). Other stream of RDI focuses on supporting citizen participation and social inclusion, especially for vulnerable groups in society, DigiIN and VoimaProfi projects are examples of this research stream. Questions of diversity and multiculturalism relate to this topic (Varava project). Third topic area is wellbeing in work, especially in healthcare services.

Democracy enhancement

- **Housing, Neighbourhoods and Public Spaces**

Housing and their surrounding conditions are a central challenge for cities. In material terms, houses need to be cheaper and with better living conditions. So, municipalities and the state should know very well the housing conditions of their citizens. Interoperability of data could help, by using several types of databases but also digital geographic data. The reduction of energy costs is also fundamental and cities dot not have sufficient solar panels in their buildings specially in countries which can benefit from sun energy. Community ties are tearing apart in several cities, so local democracy and taking care of neighbourhoods and public spaces, are also urgent problems that need to have special attention by science. Here again, the ecosystem co-creation

process is fundamental, but with a more accurate partnership with companies and the state.

LxHabidata is an open access data platform: data on housing (e.g. prices, contracts, permits, affordable housing dwellings, etc.), indicators constructed by the team (e.g. effort rates) or other apparently more indirect data (e.g. tax revenues resulting from real estate and tourism, or nationality of foreign residents). Those data are an essential instrument to a grounded analysis of the Lisbon Metropolitan Area current transitions, which are quite dependent on what happens in the housing sector

- **Citizen Participation**

I was a member of the scientific board of the first national wide citizens assembly in Germany (on democracy), I accompanied other participative processes on city levels, I am familiar with all steps and processes eager to include citizen participation in social change processes. Science denying and inclusive communication strategies for public spaces.

- **Pan-European Living Labs / Democracy interventions**

In an EU-wide project about democracy, local instances (labs) explore opportunities for engaging in key questions around European values, identity and future opportunities.

- **Self-organisation**

How to implement, support and lead self-organised teams in an agile work setting – how include /self-organised agile teams in social transition processes, how to implement voluntary and participative work in change processes without beyond hierarchies.

- **Coherent Security research**

For Coherent Security program there are two current hot topics to focus on. First there is need to increase citizens knowledge and countermeasures to disinformation campaigns. Other current focus area for research is hybrid threats landscape as part of societal sustainability and resilience. Disinformation seriously impacts on the attitudes of citizens towards public authorities (trust in police, local and national government, etc.) This, in turn, affects the ability of citizens and authorities alike to act and to cooperate in time of varied crises. Hybrid threats refer to damaging external influence by which a states or other actors including terrorist organisations or organised crime groups seek to influence the targeted country by combining different means. The aim is to exploit the vulnerabilities of the selected state and to do this as covertly as possible. Those responsible for internal security can help strengthen social sustainability and counter various attempts to exert influence.

Justice and inclusion by spatial design

- **Just and Inclusive city**

Architecture is by definition conceived for the community. Referring to just and inclusive city and architecture thus seems a paradox because it presupposes that it is necessary to explicitly formulate justice and inclusiveness so that architecture responds to the needs of all citizens. Reality shows us that the built environment space often has

characteristics that make it difficult for certain individuals to access certain spaces. When this happens, architecture, and urban planning, does not respond to individual and collective needs. The research developed aims at: i) identifying aspects in the built environment that promote segregation and difficulties to access; ii) propose architectural design solutions to suppress them; iii) involve citizens in the assessment of their built environment.

- **New Perspectives for an inclusive future of roças in São Tomé and Príncipe**

São Tomé and Principe was, from the 15th to the 20th century a Portuguese colony. During that period the land was altered and extensively used for crash crop in large plantations called roças. The African people brought there by the Portuguese were subjected to slavery and later forced work. The ongoing research tackles timely aspects about shared heritage through the ethical reanalysis of roças using new inclusive narratives. It provides new insights on the design of roças as it was conceived and how it evolved until today. Moreover, historical biases and underrepresented narratives are also disclosed. More info available here https://istar.iscte-iul.pt/portfolio-posts/shared-heritage-for-enriched-futures-rocas-in-sao-tome-and-principe/

- **Land Use and Transport Integration (LUTI)**

Transportation planning and land use planning are rarely addressed in an integrated way in research or in the planning practice. Yet LUTI models show how car-based infrastructure development leads to a cycle of sprawl and congestion, further entrenching a range of wider externalities (land use fragmentation, air pollution, car dependency, poor health etc). Based on concepts such as new urbanism, transit-oriented development, "isobenefit urbanism", liveable or walkable cities, and complete streets, the latest trend has coined the '15 minute city' as the go-to approach for transitioning cities around principles of proximity (for land use planning) and active mobility (for transport planning), with the added benefit of improved neighbourhood economies and healthier lifestyles.

Citizen's behaviour, needs and expectations

- **Mobility and Transports**

Climate-friendly mobility practices and the actions of citizens in terms of transportation, especially for working and studying are also decisive challenges of cities. Telework could be viable a solution for reducing pollution footprints, but that is not a solution to every kind of work. Again, we need to know deeply the reasons for people make their choices in terms of mobility and transportation, and try to figure out how they could change towards more sustainable options. Labour markets and their demands, and family everyday pressures, are the fundamental reasons for these mobility-transportation behaviours. In the co-creation decision-making process, universities, trade-unions, companies, local authorities and the state, should be present. Clearly, we need systematic and updated data for having a broad and comparable perspective of mobility and transportation for better policy-solutions in cities.

- **Psychology & Sustainability &narratives to support behavioural change**

Changing behaviour is one of the hardest goals to reach. And yet, changes towards sustainability, Social Transitions demand huge changes. How can we introduce and promote behavioural change towards sustainability on a collective level? What narratives are needed, how can we support, use and influence activism?

8.1.2 State of the art of research topics for the next 5 years (Question 2)

This section presents all the proposals provided by all HEI members of the InCITIES project while answering to question 2 regarding the research topics for the next 5 years regarding the thematic of HUB 1.

Welfare futures

- **Community-Wellbeing**

The higher levels of scientific research are already looking to "community-wellbeing" as a central piece of modern cities and societies. Those ties are fundamental for cohesive cities and wellbeing. Proximity practices are the best approaches for municipalities implement their policies, the challenge is to enlarge them and involve more people, with the necessary conditions lasting for being permanent during several years

- **Future topics for Sustainable and Versatile social and healthcare**

The importance of digitalisation and knowledge management and broad understanding of this phenomena in healthcare and social services. Aging population, digital services and skills, digital marginalization, and exclusion (vulnerable groups) will grow even more important in near future

Democracy enhancement

- **The Digital City**

The digital city should not be a slogan. Broadly, public information does not reach the mainstream media and consequently the people, and misinformation and fake news have aggravated this problem. The main economic and political strategies of contemporary conflicts have social media as their main target. Digital literacy and inclusive information should be a growing concern of academia, municipalities, public authorities, and associations.

- **Citizen participation in the design of the built environment**

The built environment does not respond to the needs and expectations of its users and by doing so it creates dissatisfaction. Some of situations of dissatisfaction lead to real social problem and affect neighbourhoods and communities. Techniques for participatory design and co-design of the built environment are known for long but often not applied. Possible approaches: develop digital solutions to enable an easy participation. Relevant partnerships: local authorities, design professionals

- **The Democratic City**

Without meaningful information, ways of solving real-life issues, several of them at the local level, and if politicians and public authorities continue to be distant from people, gradually the sense of democracy will be an empty word. The democratic city should be an international imperative, in the absence of this focus populist and fascist movements will be stronger. Science and their partners in city-ecosystems can discover the best practices around the world, understand quite well what are the drivers of vibrant democracies, and try to dismantle the structures that today are killing one of the most important conquests of modernity. Real-life problems should be collectively solved, and at the local level, several social experiments can envision a more democratic city

Enablers of change

- **Transition management**

Although the 15 min city may be a promising and easy-to-understand concept, its implementation faces serious socio-technical barriers, which are often very specific to their context of application e.g. 1) materiality: inertia of the build environment, vehicle sizes and flows 2) Vested interests, agency of actors 3) Mainstream discourses, culture and preference for unfettered motorised mobility 4) Institutionalisation of 'old' expertise and tools etc. Need for analysis, support and best practices at all scales. Conceptually: how can/should the 15min city concept be scaled at the regional level, under what conditions can the concept contribute to increased resilience (climate change, food and energy production, biodiversity/rewilding etc). Impact and potential of remote work arrangements on land use and transport integration planning.

- **Psychology & Sustainability**

Why do we fail to act against Climate and Biodiversity Crisis – and how can we change this

- **Rapid / radical change**

There is a growing disconnect between ecological science and political action. On one hand the IPCC reports give a 300Gt CO2 emissions budget from 2020 for an 83% chance to remain within the safer 1.5C warming, which at current rates (~40Gt/year) means the world should be fully carbon neutral by summer 2027. On the other hand, climate action is driven by political goals of emission reduction in the 2035 or 2050 timeline. Most policies in place today often both not ambitious enough and often unmet (e.g. the EU's average emission of private cars in g/km). There is a need to explore binding ways to implement COVID-style radical actions without undermining democratic processes, and at the same time to avoid unwanted unilateral national or local reaction once a crisis hits (e.g. closing of borders, stopping food or water exports etc).

- **Divided cities and communities**

Communication strategies and science communication for inclusive societies

- **Insider Activism in Organizations and communities**, Forms of Activism and how to include them.

8.1.3   Relevant Publications

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8.1.4   Current projects related to the topic (local, national or European project)

- Care(4)Housing - A care through design approach to address housing precarity in Portugal (DINÂMIA'CET-Iscte as leader). Newly started, Care(4)Housing intends to understand how Architecture, as a discipline, can rethink and integrate the idea of care of/in the built

environment, contributing to the construction of better and urgent answers to the current housing precarity. Care(4)Housing explores four dimensions on care through design. The first (Spatial) is rooted on the idea that we need to Care for Space. The second (Social), follows the awareness that we need to Care for People. The third dimension, (Technical), it's strongly related to Building with Care, consonant on how we, as a collective, care for the planet. https://ciencia.iscte-iul.pt/projects/care4housing---a-care-through-design-approach-to-address-housing-precarity-in-portugal/1745

- "GreenCity4Aging: the effects of urban green-streets in the mobility, social integration and ageism against older persons." National Project. Concurso Projetos de IC&DT em todos os Domínios Científicos, FCT. PI: Sibila Marques (Iscte, CIS), Co-PI: Sara Eloy (Iscte, ISTAR). Other institution: Santa Casa da Misericórdia de Lisboa. Budget: 249 957,81€. March 2023 to March 2026.

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- "Kinaesthetic Analysis on Older People Perceptions on the Outdoor Built Environment". National. Ongoing PhD research by Marcos Figueiredo, FCT grant UI/BD/151027/2021. Supervision: Sara Eloy, Sibila Marques. Available here https://istar.iscte-iul.pt/portfolio-posts/phd-thesis-kinaesthetic-analysis-on-human-interface-for-interiors-architecture-design-using-virtual-reality/

- ANIMORT: Jean Estebanez, funding: i-sites Futures, local program.

- CABaS (CAdres de vie en BAnlieueS): Emmanuelle Faure, funding: City of Gennevilliers, local program.

- Circular Economy Laurea Living Lab (CELLL) Toolkit is a design tool for developing circular business and business models. See for example above article by Purola et al. 2019.

- COBRA: Sonia Guelton, Claire Carriou, Claire Aragau, funding: Union Sociale pour l'Habitat, national program.

- CoCo Tool Kit 2.0 - CoCo Cosmos Toolkit. CoCo Tool Kit co-creation tool developed in Laurea helps different stakeholders to communicate and design service environments to meet the needs of users better. https://www.laurea.fi/en/cocotoolkit/

- DISGOUVDYN: Julien Aldhuy & Sophie Didier, funding: i-site futures, local project.

- GERTRUD: Joel Idt, funding: ANR, national program.

- LOTUS (Locally organized transition of urban sustainable spaces): Joel Idt, Margot Pellegrino, Katia Laffrechine, funding: Erasmus + program, Coord. University of Applied Sciences Kehl.

- MAMA (Monde d'Avant Monde d'Après): Emmanuelle Faure, funding: CNRS, national program.

- National Survey of Associations of Culture, Sport and Leisure (CPCCRD and CIES-Iscte) (co-coordination).

- National, LXHabidata is a housing data platform with permanent updates relating to the municipalities and parishes of the Metropolitan Area of Lisbon: https://lxhabidata.iscte-iul.pt/

- Observatory of Popular Associativism, CPCCRD, Iscte, FCSH-UNL and U.Lusófona (coordination).

- PUCA: Nadia Arab, funding : PUCA, national program.

- SENOVIE: Myriam Baron, Léa Prost, funding: Institut National du Cancer (InCa), national program.
- SPLACH - Spatial planning for change (DINÂMIA'CET-Iscte as partner). Recently finished, SPLACH focused on the proactive role of planning to constitute a transformative device in our cities in Europe and elsewhere, particularly in the present times and with a view into the long term. Indeed, current changes seem far more deep within the existing urban tissues experiencing profound recompositions of functions and activities, than in physical terms, strictly speaking, where past investments in infrastructures and in the built environment seemed to have exceeded the real demand and generated a surplus of the building stock that, some years later, still remains partially empty or underused. https://ciencia.iscte-iul.pt/projects/spatial-planning-for-change/770
- STILL MAP: Jennifer Buyck, funding: ANR, national program.
- Stronger - Stronger Peripheries: A Southern Coalition (DINÂMIA'CET-Iscte as partner). It gathers 14 organizations from 10 countries: all to some extent identifying with a loosely defined 'Southern Europe', all committed to foster local community engagement in the arts and all devoted to overcoming the obstacles in their specific contexts by increasing mutual cooperation. It is mainly a cultural concept instead of a geographical one, where "South" is broadly understood. It refers particularly to those affected by the political and economic crisis, interested in collaborative strategies based on a set of common values and needs that derive specifically from working in the peripheries. https://ciencia.iscte-iul.pt/projects/stronger-peripheries-a-southern-coalition--sp/1515
- Sus2Trans - Sustainable Transformative Transitions (DINÂMIA'CET-Iscte as leader). Sus2Trans conciliate Accelerated Low Carbon Transitions with System Transformations. The project investigates the types of decarbonisation strategies that comply with the Paris Agreement, whose implementation requires the transformation of several sectors in addition to energy, such as mobility, construction, food and industry. This sectoral transformation raises challenges for the development of countries and regions, which have become particularly pressing as states will have to accelerate the low-carbon transition with more fragile finances and the need for economic recovery after the pandemic crisis. The research combines theories of socio-technical transitions and economic geography to identify low-carbon transition pathways with the greatest transformative potential and to investigate how countries and regions are preparing for such transformation. The focus of this research is on the type of transition strategies that are most beneficial to the economy, that is, that have the capacity to generate changes in other sectors.
- UCCRN-EDU: Bruno Barroca, Margot Pellegrino, funding: Erasmus + program, Coord. University Federico II of Naples.
- URBA-RE (Urban issues of energy renovation): Margot Pellegrino, funding: i-site Future, local project.

8.2 Thematic HUB 2 - Nature in the city

The subtopic titles were consensually found during the workshops done in task 2.1. As mentioned above, one workshop was organised per thematic HUB, where all contributors of the corresponding thematic HUB were invited.

Table 9 - Subtopics and topics identified for the Thematic HUB 2 - Nature in the city.

Subtopic	Hot Research topic	Research topic in 5 years
Protection of nature	• Good practice to increase the biodiversity in cities	• Integrating the natural world into urban life
Sustainable production from nature	• Food security and transitions towards sustainability: Diagnosis in urban contexts • Food security: public policies in urban contexts • Agriculture in metropolitan areas: case studies • Home farming of macroalgae • Proximity Food Systems • Food growing in urban gardens • Recycled materials for urban gardens	• Distributed Ledger Technologies for food provenance • Proximity food systems: empowering smallholder farming & local stakeholders • Nexus soil-water-food for gardening in resilient cities
Adaptation (mitigation) connected to climate changes risks	• Nature as transformative power in the day-to-day production and management of the city (to be confirmed) • Living Walls • Nature-based solutions (NbS) • Climate resilience of cities • Social-ecological vulnerability and resilience • Ecosystem services for hazard mitigation	• The main challenges regarding food security within urban and metropolitan contexts • Detection of plant response to determine the health status • Biomonitoring of green walls • Potential of green-blue infrastructure in urban landscapes • Evaluation of green-blue urban infrastructure measures • Modification of plant-related microbiota • Identify innovative models (formal and informal) of

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		naturalization of the habitat in its various scales
Cross cutting: Governance, citizen engagements		• Nature as new agent in the production of the city • Urban farming

8.2.1 State of the art of current "hot" research topics (Question 1)

This section presents all the proposals provided by all HEI members of the InCITIES project while answering to question 1 regarding the "hot" research topics for the thematic HUB2.

Protection of nature (biodiversity conservation)

• **To collect examples of good practice in projects to increase biodiversity in cities**

Urban bees, non-intervention meadows, green roofs and facades - a workshop with the search for worthy locations and solutions in cooperation with the municipality. Cooperation with local government deputies on already started projects to return small watercourses to the city in a sustainable way.

Sustainable production from nature

• **Food security and transitions towards sustainability: Diagnosis in urban contexts**

The increase of cereals price in 2007-2008, the pandemic crisis, and, more recently, the war between Russia and Ukraine, are facts that explain the re-emergence of food security in developed countries. A first step to address this topic is the diagnosis of the problem of food security in urban territories.

• **Food security: public policies in urban contexts**

Public policies are critical to address the problem of food security in urban contexts. Therefore, it is important to identify and critically address the public policies that are being adopted in each country to address food security, namely in urban territories. The mapping of public policies in this domain adopts a multidimensional and multilevel (local, regional, national, international) approach.

• **Agriculture in metropolitan areas: case studies**

The role of urban contexts in food security actions depends on the resources available, namely land. Therefore, it is important to identify case studies involved in the food system (production, transformation, consumption) that can be used to explore the main drivers and challenges faced by this initiative in urban contexts.

• **Home farming of macroalgae**

We developed a macroalgae tank that produces edible algae and is suitable as a substitute for fishermen.

• **Proximity Food Systems**

Exploring and supporting local stakeholders in food supply chains. Connecting actor and stakeholders along the supply chain. Raise awareness, create transparency, use data and sensor technology to create new relations.

- **Food growing in urban gardens**

Non-commercial types of urban agriculture (community gardens, above-ground planters, nurturing landscapes, etc.) are listed among the most popular NBS. Their multifunctionality is of major interest to local authorities, who consider them a way of reintroducing nature into the city, while meeting a very strong societal demand. But the issue of soil quality is particularly relevant in urban environments due to exposure to air pollution, soil pollution and, in some cases, watering pollution. Under these conditions, the mapping and preservation of good quality soils is crucial for the development of urban gardening.

- **Recycled materials for urban gardens**

Recycling urban wastes to be used as for urban gardening is becoming more and more popular due to the importance of circular economy. However, both organic and inorganic materials used with this aim can bring contamination to the soil with the risk of transfer to the plants. Moreover, urban soils present often degraded physico-chemical characteristic or contamination and do not enable healthy plant growth. Therefore, replacing these soils with substrate mixtures (known as technosols) or amending them with other organic materials in urban environments, can contribute towards healthy production. Thus, the synergic effects of those contaminants in urban agriculture soils or technosol mixtures used as growing substrate must be assessed with intensive food production and contamination (of the soil/substrate, water and plant) being two key factors.

Adaptation (mitigation) connected to climate changes risks

- **Nature as transformative power in the day-to-day production and management of the city**.

The idea is to not understand Nature as mere variable but as central element in our understanding of current urban arrangements. Current projects as example:

- The coexistence of humans and animals in the city in line with One Health programs, with international project ANIMORT looking at the differences in the training of veterinarians in Paris and Pondicherry with regards their approaches to death.
- Rivers in the city as affective as well as risk-prone environments in post-catastrophe contexts such as Louisiana: project StillMap aimed at mapping the layers of meaning of the Mississippi river in order to come up with a more complex understanding of resilience to flooding.

- **Living Walls**

We are concerned with the development of green walls that improve air quality and affect temperature. We discuss the types of installation and plants with various manufacturers. The absorption capacity of mosses and their possible uses were examined in research projects.

- **Nature-based solutions (NbS)**

The focus is on developing nature-based solutions for adapting to climate change (Ecosystem-based adaptation – EbA) and mitigating natural hazards (Ecosystem-based disaster risk reduction – Eco-DRR). Methods include the identification and assessment of NbS in different landscape units including urban landscapes based on multi-criteria analysis and GIS-based tools.

- **Climate resilience of cities**

Adapting to climate change poses a variety of challenges for cities and communities. As part of a funded module (master course "green building engineering") we conduct research into the participatory development of product and process solutions of local climate change consequences, e. g. urban heat spots, shading systems, flood protection and urban gardening

- **Social-ecological vulnerability and resilience**

The aim is reducing vulnerability to natural hazards by strengthening social-ecological resilience. Methods include analysis of social-ecological systems with a focus on the ecological side. In the context of urban systems, the focus is on how green-blue infrastructure can contribute to improving resilience to the impacts of climate change, extreme weather events, and natural hazards, and how appropriate measures can be embedded in an overall social-ecological context.

- **Ecosystem services for hazard mitigation**

Assessment and evaluation of vegetation- and soil-related ecosystem services in urban landscapes related to natural hazards, such as floods, droughts, and heat islands. Methods include ecosystem services assessment and valuation based on multi-criteria analysis, indicator systems, and GIS-based tools, as well as the analysis of trade-offs.

8.2.2 State of the art of research topics for the next 5 years (Question 2)

This section presents all the proposals provided by all HEI members of the InCITIES project while answering to question 2 regarding the research topics for the next 5 years regarding the thematic HUB2.

Cross cutting: Governance, citizen engagements

- the role of **Nature as new agent in the production of the city**, as well as how different professionals or expert users (such as gardeners for instance) attached to tending to Nature in the City are in the process of gaining influence in local governance arrangements.
- **Urban farming**

Urban farming is a growing trend that has been spreading across major cities in Europe. However, it is not known the real impact its adoption, nor how citizens actually perceive this new trend. By studying both social media opinions about it, it is possible to understand the perceived benefits which can translate into improved life quality.

Protection of nature (biodiversity conservation)
- Programmes **integrating the natural world into urban life** (urban forest programme, urban ecology and urban wildlife) A new study and better ways of understanding urban wildlife and habitat in combination. The birds as bio-indicators.

Sustainable production from nature
- **Distributed Ledger Technologies for food provenance**

Analysis on how are DLT and blockchain technologies being used to register food provenance and helping food quality and security"
- **Proximity food systems: empowering smallholder farming & local stakeholders**
- **Nexus soil-water-food for gardening in resilient cities**

Under the impulsion of the Biodiversity Law (2018) and the "Zero Net Artificialisation" doctrine, associated with the development of city climate plans, land occupation and use are at the heart of the citizen and political debate on the making of the city. A growing number of projects or citizen initiatives are emerging with the objective of combining different uses within the same urban space, for example reconciling rainwater management with vegetable production in the open ground or above ground, or the creation of public green spaces and the reuse of treated wastewater. The transformation of the soil into a multifunctional urban space is thus situated on two levels: technical (interrelation of water, energy and soil) and socio-cultural. This multifunctionality leads to the establishment of a set of actors, whose relationships for the development of projects for food growing, but also, and perhaps even more so for their sustainability, constitute a real challenge.

Adaptation (mitigation) connected to climate changes risks
- What are the **main challenges regarding food security within urban and metropolitan contexts**?

Which public policies aim food security regarding urban and metropolitan contexts?
What can we learn from case studies of food system actors located in urban and metropolitan areas (drivers and main challenges)?
- **Detection of plant response to determine the health status**

Plants and their microbiomes are able to react by abiotic and biotic stress factors in their immediate environment. The response ranges from changes in gene expression to physiology, from plant architecture to primary, and secondary metabolism, allowing the plants and its microbiome to tolerate adverse conditions. The microbiome's response is also visible in its abundance and its activity. We aim to use the microbial activity in plant microbial fuel cells to monitor the botanical system's response to its environment.
- **Biomonitoring of green walls**

Building Services Engineering is a "norm-driven", regulated domain. The implementation of biological systems on a bigger scale will only be possible if these systems become controllable. Our goal is to be able to experiment with and develop bio-monitoring methods, devices and systems that make use of the advancements of micro-

/nanoelectronics and artificial intelligence. This will also allow us to integrate complex biosystems in future smart home scenarios.

- Analysis of the **potential of green-blue infrastructure in urban landscapes** and development of suitable measures and implementation strategies in co-development processes with municipalities, planning authorities, citizens and relevant stakeholders.
  - **Evaluation of green-blue urban infrastructure measures** based on the concept of ecosystem services. Identification and evaluation of benefits and trade-offs.
  - **Modification of plant-related microbiota**

The plant-related microbiota is (at least partly) accountable for the health of the plant and its ability to perform "tasks" like filtering the air from unwanted pollutants. Furthermore, it is part of the building-related microbiota, which has a large impact on our health. The same as in medical research, being able to observe microbial mechanisms will be key, in order to invent applications able to improve the indoor air quality and fight pathogens

  - **Identify innovative models (formal and informal) of naturalization of the habitat in its various scales** (dwelling, building, surrounding), which implies strategies to reduce pollution (noise and environmental), inclusion of green spaces and/or small food production for self-consumption and solutions to strengthen light mobility (pedestrianisation, bicycles, public transport, etc.).

8.2.3 Relevant Publications

- Aldhuy J., Didier S. & Vadelorge L. (forthcoming in 2023) "Peripheral centralities in Val d'Europe, east of Paris: the logics of assemblage between Disneyland Paris and New Town principles of planning". in Peripheral centralities #3, R. Keil, P. Magin & N. Phelps (eds.). Princeton Architectural Press.
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- Äyväri A & Hirvikoski T (2021): Review of Finnish social and health care ecosystems' websites supporting the co-creation and testing of innovations. Laurea Publications 172. URl: https://www.theseus.fi/bitstream/handle/10024/505460/Laurea%20Julkaisut%20172.pdf?seque nce=5&isAllowed=y
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- Buyck J., Meyfroidt A., Brand C. & Jourdan G., (2021) "Bringing sustainable urban planning down to earth through food: the experience of the food transects of Grenoble and Caen. Review of Agricultural, Food and Environmental Studies, 102, pp.319-347. ⟨10.1007/s41130-021-00147-x⟩.
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- Doswald, N. S. Janzen, U. Nehren, et al. (2021): Words into action: Nature-based solutions for disaster risk reduction. UN Office for Disaster Risk Reduction, Engaging for resilience in support of the Sendai Framework for Disaster Risk Reduction 2015-2030.
- Estebanez J., Boireau P. (2022) "One Health: A social science discussion of a global agenda", Parasite 29, 17 doi: https://doi.org/10.1051/parasite/2022014

- EU Hybnet, Deliverable 2.12 (2022): Articles and Publications on Themes and Measures. Lead Author: UiT, Contributors: URJC, Hybrid CoE, L3CE, JRC, COMTESSA, Laurea Deliverable classification: Public (PU)
- Ferreira da Silva C., Rupino da Cunha P., Melo, P. (2022) The Organizational and Social Impact of Emerging Technologies: The Case of Blockchains, Sistemas de Informação Diagnósticos e Prospetivas, Ed. Sílabo. ISBN 978-989-561-212-3
- Fontanella Pisa, P., U. Nehren, Z. Sebesvari, R. Shivani & I. Wong (2023): Nature-based solutions (NbS) to reduce risks and build resilience in mountain regions. In: Safeguarding Mountains: A Global Challenge - Facing emerging risks, adapting to changing environments and building transformative resilience in mountain regions worldwide, GLOMOES/EURAC (accepted manuscript)
- Gardesse C., Lelevrier C. (2020) "Refugees and Asylum Seekers Dispersed in Non-Metropolitan French Cities: Do Housing Opportunities Mean Housing Access?" Urban Planning Vol 5, No 3 https://doi.org/10.17645/up.v5i3.2926.
- Guedes, M. & Ferreiro, M.F. (2022). Feeding the future: the critical role of genetic banks in food security. In Alberto Baptista and Catarina Cepeda, Proceedings of the 9th Conference on Localized agri-food systems (SYAL), Universidade de Trás-os-Montes e Alto Douro.
- Heinzlef C., Barroca B., Leone M. & Serre D. (2022) "Urban resilience operationalization issues in climate risk management: A review". International Journal of Disaster Risk Reduction, 102974.
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8.2.4 Current projects related to the topic (local, national or European project):

- AI-TIE – AI Technology Innovation Ecosystems for Competitiveness of SMEs. The objective of the project is to move the AI discussion from a general level to industry-specific training, mentoring and accelerator operations. The project targets the fields of cleantech and wellbeing, social and

health industry. (https://www.haaga-helia.fi/en/rdi-projects/ai-tie-ai-technology-innovation-ecosystems-competitiveness-smes)

- ANIMORT: Jean Estebanez, funding: i-sites Futures, local program.
- As good as new: Enhancing the behavioural and business change of the second-hand textile industry in the Central Baltic region (BALTIC2HAND) Central Baltic 2021-2027. The project aims to improve textile reuse and reduce textile waste, which will be achieved through improving the business models of second-hand companies and other companies that want to add a second-hand operation to their business and also through enhancing consumers' use of second-hand market as both sellers and consumers. The main outputs of the project are: an open-access digital platform; a set of improved business models and concepts; a library of consumer nudges; a set of change management activities; online educational materials for industry professionals and students; scoping reviews of the current state and problems, opportunities in the second-hand textile market.
- BMBF - BioAbsorp-it (national)
- BMBF – Norifarm (national)
- CABaS (CAdres de vie en BAnlieueS): Emmanuelle Faure, funding: City of Gennevilliers, local program.
- CELICE (international) – Strengthening the climate change, ecosystems and livelihood nexus in coastal zones of Ecuador through transdisciplinary research and innovative teaching (DAAD; project head)
- Co-creation in the region - Systemic and innovative transfer development (Co-Site) (BMBF; work package head "green infrastructure") (National)
- Central Baltic Mentoring for Migrant Women seeking Employment (CeMeWE) Central Baltic 2021-2027. The objective of the project is to increase the employability of immigrant women through a model which helps to overcome individual, domestic, and societal barriers. As a result, the participants will have a clear understanding of their employment opportunities, an increase in skills and a clear chart of the steps needed for employment. They will also have the necessary support to take these steps through mentoring. After participation the immigrant women will have secured employment, or a clear understanding of the actions still needed to gain employment.
- Circular Economy Goes East and West (https://cego.fi/in-english/) The objective of the project is to facilitate the realization of business opportunities in accordance with circular economy and the building up of a circular economy business ecosystem at Helsinki-Uusimaa Region. The project's business development companies will develop business ecosystems in accordance with their specific focus areas, and Laurea will coordinate and integrate the different parts of the project into a coherent whole. Funding European Regional Development Fund 2021-2027. National funding for Helsinki-Uusimaa Region.
- Circular Economy Laurea Living Lab (CELLL) Toolkit is a design tool for developing circular business and business models. See for example above article by Purola et al. 2019.
- COBRA: Sonia Guelton, Claire Carriou, Claire Aragau, funding: Union Sociale pour l'Habitat, national program.
- CoCo Tool Kit 2.0 - CoCo Cosmos Toolkit. CoCo Tool Kit co-creation tool developed in Laurea helps different stakeholders to communicate and design service environments to meet the needs of users better. https://www.laurea.fi/en/cocotoolkit/
- DigiIN2: Towards socially inclusive digital society, Funding Academy of Finland
- DISGOUVDYN: Julien Aldhuy & Sophie Didier, funding: i-site futures, local project.

- Dobšinského orchard, community space and orchard in the Vlčince housing estate in Žilina. Mgr. Ing. Marek Sobola , PhD. https://www.komarch.sk/dielo/197-dobsinskeho-sad-v-ziline
- Empowering a Pan-European Network to Counter Hybrid Threats EU HybNet (https://euhybnet.eu/). The project aims at enriching the existing European networks countering hybrid threats and ensuring long term sustainability. This will be achieved by defining the common requirements of European practitioners' and other relevant actors in the field of hybrid threats. Ultimately, this can fill knowledge gaps, deal with performance needs, and enhance capabilities or research, innovation and training endeavors concerning hybrid threats. EU-HYBNET will monitor developments in research and innovation activities as applied to hybrid threats; so to indicate priorities for innovation uptake and industrialisation and to determine priorities for standardization for empowering the Pan-European network to effectively counter hybrid threats. EU-HYBNET will establish conditions for enhanced interactions with practitioners, industry, and academia for a meaningful dialogue and for increasing membership in the network. Project Funding: European Union's Horizon 2020 research and innovation programme under grant agreement No883054.
- Foodwaste ecosystem – utilizing foodwaste. Funding European Regional Development Fund 2021-2027. National funding for Helsinki-Uusimaa Region. The aim is to develop the ability of service providers to utilise edible food waste and serve it to the end consumers as practically and safely as possible. The project also measures the amount and quality of food waste. Understanding the quality of food waste helps assess whether and how it can be processed for commercial use. The project brings together companies in the food and circular economy industries, RDI-institutions, and food aid providers. Through this cooperation, opportunities are created for new business ideas.
- GERTRUD: Joel Idt, funding: ANR, national program.
- Immune 2 Infodemic : Beside the current pandemic, we also have infodemic spreading increasingly among EU citizens which can severely impact their democratic participation and engagement. This may include disinformation, misinformation, fake news, and other types of interference on different issues related with public life, such as elections, vaccination, migration. A pre-emptive approach needs to be taken for decreasing the worsening impact, such as using vaccination against the spread of the pandemic. IMMUNE 2 INFODEMIC aims to immunise EU citizens against the disinformation and misinformation on selected themes by empowering and equipping them with several methods using eye-catching material and easy-to-use tools. The project consortium formulates and co-produces 3 instruments (vaccines): digital literacy, media literacy, critical thinking; and applies these instruments on 3 selected hot themes (boosters): elections, COVID-19 and migration. Vulnerable citizens/residents having limited/no knowledge about mis/disinformation activities but using social media extensively, youth generation (18-25 y). In addition to other citizen groups, seniors (65+ y) will be a targeted for project action. Project Dates: 1 January 2023 – 31 December 2024; Funding: CERV-2022-CITIZENS-CIV
- InCITIES - Inclusive, sustainable, and resilient cities in Europe Horizon Europe: Widening Participation.
- Information Resilience in a Wicked Environment (IRWIN) is a three-year project (2021-2023), funded by the Academy of Finland, where researchers from the University of Vaasa, the University of Eastern Finland, the Laurea University of Applied Sciences and the National Defense University seek to study Information Resilience in Complex Environments. We seek to develop a participatory model of national preparedness in which decision-makers, civil society and the

business sector work together to promote crisis preparedness. https://www.irwinproject.fi/en/home/

- LOTUS (Locally organised transition of urban sustainable spaces): Joel Idt, Margot Pellegrino, Katia Laffrechine, funding: Erasmus + program, Coord. University of Applied Sciences Kehl.
- MAMA (Monde d'Avant Monde d'Après): Emmanuelle Faure, funding: CNRS, national program.
- ManagiDiTH 2022-2026. Master of Managing Digital Transformation in the Health.
- MEB consulting s.r.o. Urban study of Central square, Solinky, Žilina. Local project/proposal if revitalisation of brownfield parking place in the middle of the Solinky housing estate. The local minor stream (currently in the pipeline) should be opened up and included in the rain garden design, surrounded by greenery. https://www.zilina.sk/aktuality/2021/mesto-bude-revitalizovat-vnutroblok-na-solinkach-vznikla-urbanisticka-studia/, https://www.zilina.sk/uzemne-planovanie/urbanisticke-studie/
- My Business Hub – increasing the competitiveness of urban districts (My Business Hub). Funding European Regional Development Fund 2021-2027. National funding for Helsinki-Uusimaa Region. Project develops a concept in which city of Vantaa, educational institutions, third and private sector organisations support business services are brought together for better coordination and in a more proactive fashion. Laurea is a partner in the project. No English website.
- PUCA: Nadia Arab, funding : PUCA, national program.
- Revitalization of the inner block on Fatranska street in Žilina. It contains a relaxation area with deckchairs, greenery, composters and herb gardens. https://www.zilina.sk/aktuality/2021/vnutroblok-na-fatranskej-ulici-ma-vdaka-revitalizacii-novy-atraktivny-vzhlad/
- SENOVIE: Myriam Baron, Léa Prost, funding: Institut National du Cancer (InCa), national program.
- SHAPES project launched: harnessing digital services to support the well-being of ageing individuals - Laurea-ammattikorkeakoulu
- STILL MAP: Jennifer Buyck, funding: ANR, national program.
- UCCRN-EDU: Bruno Barroca, Margot Pellegrino, funding : Erasmus + program, Coord. University Federico II of Naples.
- URBA-RE (Urban issues of energy renovation): Margot Pellegrino, funding: i-site Future, local project.
- VARAVA Receptive UAS, nationwide against racism 2021-22. The aim of the VARAVA project is to increase the receptiveness of universities of applied sciences. The project identifies, acknowledges and intervenes in the phenomena of structural racism and promotes the adoption of an anti-racist operating culture as a guiding value of Finnish universities of applied sciences. Fundi EU's Asylum, Migration and Integration Fund.
- VIHTA – Digital Solutions for Green Work project will cultivate green and digital work for the future. Project is created to support and educate advisors who work in counselling for unemployed or entrepreneurs. Some of them are immigrants thar are a huge potential for Helsinki-Uusimaa region. Project focuses on contents, innovations, facilitation, service design, anticipation, counselling, and guiding that will increase and improve digital and green work in the society. Funding European Regional Development Fund 2021-2027. National funding for Helsinki-Uusimaa Region.
- VITALISE Virtual Health and Wellbeing Living Lab Infrastructure. Funding H2020
- VoimaProfi: Empowering people Towards socially inclusive society, national funding (Ministry of Education RDI development funding).

- VW Stiftung – GreenING Lab (national).

8.3 Thematic HUB3 - Energy in the City

The subtopic titles were consensually found during the workshops done in task 2.1. As mentioned above, one workshop was organised per thematic HUB, where all contributors of the corresponding thematic HUB were invited.

Table 10 - Subtopics and topics identified for the Thematic HUB 3 – Energy in the city.

Subtopic	Hot Research topic	Research topic in 5 years
Energy management	• Energy demand • Optimal Energy management of vehicles and transport systems	• Sustainable power supply • Energy consumption and environment • Energy management of local and global smart grids for integrated housing and mobility use
Decentralized production	• Local Clean-Energy • Individual Energy production	• Energy production • Distributed ledger technologies for energy empowerment
Sustainability assessment of energy systems	• Life cycle assessment of electric and hybrid vehicles • Battery modelling and testing for a better understanding and prediction of lifetime • Energy and environment • Policy for Sustainable power supply, Energy consumption	• Energy and the transformation of services • Life cycle assessment consolidation • How digital transition affects the production and consumption of services • Natural resources (strategic perspective)
Energy communities	• The energy supply in the cities • The renewable energy use for charging storage batteries and green hydrogen production • Decentralised charging management of electric vehicles/Decentralised power grid control • Collecting best practices for citizens collaboration using electric energy, e.g. common district battery	• Introduction of local electricity generation grids using renewable energy at the scale of a district in European cities • 100% power supply with renewable energies • Organisation and market introduction of long-term storages • Citizen involvement in regional power generation with renewable energies.

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	storage • Sector-Coupling of Electricity, Heat & Cold and Transport including Energy Storage • Roaming service for electric vehicle charging using blockchain-based digital identity	
Energy modelling and prediction	• Artificial intelligence to classify the energy performance • Prediction of future energy consumption demand • Predictive modelling of building energy consumption	• Future's energy generation • Energy Poverty

8.3.1 State of the art of current "hot" research topics (Question 1)

This section presents all the proposals provided by all HEI members of the InCITIES project while answering to question 1 regarding the "hot" research topics for the thematic of HUB 3.

Energy management
• Energy demand (previously Energy in the city)
We are studying the transformations needed in the energy system to achieve the goal of stabilising the increase of the temperatures to 1.5ºC. Of special interest are solutions that include, but are not limited to, demand-side reductions as they have great potential to lower overall energy and material demand, reducing the need for more speculative technology development centered, for instance, in negative emissions and geoengineering technologies. Energy demand from sectors such as transport or residential and commercial buildings are a focus of this research and concern directly the organisation of cities.
• Optimal Energy management of vehicles and transport systems
Energy management is a key point in the viability of new solutions for decarbonising transport. The optimal energy management proposed is based on a system approach using modelling and testing for validation. In terms of individual vehicles, our latest research works deal with optimal control of plug-in hybrid vehicles. Transport system energy optimisation has been initiated as well by developing smart recharging algorithms for electric bus fleet in order to minimise energy cost, battery degradation and the impact on the grid

Decentralised production

- **Local Clean-Energy**

Due to several recent factors, energy has become a central issue for cities. Citizens, organised around buildings, neighbourhoods, parishes and municipalities, with potential fiscal benefits from the state, could benefit if they decided to invest in clean energies. The same outcomes could be foreseen by companies and public services, benefitting all by reducing fixed costs. Research and their partners should better understand what are the current constraints and opportunities for having more or less clean-energy in cities, not only in buildings, but also in private and public transportation.

- **Individual Energy production**

Historically, fossil fuels have become the most important source of energy, and they continue to be the most important commodity in the production of electricity, driving a car, or heating households and other buildings in the city. However, these sources contribute significantly to environmental pollution. The aim of this topic is to identify individual sources of energy in a city or region, classify their use and assess the current state of energy use. It is necessary to determine the efficiency of individual energy sources, such as heat pumps, biomass and solar energy. It is also advisable to determine the suitability of the given source for the chosen application.

Sustainability assessment of energy systems

- **Life cycle assessment of electric and hybrid vehicles**

All the solutions proposed to deal with transport externalities mitigation have to be assessed in a global way. Life Cycle Assessment has proven its relevance for vehicles comparison, instead of comparing only consumption and emissions. A current work in the laboratory is the LCA of Plug-in hybrid vehicles including a battery aging model for more accuracy of the results [6]. Indeed, the battery assessment has an important weight in the global balance. That is why it is also explored the possibility of attributing a second life use to the battery after a first use in electric vehicles.

- **Battery modelling and testing for a better understanding and prediction of lifetime**

The batteries are the most sensitive element of plug-in hybrid and electric vehicles. Electric and thermal characterisation and modelling of batteries is needed in order to understand and predict battery behaviour in different use conditions [3]. One of the most critical parameters is the battery lifetime. Battery aging is sensitive to many parameters impacted by the use. Minimising battery aging by the mean of smart management and smart charging is a key point for electric vehicle fleets as well as for stationary applications in energy systems.

- **Energy and environment**

The use of energy is related to the efficiency of energy conversion, but also to the management of the elements of the energy system. Energy transmission efficiency, energy conversion efficiency and energy supply to the end user are determined. The way and management of the use of the given resource can negatively affect the environment of the city and its area. The use of energy in the city is a source of pollution, emissions and

production of particulate matter. It is necessary to define and quantify these pollutants with regard to their origin, for example from the burning of fossil fuels.

- **Policy for Sustainable power supply, Energy consumption**

The city's energy policy defined goals with regard to sustainable development. The aim is to achieve development that will not have a negative impact on the environment. It becomes necessary to use renewable resources that are available in the given area. The task is the classification of individual sources, determining the suitability of given sources for selected buildings or installation locations. It is also necessary to deal with energy supply systems, whether local or central, with regard to sustainable energy production and supply. The legislative framework determines the requirements and properties of the given systems and is an important part of the energy industry. An important parameter is also the properties of the objects to which the energy is supplied, especially their technical condition and thermal-technical properties.

Energy communities

- The **energy supply in the cities**, more and more with the decentralised generation systems and holistic energy supply by sectoral coupling are the topics we see as important for future's energy security and decarbonization. Therefore, we have focus more on the system analysis of energy sector.
- The **renewable energy use for charging storage batteries and green hydrogen production** to be used in possible fuel cells vehicles of future.
- **Decentralised charging management of electric vehicles/Decentralised power grid control**
- **Collecting best practices for citizens collaboration using electric energy, e.g. common district battery storage**
- **Sector-Coupling of Electricity, Heat & Cold and Transport including Energy Storage**
- **Roaming service for electric vehicle charging using blockchain-based digital identity**

Blockchain technologies are applied to support the identity management process of users charging their vehicles and to record energy transactions securely. At the same time, off-chain cloud-based storage is used to record the transaction details. A user wallet settled on a mobile application stores user verified credentials; a backend application in the vehicle charging station validates the user credentials to authorise the energy transaction. The current model can be applied to similar contexts where the user may be required to keep several credentials from different providers to authenticate digital transactions.

Energy modelling and prediction

- **Artificial intelligence to classify the energy performance**

How can we automatically classify the energy performance of dwellings and their energy-efficient retrofitting measures, using AI data science and AI approaches, to better inform citizens, institutions and public policies in this domain?

- **Prediction of future energy consumption demand**

Prediction of future energy consumption demand, towards improved energy efficiency in dwellings, buildings and cities. Therefore, we can raise a related research question: How can we automatically predict the energy consumption of dwellings, using data science and AI approaches, to better inform citizens, institutions and public policies in this domain?

- **Predictive modelling of building energy consumption**

Predictive modelling in buildings is a key task for the optimal management of building energy. Relevant building operational data are a prerequisite for such task, notably when deep learning is used. However, building operational data are not always available, such is the case in newly built, newly renovated, or even not yet built buildings. To address this problem, we propose a deep similarity learning approach to recommend relevant training data to a target building solely by using a minimal contextual description on it. Contextual descriptions are modelled as user queries. We further propose to ensemble most used machine learning algorithms in the context of predictive modelling. This contributes to the genericity of the proposed methodology. Experimental evaluations show that our methodology offers a generic methodology for cross-building predictive modelling and achieves good generalisation performance.

8.3.2   State of the art of research topics for the next 5 years (Question 2)

This section presents all the proposals provided by all HEI members of the InCITIES project while answering to question 2 regarding the research topics for the next 5 years regarding the thematic HUB3 .

Energy management
- **Sustainable power supply**

Deliveries of electricity energy and heat can be provided by local or central systems. Both systems have the advantages and also management method. Based on the analysis, properties and requirements of the objects, the suitability and selection of the energy supply system will be determined. It is also necessary to take into account local conditions, such as the location of the building but also the surroundings of the building, which have an impact on the operation of the building, for example by affecting the solar gains of the building. The location of the building also has an impact on the selection of available renewable resources around the building.

- **Energy consumption and environment**

Current legislation sets requirements for reducing energy consumption, and therefore it is necessary to ensure the reconstruction of buildings, with regard to their insulation, replacement of windows, reconstruction or replacement of outdated heat sources and equipment with intelligent energy consumption management. Energy management plays an important part in saving consumption, financial costs and also reducing the environmental burden. The next step is to design smart buildings with zero CO_2 production.

- **Energy management of local and global smart grids for integrated housing and mobility use**:

With the growth of the EVs share in the European vehicle fleet, the charging of all these vehicles will be challenging for the electricity suppliers mainly from instantaneous power perspectives. Adapting energy availability to energy demand using V2X connectivity and EVs batteries as electricity storage systems could be a good opportunity for grid stability. More the user profiles are different (EVs, lightening, Air conditioning, …) more are the possibilities of optimising the efficiency of the whole system. Model based approaches are in our opinion the best way to help finding and then implementing the best control solutions.

Decentralised production

- **Energy production**

The current energy crisis has highlighted the essential need for the EU to ensure sustainable and stable energy, which will be resistant to environmental influences, such as Russia's invasion of Ukraine. Therefore, it is desirable to expand the use of local RES, with a focus on solar energy and electricity production by photovoltaic panels. Another suitable local source of energy for cities is municipal waste, which mostly ends up in landfills and its energy potential remains unused. It is an energy source that is renewable and has a minimal impact on the environment when using BAT.

- **Distributed ledger technologies for energy empowerment**

Analysis on how DLT can help citizens to generate and sell their energy production and as so be more empowered and autonomous.

Sustainability assessment of energy systems

- **Energy and the transformation of services**

Analysis on energy and the transformation of services, and the impact on the organization of key social functions (mobility, heat and cooling, substance), including the potential to reduce carbon emissions and improving living standards for all.

- **Life cycle assessment consolidation**

Many LCA studies have been carried out in the past to evaluate the relevance of introducing electric, Hydrogen and plug in hybrid vehicles according to the country electricity generation mix and many other parameters. The main issue is that the results of these studies are not necessarily similar due to assumptions divergence and data accuracy mainly for extraction, production and recycling processes. There is a need to consolidate data and methodology for the battery cycle analysis (mainly recycling phase) and more generally for the whole energy system (generation and consuming)

- **How digital transition affects the production and consumption of services**

Digitalisation in transformation of services, including the modes that the digital transition affects the production and consumption of services and the effects for the reduction of overall energy and materials demand.

- **Natural resources (strategic perspective)**

The climate changes that are currently felt and the strategies for improving environmental quality and preservation of resources that are under development and application may continue as concerns of societies. Alternative energies or new consumption will pose other

challenges, new consequences of their use, and it is necessary to continue research in this theme, with the aim of creating solutions. Climate will continue to be a hot point with new challenges.

- **New statistical indicators for monitoring energy efficiency and energy poverty**

To feed LxHabidata with new statistical indicators for monitoring energy efficiency and energy poverty, creating knowledge about the socio-economic and territorial factors that explain the previous. At the level of housing models and ways of inhabiting, it is crucial to identify the energy consumption practices of the residents, but also their social representations on this issue, which we consider an important conditioning factor of those practices.

Energy communities

- **Introduction of local electricity generation grids using renewable energy at the scale of a district in European cities:**

Most of the local renewable energy generation equipment today are for individual houses, individual buildings (home or work) or parking places in some supermarkets. Some small cities or even villages began to invest in renewable energies by the initiative of mayors or even citizens. These initiatives need to be encouraged and accompanied with research and development programmes in order to optimise the implementation and the use of this energy the most locally possible and decrease the demand on the global grid.

- **100% power supply with renewable energies**
- **Organisation and market introduction of long-term storages**
- **Citizen involvement in regional power generation with renewable energies**.

Energy modelling and prediction

- **Future's energy generation**

supply is going to be focused more on data sciences than the technologies themselves (by assuming the technology will reach maturity among renewables as well). This is particularly true on trading and load management. Therefore, this digitalisation of energy sector will be one of our future work's focus.

- **Energy Poverty**

Energy Poverty refers to the lack of access to reliable, affordable energy sources that is necessary to meet basic needs such as lighting, heating, and power for appliances. According to Eurostat's figures, about 35 million EU citizens (approximately 8% of the EU population) were unable to keep their homes adequately warm in 2020. In Portugal alone, this phenomenon affects between 1,9 and 3 million persons. Regarding this topic, we can raise the following research question: How can we automatically find clusters of dwellings with energy poverty conditions, at various levels of European territorial units (NUTS 0-3, District, Municipality, Parish, Neighbourhood, using data science and AI approaches, to better inform public policies in this domain? This approach would leverage available open (public) data sources, such as level of income of citizens, citizens with reduced energy bills,

electricity and gas prices, energy consumption of dwellings, weather and climate, energy performance of buildings via their energy performance certificate, amongst other sources.

8.3.3   Relevant Publications

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- Christian Hotz, Sergej Baum, Eberhard Waffenschmidt, Ingo Stadler, "Topology Estimation in Low Voltage Grids Using Wallbox Charging Data Recordings", CIRED workshop on E-mobility and power distribution systems, Porto, Portugal, 2.-3. June 2022, Paper no. 1358
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- Thermal modeling of batteries for EV energy management Ali ABBAS, Nassim RIZOUG, Rochdi TRIGUI, Anthony BABIN, Eduardo REDONDO, Serge PELISSIER 2021 IEEE Vehicle Power and Propulsion Conference, VPPC 2022, Merced, California, USA
- Waffenschmidt, Eberhard; Hotz, Christian; Baum, Sergej; Stadler, Ingo: Swarm Grids : Verteilte Stromnetzsteuerung für verteilte erneuerbare Energieerzeugung. In: Tagung Zukünftige Stromnetz / Conexio-PSE GmbH (Hrsg.). - Tagung Zukünftige Stromnetze 2022, online, 26.01.-27.01.2022 - 1. Auflage, Pforzheim: Conexio-PSE GmbH
- Wilson C., Grubler A., Bento N., Healey S., De Stercke S., Zimm C. (2020), "Granular Energy Technologies for Accelerating Low-Carbon Transformation," Science 368 (ISSUE 6486), 3 April 2020.

8.3.4   Current projects related to the topic (local, national or European project):

- 4Blife project: (ongoing national project) This project allows to study energy management in an electricity generation network integrating a share of renewable energy and self-consumption with housing and electric vehicles as consumers. This management will be optimised by integrating an aging criterion for second-life batteries, mainly recycled from an electric vehicle application.
- EDITS - Energy Demand changes Induced by Technological and Social innovations project network, coordinated by the Research Institute of Innovative Technology for the Earth (RITE) and International Institute for Applied Systems Analysis (IIASA), and funded by Ministry of Economy, Trade, and Industry (METI), Japan (DINÂMIA'CET-Iscte is member since 2020). Global.
- ERS Project (Electric Road System), submitted national project: The transport sector represents 31% of CO2 emissions in France, 20% of which occur on the motorway. The electrification of heavy Trucks with batteries as the only on-board source would require a large quantity of batteries to be manufactured and recycled. The idea of the ERS is to electrify part of the French motorways to allow electric trucks to operate while recharging their batteries. A significant reduction in the size of the batteries is then possible to allow trucks to reach the electrified highway or their delivery points.
- Grid4mobility project: (ongoing national project) This is a montage of an experimental full-scale intelligent network on the site of the experimental city Transpolis. Eventually, this site will allow the testing of rechargeable electric and hybrid vehicles of different sizes (including buses and heavy Trucks) following the installation of slow and fast charging stations linked to the renewable electricity generation network.
- PROGRESSUS: "Elektroniksysteme für die Energieversorgungsinfrastruktur der nächsten Generation". Laufzeit: 1.4.2020 - 31.3.2023. Externe Partner: Infineon Technologies, Devolo

Mixed Mode, CEUS, Friedrich-Alexander Universität Erlangen sowie weitere europäische Projektpartner. Partner TH-Köln: Prof. Dr. Ingo Stadler. Fördermittelgeber: Bundesministerium für Bildung und Forschung, Rahmenprogramm der Bundesregierung für Forschung und Innovation 2016-2020 "Mikroelektronik aus Deutschland - Innovationstreiber der Digitalisierung", Förderkennzeichen 16MEE0006 sowie Fördermittel der EU, RPME-ECSEL Joint Undertaking.

- QUIRINUS-Control: Spannungsqualitätssicherung im Rheinischen Revier. Laufzeit: 1.6.2022 - 31.5.2026. Externe Partner: Forschungsgemeinschaft für Elektrische Anlagen und Stromwirtschaft e.V., Rheinische NETZGesellschaft mbH (RNG), SOPTIM, Bocholter Energie- und Wasserversorgung GmbH, Stadtwerke Brühl GmbH, Energiewirtschaftliches Institut an der Universität zu Köln gGmbH, Stadtwerke Bühl GmbH, Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V., evelio GmbH, Leitungspartner GmbH, RWE Power AG, Gridhound GmbH, Regionetz GmbH, RWTH-Aachen, morEnergy (assoziiert). Partner TH-Köln: Prof. Dr. Ingo Stadler. Fördermittelgeber: Bundesministerium für Wirtschaft und Klimaschutz, Förderkennzeichen. 03EI4048R, 03EI4048RV
- RARSUS: Risk Assessment and Reduction Strategies for Sustainable Urban Resource Supply in Sub-Saharan Africa
- RETO-DOSSO: Researchers Back to the Secondary School – Renewable Energy Powered Water-Food-Economy Nexus for the Sustainable Livelihood at Dosso Region nin Niger – ITT Sub-Project: Renewable Energy for Energy Economy-Hub
- SEMALI: Risk Assessment and Reduction Strategies for Sustainable Urban Resource Supply in Sub-Saharan Africa – Focus on Sustainable Energy Supply in Mali
- Solardachpfanne: "Solardachpfanne.NRW - Dezentrale Strom- und Wärmeversorgung made in NRW". Laufzeit: 1.5.2019 - 30.4.2022. Partner: Prof. Dr. Christian Dick, Prof. Dr. Ulf Blieske, Prof. Dr. Ruth Kasper, Kollegen TH-Köln, Fa. PaXos, Köln. Fördermittelgeber: Land Nordrhein-Westfalen unter Einsatz von Mitteln aus dem Europäischen Fonds für regionale Entwicklung (EFRE) 2014-2020, FKZ-EFRE: EFRE-0801561.
- SUS2TRANS - Sustainable Transformative Transitions: Conciliate Accelerated Low Carbon Transitions with System Transformations, coordinated by DINÂMIA'CET_Iscte with the participation of LNEG, IGOT/University of Lisbon, ESTGV/Polytechnic Institute of Viseu, INESC ID/University of Lisbon, Utrecht University, ETH Zürich, and financed by national FCT (PTDC/GES-AMB/0934/2020) awarded in November 2020 for the period 2021-2023
- WESA: Water and Energy Security for Africa.

8.4 Thematic HUB 4 - Vulnerability, inclusion, and health in the city

The subtopic titles were consensually found during the workshops done in task 2.1. As mentioned above, one workshop was organised per thematic HUB, where all contributors of the corresponding thematic HUB were invited.

Table 11 - Subtopics and topics identified for the Thematic HUB 4 -Vulnerability, inclusion and health in the city.

Subtopic	Hot Research topic	Research topic in 5 years
Multidimensional inequalities and vulnerabilities	- Vulnerability of people in their mobility - Territorial inequalities - Place-based inequalities - Understanding vulnerability (different types of vulnerability) and assessing the degree of vulnerability of the population (society) in the city "How I Feel" - Europeans' perceptions of well-being - Energy crisis and mobility inequalities	- New vulnerable people in their mobility - Inequality reduction - Links between income inequality and increase in inequality in mobility
Pollution and health impacts	- Effect of pollution (noise, air pollution) on health - Studying exposure to pollution - Air pollution - Environmental inequalities - Automated measurement of negative environmental factors - Data analysis and visualisation applied to pollution	- Effect of air pollution and noise on populations in urban areas - Air quality
Accessibility and disability situations	- Mobility and disability situations - Services and their accessibility for vulnerable population	- Services and their accessibility for vulnerable population - Mobility and disability situations - Inclusive Mobility - Accessibility for the Disabled - Design of a Barrier Free Environment
Vulnerable groups and healthcare solutions	Inequalities in access to city resources (health, housing…), and specifically for vulnerable populations	- The health - mobility – sustainability tryptic - Health-oriented planning - Promoting an ambient

	• Ambient assisted living • Versatile and sustainable healthcare research	assistant living for elderly people • Sustainable and Versatile social and healthcare
Wellbeing economy	• Health issues and their economic and societal impact • Urban housing affordability • Economic and social costs of mobility related casualties	• Assessment of the developments and impact of DLT and blockchains for social good and inclusiveness • The impact of technological development, globalisation and ageing
Vulnerability and crisis management		• Reducing the vulnerability of the population and increasing the preparedness of the population for crisis situations

8.4.1 State of the art of current "hot" research topics (Question 1)

This section presents all the proposals provided by all HEI members of the InCITIES project while answering to question 1 regarding the "hot" research topics for the thematic of HUB 4.

Multidimensional inequalities and vulnerabilities

- **Vulnerability of people in their mobility**.

Vulnerability was here addressed with a multi-disciplinary approach from both the socio-psychologic and engineer points of view. Vulnerability is considered either as: Individual-centered, investigating the increased exposure to risk of these so-called road users: elderlies (having a reduced tolerance and resilience to impact) or children (less adapted in both their physical and cognitive development to urban infrastructures) AND vehicle or transport mode-centered, investigating the specific impact conditions and injury mechanisms of motorcyclists, cyclists, and pedestrians (due to their cohabitation with much heavier motorized vehicles).

- **Territorial inequalities**.

It is widely admitted that social and geographical inequalities exist on exposure to risk (pollution, transports), accessing transport modes and travel conditions. Moreover, as likewise most health problems, the distribution of risk (road accidents, in particular) is socially stratified, regardless of the considered populations. A better understanding of the social dimension of this phenomenon can also help to propose adequate policies, well adapted to different audiences. Several approaches are being considered, such as the analysis of differences in mobility according to social and spatial factors, and the links and influence these factors may have on risk.

- **Place-based inequalities**

Place-based inequalities is a European central issue. By having a multidimensional, intersectional, systemic and cumulative perspective of the several types of inequalities that characterise each territory (neighbourhood, parish, municipality, cities, metropolitan areas), is it possible to understand their potential consequences in cities for instance, in terms of social wellbeing and quality of life, mobility practices and leisure, access to culture, decent work, work-life balance, health, access to the digital society, housing, civic participation, sociability and subjective well-being. This wellbeing approach is a fruitful way by the ecosystem partners to see development and social progress not only in terms of GDP and economic growth, but instead putting people-first in their several policy options, for instance in terms of budget like New Zealand is actually doing.

- **Understanding vulnerability (different types of vulnerability) and assessing the degree of vulnerability of the population (society) in the city**

Different groups of the population (children, young, old, immovable, people on the verge of poverty, socially excluded groups, etc.) are differently prepared and able to react to situations that affect their security. Understanding vulnerability, finding weak points and assessing the degree of this vulnerability to various environmental influences, to the effects of extreme weather and crisis events is a necessary assumption for planning appropriate measures. These will subsequently serve to reduce the level of this vulnerability and contribute to building capacities to manage the negative impacts of negative events in society. The analysis of events (e.g., crisis events) from the past and their effects on society is a suitable initial tool for understanding the negative impacts and vulnerability of the population of the affected city.

- **"How I Feel" - Europeans' perceptions of well-being**

The diagnosis of health well-being, decent work or environmental quality, among others, is fundamental to assess the state of ""health"" of societies. For example, the challenges raised with telework present new problems of employability, work and leisure time balance, health or social contacts. These changes are visible in an adult population that has suffered the change of processes, but the population of young adults who are starting their autonomous life and forming relationships deserves special attention.

To assess the different dimensions of well-being, official and objective statistics may be used, but it is fundamental to measure people's perceptions, understand the interdependencies of these dimensions and their relations with inequality factors (e.g. education, income, gender, origin, ethnicity or religion). Initially based on indicators from currently existing European studies, this approach may contribute to the creation of new indicators, in order to follow the new challenges of societies and may be developed in a multi-level perspective, local, regional (NUTSII) and national, involving the different countries of Europe.

- **Energy crisis and mobility inequalities**.

The legacy of the Glorious Thirties, the democratisation of access to household motorisation as well as the generalised improvement in mobility conditions probably explained until recently the scientific community's relative lack of interest in identifying, identification and evaluation of the various forms of inequality in mobility practices. However, the diffusion of

the automobile has also favoured changes in land use and the provision of services (location of housing, jobs, shopping centers, etc.) which make the use of the car necessary. It was therefore accompanied by an increase in the share of the captive car population. This dependence on the car, the intensity of which varies according to individual circumstances and types of travel, means that users have difficulty in adjusting their behaviour (particularly for the most modest among them) in the event of increases in the cost of transport use. In addition, with the increase in motorisation among low-income groups, car-use expenses take up a larger share of their budget than it does for the most affluent. Thus, the burden of taxes imposed on the goods and services of automobile use tends to affect low-income households more than rich ones.

Pollution and health impacts

- **Effect of pollution (noise, air pollution) on health**.

This topic is currently addressed by studying factors affecting how individuals feel the effects of noise and air pollution, and investigating how these factors (and how those are felt) act on these individuals health, as declared and actual symptoms. Other studies should also be mentioned, aiming to identify a possible link between noise patterns (those of cars, guided transports, airplanes, wind turbines) and cardiovascular pathologies or quality of sleep. Air pollution related to motor vehicles and its possible relation to health in the context of home-to-work journeys was also investigated.

- **Studying exposure to pollution**

In Slovakia, air pollution caused by high concentrations of PM2.5, PM10 and NO2 particles causes 1,600 premature deaths per year, five percent of this number falls on the three most polluted areas. Two of them - Žilina and Ružomberok, are in the Žilina Region, the third is Košice. Within this topic attention will be focused on:

- the effects of the current concentration of pollutants air in the Slovak Republic for the health of the population,
- measures to reduce emissions of PM2.5, nitrogen oxides (NOx), sulfur dioxide (SO2) and ammonia (NH3) in transport, household heating and agriculture defined within the National Air Pollution Reduction Program in Slovakia (NAPCP),
- the health effects of the implementation of the NAPCP on the health of the inhabitants of Slovakia (decrease in mortality, reduction in morbidity),
- NAPCP cost-benefit analysis.

- **Air pollution**

Air pollution is a major concern in developing countries. Typically, air quality is measured with static and costly ground stations. They provide accurate measures but with low spatial resolution. An alternative are Low Cost Sensors (LCS) that enable the deployment of mobile sensor networks with a high number of sensing units. In the ExpoLIS project we have developed a set of mobile LCS. Although they have low sensitive and accuracy, they can be used to identify major spikes in pollution. I am interested in exploring the knowledge gained

in the ExpoLIS by deploying a system based on LCS to monitor air quality, to provide information for both citizens and scientists.

- **Environmental inequalities**

Air quality is key towards life quality. However, in large cities that host everyday crowds of inhabitants and workers, pollution is a reality. By monitoring with sensors air quality, city managers and planners can rely on data to take judged decisions that can improve air quality in city locations more severely affected

- **Automated measurement of negative environmental factors**

In order to make effective and efficient management decisions aimed at suppressing negative environmental factors and their impact on society, reliable measurements must be conducted regularly in the environment. We identify two main approaches for the data collection, that should be discussed within this topic:

- static sensor networks – utilising multiple independent sensor nodes measuring the required environmental properties (e. g. air pollution parameters like particle concentration) communicating the information towards database (usually cloud) using Internet of Things approaches. In order to achieve full coverage of the city, these sensor nodes need to be installed in large numbers within the monitored area while having access to internet (mobile network or WiFi).
- mobile robotics – utilising smaller number of autonomous vehicles (ground or aerial) constantly measuring the critical parameters of the environment. Mobile robots can cover larger areas due to their movement ability and may actively localise the source of the pollution, providing better situational awareness. Such an approach is especially suitable for deployment in emergency situations when there is no existing static measurement infrastructure installed.

- **Data analysis and visualization applied to pollution**

Big data obtained by automated measurement needs to be processed into compact and reliable information and then presented to both people in charge (rescue teams, law enforcement, municipal office) and public, optimally with low latency. Analysing long-term trends with the aid of artificial intelligence allows to identify the critical areas (highly polluted areas, sources of pollution), to predict further development and make effective decisions. If the environmental information is available online as a service, automated control systems (e. g. traffic control within the city) may use them to make active countermeasures.

Accessibility and disability situations

- **Mobility and disability situations**.

in France, since the early 1990s, national transport surveys have shown a constant rate of people who are ""inconvenienced"" during their travel, around 10% of the population. However, little is known at present in France about the populations that have difficulty in travelling in relation with a disability or reduced mobility (mainly disabled or elderly people),

as well as their travel practices (or lack of travel) and their needs in terms of access and mobility.

In line with interactionist and social approaches of disability issues, this research will aim to identify the mechanisms that lead to the production of disability situations in the use of transport, by looking at all the factors, both personal and environmental (physical and social environment), that interact to produce these situations and hinder the social participation of the people concerned. It will question the impact of making transport systems accessible - in particular via the use of digital technology - in reducing these situations of disability, as well as the gender differences that can be observed and the interaction with economic or location difficulties.

- **Services and their accessibility for vulnerable population**

Within this topic, attention will be focused on the analysis of the possibilities of access of different population groups to services that are supposed to help the most vulnerable groups manage the adverse effects of crisis situations and environmental influences. For example, areas and services such as:

- access to basic life needs - food, electricity, etc.
- health care,
- social care, etc.

Normal conditions will be analysed but also crisis situations, when the demand and availability of the given services may change. An important role during crisis situations is played by crisis management (from the local to the national level) and the system of civil protection of the population which has the resources and possibilities to deal with such situations.

Vulnerable groups and healthcare solutions

- **inequalities in access to city resources (health, housing…), and specifically for vulnerable populations**.

Current projects as examples: the territorial determinants for breast cancer diagnostics for migrant women in Ile-de-France; experimenting affordable and emergency housing solutions for vulnerable populations or alternative solutions to the loss of autonomy for elderly citizens in the city; access to mental health resources for refugees in Paris; the politics of refugee hospitality in mid-sized towns

Another strand of research focuses on the urban politics of redistribution as a means to fight inequalities in the city.

Current project as example: growth coalitions in Disney-dominated territories and the issues of redistribution at city and neighbourhood levels of the tourism revenues they generate

- **Ambient assisted living**

Promoting an ambient assisted living for elderly people: Societies are getting older and there is the need to support the development of products and services that aim to improve people's lives and aid the ones caring for the older ones. Current research applies IoT to elder people houses and on usable devices in order to gather data and provide support and help in case of necessity. Regarding people with dementia and their caregivers, there are

over 55 million people worldwide living with dementia in 2020. This number will almost double every 20 years, reaching 78 million in 2030 and 139 million in 2050. The current and past research developed a computerised environment to support technicians in their daily treatment routines and applied cognitive stimulation games to patients to help preventing the progression of the illness.

- **Versatile and sustainable healthcare research**

Hot research topics for the programme focus on 1) supporting **wellbeing and health of the citizens**. This area has varied projects that study and develop areas such as virtual health and wellbeing living labs (Vitalise project) and possibilities for elderly people continue to live at home (Shapes project). Other stream of RDI focuses on **supporting citizen participation and social inclusion**, especially for vulnerable groups in society, DigiIN and VoimaProfi projects are examples of this research stream. Questions of diversity and multiculturalism relate to this topic (Varava project). Third topic area is **wellbeing in work, especially in healthcare services**.

Wellbeing economy

- **Health issues and their economic and societal impact**

Health problems can have a significant impact in societies, which can spill to economies. The recent pandemic crisis created by the COVID-19 disease has leveraged research in these areas. By taking advantage of data gathered related to COVID-19, novel research was leveraged to find out the real impacts of this pandemic

- **Urban housing affordability**

The global crisis of urban housing affordability, which results from an intense gap between local wages and housing prices (now determined by the international circuits of tourism and real estate investment), reached Lisbon in the last 8 years, affecting large segments of the population beyond the most vulnerable social groups. Our work is to make relevant contributions to a revision of the current housing policies (evidence-based policy making - EBPM) that can reduce the current problem of housing affordability, which is, nowadays, one of the most important causes of social vulnerability and exclusion in the metropolitan area of Lisbon.

- **Economic and social costs of mobility related casualties**

Road related casualties are associated with an economic burden (material damages and injuries). The importance of road crash costs justifies the intervention of authorities through adapted and efficient preventive public policies. A better understanding of such costs is crucial and has been investigated. An accurate assessment of the different cost components is also critical to understand the consequences for the victim and the authorities and other third parties. Moreover, a better evaluation of the monetary value of a statistical life is essential for evaluating some interventions from the economic standpoint.

8.4.2   State of the art of research topics for the next 5 years (Question 2)

This section presents all the proposals provided by all HEI members of the InCITIES project while answering to question 2 regarding the research topics for the next 5 years regarding the thematic of HUB 4.

Multidimensional inequalities and vulnerabilities

- **New vulnerable people in their mobility.**

In the context of "vision zero fatalities" and "decarbonised mobility" already adopted by an increasing number of urban areas, the rapid development of new displacement modes, such as e-scooters, raise a number of new questions on vulnerabilities. Research questions that should be addressed on this topic include epidemiology on casualties, studies on the best ways of sharing space between road-users, education and public awareness, personal protective equipment's evaluation, efficiency of existing regulations.

- **Inequality reduction**

Several current problems derive from the increasing inequality, not only of wealth and income, but also regarding spatial, cultural, institutional and political inequalities. Social science production and international organisations are documenting very well these trends, and today the problematic of inequality is one of the strongest for understanding the world today, closely interlinked with the global challenges of the UN Sustainable Development Agenda. SDG 10 aims the reduction of inequalities within countries and between countries, and cities are a decisive balance of the success of these goals. Science and universities, co-creating with the city-partners, need to find the concrete research and political solutions and overcome the ideological myth, already destroyed by the recent literature, that equality is an obstacle to economic growth.

- **Links between income inequality and increase in inequality in mobility**

Using an empirical approach, based in particular on data from the 2019 National Mobility Survey, recent waves of the Parc-Auto panel, Family Budget surveys (expenses and income), etc., the aim of the work consist to show, with econometric work, the relationship between transport and income and then the role of other determining factors: gender, age, level of study, residential location, size of the urban area, location in the urban area (for example, forms of labour mobilisation, with night workers clearly car-dependent since generally without access to public transport). Does an increase in income inequality also lead to an increase in inequality in mobility or in the inequality in the rate of car ownership and car use? We will also ask the question of the evolution of these inequalities over time. It should be possible to assess the effect on these inequalities of different measures (and their targeting) intended to compensate for the effects of energy costs: tariff shield, reduction in the price of fuel at the pump, energy check, distribution of electric vehicles and heat pumps, etc.

Pollution and health impacts

- **Effect of air pollution and noise on populations in urban areas**

In the context of changing urban noise, in particular with post-covid expansion of bar terraces, how these changes will act on health should be further investigated to better

anticipate actions. Innovative statistical analysis methods such as causal inference could help understand how noise and air pollution can be mediated by trouble and health effects, in order to identify and quantify a link with particular pathologies: blood pressure, hypertension, diabetes, risk of myocardial infarction, but also some cancers which remain to be explored.

Developing methods to predict air pollution risk of exposure in urban areas based on satellite images analysis, in order to produce input data for real time information apps.

- **Air quality**

The transport sector has a significant negative impact on the environment and human health. Transport is responsible for a quarter of the EU's greenhouse gas emissions, causing air pollution, noise and habitat fragmentation.

The urban area is more active in terms of transport dynamics and the exposure of the population to pollutants is more intense.

Future research will focus on non-exhaust PM emissions from road transport and their impact on human health in cities.

It is expected to investigate:

- options and measures to protect the most vulnerable citizens of Slovakia from polluted air (asthmatics, people with diseases of the respiratory system and cardiovascular system, very young children, pregnant women, old people, etc.),
- measures to improve air quality inside buildings,
- measures to improve air quality in the Žilina region and specific cities of this region.

Participation and cooperation at the local level with representatives of the city and the main air polluters in the area, or with partners at the national level, is expected.

Accessibility and disability situations
- **Services and their accessibility for vulnerable population**

It is necessary to think not only about the vulnerability of city inhabitants but also about the very vulnerability of important services for society and their availability, especially during the emergence and acting crisis events. It is in these situations that the problems of the most vulnerable population groups are exacerbated, as in most cases they are unable to manage the negative effects of these events by themselves and their lives and health may be at risk. Various indicators of the societal vulnerability (vulnerability index) can be used to assess the vulnerability of basic services for the population, e.g., in the event of large-scale disruption of electricity supplies (e.g., for the social sector, healthcare, transport, etc.). The result is the determination of the final value of the Vulnerability Index and the determination of the measures resulting from the achieved value of the vulnerability index for the given city.

It will probably be appropriate to cooperate with representatives of the crisis management department at the district office and with representatives of the municipal office which are responsible for crisis management.

- **Mobility and disability situations.**

The methods of investigation could integrate:
  - The analysis of existing data (notably French national surveys) on the travel practices of disabled people and people with reduced mobility
  - The elaboration, collection and analysis of a first survey of people with disabilities (motor, sensory, intellectual or psychological), of the ""life course"" type, as well as a second survey using semi-directive interviews, to examine in greater depth the difficulties encountered and the means to overcome them.
  - International comparisons on travel discomfort and its determinants.

- **Inclusive Mobility - Accessibility for the Disabled - Design of a Barrier Free Environment**

Designing, building, and maintaining an accessible public infrastructure is crucial for ensuring that disabled people are not excluded from society. For this purpose, we have to deal with the technical considerations and measures to be taken into account in the planning of the built-up environment. This includes issues related to the design of several complementary domains: open spaces, streets and pathways, building entrances, etc. There are two main topics which are needed to discuss in the scope of providing a barrier-free environment in cities for the independence, convenience, and safety of all people with disabilities: Urban design considerations (solutions to the problems in the design of an accessible outdoor environment - design requirements of open spaces and pedestrian routes) and Architectural Design Considerations (design requirements of vertical and horizontal access in both new and existing constructions). These Considerations deal with issues such as obstructions, signage, street furniture, pathways, curb ramps, pedestrian crossings, parking, entrances, stairs, railings and handrails, and bus stops.

Vulnerable groups and healthcare solutions

- **The health - mobility – sustainability tryptic**.

Within this framework, multidisciplinary research should be carried out to identify and quantify the determinants of mobility that simultaneously impact the health dimension (cardiovascular disease, obesity, etc.) and the sustainability dimension (carbon footprint, soft modes, etc.). In fact, for certain populations (elderly people, low-income population…), these determinants may be difficult to reconcile. Emphasis will be placed on the development of preventive tools based on both human and social sciences and AI.

- **Health-oriented planning**

the expansion of pro-bike policies in Ile-de-France in the post-covid context (project MAMA: Emmanuelle Faure); the correlation between Health and access to quality food in deprived neighbourhoods of Ile-de-France (project CABas)

Other projects are developed around affordable access to land and housing: project COBRA in particular looks at new financial models designed to foster affordable access to housing via a decoupling of land and housing property

- **Promoting an ambient assistant living for elderly people**

In future developments the research should give a step forward by applying Artificial Intelligence algorithms to detect potential harmful situations and alert the right entities.
Supporting people with dementia and their caregivers: in future developments there is the need to consider not only the needs of the dementia patients but also their caregivers and families by supporting their needs and dealing with the inherent ethical dilemmas involved. There is the need to develop further studies on legal frameworks and guidelines in order to achieve inclusion and equity in the multitude of situations that rise.

- **Sustainable and Versatile social and healthcare-**

The importance of digitalisation and knowledge management and broad understanding of this phenomena in healthcare and social services. Aging population, digital services and skills, digital marginalization, and exclusion (vulnerable groups) will grow even more important in near future.

Digitalisation, population changes affect to work skills and competences in social and healthcare sectors. Also places of care are changing (roles of public sector, private sector, third sector, domestic care services, etc.), which in turn have an impact on organisation of care. This changing environment of care and social have an impact on work competencies. Care work will be more multi-professional, require cooperation, and communication competences. Ethical competences, and ability to develop one's work are focal RDI areas will be even more significant. These topics may not fit under the hubs directly. However, they can have significant impact on the wellbeing and health of citizens and the quality and functionality of public and private social and healthcare services. Above mentioned topics in social and healthcare sector, together with changing policy guidance and legislation call for better understanding of ethical issues, especially when new services are being co-created and developed in multi-actor contexts.

Wellbeing economy

- **Assessment of the developments and impact of DLT and blockchains for social good and inclusiveness**

Analysis of the organisational and social impact of the inclusion and use of Blockchain (BC), Distributed Ledger Technologies (DLT) and smart contracts in information systems with a focus on the wellbeing economy.

- **The impact of technological development, globalisation and ageing**

The technology we develop today will enable countless benefits and progress, but it may have consequences in the widening of inequalities. In the labour sphere, there will be new employability challenges, new professions, new training needs and new teaching-learning processes. Regarding health, the challenges are linked to an intense action of prevention of consumption habits and health care. Ageing, a current topic, will have greater concerns in the medium term, about how to manage active ageing, creating work/occupation solutions, how to increase the average life expectancy after 65 with health and how to manage housing problems with a high senior occupancy and with specific care needs. It will be necessary to rethink cities, the communities that form them and use technological advances to support these populations.

Vulnerability and crisis management

- **Reducing the vulnerability of the population and increasing the preparedness of the population for crisis situations**

In the next period, further investigation is considered:

- possibilities of increasing the preparedness of the urban population for the effects of crisis events (increasing the knowledge base, practical abilities and skills of self-protection and protection of close contacts, implementation of adaptation measures against climate change, etc.) mainly in connection with the expected increased and more serious occurrence of crisis events due to climate change.
- possibilities of citizens' participation in reducing risks threatening their security in the city and in reducing their vulnerability.
- possibilities of engagement and inclusion of the population in the fight against the negative effects of the environment through joint participation in various activities in cooperation with representatives of the city (municipality), district authorities (departments of crisis management and civil protection, voluntary associations (e.g., Red Cross), specific threats (e.g., large industrial enterprises, enterprises working with dangerous substances) in the city.

8.4.3 Relevant Publications

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- ANIMORT: Jean Estebanez, funding: i-sites Futures, local program.
- Assessing the vulnerability of society due to the failure of important systems and services in the electricity industry, VEGA 1/0371/19, (2019-2021). Maria Luskova – Project leader. National project.
- BMBF - BioAbsorp-it (national)
- BMBF – Norifarm (national)
- BROUHAHA (national funding) investigating the possible link between noise patterns and cardiovaculat diseases and metabolic parameters
- CA20105 - Slow Memory: Transformative Practices for Times of Uneven and Accelerating Change (https://www.cost.eu/actions/CA20105)
- CA21137 - Ethics in Dementia (https://www.cost.eu/actions/CA21137/)
- CABaS (CAdres de vie en BAnlieueS) : Emmanuelle Faure, funding: City of Gennevilliers, local program.
- CELICE – Strengthening the climate change, ecosystems and livelihood nexus in coastal zones of Ecuador through transdisciplinary research and innovative teaching (DAAD; project

head) National: Co-creation in the region - Systemic and innovative transfer development (Co-Site) (BMBF; work package head "green infrastructure")

- COBRA : Sonia Guelton, Claire Carriou, Claire Aragau, funding: Union Sociale pour l'Habitat, national program.
- Co-Site project: Co-Creation in the Region – Systemic and Innovative Transfer Development 2023-2027, local project with national and regional funding in the region Cologne and Bonn in Germany
- DEBATS (national funded project), investigating airplanes noise effects on populations http://debats-avions.ifsttar.fr/
- DISGOUVDYN: Julien Aldhuy & Sophie Didier, funding: i-site futures, local project.
- Dusan Nemec – FEITMobile robotic systems for support during crisis events, VEGA 1/0241/22 2022-2024, Project leader – Rastislav Pirnik. National project.
- Establishing the principles and sequence of steps to measure the awareness and preparedness of the population to the risks of natural disasters. VEGA 1/0805/18. 2018-2020. Project leader – Michal Titko. National project.
- GERTRUD: Joel Idt, funding: ANR, national program.
- Impact of Blockchains and Distributed Ledger Technologies, 2022, national funds, Blockchains (BC) and Distributed Ledger Technologies (DLT) are being included in several real-world scenarios, not only in the financial context but also in several others, such as healthcare and supply chains. The characteristics of these technologies that encourage exchanges and transactions between participants without the need for a third party (central authority) have raised increasing interest in the application of technology to a wide range of organisational, inter-organizational and societal problems. However, even if important digital, organisational and economic transformations can be anticipated, the impact of the introduction of these disruptive technologies is not yet well studied. This project intends to analyse the organizational and social impact of the inclusion and use of Blockchain (BC), Distributed Ledger Technologies (DLT) and smart contracts in information systems. Interviews, surveys, analysis and testing of a set of BC and DLT tools will be conducted in order to justifiably position them in the context of existing Technology Adoption Models (TAM). This project is in line with the Thematic Line 5 - Digital Transformation of the SocioDigital Associated Lab. https://ciencia.iscte-iul.pt/projects/impact-of-blockchains-and-distributed-ledger-technologies/1691
- iNSPIRE - The iNSPIRE Social Entrepreneurs Network (iNSPIRE) project will create a learning HUB that will develop inspiring apprenticeships processes, based on the identification of transferable lessons from the formal and informal learning environment to support the development of a social entrepreneurship network in several European countries (Turkey, Portugal, Ireland, France, and Belgium). Ireland and Belgium have already an important background in social entrepreneurship and will contribute to creating a strong partnership to support and develop a European social cluster. Evidence from Ireland and Belgium shows that social entrepreneurship demonstrates great potential for employment growth. The iNSPIRE goal is to improve skills for social entrepreneurs and increase the potential for social enterprise creation. The project will engage diverse stakeholders in dialogue and cooperation including non-profit associations, universities, training providers, social innovation organizations, research centers, and public agencies. It will capture the experience, including learning mechanisms, approaches to management, and

networking competencies from other projects in the social field, mainly developed by the partners, for instance, capacity building.

- LOTUS (Locally organized transition of urban sustainable spaces): Joel Idt, Margot Pellegrino, Katia Laffrechine, funding: Erasmus + program, Coord. University of Applied Sciences Kehl.
- MAMA (Monde d'Avant Monde d'Après) : Emmanuelle Faure, funding: CNRS, national program.
- National project: DSAEI - Data science analysis for environmental inequalities, CIES-Iscte and ISTAR-Iscte, https://ciencia.iscte-iul.pt/projects/data-science-analysis-for-environmental-inequalities/1740 Digital society and AI are posing new challenges to cities through opportunities to improve the performance and democratization of local and regional public administrations in their relationship with citizens and companies. Digital and AI's impacts on the structure of inequality have not yet been sufficiently studied within and between countries and at the city levels. We aim to analyse environmental data and inequalities, by simultaneously advancing the social science problem of sustainable development, and improving the digital tools for city problem-solving, together with social stakeholders and municipalities. Through data science and the application of machine learning, statistical data, and place-based knowledge concerning climate problems, the project intends to produce a digital toolkit of geographical-interactive maps of sustainable footprint, supported by a system of multidimensional indicators of environmental inequalities and urban lifestyles, mobility patterns and transport usage. Start date : 2022-01-01 | Expected end date : 2023-12-31 |Locally funded project
- National, LXHabidata is a housing data platform with permanent updates relating to the municipalities and parishes of the Metropolitan Area of Lisbon: https://lxhabidata.iscte-iul.pt/
- Proposal of adaptation measures to reduce the risks arising from climate change in terms of the occurrence of disasters and extreme weather events. VEGA 1/0459/21. 2021-2023. Project leader – Michal Titko. National project.
- PUCA: Nadia Arab, funding: PUCA, national program.
- RIBEOLH (national funded project), investigating the possible effect of wind turbines on human health https://ribeolh.univ-gustave-eiffel.fr/
- Risk Analysis of Infrastructure Networks in response to extreme weather (RAIN), FP7 608166, (2014-2017) Maria Luskova – Project leader. European project.
- SENOVIE: Myriam Baron, Léa Prost, funding: Institut National du Cancer (InCa), national programme.
- STILL MAP: Jennifer Buyck, funding: ANR, national program.
- Synclusive - System approach to close the employment gap and create a more inclusive labor market for vulnerable people, Dutch Centre for Applied Research – TNO (coord.) (Netherlands), Applied Research and Communications Fund (Bulgaria), Finnish Institute of Occupational Health (Finland), Iscte-University Institute of Lisbon (Portugal), Sofia Development Association (Bulgaria), National Institute for Insurance against Accidents at Work (Italy), Tilburg University (Netherlands), University College Cork (Ireland), Municipality Amersfoort (Netherlands), Estonian Centre for Applied Research – CentAR (Estonia), TermCerto (Portugal), Municipality of Lagoa, Faro (Portugal), Rede do Empresário - Entrepreneurs Network (Portugal), Science and Technology Parc of Alentejo (Portugal), Ministry of Labor Portugal (Portugal), City of Kokkola (Finland). International project.

- System approach to close the employment gap and create a more inclusive labor market for vulnerable people, Dutch Centre for Applied Research – TNO (coord.) (Netherlands), Applied Research and Communications Fund (Bulgaria), Finnish Institute of Occupational Health (Finland), Iscte-University Institute of Lisbon (Portugal), Sofia Development Association (Bulgaria), National Institute for Insurance against Accidents at Work (Italy), Tilburg University (Netherlands), University College Cork (Ireland), Municipality Amersfoort (Netherlands), Estonian Centre for Applied Research – CentAR (Estonia), TermCerto (Portugal), Municipality of Lagoa, Faro (Portugal), Rede do Empresário - Entrepreneurs Network (Portugal), Science and Technology Parc of Alentejo (Portugal), Ministry of Labor Portugal (Portugal), City of Kokkola (Finland)
- UCCRN-EDU: Bruno Barroca, Margot Pellegrino, funding: Erasmus + program, Coord. University Federico II of Naples.
- URBA Santé (national funded project), investigating quality of life in urban neighbourhoods https://urbasante.fr/
- URBA-RE (Urban issues of energy renovation): Margot Pellegrino, funding: i-site Future, local project.
- VW Stiftung – GreenING Lab (national).

8.5 Thematic HUB 5 - Mobility

The subtopic titles were consensually found during the workshops done in task 2.1. As mentioned above, one workshop was organised per thematic HUB, where all contributors of the corresponding thematic HUB were invited.

Table 12 - Subtopics and topics identified for the Thematic HUB 5 -Mobility.

Subtopic	Hot Research topic	Research topic in 5 years
Travellers needs toward inclusive mobility	• Transport systems design and planning for social equity • Researches on vulnerable categories and dependency on mobility • Travel experience and worthwhile travel time	
First and last mile urban logistics	• Last-mile logistics urban delivery using e-cargo bikes • Last-mile	• Urban Freight Logistics
Cycling systems design	• Bike-sharing systems in urban settings • The design of the bicycle infrastructure	
Transport operations modelling	• Public transportation disruption: how to prevent it • Mobility in the field of Urban Engineering • Mobility in the Transport modelling • Travel time • Accessibility of ordinary destinations	• Accessibility of ordinary destinations, Mobility in the Transport modelling • Impact assessment of mobility services • Explicitly internalise the quality of the travel experience in transport planning
Intelligent Transport Systems and transformation of mobility	• Services for intelligent transport applications • Technological innovation and their place in the transformations of the mobility services and practices	
Monitoring travel behaviour	• Consideration of citizens´ views to plan new mobility services • Continuous travel surveys • Mobility knowledge tools (observation techniques, data, models)	• Urban Mobility of Citizens • Sustainable city tourism mobility • Mobility and Transports • Continuous travel surveys

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	• Latest and future mobility trends • Demand and capacity forecasting for transport systems • TrendAuto2030plu**s**	
Interventions in public spaces	• Greencity4Aging • Traffic calming in cities • Sustainable Urban Mobility Planning	• Capacity building for Local Authorities to plan and implement new mobility services • Complementarities of transport modes and promotion of more sustainable service for first and last-mile mobility

8.5.1   State of the art of current "hot" research topics (Question 1)

This section presents all the proposals provided by all HEI members of the InCITIES project while answering to question 1 regarding the "hot" research topics for the thematic of HUB 5.

Travellers needs toward inclusive mobility

- **Transport systems design and planning for social equity**

Balancing societal requirements and business operations is a challenging topic. On one hand, different passenger and pedestrian groups require different services. On the other competition in the market and volatility in demand force operators to prudently use their resources. The user requirements can be explored through focus groups and survey data collection. Then the resources and operations of transport operators (fleet, routes) can be optimized in order to respond to society´s mobility requirements and companies´ business objectives by responding to possible variations in demand levels.

- **Research on vulnerable categories and dependency on mobility**

- Questioning the visibility/invisibility of certain mobility practices

- Work on the mobility of workers exposed to long journeys, single mothers from the working/precarious classes, the elderly, children, delivery drivers, motorised households [compare practices with different social/spatial parameters]; walking; residential choices (degree of constraint and openness); the media treatment of the autonomous vehicle

- research on individual or collective representations in connection with mobility practices.

- **Travel experience and worthwhile travel time**

Traditional transport planning considers travel time wasted, and therefore considers minimising travel time (or maximising travel time savings) as a key goal for transport

planning. Yet research has unequivocally showed travel time can bring value other than that derived from reaching activities at destination. Activities during travel can be enjoyable, productive, or healthy (in the case of active modes). More sustainable modes (e.g. walking, cycling, comfortable rail) are consistently rated as having a higher value from traveller perspectives.

First and last mile urban logistics
- **Last-mile logistics urban delivery using e-cargo bikes**

How can we model and understand the spatiotemporal patterns of e-cargo bike fleet behaviour in last-mile urban logistics?

How can we predict the expansion of micro and nano logistic hubs to support the operation e-cargo bikes in last-mile urban logistics in the city?.

- **Last-mile**

The ever-faster-growing world population and growing megacities increasingly densify tight urban space. Ever-growing buildings require entirely new concepts for the transportation of people and goods, because conventional, rope-driven elevators are reaching their limits in current high rises.

Cycling systems design
- **Bike-sharing systems in urban settings**

How can we model and understand the spatiotemporal station and trip activity patterns in urban bike-sharing systems, using data science and AI approaches, towards better understanding and planning of the expansion of sustainable urban transportation?

- **The design of the bicycle infrastructure**

Building a cycling infrastructure is a very important task not only from point of view of increasing the safety of vulnerable people in the transport process but also from point of view of improving the quality of the environment and people's health and also decreasing emissions. The main topics: basic principles of the design and design criteria, the selection of optimal type of a bicycle path or a path location (exclusive off-road path, separated path, shared path) according to spatial conditions, traffic load, speed limits etc. Design criteria – operating speeds, width of paths, clearances, horizontal and vertical alignment. Intersections – paths with pats, paths with roads. Paths at structures, special treatments, facilities of bicycle infrastructure, (parking, wheeling ramps, etc.).

Transport operations modelling
- **Public transportation disruption: how to prevent it**

Many issues can lead to public transportation disruption, including management problems, excess of demand from citizens, and natural disasters. Data science and decision support systems can help by showing trends based on past data and predict likely events in the near future

- **Mobility in the field of Urban Engineering**

The attractiveness of territories and zones is generally based on their availability. The concept of accessibility covers several indicators, such as amenities, type of territory or urban transport. As part of the topic, elements that can be used to increase the accessibility and attractiveness of the area in the city will be shown.

- **Mobility in the Transport modelling**

Traffic modelling is used as an effective tool for determining the consequences of changes. The adjustment of transport organization, demography, structural variables in the territory define the mobility of the population in the current but especially in the forecasted state. The topic of population movements modelling is very current. Smart applications form useful databases that partially replace very expensive mobility survey.

- **Travel time**

Travel time is used as the main indicator of the efficiency of transport solutions. It is necessary to minimise it, not only from the point of view of new infrastructure, but also of the availability of road destinations. The topic "Travel time" covers the issue of the traffic habits of the population as well as the level of the transport infrastructure.

- **Accessibility of ordinary destinations**

The topic of accessibility covers the issue of the performance of the road network as well as the suitability and effectiveness of locating the destinations of paths with a specific purpose (shopping, school, work,...).The current topic of cities is the restoration of gravity areas for a specific territory. For ordinary paths, residents do not have to travel across the territory, but equip them at an accessible distance. The goal is to create an alternative option for choosing a mode of transport.

Intelligent Transport Systems and transformation of mobility

- **Services for intelligent transport applications**

Development of service-oriented architecture and distributed technologies open new perspectives for democratising the use of efficient and personalised big data management and analytics in support of intelligent transport applications

- **Technological innovation and their place in the transformations of the mobility services and practices**

Examples: Innovation in mobility (car sharing, carpooling, etc.), teleworking, e-commerce, etc. From the perspective of analysing individual practices and public policies aimed at regulating/encouraging these practices and the economic strategies of operators.

Work on autonomous mobility, light trains, rail-micro mobility intermodality, shared mobility, digital technology and dematerialisation, the reorganisation of the logistics and air transport sectors, delivery and work.

Monitoring travel behaviour

- **Consideration of citizens´ views to plan new mobility services**

The needs of citizens based on their current experiences are explored and identified though surveys and digital footprints. The collected data is modelled to group the needs and extract

insights for the design of new mobility services such as aerial connections and territorial on-demand mobility services.

- **Continuous travel surveys**

In most countries, conventional cross-sectional travel surveys are conducted roughly once a decade (i.e., they are "one-off" exercises) and only one weekday is surveyed for each respondent. This is not enough to gain a proper description of the above long-term trends, as well as of changes in behaviour. One-off surveys are also subject to unpredictable events (e.g. pandemic, strikes, extreme weather conditions, …) and do not allow a clear distinction between long-term trends and short-term events (economic boom or recession).

- **Mobility knowledge tools (observation techniques, data, models)**

- Works using (and improving…) digital traces, mapping, classic surveys enriched with spatio-temporal data, the dialogue between science and art(s), between quantitative and qualitative methods…
- Research on the modelling of transport systems (multi-agent systems or other) and on data
- Research on the socio-economic evaluation of transport projects / the financing of public transport, and more generally the adaptability of transport networks to contextual changes (sustainability injunction, competition, etc.)

- **Latest and future mobility trends**

The description of mobility is built based on a available data. Several indicators can be analysed from the databases related to the need to change the traffic habits of the population. The purpose of this topic is to understand traffic behaviour and different regional mobility indicators.

- **Demand and capacity forecasting for transport systems**

In a dynamic environment where new mobility services are continuously appearing and affecting the current transport business models, it is essential to update the forecasting estimations frequently and make subsequent decisions on the capacity of the system. This helps managers make decisions on their resources while maintaining a certain level of service for the passengers. The assessment of the performance is key in analysis as well

- ongoing research project "TrendAuto2030plus" includes scenario studies about the future trends of mobility as a whole, focusing primarily on individualised mobility. The aim is to derive strategic and technological implications for the automotive industry (OEMs and suppliers).

Interventions in public spaces

- **Greencity4Aging**

Expected aging of the population puts enormous pressure to adjust urban structures in order to guarantee and promote an active and healthy lifestyle to older adults. At the same time, the need to adjust for other challenges, namely climate change, has promoted the development of different types of street design and public planning, including increased exposure to green elements (e.g., vegetation) and active forms of mobility such as walking and cycling. This multidisciplinary project brings together a team of psychologists,

sociologists, architects, and computer scientists to explore this issue. The main goal of this project is to explore the effects of green streets in the mobility and social integration of older people. Innovatively, in this work, we are especially interested in understanding how green street design may affect the feelings of perceived discrimination and ageism by older people.

- **Traffic calming in cities**

Traffic calming measures can have many forms but with the same goal, to reduce vehicular speeds, reduce the number and severity of collisions, improve pedestrian and cyclist safety, and potentially improve the quality of the environment. The traffic calming measures can be identified into three groups: Non-Construction Measures (Striping, Pavement Materials and other Surface Treatments, Radar Speed Signs, Signal Progression), Horizontal Measures (Lane Narrowing, Limiting corner radii, Gateway Treatments, Pinchpoints, Chicanes, and Lane Shifts, Medians and Refuge Islands, Mini Roundabouts, Diverters), and Vertical Measures (Speed Humps, Cushions and Tables). Each of the listed measures has advantages and disadvantages so there is a need to choose the appropriate traffic calming method or treatment for the street typology.

- **Sustainable Urban Mobility Planning**

The mobility behaviour of the population is not homogeneous. It depends on environmental conditions and trends. It often happens that the proposed measures do not achieve the desired effect in the daily traffic. The sustainability of urban mobility is related to the real utility of alternative routes and means of transport. Utility must be planned based on real and local conditions.

8.5.2 State of the art of research topics for the next 5 years (Question 2)

This section presents all the proposals provided by all HEI members of the InCITIES project while answering to question 2 regarding the research topics for the next 5 years regarding the thematic of HUB 5.

First and last mile urban logistics

- **Urban Freight Logistics**

Urban freight logistics is responsible for substantial and increasingly high carbon emissions, urban noise, air pollution, safety risk and traffic congestion, which cost the European economy an estimated 100 billion euros per year. Although, it only accounts for up to 15% of traffic, urban logistics contributes with around 25% of all urban transport-related CO_2 emissions, and between 30% and 50% of particle matter and nitrogen oxides in the city air.

"How can we enable the transition of inner-city transportation to greener modes, with the support of urban freight logistics solutions serving the needs of concrete logistics pilots?. The approach would leverage AI, IoT, Big Data, Cloud Computing, Geolocation and Blockchain technologies, including a data analytics and business intelligence dashboard for Urban Freight Logistics strategic and operational decision support. Results could have

potential positive impacts in the European cities SUMPs (Sustainable Urbam Mobility Plans) & SULPs (Sustainable Urban Logistic Plans) and contributing to the EU Green Deal ambition of greenhouse gas emissions reduction target by 2030 of 55%, compared to 1990 levels.

Transport operations modelling

- **Accessibility of ordinary destinations, Mobility in the Transport modelling**
- **Impact assessment of mobility services**: this analysis would allow the identification of impacts and measures to quantify them
- Research needs to consider how to **explicitly internalise the quality of the travel experience in transport planning,** particularly in the early stages when considering various modal alternatives (e.g. train track vs new highway). There is a need to 1) better categorise traveller groups beyond simple socio-demographics such as age or gender, but also along habits, attitudes and preferences for different types of door-to-door solutions and for how to spend time while travelling, 2) to assess the potential for 'quality travel time' to contribute to a sustainable mobility transition (also within concepts within the 15min city).

Monitoring travel behaviour

- **Urban Mobility of Citizens**

How can we model the dynamics of urban bike-sharing systems (BSS) based on their expansion over time, using centrality measures and data science approaches, to evaluate BSS network efficiency and resiliency?

How can we model and understand the travel behaviour of BSS use in the first and last mile, in the context of multimodal urban mobility, including the prediction of demand on BSS station and trip levels?

- **Sustainable city tourism mobility**

Tourism is a major economic activity, and many touristic cities rely on this important source of revenue. However, mass tourism is jeopardizing large cities' environment, leading to a certain loss of identity. By monitoring tourists' activities through social media and mobile applications, city planners can promote activities that spread tourists across other less crowded attractions and manage transportation issues.

- **Mobility and Transports**

Climate-friendly mobility practices and the actions of citizens in terms of transportation, especially for working and studying are also decisive challenges of cities. Telework could be viable a solution for reducing pollution footprints, but that is not a solution to every kind of work. Again, we need to know deeply the reasons for people make their choices in terms of mobility and transportation, and try to figure out how they could change towards more sustainable options. Labour markets and their demands, and family everyday pressures, are the fundamental reasons for these mobility-transportation behaviours. In the co-creation decision-making process, universities, trade-unions, companies, local authorities and the state, should be present. Clearly, we need systematic and updated data for having a broad

and comparable perspective of mobility and transportation for better policy-solutions in cities.

- **Continuous travel surveys**

Good quality travel data are needed both to portray existing situations and to help identifying problems related to the operation of today's increasingly complex transport systems; they are also important to estimate the models that are quintessential for urban and regional planning, especially to give them a real dynamic dimension. In fact, the most typical (and difficult) need has always been for data to calibrate the large strategic transport-models used in long-term project evaluation and environmental assessment. Based on reasons of usefulness and cost-effectiveness, we wish to challenge the practice of using one-off cross-sectional surveys and make a strong case for change. We believe that all urban areas over a certain limit (say one million inhabitants) should be involved in collecting mobility data on a continuous basis as part of their efforts to guarantee sustainable development. We argue that continuous travel surveys, where mobility is described along a relatively long period of time, are indispensable to gain a proper understanding of the complex issues faced by contemporary planners.

Interventions in public spaces

- **Capacity building for Local Authorities to plan and implement new mobility services**
- **Complementarities of transport modes and promotion of more sustainable service for first and last-mile mobility**.

8.5.3   Relevant Publications

- Aguiléra Anne & Pigalle Eléonore, 2021, The Future and Sustainability of Carpooling Practices. An Identification of Research Challenges. Sustainability
- Albuquerque, V., Andrade, F., Ferreira, J., Dias, J. & Bacao, F. (2021). Bike-sharing mobility patterns: a data-driven analysis for the city of Lisbon. EAI Endorsed Transactions on Smart Cities. 21 (16)
- Albuquerque, V., Sales Dias, M., Bacao, F. (2021) Machine Learning Approaches to Bike-Sharing Systems: A Systematic Literature Review. ISPRS International Journal of Geo-Information, 10, 62. https://doi.org/10.3390/ijgi10020062
- André Ulrich, Sergej Baum, Ingo Stadler, Eberhard Waffenschmidt, Christian Hotz, "Maximising Distribution Grid Utilisation by Optimising E-Car Charging Using Smart Meter Gateway Data", SDEWES 2022, Paphos, Cyprus, 06.-10. Nov.2022
- Atkinson-Clement Cyril & Pigalle Eléonore, 2021, What can we learn from Covid-19 pandemic's impact on human behaviour? The case of France's lockdown. Humanities and Social Sciences Communications
- Boutueil Virginie, Nemett Luc, Quillerier Thomas, 2021, Trends in Competition among Digital Platforms for Shared Mobility: Insights from a Worldwide Census and Prospects for Research, Transportation Research Record: Journal of the Transportation Research Board, https://doi.org/10.1177/03611981211036346

- Bozzi, A.D., Aguilera, A., 2021, Shared E-Scooters: A Review of Uses, Health and Environmental Impacts, and Policy Implications of a New Micro-Mobility Service
- Christian Hotz, Marian Sprünken, Sergej Baum, Eberhard Waffenschmidt, Ingo Stadler, "Generation of Synthetic Load Profiles of Electric Vehicles Based on Household Activity Profiles", SDEWES 2022, Paphos, Cyprus, 06.-10. Nov.2022
- Christian Hotz, Sergej Baum, Eberhard Waffenschmidt, Ingo Stadler, "Topology Estimation in Low Voltage Grids Using Wallbox Charging Data Recordings", CIRED workshop on E-mobility and power distribution systems, Porto, Portugal, 2.-3. June 2022, Paper no. 1358
- Costa, J., Alves, T., Andrade, A., Kalakou, S. (2021). Assessing efficiency in public service obligations in European air transport using data envelopment analysis. Case studies on transport policy, Volume 9, Issue 4. DOI: 10.1016/j.cstp.2021.09.004
- Eberhard Waffenschmidt, "Community Battery Storage", International 100% Renewable Energy Conference (IRENEC 2022), online organized in Istanbul, 9.-11. June 2022
- Eberhard Waffenschmidt, "Swarm Grids—Distributed Power Grid Control for Distributed Renewable Power Generation",In: Tanay Uyar, Nader Javani (eds), "Renewable Energy Based Solutions. Lecture Notes in Energy", vol 87. Springer, Cham., pp 149-165, 2022, ISBN 978-3-031-05124-1, https://doi.org/10.1007/978-3-031-05125-8_6
- Eberhard Waffenschmidt, Christian Hotz, Sergej Baum, Ingo Stadler, "Swarm Grids - Verteilte Stromnetzsteuerung für verteilte erneuerbare Energieerzeugung", Tagung Zukünftige Stromnetze 2022, 26. - 27. Januar 2022, online
- Eberhard Waffenschmidt, Kira Meisenzahl, "Vorteile und Betriebskonzepte von Quartiersspeichern", EW - Magazin für die Energiewirtschaft, Ausgabe 6/2022, S. 22-25, VDE-Verlag, Juni 2022
- Fernandes, N., Moro, S., Costa, C. J., & Aparício, M. (2020). Factors influencing charter flight departure delay. Research in Transportation Business & Management, 34, 100413.
- Gil, B., Albuquerque, V., Dias, M. S., Abranches, R., Ogando, M. (2022), Data driven spatiotemporal analysis of e-cargo bike network in Lisbon and its expansion: the Yoob case study. EAI INTSYS
- Gonçalves, H. S., & Moro, S. (2022). On the economic impacts of COVID-19: A text mining literature analysis. Review of Development Economics. In press.
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- KUHNIMHOF, T. ; ARMOOGUM, J. ; BUEHLER, R. ; DARGAY, J. ; DENSTADLI, JM.; YAMAMOTO, T. (2012), Trends in Young Adult's Mobility in Six Industrialized Countries, Transport Reviews: A Transnational Transdisciplinary Journal, Vol 32:6, pp 761-779

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- Leandro, F., Andrade, R. A. & Kalakou, S. (2021). Designing aviation networks under Public Service Obligations (PSO): A case study in Greece. Journal of Air Transport Management. 93
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8.5.4   Current projects related to the topic (local, national or European project)

- "GreenCity4Aging: the effects of urban green-streets in the mobility, social integration and ageism against older persons." National Project. Concurso Projetos de IC&DT em todos os Domínios Científicos, FCT. PI : Sibila Marques (Iscte, CIS), Co-PI : Sara Eloy (Iscte, ISTAR). Other institution: Santa Casa da Misericórdia de Lisboa. Budget: 249 957,81€. March 2023 to March 2026.

- "Kinaesthetic Analysis on Older People Perceptions on the Outdoor Built Environment". National. Ongoing PhD research by Marcos Figueiredo, FCT grant UI/BD/151027/2021. Supervision : Sara Eloy, Sibila Marques. Available here https://istar.iscte-iul.pt/portfolio-posts/phd-thesis-kinaesthetic-analysis-on-human-interface-for-interiors-architecture-design-using-virtual-reality/
- Global Continuous Travel Survey H2020 (local projects with Ile-de-France Mobilité).
- MAP 2050 - MODÉLISATIONS ET ANALYSES PROSPECTIVES POUR LES TRAJECTOIRES BAS-CARBONE DES TERRITOIRES À HORIZON 2050 - MODELING AND PROSPECTIVE ANALYZES FOR THE LOW-CARBON TRAJECTORIES OF TERRITORIES BY 2050 (Appel à projet 2021 de l'ADEME Planifier et Aménager, face au Changement climatique, la Transition des Territoires : PACT2e ; other partners : Efficacity, Armines & Université Gustave Eiffel–LVMT
- Methodology of the Global Continuous Travel Survey 2023-2027 (local projects with Ile-de-France Mobilité).
- MOBS - MOBILITIES OF E-SHOPPING (National funding – ANR, Agence Nationale pour la Recherche). Other partners: THEMA, université de Bourgogne (coordinator); DEST, SPLOTT, LAET, ENTPE, CNAM
- MULTIFRAC - MULTIFRACTAL ANALYSIS AND MODELLING FOR CITIES (Local funding: I-Site Future. Projet IMPULSION retenu dans le cadre de l'appel à projet 2018-2019 de l'I-Site FUTURE
- MUTANDIS - INNOVATIVE SOLUTIONS FOR SUSTAINABLE MOBILITY IN PERIURBAN AREAS (Local funding Isite FUTURE au titre des projets Tremplin, 2018-2023. Partners : 12 laboratoires relevant de 5 grandes institutions de recherche du périmètre des partenaires de la COMUE Paris Est (IFSTTAR, École des Ponts, Université Paris-Est), Université de Rennes, DLR (Allemagne) et d'universités espagnoles. Draw up an inventory of mobility experiments in sparsely populated areas in order to propose a multi-criteria evaluation. Suggest mobility solutions adapted to the needs of users. Identify the conditions for the emergence, production and support of these mobility experiments in local policies
- National Survey of Associations of Culture, Sport and Leisure (CPCCRD and CIES-Iscte) (co-coordination).
- Observatory of Popular Associativism, CPCCRD, Iscte, FCSH-UNL and U.Lusófona (coordination).
- PROGRESSUS: "Elektroniksysteme für die Energieversorgungsinfrastruktur der nächsten Generation". Laufzeit: 1.4.2020 - 31.3.2023. Externe Partner: Infineon Technologies, Devolo

Mixed Mode, CEUS, Friedrich-Alexander Universität Erlangen sowie weitere europäische Projektpartner. Partner TH-Köln: Prof. Dr. Ingo Stadler. Fördermittelgeber: Bundesministerium für Bildung und Forschung, Rahmenprogramm der Bundesregierung für Forschung und Innovation 2016-2020 "Mikroelektronik aus Deutschland - Innovationstreiber der Digitalisierung", Förderkennzeichen 16MEE0006 sowie Fördermittel der EU, RPME-ECSEL Joint Undertaking.

- QUIRINUS-Control: Spannungsqualitätssicherung im Rheinischen Revier. Laufzeit: 1.6.2022 - 31.5.2026. Externe Partner: Forschungsgemeinschaft für Elektrische Anlagen und Stromwirtschaft e.V., Rheinische NETZGesellschaft mbH (RNG), SOPTIM, Bocholter Energie- und Wasserversorgung GmbH, Stadtwerke Brühl GmbH, Energiewirtschaftliches Institut an der Universität zu Köln gGmbH, Stadtwerke Bühl GmbH, Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V., evelio GmbH, Leitungspartner GmbH, RWE Power AG, Gridhound GmbH, Regionetz GmbH, RWTH-Aachen, morEnergy (assoziiert). Partner TH-Köln: Prof. Dr. Ingo Stadler. Fördermittelgeber: Bundesministerium für Wirtschaft und Klimaschutz, Förderkennzeichen. 03EI4048R, 03EI4048RV
- RARSUS: Risk Assessment and Reduction Strategies for Sustainable Urban Resource Supply in Sub-Saharan Africa
- REFMAP: European project funded by H2020, https://ciencia.iscte-iul.pt/projects/reducing-environment-footprint-through-transformative-multi-scale-aviation-planning/1841
- RETO-DOSSO: Researchers Back to the Secondary School – Renewable Energy Powered Water-Food-Economy Nexus for the Sustainable Livelihood at Dosso Region in Niger – ITT Sub-Project: Renewable Energy for Energy Economy-Hub
- SAM (Sécurité et l'Acceptabilité de la conduite et de la Mobilité autonome - Safety and Acceptability of Autonomous Driving and Mobility). Sponsor : ADEME, Appel à Projets Expérimentation du Véhicule Routier Autonome (EVRA) (National Funding PIA). Other partners Plateforme Automobile (PFA). Eleven companies (Alstom, Cofiroute, EasyMile, Keolis, Stellantis, groupe RATP, Renault, SNCF, Transdev, TwinswHeel, Valeo) & ten academic partenrs (ENPC/LVMT, Cerema, IFP Energies Nouvelles, Le LAB, SystemX, VEDECOM).
- SEMALI: Risk Assessment and Reduction Strategies for Sustainable Urban Resource Supply in Sub-Saharan Africa – Focus on Sustainable Energy Supply in Mali
- SENCYCLO - GENRE ET ESTHÉTIQUE DU VÉLO : LE POTENTIEL POUR LA VILLE DURABLE DES PROCESSUS DE CONSTRUCTION DE GENRE AUTOUR DES PRATIQUES, ÉQUIPEMENTS ET INFRASTRUCTURES DU VÉLO - GENDER AND BIKE AESTHETICS : THE POTENTIAL FOR THE SUSTAINABLE CITY OF GENDER CONSTRUCTION PROCESSES AROUND PRACTICE, EQUIPMENT AND INFRASTRUCTURE (funding EXCELLENT SCIENCE - Marie Skłodowska-Curie Actions - MSCA-IF)
- SmartVitiNet: European project funded by H2020, https://ciencia.iscte-iul.pt/projects/rede-de-excelencia-de-viticultura-inteligente-e-sustentavel-assistida-por-drones--/1837
- Solardachpfanne: "Solardachpfanne.NRW - Dezentrale Strom- und Wärmeversorgung made in NRW". Laufzeit: 1.5.2019 - 30.4.2022. Partner: Prof. Dr. Christian Dick, Prof. Dr. Ulf Blieske, Prof. Dr. Ruth Kasper, Kollegen TH-Köln, Fa. PaXos, Köln. Fördermittelgeber: Land Nordrhein-Westfalen unter Einsatz von Mitteln aus dem Europäischen Fonds für regionale Entwicklung (EFRE) 2014-2020, FKZ-EFRE: EFRE-0801561.
- TOD-IS-RUR - TRANSIT ORIENTED DEVELOPMENT (TOD) FOR INCLUSIVE AND SUSTAINABLE RURAL-URBAN REGIONS (APPEL À PROJET H2020-MSCA-ITN-2020 - H2020-EU.1.3. –

EXCELLENT SCIENCE – Marie Skłodowska-Curie Actions MAIN PROGRAMME, H2020-EU.1.3.1. – Fostering new skills by means of excellent initial training of researchers; other partners: Ecole Polytechnique Fédérale de Lausanne, Ecole des Ponts ParisTech, Kungliga Tekniska Högskolan, Sveriges Lantbruksuniverstet, Technische Universität Berlin, Technische Universiteit Eindhoven, Université Gustave Eiffel, Universiteit Antwerpen ; coordinator Universiteit van Amsterdam)

- TrendAuto2030plus (national project)
- UAMschool4Cities: European project funded by Erasmus+ Agency in Portugal, https://ciencia.iscte-iul.pt/projects/-urban-air-mobility-school-for-cities/1738
- URBAINS - URBANISME INÉGALITÉ ET SANTÉ I-SITE FUTURE (local funding appel à projet « Impulsion » de l'I-Site FUTURE).
- WESA: Water and Energy Security for Africa.

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8.6 Thematic HUB 6 - Digital transition

The subtopic titles were consensually found during the workshops done in task 2.1. As mentioned above, one workshop was organised per thematic HUB, where all contributors of the corresponding thematic HUB were invited.

Table 13 - Subtopics and topics identified for the Thematic HUB 6 -Digital Transition.

Subtopic	Hot Research topic	Research topic in 5 years
Cybersecurity and security	• What is a cyber-secure smart city? • Coherent Security research • Identification and analysis of vulnerabilities potentially enabling cyber attacks	• Coherent Security • Classification and definition of the characteristics and functionalities of methods and tools for semi-automated and automated testing of potential vulnerabilities
Sensors in smart cities	• Smart Cities • Environmental smart cities, environmental low-carbon mobility • Sensors and micro-systems for the analysis of complex environments	• Sensing cities: Using sensors for environmental data through citizen sensing
Business models for smart cities	• The impact of Artificial Intelligence for Businesses in an integrated and Smart Society • A new landscape of Extended Realities and its implications for businesses and society • TrendAuto2030plus • Service Business and Circular Economy Research- digitalisation in business development	• Development of new business models for the digital services that are offered by a smart city • Distributed Ledger Technologies
Metrics and Analytics	• Metrics • Urban Data and Analytics • The University as a driver of innovation, transformation and relations between stakeholders	• Digital Transition and Data Uncertainty • Analysis of data from highly innovative cities and local data collection Digital Transition and Data Privacy • Speed, veracity, data protection, storage and sharing

Urban planning and management	• How can the digital footprint of citizens and smart cities infrastructure be used to develop sustainable, new and more satisfying experiences for all the stakeholders in the society • Artificial Intelligence to increase process efficiency • Services and Digital transition • Distributed Ledger Technologies (also related with HUB 4) • Transport in buildings, especially Rope-Free, Linear Driven Elevators • Revolution in architecture and urban planning	• How digital transition affects the production and consumption of services • the use of home digital platforms to manage energy consumption and domestic tasks (cooking, cleaning) • the impacts of the use of digital media in the households uses/appropriation of the several domestic spaces • Simulation and optimization of new transport systems for the last-mile. • Connecting cities and rural areas
Digital twins	• Digital Twins • Communication technologies and digital infrastructure for CCAM	• Communication technologies and digital infrastructure for CCAM • Self-Sovereign Personal Digital Twin Wallet
Inclusive Digitalisation	• Assessment of the impact of the Digital Transition on vulnerable population • Inclusive digital transition	• Acceptability of the Digital Transition • Assessment of the impact of the Digital Transition on vulnerable population • Innovative and inclusive practices of telecare
RFID and Radio-wave propagation in smart cities	• Radio-wave propagation and radiating devices in complex electromagnetic media and environments • Monitoring of civil engineering infrastructures based on RFID technologies and machine learning • Radio frequency identification (RFID) devices for applications in transport and civil engineering	• Information security of RFID systems
AI impacts on humans		• Human vs. AI creativity • Transhumanism

		(integrating the technology in human beings)
		• Technology to drive pro-environmental behaviours

8.6.1 State of the art of current "hot" research topics (Question 1)

This section presents all the proposals provided by all HEI members of the InCITIES project while answering to question 1 regarding the "hot" research topics for the thematic of HUB 6.

Cybersecurity and security
   • **What is a cyber-secure smart city?**
"Digitalisation changes companies' business models significantly from product manufacturing to the selling of digital services. Thus, smart city applications profit from a high number of interconnected, information exchanging devices. This creates issues for critical infrastructures such as water and energy supply, making them vulnerable to cyber-attacks.
   • **Coherent Security research**
For Coherent Security program there are two current hot topics to focus on. First there is need to increase citizens knowledge and countermeasures to disinformation campaigns. Other current focus area for research is hybrid threats landscape as part of societal sustainability and resilience. Disinformation seriously impacts on the attitudes of citizens towards public authorities (trust in police, local and national government, etc.) This, in turn, affects the ability of citizens and authorities alike to act and to cooperate in time of varied crises. Hybrid threats refer to damaging external influence by which a states or other actors including terrorist organisations or organised crime groups seek to influence the targeted country by combining different means. The aim is to exploit the vulnerabilities of the selected state and to do this as covertly as possible. Those responsible for internal security can help strengthen social sustainability and counter various attempts to exert influence.
   • **Identification and analysis of vulnerabilities potentially enabling cyber-attacks primarily against integrity, confidentiality and availability (CIA triad) of devices, components and infrastructure**.
The result of the activity will be an identified set of security relevant vulnerabilities, which will enable a subsequent more targeted selection of methods and tools for their identification and elimination during the design, deployment and operation of the system.

Sensors in smart cities
   • **Smart Cities**

Digital transition in smart cities refers to integrating technology into managing and operating a city's infrastructure, including its water and energy systems. It can include using sensors and internet of things (IoT) devices to monitor and control water and energy usage, as well as using data analytics and machine learning to optimise the performance of these systems. In this context, University Gustave Eiffel deals with water systems, in which digital transition includes using sensors to monitor water levels, flow rates, and water quality and smart valves and other control systems to manage water distribution (Leyli-Abadi et al., 2018). Additionally, digital technologies can be used to detect and prevent leaks in the water supply and to optimise the operation of water treatment plants. For the digital transition in the energy sector, University Gustave Eiffel researchers are interested in using sensors and IoT devices to monitor and control energy consumption and integrating renewable energy sources, such as solar and wind power, into the city's energy mix. Smart grid systems can be used to optimize the distribution of electricity and to balance supply and demand (e.g., Heinrich et al., 2022).

- **Environmental smart cities, environmental low-carbon mobility**

The complexity of the solution is assumed from the point of view of environmentally acceptable places in connection with mobility in the city. The solution goes through several levels, from monitoring the characteristics of the environment with smart sensors (sensor network), their verification and calibration, communication in the Internet of Things (IoT), data storage and processing through their visualisation to the calibration of road traffic model conditions and the determination of environmentally acceptable mobility (low-emission mobility).

- The creation of **complex sensor networks consisting** of IoT devices that will work in the line of smart sensors - communication - storage - data visualization is expected.

- **Sensors and micro-systems for the analysis of complex environments**

Kinetic, thermal and electromagnetic micro energy harvesting for IoT devices: Energy harvesting (also known as power harvesting or energy scavenging) is the process in which energy is captured from a system's environment and converted into usable electric power. Energy harvesters usually provide a very small amount of power for low-energy electronics. The energy source for energy harvesters is present as ambient background. For example, temperature gradients exist from the operation of a combustion engine and in urban areas, there is a large amount of electromagnetic energy in the environment due to radio and television broadcasting.

Business models for smart cities

- **The impact of Artificial Intelligence for Businesses in an integrated and Smart Society**

Although Artificial Intelligence is still in its early stages, we are already witnessing the use of AI in many day-to-day activities that impact society in general and cities in particular. For example, AI can be further used to interact with citizens via smart devices or even to manage the city infrastructure (energy, water supply, etc). Such intelligent systems can be integrated in both functional and emotional responses to citizens or even support the

business landscape. The human-machine interaction that comes with this digitalisation is being further studied in terms of its ethical implications and human/citizen behaviour challenges via experimental studies

- **A new landscape of Extended Realities and its implications for businesses and society**

Virtual and Augmented reality can have important implications for creating more digital and sustainable cities. For example, virtual reality can create new business models for city wide experiences while at the same time allow a city to reduce the overcrowding effect that exists in more iconic cities. Augmented reality, specially using AR glasses can be used to guide tourists around the cities and help citizens to engage better with the physical landscape. Further studies are being done in order to go beyond technology acceptance models and understand the emotional and cognitive perceptions of using such digital environments via quantitative and experimental studies

- The project "TrendAuto2030plus" also focusses on the digital transformation of the automotive industry – products, processes and business models."

- **Service Business and Circular Economy Research- digitalisation in business development.**

This topic focuses on the capabilities of small and medium size companies to utilise digitalisation of business management, as well as artificial intelligence. Topic focuses on increasing the skills and competencies of individual entrepreneurs and employees, thus increasing the capabilities of companies. Related to all above mentioned topics and to all three research programmes are Laurea's methodological capabilities and approaches. The use and development of co-creation methods in complex, multi-actor environments, ecosystem orchestration, as well as foresight capabilities are central in digitalisation of society, in sustainability transitions, in urban development. Systemic change requires these types of skillsets, competences and capabilities.

Metrics and Analytics

- **Metrics**

For the development of R&I in different areas of knowledge, it is essential to gather the appropriate indicators and measurement strategies. It is imperative to reflect on the ""how to measure"", validity, robustness, comprehensiveness or objectivity of measurement of the indicators to be used in each study.

- **Urban Data and Analytics**

Urban data is collected, analysed, and used to inform decisions about urban areas, such as cities and towns. This data can be used for various purposes, including urban planning, transportation, public safety, and environmental monitoring. Urban analytics uses data and analytical methods to understand and improve urban systems and services. This can include using data to identify patterns and trends and models to simulate and predict future conditions. Urban data and analytics can help city leaders and planners make more informed decisions about designing, managing, and improving urban areas for residents and visitors. They involve collecting, analysing, and interpreting large data sets to inform urban

decision-makers. The data include traffic patterns, vehicle, and pedestrian movements, public transportation usage, etc.

Examples of how University Gustave Eiffel researchers use data analytics and big data include:

- Predictive congestion in public transportation: Using ticketing data to predict and plan for future congestion in public transportation modes.
- Real-time traffic monitoring: Collecting and analysing data on traffic in real-time to inform traffic management decisions, e.g., traffic lights control.
- Public transportation optimization: Analysing data on public transportation usage to optimise routes, schedules, and resource allocation
- Smart parking: Using data on parking usage to optimise parking availability and reduce congestion

- **The University as a driver of innovation, transformation and relations between stakeholders**

Universities play a key role in the advancement of knowledge, being a space for reflection and for creating dynamics between the different agents of society. In an era of abundant data, it is essential to create synergies between the different stakeholders to create an efficient strategy for managing the large volume of data (big data), helping institutions to define access and share data, with reliability, for research. Guaranteed the necessary confidentiality and protection of data, it is possible to create new indicators, analytical models and statistics to solve problems, support decision making and improve the definition of management strategies or public policies. The InCITIES observatory may be a central agent in this interaction, in the collection, processing and dissemination of data, diagnostics and results, in free digital access, with connection and sharing with different international observatories and statistical institutions, as a vehicle for the dissemination of science, with reflection on the progress of societies.

Urban planning and management

- **How can the digital footprint of citizens and smart cities infrastructure be used to develop sustainable, new and more satisfying experiences for all the stakeholders in the society**

The use of technology creates a very wide number of data that results from the interaction of citizens with the city smart infrastructure (using IoT sensors, AI agents, XR experiences and other). Each time a person engages with a traffic light, disposes its recyclable garbage, interacts with digital services they are producing valuable information. Such data is being used to create new innovative business models that may help cities to increase the level of citizen and tourists' satisfaction via the use of machine learning algorithms.

- **Artificial Intelligence to increase process efficiency**

Artificial Intelligence is able to increase process efficiency, i.e. lower energy consumption, optimise routing for public transportation. One hot topic is to use advances in AI techniques to minimise energy and greenhouse gas emissions in cities by optimising a city's systems.

- **Services and Digital transition**

We are looking on the different aspects that digitalisation has on the transformation of the provision of crucial services (mobility, thermal comfort, refrigeration, entertainment, productivity, food). The current production and consumption of these services is environmentally, economically and socially unsustainable and must evolve to address grand social challenges such as climate change. We are looking on the impacts on the demand-side and the consequence for the reorganisation of production.

- **Distributed Ledger Technologies (also related with HUB 4)**

Blockchains (BC) and Distributed Ledger Technologies (DLT) are being included in several real-world scenarios, not only in the financial context but also in several others, such as healthcare and supply chains. The characteristics of these technologies that encourage exchanges and transactions between participants without the need for a third party (central authority) have raised increasing interest in the application of technology to a wide range of organisational, inter-organisational and societal problems. However, even if important digital, organisational and economic transformations can be anticipated, the impact of the introduction of these disruptive technologies is not yet well studied

- **Transport in buildings, especially Rope-Free, Linear Driven Elevators**

Planning, controlling, and maintaining the new, linear-driven elevators poses a real challenge. The flexibility of movement that the new linear drive offers requires new, complex software that works with AI. The crux of the matter lies in the novelty of the system. Unlike conventional elevators, you cannot fall back on years of collected data. For AI however, the data requirement is mandatory. So we use targeted simulations and machine learning within these simulations to generate the necessary data collection.

- **Revolution in architecture and urban planning**

New times are dawning for architects and urban planners; not only a new aesthetic in architecture, but also previously unimaginable possibilities for traffic planning and new urbanity are opening up. The elevator becomes even more an essential part of the logistics for the transportation of people and goods. It can connect parts of the building as well as create a connection to the surrounding infrastructure, e.g. subway stations.

Digital twins

- **Digital Twins**

Digital twins are digital replicas of physical entities that can be used for various purposes, such as urban planning, infrastructure management, and disaster response. The digital transition in this context refers to creating and maintaining these digital twins, which typically involves collecting and integrating large amounts of data from various sources, such as satellite imagery, sensor networks, and social media. This data is then used to create accurate digital city models, which can be used for various simulations and analyses. The digital transition can also include integrating artificial intelligence and machine learning

techniques to make the digital twin more responsive and adaptable to changing conditions in the physical city.

University Gustave Eiffel deals with digital twins at several levels:

- Urban digital twins and city information models
- Immersive simulation tools for pedestrians, drivers, etc.
- Multi-agent simulation platforms allowing to have a replica of the mobility system
- Road transport system digital twin, allowing to test of advanced driver assistance and autonomous driving systems (Transpolis platform)

- **Communication technologies and digital infrastructure for CCAM**

DSRC-, 4G- and 5G-based communication technologies and services as enablers for increased traffic safety and efficiency. Computer modelling and performance evaluation of V2X communication technologies in different application and environment contexts. Definition of use cases, service requirements and technical specifications. Collection and assessment of data related to digital infrastructure for scoring segments of physical and digital infrastructure based on their features and readiness to expedite the deployment of Connected and Automated Vehicles (CAVs).

Inclusive Digitalisation

- **Assessment of the impact of the Digital Transition on vulnerable population**

In the last years, a number of services needed in the city turned to only be accessible by digital means – the water company app, the electricity company app, the city council app – and the physical locations where once those services could be contracted are disappearing. Although there are obvious advantages arising from this digital transition, such an approach segregates more the already segregated communities of vulnerable population like older people, poor and info-excluded. For such vulnerable groups other types of solutions need to be developed. Relevant partnerships: scientific community, public and private institutions, local authorities.

- **Inclusive digital transition**

The digital transition is also another strong objective of the European Union for the next years. An inclusive digital transition means considering the ever-growing impacts that the digital revolution will have: 1) in economies, politics and societies; 2) in labour markets, creation-destruction and quality of employment; 3) in labour relations and the organisation of work; 4) in skills, competencies and formation needs; 5) in collective bargaining, trade-unions and collective action; and 6) in the growing inequalities and development tendencies. European instruments like the "European Pillar of Social Rights", the cohesion instruments, policies and funds, and the resilient and recovery national plans, are considering inclusive digital paths.

RFID and Radio-wave propagation in smart cities

- **Radio-wave propagation and radiating devices in complex electromagnetic media and environments**

Non-line-of-sight (NLOS) radio propagation occurs outside of the typical line-of-sight (LOS) between the transmitter and receiver. Near-line-of-sight (also NLOS) conditions refer to partial obstruction by a physical object. Obstacles that commonly cause NLOS propagation are numerous in urban and indoor environments. These complex media are analysed using our own numerical and theoretical models and with dedicated measurement campaigns.

- **Monitoring of civil engineering infrastructures based on RFID technologies and machine learning**

Battery-less RFID (Radio-frequency Identification) traffic/load sensors to be buried in the road surface (asphalt), capable of supporting heavy loads. These sensors provide information on the traffic load (especially trucks which are the main source of road degradation) using accelerometers or geophones sensitive to vertical deformations of the pavement. The sensor data is then transmitted wireless via a low-power RFID technology to a mobile reader on the road or fixed on the roadside. The possibility offered by hybrid model-based and data-driven approaches or by the so-called physic-informed neural networks can be exploited to bring into the SHM monitoring additional information collected by the sensors

- **Radio frequency identification (RFID) devices for applications in transport and civil engineering**

For the qualified deployment of RFID technology in the urban environment (transport and communications), basic physical laws enabling the operation of the RFID system must be respected and basic technical standards and regulations must be considered, especially in the field of electromagnetic compatibility.

- Physical principles of RFID operation based on inductive and electromagnetic coupling, regulatory restrictions affecting the operation of RFID systems
- Frequency bands, antennas for RFID and their characteristics
- Selected types of RFID transponders suitable for use in transport and tourism

Localisation and identification of underground facility networks (pipes and cables) in cities using RFID technology makes it possible to refine the registration of underground objects and significantly shorten the time of traffic closures in the event of service intervention in the underground infrastructure.

8.6.2   State of the art of research topics for the next 5 years (Question 2)

This section presents all the proposals provided by all HEI members of the InCITIES project while answering to question 2 regarding the research topics for the next 5 years regarding the thematic of HUB 6.

Cybersecurity and security

- **Coherent Security**

1) critical infrastructure protection; back up (as resilience), foreign direct investment related risks in connection to critical infra (airports, harbours, public administration local / national, mobility – road and rail);

2) Citizen focused societal resilience (ability to act during different crises, skills in media literacy, competences, roles of 3rd and 4th sector in organising activity),

3) Varied aspects of safety and security of public spaces such as marketplaces, religious buildings, and government buildings, etc.

4) street violence and violent delinquency, radicalisation (gangs and organised crime).

- **Classification and definition of the characteristics and functionalities of methods and tools for semi-automated and automated testing of potential vulnerabilities** against integrity, confidentiality and availability (CIA triad) of devices and components of city infrastructure systems in connection with the related cloud/edge/fog architecture. Vulnerability information available in the CVE database and its equivalents will be used. In order to achieve a complex and relevant view and data partnerships with cities, local authorities and other stakeholder is highly recommended.

Sensors in smart cities

- **Sensing cities: Using sensors for environmental data through citizen sensing**. Integrating citizen in living labs for building sensors and planning activities. Using sensors to connect to agricultural data and farming in peri-urban areas, building new relations, raise acceptance and awareness

Business models for smart cities

- **Development of new business models for the digital services that are offered by a smart city**
  - What digital services are available to the public?
  - Development of new business models incorporating new technologies, i.e. blockchain, so that the smart city is economically viable, socially inclusive and environmentally sustainable.
  - Implementation of theses business models in the public transportation, waste or water sector
- **Distributed Ledger Technologies**
  - Analysis of the impact of DLT and blockchains in digital transition.
  - Development of new business models and analysis of changes brought by DLT and blockchains to the information systems.

Metrics and Analytics

- **Digital Transition and Data Uncertainty**

Data uncertainty in smart cities refers to the lack of accuracy and reliability of the data being collected and used to make decisions. This can lead to problems such as poor decision-making, lack of trust in the system, and inefficiency. Additionally, data uncertainty can lead to ethical concerns, such as privacy violations and biased decision-making. Smart city systems need to have robust data validation and quality control processes in place and for the data to be transparent and accessible to all stakeholders. Dealing with data uncertainty

in smart cities can be challenging, but Gustave Eiffel researchers could work on several strategies to mitigate this issue. One approach is to propose advanced data analytics techniques, such as machine learning, to identify patterns and anomalies in the data that may indicate uncertainty. It can be helpful to involve stakeholders, such as citizens and city officials, in the data collection and validation process to ensure that the information used is accurate and relevant. Regularly updating the data can also help reduce uncertainty and incorporate feedback loops to improve the data collection process.

- **Analysis of data from highly innovative cities and local data collection**

Analysis of data from highly innovative cities and local data collection to understand the roots of changing user behaviour and effects of digitalization in the global and local contexts; adaptation of best practices to the local context and knowledge sharing to build capacity in cities in terms of addressing the effects and seizing the opportunities of digital transition.

- **Digital Transition and Data Privacy**

Data privacy is vital for a successful digital transition for cities. Indeed, there are potential risks and challenges associated with data collection, storage, and use in smart cities. These risks include data breaches, unauthorised access, lack of transparency, control, regulation, etc. To deal with these issues, cities must develop comprehensive data privacy policies, provide transparent communication, and implement technical and organisational measures to protect citizens' data. The city's collection and usage processes should also comply with data protection and privacy regulations such as GDPR. From a scientific perspective, Gustave Eiffel researchers could consider using federated learning. This machine learning technique trains models on multiple decentralised devices or systems, such as smartphones or IoT devices, without centralising the data. It could potentially be used to analyse large amounts of data collected from various sensors or devices throughout a city without transporting it to a central location for physical processing. This could enable researchers to understand better a city's infrastructure, traffic patterns, and other essential factors and make more informed decisions about urban planning and development

- **Speed, veracity, data protection, storage and sharing**

With the advance of technological development, mobility and globalisation, the speed of circulation of information on societies' transformations will be increasingly faster. This situation requires constant and reliable diagnoses to enable decision-making entities to act. The speed of diagnosis-decision is decisive for the success of the processes. Thus, it becomes necessary to guarantee the veracity of the data and information transmitted, and to have immediate access to data for regular and iterative diagnoses to reflect the necessary changes. Transformation and innovation in the form of storage and/or in the format or structure of data continue to be a key research topic.

Urban planning and management

- **How digital transition affects the production and consumption of services**

Digitalisation in transformation of services, including the modes that the digital transition affects the production and consumption of services and the effects for the reduction of overall energy and materials demand

- **the use of home digital platforms to manage energy consumption and domestic tasks (cooking, cleaning)**
- **the impacts of the use of digital media in the households uses/appropriation of the several domestic spaces**
- **Simulation and optimization of new transport systems for the last-mile.**
- **Connecting cities and rural areas.**

Digital twins

- **Communication technologies and digital infrastructure for CCAM**

Computer modelling and performance evaluation of emerging V2X communication technologies in different application and environment contexts. Definition of use cases, test scenarios, service requirements and technical specifications for digital infrastructure. Development of simulation models based on state-of-the-art communication technologies and development of mechanisms to mitigate the effects of incomplete data caused by communication failures in the context of CCAM.

- **Self-Sovereign Personal Digital Twin Wallet**

The emergence of blockchain allowed the emergence of Self-Sovereign Identity (SSI) which allows consumers to have their own identity independently of any third parties. SSI enables novel opportunities in the Personal Data Ecosystem (PDE) as it allows consumers to have possession of their personal data. At the same time, recent advances on the Internet of Things (IoT) and machine learning led to the accelerated growth of the Digital Twin (DT) concept. Together SSI (e.g., Indicio, Sovrin) and DT (e.g., Eclipse Ditto) enable consumers to have control of a fast-emerging concept; the Self-Sovereign Personal Digital Twin (SS-PDT). The Personal Digital Twin is currently one of the hottest topics in the world of technology, as the largest software companies (e.g., Apple) in the world are jockeying for its control and the Linux Foundation launches the Open Metaverse Foundation. A consumer-possessed Personal Digital Twin has the potential to challenge the status quo and give birth to new economic models and uncharted territory economic opportunities.

Inclusive Digitalisation

- **Acceptability of the Digital Transition**

For a successful digital transition, the acceptance of the individual is a crucial part. If the citizens do not adopt the transformation and adapt their behaviour to take full advantage of it, the digital transition is doomed to failure. Gustave Eiffel researchers could extend their research on acceptability for more general urban systems. As many new developments are still in the making and are not yet available to the public, an immersive experience can also address acceptance. Immersive virtualization technologies such as Virtual Reality and digital twins offer great potential to solve this problem. Gustave Eiffel researchers can build on

their previous work to model future urban systems and uses other than transportation systems

- **Assessment of the impact of the Digital Transition on vulnerable population**

In the last years, a number of services needed in the city turned to only be accessible by digital means – the water company app, the electricity company app, the city council app – and the physical locations where once those services could be contracted are disappearing. Although there are obvious advantages arising from this digital transition, such an approach segregates more the already segregated communities of vulnerable population like older people, poor and info-excluded. For such vulnerable groups other types of solutions need to be developed. Relevant partnerships: scientific community, public and private institutions, local authorities.

- **Innovative and inclusive practices of telecare** (aged people care)

RFID and Radio-wave propagation in smart cities

- **Information security of RFID systems**

With the growing number of RFID applications, the importance of securing data stored in RFID transponders is also increasing. Therefore, it is necessary to have knowledge in the field of information security of these systems. These are mainly the types of ciphers used, the possibilities of data misuse on RFID transponders and RFID transponders with known security weaknesses. It is also necessary to consider the physical possibilities of unauthorised interception of RFID communication and the creation of side channels.

AI impacts on humans

- **Human vs. AI creativity**

There is an open debate on whether Artificial Intelligence will replace or be a helpful guide in developing new business models for more sustainable cities. Innovative platforms such as OpenAI (ChatGPT, DALL-E) have showed that AI is rapidly evolving to be useful for more creative tasks. Therefore, there is a need to understand the impact of such emergence on how society will be shaped in the future, namely how AI can be used as a complementary tool to create new and innovative ways to overcome human challenges.

- **Transhumanism (integrating the technology in human beings)**

For the next 5 years it is expected that companies that are developing brain-to-computer devices (Neuralink, Synchron Inc. and others) begin human trials. Although the first solutions will cover treatments for overcoming health related traumas, the prospect of having human beings with integrated technology can have implications for how such data can be used and integrated. Ethical and moral issues need to be researched in order to develop ways to handle privacy concerns while at the same time allow for new solutions to improve well-being and satisfaction of those who use such technology

- **Technology to drive pro-environmental behaviours**

Pro-environmental behaviours are those that become innate in human beings regarding the concern for protecting the natural environment in economic, waste management and other

areas that can negatively affect the world sustainability. Technological advances can be a driving force of such change. For example, Artificial Intelligence embedded devices can be used to promote pro-environmental behaviours that become innate and sustainable over time.

8.6.3 Relevant Publications

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- Äyväri A & Hirvikoski T (2021): Review of Finnish social and health care ecosystems' websites supporting the co-creation and testing of innovations. Laurea Publications 172. URl: https://www.theseus.fi/bitstream/handle/10024/505460/Laurea%20Julkaisut%20172.pdf?sequence=5&isAllowed=y
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- Ferreira da Silva C., Rupino da Cunha P., Melo, P. (2022) The Organizational and Social Impact of Emerging Technologies: The Case of Blockchains, Sistemas de Informação Diagnósticos e Prospetivas, Ed. Sílabo. ISBN 978-989-561-212-3

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8.6.4   Current projects related to the topic (local, national or European project):

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- AI-TIE – AI Technology Innovation Ecosystems for Competitiveness of SMEs. The objective of the project is to move the AI discussion from a general level to industry-specific training, mentoring and accelerator operations. The project targets the fields of cleantech and wellbeing, social and health industry. (https://www.haaga-helia.fi/en/rdi-projects/ai-tie-ai-technology-innovation-ecosystems-competitiveness-smes)
- As good as new: Enhancing the behavioral and business change of the second-hand textile industry in the Central Baltic region (BALTIC2HAND) Central Baltic 2021-2027. The project aims to improve textile reuse and reduce textile waste, which will be achieved through improving the business models of second-hand companies and other companies that want to add a second-hand operation to their business and also through enhancing consumers' use of second-hand market as both sellers and consumers. The main outputs of the project are: an open-access digital platform; a set of improved business models and concepts; a library of consumer nudges; a set of change management activities; online educational materials for industry professionals and students; scoping reviews of the current state and problems, opportunities in the second-hand textile market.
- Central Baltic Mentoring for Migrant Women seeking Employment (CeMeWE) Central Baltic 2021-2027. The objective of the project is to increase the employability of immigrant women through a model which helps to overcome individual, domestic, and societal barriers. As a result, the participants will have a clear understanding of their employment opportunities, an increase in skills and a clear chart of the steps needed for employment. They will also have the necessary support to take these steps through mentoring. After participation the immigrant women will have secured employment, or a clear understanding of the actions still needed to gain employment.
- Circular Economy Goes East and West (https://cego.fi/in-english/) The objective of the project is to facilitate the realisation of business opportunities in accordance with circular economy and the building up of a circular economy business ecosystem at Helsinki-Uusimaa Region. The project's business development companies will develop business ecosystems in accordance with their specific focus areas, and Laurea will coordinate and integrate the different parts of the project into a coherent whole. Funding European Regional Development Fund 2021-2027. National funding for Helsinki-Uusimaa Region.
- Circular Economy Laurea Living Lab (CELLL) Toolkit is a design tool for developing circular business and business models. See for example above article by Purola et al. 2019.
- CoCo Tool Kit 2.0 - CoCo Cosmos Toolkit. CoCo Tool Kit co-creation tool developed in Laurea helps different stakeholders to communicate and design service environments to meet the needs of users better. https://www.laurea.fi/en/cocotoolkit/
- DigiIN2: Towards socially inclusive digital society, Funding Academy of Finland
- EDITS - Energy Demand changes Induced by Technological and Social innovations project network, coordinated by the Research Institute of Innovative Technology for the Earth (RITE) and International Institute for Applied Systems Analysis (IIASA), and funded by Ministry of Economy, Trade, and Industry (METI), Japan (DINÂMIA'CET-Iscte is member since 2020). Global.
- Empowering a Pan-European Network to Counter Hybrid Threats EU HybNet (https://euhybnet.eu/). The project aims at enriching the existing European networks countering hybrid threats and ensuring long term sustainability. This will be achieved by defining the common requirements of European practitioners' and other relevant actors in the field of hybrid threats. Ultimately, this can fill knowledge gaps, deal

with performance needs, and enhance capabilities or research, innovation and training endeavors concerning hybrid threats. EU-HYBNET will monitor developments in research and innovation activities as applied to hybrid threats; so, to indicate priorities for innovation uptake and industrialisation and to determine priorities for standardisation for empowering the Pan-European network to effectively counter hybrid threats. EU-HYBNET will establish conditions for enhanced interactions with practitioners, industry, and academia for a meaningful dialogue and for increasing membership in the network. Project Funding: European Union's Horizon 2020 research and innovation programme under grant agreement No883054.

- Foodwaste ecosystem – utilizing foodwaste. Funding European Regional Development Fund 2021-2027. National funding for Helsinki-Uusimaa Region. The aim is to develop the ability of service providers to utilise edible food waste and serve it to the end consumers as practically and safely as possible. The project also measures the amount and quality of food waste. Understanding the quality of food waste helps assess whether and how it can be processed for commercial use. The project brings together companies in the food and circular economy industries, RDI-institutions, and food aid providers. Through this cooperation, opportunities are created for new business ideas.

- Housing Co-design: A framework definition based on generative design systems. National. Ongoing PhD research by Micaela Raposo, FCT Grant SFRH/BD/146044/2019. Supervision: Sara Eloy, Miguel Sales Dias. Available here https://istar.iscte-iul.pt/portfolio-posts/phd-thesis-housing-co-design-a-framework-definition-based-on-generative-design-systems/

- Immune 2 Infodemic: Beside the current pandemic, we also have infodemic spreading increasingly among EU citizens which can severely impact their democratic participation and engagement. This may include disinformation, misinformation, fake news, and other types of interference on different issues related with public life, such as elections, vaccination, migration. A pre-emptive approach needs to be taken for decreasing the worsening impact, such as using vaccination against the spread of the pandemic. IMMUNE 2 INFODEMIC aims to immunise EU citizens against the disinformation and misinformation on selected themes by empowering and equipping them with several methods using eye-catching material and easy-to-use tools. The project consortium formulates and co-produces 3 instruments (vaccines): digital literacy, media literacy, critical thinking; and applies these instruments on 3 selected hot themes (boosters): elections, COVID-19 and migration. Vulnerable citizens/residents having limited/no knowledge about mis/disinformation activities but using social media extensively, youth generation (18-25 y). In addition to other citizen gropus, seniors (65+ y) will be a targeted for project action. Project Dates : 1 January 2023 – 31 December 2024 ; Funding: CERV-2022-CITIZENS-CIV

- Impact of Blockchains and Distributed Ledger Technologies, 2022, national funds, Blockchains (BC) and Distributed Ledger Technologies (DLT) are being included in several real-world scenarios, not only in the financial context but also in several others, such as healthcare and supply chains. The characteristics of these technologies that encourage exchanges and transactions between participants without the need for a third party (central authority) have raised increasing interest in the application of technology to a wide range of organizational, inter-organizational and societal problems. However, even if important digital, organizational and economic transformations can be anticipated, the impact of the introduction of these disruptive technologies is not yet well studied. This project intends to analyze the organizational and social impact of the inclusion and use of Blockchain (BC),

Distributed Ledger Technologies (DLT) and smart contracts in information systems. Interviews, surveys, analysis and testing of a set of BC and DLT tools will be conducted in order to justifiably position them in the context of existing Technology Adoption Models (TAM). This project is in line with the Thematic Line 5 - Digital Transformation of the SocioDigital Associated Lab. https://ciencia.iscte-iul.pt/projects/impact-of-blockchains-and-distributed-ledger-technologies/1691

- InCITIES - Inclusive, sustainable, and resilient cities in Europe Horizon Europe: Widening Participation.
- Information Resilience in a Wicked Environment (IRWIN) is a three-year project (2021-2023), funded by the Academy of Finland, where researchers from the University of Vaasa, the University of Eastern Finland, the Laurea University of Applied Sciences and the National Defence University seek to study Information Resilience in Complex Environments. We seek to develop a participatory model of national preparedness in which decision-makers, civil society and the business sector work together to promote crisis preparedness. https://www.irwinproject.fi/en/home/
- ManagiDiTH 2022-2026. Master of Managing Digital Transformation in the Health.
- Mobilletic https://journals.openedition.org/cybergeo/33189?lang=en - - national project
- My Business Hub – increasing the competitiveness of urban districts (My Business Hub). Funding European Regional Development Fund 2021-2027. National funding for Helsinki-Uusimaa Region. Project develops a concept in which city of Vantaa, educational institutions, third and private sector organisations support business services are brought together for better coordination and in a more proactive fashion. Laurea is a partner in the project. No English website.
National data collection project. Type: Data collection campaign coordinated by Slovak government. Objective: Data collection from sensors, vehicles and their analysis oriented towards physical and digital infrastructure and vehicle dynamics with respect to safety for CCAM in cities under real traffic conditions. Duration: 1 month (04/2021).
- Pilot Bergische Ressourcenschmiede (local EFRE project)
- RARSUS: Risk Assessment and Reduction Strategies for Sustainable Urban Resource Supply in Sub-Saharan Africa
- RETO-DOSSO: Researchers Back to the Secondary School – Renewable Energy Powered Water-Food-Economy Nexus for the Sustainable Livelihood at Dosso Region in Niger – ITT Sub-Project: Renewable Energy for Energy Economy-Hub
- SCE - Smart city energy analytics (Funded by IRT SystemX - https://www.irt-systemx.fr/en/projets/sce/) - national project
- SEMALI: Risk Assessment and Reduction Strategies for Sustainable Urban Resource
SENECA - ICT and Smart cars for Efficient emergeNcy responsE and traffiC management. Type: Nationally funded project with bilateral collaboration (Slovakia-Israel). Objective: The aim of the project was to evaluate and quantify potential benefits of intelligent transport systems and information communication technologies deployment for future emergency rescue systems in urban areas. Duration: 3 years (10/2018 – 11/2021)
- SHAPES project launched: harnessing digital services to support the well-being of ageing individuals - Laurea-ammattikorkeakoulu
- Supply in Sub-Saharan Africa – Focus on Sustainable Energy Supply in Mali
- SUS2TRANS - Sustainable Transformative Transitions: Conciliate Accelerated Low Carbon Transitions with System Transformations, coordinated by DINÂMIA'CET_Iscte with the

- participation of LNEG, IGOT/University of Lisbon, ESTGV/Polytechnic Institute of Viseu, INESC ID/University of Lisbon, Utrecht University, ETH Zürich, and financed by national FCT (PTDC/GES-AMB/0934/2020) awarded in November 2020 for the period 2021-2023
- The Andre (funded by the iSite Future) - local project
- The Vedif project (funded by Veolia Ile-de-France) - national project
- Transpolis (https://transpolis.fr/) - national project
- UMii - Urban Mobility Innovation Index. Type: Research and consulting contract for UITP. Objective: To share knowledge and gather insights into cities' ways of fostering innovation to address urban transport challenges. Duration: 18 months (12/2020 – 5/2022)
- VARAVA Receptive UAS, nationwide against racism 2021-22. The aim of the VARAVA project is to increase the receptiveness of universities of applied sciences. The project identifies, acknowledges and intervenes in the phenomena of structural racism and promotes the adoption of an anti-racist operating culture as a guiding value of Finnish universities of applied sciences. Fundi EU's Asylum, Migration and Integration Fund.
- VESTENICKÝ, M - VESTENICKÝ, P.: Mathematical analysis of parasitic elements influence in resonant circuit of RFID antenna. In: Radioelektronika 2019, 29th International conference. IEEE, 2019, p. 1-5, ISBN 978-1-5386-9321-6
- VESTENICKÝ, M - VESTENICKÝ, P.: Optimum selection of the reference signal for correlation receiver applied to marker localization. In: AETA 2018, Recent Advances in Electrical Engineering and Related Sciences: Theory and Application, Lecture Notes in Electrical Engineering vol. 554, 2020, p. 382-389. Cham: Springer Nature, 2020. ISBN 978-3-030-14906-2, ISSN 1876-1100
- VESTENICKÝ, P - VESTENICKÝ, M.: Optimization of receiving window width of the correlation receiver for radiofrequency identification marker localization. In: International Journal of Distributed Sensor Networks, vol. 15, no. 9 (2019), p. 1-12, ISSN 1550-1477 (CC IF 1.151 Q4, Scopus SJR 0.324)
- VESTENICKÝ, P. – VESTENICKÝ, M.: The possibility of interference suppression by correlation receiver applied to marker localization. In: MENDEL, soft computing journal. ISSN 1803-3814, vol. 24, no. 2 (2018), p. 75-80
- VESTENICKÝ, Peter – MRAVEC, Tomáš – VESTENICKÝ, Martin: Comparison of various marker localization methods. In: Advances in Intelligent Systems and Computing, Vol. 461, pages 87-103. Springer International Publishing Switzerland, 2017. ISBN 978-3-319-44354-6, ISSN 2194-5357
- VIHTA – Digital Solutions for Green Work project will cultivate green and digital work for the future. Project is created to support and educate advisors who work in counselling for unemployed or entrepreneurs. Some of them are immigrants thar are a huge potential for Helsinki-Uusimaa region. Project focuses on contents, innovations, facilitation, service design, anticipation, counselling, and guiding that will increase and improve digital and green work in the society. Funding European Regional Development Fund 2021-2027. National funding for Helsinki-Uusimaa Region.
- VITALISE Virtual Health and Wellbeing Living Lab Infrastructure. Funding H2020
- VoimaProfi: Empowering people Towards socially inclusive society, national funding (Ministry of Education RDI development funding).
- WESA: Water and Energy Security for Africa

8.7 Thematic HUB7 - Sustainable and resilient cities

The subtopic titles were consensually found during the workshops done in task 2.1. As mentioned above, one workshop was organised per thematic HUB, where all contributors of the corresponding thematic HUB were invited.

Table 14 - Subtopics and topics identified for the Thematic HUB 7 -Sustainable and resilient cities.

Subtopic	Hot Research topic	Research topic in 5 years
Environmental wellbeing impacts analysis	• Climate-health problems • The benefits of reducing the emission load of the environment • Environmental inequalities	• Urban air quality • Increasing the energy efficiency of the wastewater treatment considering greenhouse gas emissions
Role of cities in circular economy implementation	• Sustainable circular economy • Service Business and Circular Economy Research	• Implementation of a sustainable circular economy for inner city's waste streams focusing on the production of secondary raw materials • Service Business and Circular Economy • Management of urban waste under the new imperative of circular management
Infrastructure and territorial resilience	• The importance of the site and optimising the potential of localisation • How smarts buildings can contribute to the protection and conservation of energy and hydric resources • Analysis of interdependent critical infrastructures • Spatial risk and rescue analyses • Affordable housing • Design phase for sustainable building exploration	• How a smart/intelligent building can contribute to the development of smart cities • The use of new technologies for the management of smart cities • Urban Design against Climate Change
Transformative policies analysis	• Transition, adaptation and resilience • Sustainable policies • Transitions in the mobility	• Big data and knowledge-based democracy (to be confirmed) • Public policies in the path

	system, transformation of the system of actors • Energy sobriety and the implementation of the transition • Territorial trajectories and mobility	towards making cities and buildings smarter • Evaluation of city-sustainable development • Climate-Digital Development Policies
Understanding risks	• Social vulnerability and resilience • Adaptivity & Resilience • Consensus Modelling	• Inventory of hazards, exposure and vulnerability of population and assets, potential hazard impacts and a ranked risk profile

8.7.1 State of the art of current "hot" research topics (Question 1)

This section presents all the proposals provided by all HEI members of the InCITIES project while answering to question 1 regarding the "hot" research topics for the thematic HUB7.

Environmental wellbeing impacts analysis
• **Climate-health problems**

City pollution implies specific health problems, with profound human and economic costs. Cities are decisive spaces to reverse the current environmental impacts. According to the World Health Organization, reducing air pollution levels will reduce the number of cardiovascular problems, lung cancer, and other respiratory diseases, namely asthma. It is essential to address these risk factors to protect public health. More favored social categories have a greater capacity to combat the harmful effects on health resulting from exposure to environmental pollution. The health status of individuals impacts their labor productivity and the capacity to find or keep a job, and health behaviors are constrained by poverty, suffering, segregation and vulnerability, processes that city collective actors should be aware to create successful wellbeing strategies.

• Developing the potential of knowing **the benefits of reducing the emission load of the environment** by road transport, which will be a valuable input for environmentally acceptable decision-making in the field of mobility management in cities.

The next level will be the implementation of management schemes for efficient and environmental management of the city and city functional areas.

• **Environmental inequalities**

Air quality is key towards life quality. However, in large cities that host everyday crowds of inhabitants and workers, pollution is a reality. By monitoring with sensors air quality, city managers and planners can rely on data to take judged decisions that can improve air quality in city locations more severely affected

Role of cities in circular economy implementation

- **Sustainable circular economy**

Circular economy is well known and getting implemented in more and more areas, but is it sustainable. What technical innovations are necessary considering ecological, economic, judicial as well as societal factors? We develop and analyse process chains for different municipal waste streams considering these five dimensions focusing on organic waste (plastics, household and green waste) as well as inorganic waste (construction waste) in order to produce secondary raw materials in the most sustainable way to reintroduce them into the production cycle.

- **Service Business and Circular Economy Research**

Central topic is the changing business settings and change of required skills, competences and company level capabilities caused by green transition and circular economy for SMEs', public authorities and third sector organisations. Projects within this topic investigate and develop digital and service solutions for green work, entrepreneurial competences, and resilience. Second topic, which is already and will increasingly be focal for sustainable solutions is innovation and business ecosystem development and orchestration. Projects study ecosystems and innovation hubs in the context of local and regional development, in cities and in agricultural areas. Research and innovation in this topic focus on circular economy ecosystems, cooperation between local government and private sector organisations.

Infrastructure and territorial resilience

- **The importance of the site and optimising the potential of localization**

the social/urban location, transformation of greyfield lands in green urban park, opening private plot to the public, solar orientation, local ecosystems, means of transport, safety and use of resources;

- **How smarts buildings can contribute to the protection and conservation of energy and hydric resources**

 optimisation of energy use through intelligent systems, energy production for self-consumption and recycling of water for reuse in the building.

- **Analysis of interdependent critical infrastructures**

Critical infrastructures provide the population with essential goods and services such as water, food, heat and information. These infrastructures are often interconnected with each other and with other infrastructures that enable this supply, such as transport, logistics, administration and others. The question of supplying the population in the event of infrastructure failure is analysed and deepened by examining cascade effects, since many modern infrastructures such as electricity and water, or health care, are interdependent. Also, the dependency on other infrastructures such as access roads or electricity has not yet been analysed in many planning procedures for fire brigades or hospitals.

- **Spatial risk and rescue analyses**

The use of spatial analysis through GIS and remote sensing expands the focus of many existing methods, which is either only on individual objects such as residential buildings or

on individual infrastructure systems. GIS not only helps to analyse different levels of analysis such as affected population and settlement structure, infrastructure lines, flood or forest fire hazard zones and many more together. Spatial analysis by means of GIS also helps to grasp the bigger picture, and not only to analyse object-related or for one city alone; because most hazards do not stop at administrative boundaries.

- The problem of (un) **affordable housing** affects individuals to a great extent, but also cities that run the risk of mono-function (tourism/leisure) and social homogeneity (concentration of people with high economic capacity). Our work (LxHabidata and The Housing Observatory of the Lisbon Metropolitan Area which is now being set up) aims at <u>analysing the dynamics and risk factors of urban resilience and (social and functional) sustainability</u>. It is also our mission to fuel the public, political and academic debate on this issue to find concrete "solutions" to this very complex problem

- The importance and potential of the **design phase for sustainable building exploration**: adaptability and resilience of spaces and infrastructure for multiple uses, choice of materials with environmental certification focusing on their life cycle, concern with interior environmental quality (lighting, ventilation, thermal, acoustics), use of a centralized management system that allows programming and monitoring of all systems and subsystems.

Transformative policies analysis
- **Transition, adaptation and resilience**

This particular topic is also relevant for others such as on Transforming public action where researchers assess the impact of the transition imperative of routine modes of working for professionals producing and managing the city, as well as the impact it holds for the end-users of various types of infrastructure. Current examples: The introduction of carbon rationing for mobilities as new (and hotly debated) rationale for sober modes of transportation; Instruments, incentives and the politics of densification of the built environment in peri-urban areas of Ile-de-France and in European trans-national contexts; Policies and innovations related to energy renovation of the existing building stock

- **Sustainable policies**

This is the time to put in practice sustainable policies for cities. That means city actions "out of the box", away for the premise of "business as usual", and focused in the 17 sustainable development goals and their specific targets. Today, the paradigm hasn't yet shifted, but there are some signs that are going in the direction of what was ratified by countries, which resulted in the 2030 UN Agenda.

- **Transitions in the mobility system, transformation of the system of actors**

Examples: questions about the ability of political institutions to regulate socio-economic phenomena. Role of associations and citizens, institutional reconfigurations, private actors. Work on the regulation of long distance and logistics, the influence of decision-making scopes on the configuration of the offer and on practices, etc.

Research on urban logistics (including from the angle of working conditions, public policies).

- **Energy sobriety and the implementation of the transition**

Examples: Questioning "sober" practices, aspirations for sobriety, and the modes of collective action likely to encourage these practices.

Work on citizen initiatives, on urban forms likely to induce sobriety, the deceleration of the rhythms of life in connection with policies aimed at an ecological transition of mobility, the evolution of logistics towards sobriety, etc.

- **Territorial trajectories and mobility**

Examples: questions around the adaptability of networks to context changes (particularly political and regulatory): tensions linked to the inertia of heavy infrastructures or the rapid development of lighter networks or … absence of networks. Implications for local development.

Work on small railway lines, small airports, the evolving structuring of airport networks and distribution (impact on local employment), network financing (TCU), service to sparsely populated areas.

Understanding risks

- **Social vulnerability and resilience**

The main focus of this topic is to capture the concerns of the people, "the population", but also of all actors in a crisis event, and to integrate them more strongly in analytical methods. Both "the affected" and "the caretakers" are meant and differentiated through diverse skills and competences and solutions are developed in a co-development approach where possible and appropriate. Thanks to the expertise in the field of "social vulnerability and resilience", the research focus can systematically investigate and, above all, integrate both semi-quantitative and qualitative methods. https://riskncrisis.wordpress.com/social-vulnerability-and-resilience/

- **Adaptivity & Resilience**

In a world facing global challenges like pandemics or the climate crisis, we increasingly accept and learn that designing the future is radically different from how it was a generation ago. Like every activity, designing now requires adaptations to complex systems - by understanding our environment as well as our relations to and within the environment and the way we are interdependent, entangled, and connected. Those adaptations explore and open up future possibilities. Opportunities for adaptivity are related to food and food systems.

- **Consensus Modelling**

Game theory has been used to model conflicting situations. There is a long list of simple games that have been used to model the evolution of cooperation, provision of common goods, coordination problems, among others. These games can also be used to model city dwellers behaviours such as funding public transportation to provide high quality services versus private car usage, investing in green spaces versus new buildings. These games have simpler players compared to a generic negotiation agent, which means evaluating different parameters or conditions is faster. They are more suitable in developing new tools for urban planners to quickly assess the impact of a decision. On the other hand, with Agent-Based Modelling we can have more complex agents with intricate negotiation rounds. In both

cases we need to investigate how the system can provide a justification for its results, in order to increase trustiness in using these tools.

8.7.2 State of the art of research topics for the next 5 years (Question 2)

This section presents all the proposals provided by all HEI members of the InCITIES project while answering to question 2 regarding the research topics for the next 5 years regarding the thematic HUB7.

Environmental wellbeing impacts analysis
- **Urban air quality**

As air quality deteriorates in large cities, its monitoring is key to help develop strategies that help to mitigate such problem. By using sensors, air quality can be measured, helping to guide city planners in their next decisions
- **Increasing the energy efficiency of the wastewater treatment considering greenhouse gas emissions** (link with HUB ENERGY)

o Wastewater treatment plants are the biggest energy consumers in cities and are responsible for most of the N 2 O-emissions.

o An intelligent measurement and control system that allows the measurement of GHG emissions and minimizes energy consumption is needed and should be developed.

o The water management authority is the main stakeholder for this project.

Role of cities in circular economy implementation
- **Implementation of a sustainable circular economy for inner city's waste streams focusing on the production of secondary raw materials**

o Analysis of the existing waste streams and their reuse potential (possible focus on wastewater and organic waste)

o Development of suitable process chains from logistics to valorisation (algae, thermochemical processes, etc.)

o Implementation in one exemplary city with support from the local waste and/or water management authority, the city council and at least one local university
- **Service Business and Circular Economy**

One topic will be as part of sustainability transitions, in what way circular economy becomes reality and part of everyday life of residents, business and local government? Role of larger cities and local government, NGOs and governmental organisations as developers and orchestrators and developers of innovation ecosystems, how to develop their capabilities.

In addition, cooperation between varied ecosystems (practices, rules, agreements, etc.) and their member organisations (that can be actors in several ecosystems) may become a hot topic in five years' time.

Value creation, shared understanding of value, public vs. private value (differences, similarities, etc.) may be a hot topic in near future. Public and private (corporate) value,

their meaning, structure and aims vary from each other. Simultaneously our current challenges of climate change, biodiversity loss, digitalisation and changing population structures require cooperation and co-creation of solutions in complex societal settings. Shared understanding of value and ecosystems are closely interlinked in solving the above-mentioned challenges.

- **Management of urban waste under the new imperative of circular management**

Another increasing area of research deals with the management of urban waste under the new imperative of circular management (wastewater; household waste; construction waste; excavated land). Several projects explore how this shift requires multi-dimensional innovations, from citizen behavior to the adaptation of the technical infrastructures, from operating companies to the transformation of public action and its engineering

Infrastructure and territorial resilience

- **how a smart/intelligent building can contribute to the development of smart cities**
- **The use of new technologies for the management of smart cities**, such as artificial intelligence, big data and blockchain, as one of the main focuses of the European recovery plans. (with DIGITALISATION HUB)
- **Urban Design against Climate Change**

the UCCRN-EDU network developed at European level not only explores local authorities' strategies for climate change mitigation but also connects it to a full curriculum at undergraduate and graduate levels (from awareness workshops to courses and dissemination initiatives to the general public) (project LOTUS).

Transformative policies analysis

- **Big data and knowledge-based democracy**

Big data information is posing major challenges for democracies, and all the key actors in cities will have to set the strategies to take the advantages of this potentialities, instead of losing for the real threats that bigdata also means. Science, universities and all their partners at the city level, will have to create public legitimacy for using big-data that mostly are in the hands of companies, but that are also produced by states, namely related with health, education, finance, social security, traffic, pollution and mobility, in what concerns about living in cities. Knowledge production will enhance Democracy, if those data increase the human condition and the social intelligence of cities, implying more closest work between the knowledge-producers, institutions and citizens, supported on anonymized public big data

- **Public policies in the path towards making cities and buildings smarter**, and what is the role of governance in the sustainability and development of cities
- **Evaluation of city-sustainable development**

For obtaining sustainable development in cities, it will be needed to monitoring and evaluate the progress achieved during the next years (at least until 2030). Several scientific methods will be necessary, quantitative, qualitative and mixed-methods, with the

continuing need of the work of economists, sociologists, policy experts, statisticians and data scientists, closely working with local-city actors.

- **Climate-Digital Development Policies**

If cities will have to be evaluated by their performance in reaching the 17 sustainable development goals, the most impactful actions for city-development will be the ones more successful in the taking the best use of both climate and digital transitions. For solving the climate-problems in cities, it will be needed a systemic and integrated view associated with a view of reducing inequalities and increasing social cohesion, wellbeing and sustainable development, by transversally having the digital evolution as a common good at the service of all these civilising objectives.

Understanding risks

- **inventory of hazards, exposure and vulnerability of population and assets, potential hazard impacts and a ranked risk profile** (the Climate Risk Assessment – CRA), followed by options and costs to manage these risks by emergency response and/or structural, institutional, ecological, or behavioural adaptation.

8.7.3 Relevant Publications

- A. Benbassat and M. Sipper. "EvoMCTS: A Scalable Approach for General Game Learning". In: IEEE Transactions on Computational Intelligence and AI in Games 6.4 (2014), pp. 382–394. issn: 1943-068X. doi: 10.1109/TCIAIG.2014.2306914.
- A. Benbassat and M. Sipper. "EvoMCTS: A Scalable Approach for General Game Learning". In: IEEE Transactions on Computational Intelligence and AI in Games 6.4 (2014), pp. 382–394. issn: 1943-068X. doi: 10.1109/TCIAIG.2014.2306914.
- Aldhuy J., Didier S. & Vadelorge L. (forthcoming in 2023) "Peripheral centralities in Val d'Europe, east of Paris: the logics of assemblage between Disneyland Paris and New Town principles of planning". in Peripheral centralities #3, R. Keil, P. Magin & N. Phelps (eds.). Princeton Architectural Press.
- Anttonen M, Lammi M, Mykkänen J & Repo P (2018): Circular Economy in the Triple Helix of Innovation Systems. Sustainability, vol. 10, no. 8, 2646. https://doi.org/10.3390/su10082646
- Arce, T., U. Nehren, K. Sudmeier-Rieux, P. Julio Miranda & D. Anhuf (2019): Nature-based Solutions (NbS) for reducing the risk of shallow landslides: Where do we stand? International Journal of Disaster Risk Reduction 41, DOI: 10.1016/j.ijdrr.2019.101293.
- Äyväri A & Hirvikoski T (2021): Review of Finnish social and health care ecosystems' websites supporting the co-creation and testing of innovations. Laurea Publications 172. URl: https://www.theseus.fi/bitstream/handle/10024/505460/Laurea%20Julkaisut%20172.pdf?sequence=5&isAllowed=y
- Betsch, T. Jäckel, P. Hammes M. & Brinkmann, B. (2021). On the adaptive value of paranormal beliefs. – A qualitative study. Integrative Psychological & Behavioral Sciences 55 (2), 318-328.
- Brinkmann, B. (2019). It makes sense to believe in nonsense A lead through the world of science denial, fake news, and irrational beliefs in eight theses. Journal Supervision.

https://www.dgsv.de/wpcontent/uploads/2020/11/JS_3_2019_Babette_Brinkmann_eng.pdf

- Brinkmann, B. (2022). Nonsense is no opinion: When Coaching and Consulting Meet Science Denial, Irrational Beliefs, and Seemingly Unbridgeable Differences. Postionen. https://www.dgsv.de/wp-content/uploads/2022/05/Positionen-1-2022_engl.pdf

- Buyck J., Meyfroidt A., Brand C. & Jourdan G., (2021) "Bringing sustainable urban planning down to earth through food: the experience of the food transects of Grenoble and Caen. Review of Agricultural, Food and Environmental Studies, 102, pp.319-347. ⟨10.1007/s41130-021-00147-x⟩.

- Capucha L, Nunes N, Calado A (2020), Artificial Intelligence as a Resilient Tool for Fighting Inequalities in the COVID-19 Crisis. European Journal of Engineering and Formal Sciences. 4(2), 10-19 (ISSN 2601-6311 Online) (Indexed- open access peer reviewed research journal).

- Circular Economy Laurea Living Lab (CELLL) Toolkit is a design tool for developing circular business and business models. See for example above article by Purola et al. 2019.

- CoCo Tool Kit 2.0 - CoCo Cosmos Toolkit. CoCo Tool Kit co-creation tool developed in Laurea helps different stakeholders to communicate and design service environments to meet the needs of users better. https://www.laurea.fi/en/cocotoolkit/

- Czischke D., Carriou C. & Lang, R. (2020) "Collaborative Housing in Europe: Conceptualizing the Field". Housing Theory and Society. 37(1), 1-9.

- David Hasenfratz, Olga Saukh, Christoph Walser, Christoph Hueglin, Martin Fierz, Tabita Arn, Jan Beutel, and Lothar Thiele. "Deriving high-resolution urban air pollution maps using mobile sensor nodes". In: Pervasive and Mobile Computing 16 (2015). Selected Papers from the Twelfth Annual IEEE International Conference on Pervasive Computing and Communications (PerCom 2014), pp. 268–285. issn: 1574-1192. doi: 10.1016/j.pmcj.2014.11.008. url: http://www.sciencedirect.com/science/article/pii/S1574119214001928.

- David Hasenfratz, Olga Saukh, Christoph Walser, Christoph Hueglin, Martin Fierz, Tabita Arn, Jan Beutel, and Lothar Thiele. "Deriving high-resolution urban air pollution maps using mobile sensor nodes". In: Pervasive and Mobile Computing 16 (2015). Selected Papers from the Twelfth Annual IEEE International Conference on Pervasive Computing and Communications (PerCom 2014), pp. 268–285. issn: 1574-1192. doi: 10.1016/j.pmcj.2014.11.008. url: http://www.sciencedirect.com/science/article/pii/S1574119214001928.

- David Silver, Aja Huang, Chris J. Maddison, Arthur Guez, Laurent Sifre, George van den Driessche, Julian Schrittwieser, Ioannis Antonoglou, Veda Panneershelvam, Marc Lanctot, Sander Dieleman, Dominik Grewe, John Nham, Nal Kalchbrenner, Ilya Sutskever, Timothy Lillicrap, Madeleine Leach, Koray Kavukcuoglu, Thore Graepel, and Demis Hassabis. "Mastering the game of Go with deep neural networks and tree search". In: Nature 529.7587 (2016), pp. 484–489. issn: 0028-0836. doi: 10.1038/nature16961. url: http://www.nature.com/doifinder/10.1038/nature16961.

- David Silver, Aja Huang, Chris J. Maddison, Arthur Guez, Laurent Sifre, George van den Driessche, Julian Schrittwieser, Ioannis Antonoglou, Veda Panneershelvam, Marc Lanctot, Sander Dieleman, Dominik Grewe, John Nham, Nal Kalchbrenner, Ilya Sutskever, Timothy Lillicrap, Madeleine Leach, Koray Kavukcuoglu, Thore Graepel, and Demis Hassabis. "Mastering the game of Go with deep neural networks and tree search". In: Nature

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- Design Lexikon Philipp Heidkamp, Birkhäuser, Basel, 2008, Hg.: Michael Erlhoff, Tim Marshal Beiträge zu ausgewählten Fachbegriffen im Rahmen des Design Lexikon
- Designing Public: Perspektiven für die Öffentlichkeit P. Heidkamp, Birkhäuser, Basel, 2008, Hg.: M. Erlhoff, P. Heidkamp, I. Utikal
- Dictionary of Today´s Design Heibonsha 2000 / 2004 Philipp Heidkamp, Tokyo 2000 / 2004, Hg.: Heibonsha
- Doswald, N. S. Janzen, U. Nehren, et al. (2021): Words into action: Nature-based solutions for disaster risk reduction. UN Office for Disaster Risk Reduction, Engaging for resilience in support of the Sendai Framework for Disaster Risk Reduction 2015-2030.
- EEA. Air quality in Europe – 2020 report. EEA Report No 09/2020. European Environment Agency, 2020. url: https://www.eea.europa.eu/publications/air-quality-in-europe-2020-report.
- EEA. Air quality in Europe – 2020 report. EEA Report No 09/2020. European Environment Agency, 2020. url: https://www.eea.europa.eu/publications/air-quality-in-europe-2020-report.
- Estebanez J., Boireau P. (2022) "One Health: A social science discussion of a global agenda", Parasite 29, 17 doi: https://doi.org/10.1051/parasite/2022014
- EU Hybnet, Deliverable 2.12 (2022): Articles and Publications on Themes and Measures. Lead Author: UiT, Contributors: URJC, Hybrid CoE, L3CE, JRC, COMTESSA, Laurea Deliverable classification: Public (PU)
- Fekete, A. 2022. Phasing out of nuclear-Phasing out of risk? Spatial assessment of social vulnerability and exposure to nuclear power plants in Germany. Progress in Disaster Science, 100242.
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- Fekete, Alexander; Asadzadeh, Asad; Contreras, Diana; Hamhaber, Johannes; Sandholz, Simone; Sett, Dominic (2022) Urban and rural interdependencies. Infrastructure services in: McGee, T.K., & Penning-Rowsell, E.C. (Eds.). (2022). Routledge Handbook of Environmental Hazards and Society (1st ed.). Routledge. https://doi.org/10.4324/9780367854584. eBook ISBN 9780367854584 (from 30 June 2022)
- Ferreira da Silva C, Nunes N, Moro S, Henriques J, Sousa A, Sarroeira R (2022), "Environmental inequalities in the municipality of Lisbon: spatial analysis of combustion gases". In Transport Research Procedia. TRA conference 2022, Lisbon: Elsevier (in press).
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8.7.4   Current projects related to the topic (local, national or European project)

- AI-TIE – AI Technology Innovation Ecosystems for Competitiveness of SMEs. The objective of the project is to move the AI discussion from a general level to industry-specific training, mentoring and accelerator operations. The project targets the fields of cleantech and wellbeing, social and health industry. (https://www.haaga-helia.fi/en/rdi-projects/ai-tie-ai-technology-innovation-ecosystems-competitiveness-smes)
- ANIMORT: Jean Estebanez, funding: i-sites Futures, local program.
- As good as new: Enhancing the behavioral and business change of the second-hand textile industry in the Central Baltic region (BALTIC2HAND) Central Baltic 2021-2027. The project aims to improve textile reuse and reduce textile waste, which will be achieved through improving the business models of second-hand companies and other companies that want to add a second-hand operation to their business and also through enhancing consumers' use of second-hand market as both sellers and consumers. The main outputs of the project are: an open-access digital platform; a set of improved business models and concepts; a library of consumer nudges; a set of change management activities; online educational materials for industry professionals and students; scoping reviews of the current state and problems, opportunities in the second-hand textile market.
- ATHENA - University Goes Digital for a Sustainable Global Education (european project). ISCTE's project team, planned and developed a class for students to get to know the pilot building case study for the Architecture course – "Building Sustainability and Design Through Digital Tools". This class presented the CVTT – Knowledge and Innovation, the new ISCTE building which will host the university research centres. It tackles the challenges the project team faced, the pre-existing building, the new building program, ISCTE's sustainability goals, and their final project decisions, choosing to align the project's strategy to the main sustainability agendas and plans. The notion of sustainability involves the whole complex dynamic tissue of society and so the development of this project tried to approach sustainability in an integrated way and to respond to social, economic and environmental dimensions.
- CABaS (CAdres de vie en BAnlieueS): Emmanuelle Faure, funding: City of Gennevilliers, local program.
- Central Baltic Mentoring for Migrant Women seeking Employment (CeMeWE) Central Baltic 2021-2027. The objective of the project is to increase the employability of immigrant women through a model which helps to overcome individual, domestic, and societal barriers. As a result, the participants will have a clear understanding of their employment opportunities, an increase in skills and a clear chart of the steps needed for employment. They will also have the necessary support to take these steps through mentoring. After

participation the immigrant women will have secured employment, or a clear understanding of the actions still needed to gain employment.

- Circular Economy Goes East and West (https://cego.fi/in-english/). The objective of the project is to facilitate the realization of business opportunities in accordance with circular economy and the building up of a circular economy business ecosystem at Helsinki-Uusimaa Region. The project's business development companies will develop business ecosystems in accordance with their specific focus areas, and Laurea will coordinate and integrate the different parts of the project into a coherent whole. Funding European Regional Development Fund 2021-2027. National funding for Helsinki-Uusimaa Region.
- Citizenry, Capacity building and participatory approaches in «peripheral» territories
- COBRA: Sonia Guelton, Claire Carriou, Claire Aragau, funding: Union Sociale pour l'Habitat, national program.
  Construction area: 10.135m^2
  Construction area: 10.350m^2
- Co-Site project: Co-Creation in the Region – Systemic and Innovative Transfer Development 2023-2027, local project with national and regional funding in the region Cologne and Bonn in Germany
- Dana Sitányiová (DS) - CLIMAte risk and vulnerability Assessment framework and toolboX (HORIZON-MISS-2021-CLIMA-02)
- DigiIN2: Towards socially inclusive digital society, Funding Academy of Finland
- DISGOUVDYN: Julien Aldhuy & Sophie Didier, funding: i-site futures, local project.
- Dušan Jandačka (DJ) - National project: APVV-21-0416, "REMOT - Research on mobility and emission attributes of the transport process"
- Empowering a Pan-European Network to Counter Hybrid Threats EU HybNet (https://euhybnet.eu/). The project aims at enriching the existing European networks countering hybrid threats and ensuring long term sustainability. This will be achieved by defining the common requirements of European practitioners' and other relevant actors in the field of hybrid threats. Ultimately, this can fill knowledge gaps, deal with performance needs, and enhance capabilities or research, innovation and training endeavours concerning hybrid threats. EU-HYBNET will monitor developments in research and innovation activities as applied to hybrid threats; so, to indicate priorities for innovation uptake and industrialization and to determine priorities for standardization for empowering the Pan-European network to effectively counter hybrid threats. EU-HYBNET will establish conditions for enhanced interactions with practitioners, industry, and academia for a meaningful dialogue and for increasing membership in the network. Project Funding: European Union's Horizon 2020 research and innovation programme under grant agreement No883054.
- Food Systems in Cities (Cologne, Taipei, Hongkong, Amman, Barcelona)
- Foodwaste ecosystem – utilising foodwaste. Funding European Regional Development Fund 2021-2027. National funding for Helsinki-Uusimaa Region. The aim is to develop the ability of service providers to utilise edible food waste and serve it to the end consumers as practically and safely as possible. The project also measures the amount and quality of food waste. Understanding the quality of food waste helps assess whether and how it can be processed for commercial use. The project brings together companies in the food and circular economy industries, RDI-institutions, and food aid providers. Through this cooperation, opportunities are created for new business ideas.

- GERTRUD: Joel Idt, funding: ANR, national program.
- Housing problems, inequalities and precarity in cities
  https://ciencia.iscte-iul.pt/projects/care4housing---a-care-through-design-approach-to-address-housing-precarity-in-portugal/1745
  https://ciencia.iscte-iul.pt/projects/spatial-planning-for-change/770
  https://ciencia.iscte-iul.pt/projects/stronger-peripheries-a-southern-coalition--sp/1515
- Immune 2 Infodemic : Beside the current pandemic, we also have infodemic spreading increasingly among EU citizens which can severely impact their democratic participation and engagement. This may include disinformation, misinformation, fake news, and other types of interference on different issues related with public life, such as elections, vaccination, migration. A pre-emptive approach needs to be taken for decreasing the worsening impact, such as using vaccination against the spread of the pandemic. IMMUNE 2 INFODEMIC aims to immunise EU citizens against the disinformation and misinformation on selected themes by empowering and equipping them with several methods using eye-catching material and easy-to-use tools. The project consortium formulates and co-produces 3 instruments (vaccines): digital literacy, media literacy, critical thinking; and applies these instruments on 3 selected hot themes (boosters): elections, COVID-19 and migration. Vulnerable citizens/residents having limited/no knowledge about mis/disinformation activities but using social media extensively, youth generation (18-25 y). In addition to other citizen gropus, seniors (65+ y) will be a targeted for project action. Project Dates : 1 January 2023 – 31 December 2024 ; Funding: CERV-2022-CITIZENS-CIV
- InCITIES - Inclusive, sustainable, and resilient cities in Europe Horizon Europe: Widening Participation.
- Information Resilience in a Wicked Environment (IRWIN) is a three-year project (2021-2023), funded by the Academy of Finland, where researchers from the University of Vaasa, the University of Eastern Finland, the Laurea University of Applied Sciences and the National Defence University seek to study Information Resilience in Complex Environments. We seek to develop a participatory model of national preparedness in which decision-makers, civil society and the business sector work together to promote crisis preparedness. https://www.irwinproject.fi/en/home/
- International: CELICE – Strengthening the climate change, ecosystems and livelihood nexus in coastal zones of Ecuador through transdisciplinary research and innovative teaching (DAAD; project head)
- Iscte-Knowledge and Innovation is a Technology Transfer and Enhancement Center based on the combination of two reference areas of research at Iscte - the social and human sciences and digital technologies - with the aim of providing integrated knowledge transfer solutions to society, organizations, companies, and public administration. Coordination and Architectural Project of CVTT – Innovation and Knowledge (Local project with European financing).
- Iscte-Sintra is the new school of Iscte, dedicated to teaching and research in Digital Technologies, Economy and Society, located in the city of Sintra. Iscte-Sintra started operating in September 2022 with an offer of eight-degree courses - six in Applied Digital Technologies, one in Applied Mathematics to Digital Technologies and another in Politics, Economy and Society. Coordination and Architectural Project of the new school of technologies of Iscte Sintra (Local project).

- LOTUS (Locally organized transition of urban sustainable spaces): Joel Idt, Margot Pellegrino, Katia Laffrechine, funding: Erasmus + program, Coord. University of Applied Sciences Kehl.
- MAMA (Monde d'Avant Monde d'Après) : Emmanuelle Faure, funding: CNRS, national program.
- ManagiDiTH 2022-2026. Master of Managing Digital Transformation in the Health.
- My Business Hub – increasing the competitiveness of urban districts (My Business Hub). Funding European Regional Development Fund 2021-2027. National funding for Helsinki-Uusimaa Region. Project develops a concept in which city of Vantaa, educational institutions, third and private sector organisations support business services are brought together for better coordination and in a more proactive fashion. Laurea is a partner in the project. No English website.
- DSAEI - Data science analysis for environmental inequalities, CIES-Iscte and ISTAR-Iscte, https://ciencia.iscte-iul.pt/projects/data-science-analysis-for-environmental-inequalities/1740 : Digital society and AI are posing new challenges to cities through opportunities to improve the performance and democratization of local and regional public administrations in their relationship with citizens and companies. Digital and AI's impacts on the structure of inequality have not yet been sufficiently studied within and between countries and at the city levels. We aim to analyse environmental data and inequalities, by simultaneously advancing the social science problem of sustainable development, and improving the digital tools for city problem-solving, together with social stakeholders and municipalities. Through data science and the application of machine learning, statistical data, and place-based knowledge concerning climate problems, the project intends to produce a digital toolkit of geographical-interactive maps of sustainable footprint, supported by a system of multidimensional indicators of environmental inequalities and urban lifestyles, mobility patterns and transport usage. Start date: 2022-01-01 | Expected end date: 2023-12-31 |Locally funded project]. National project.
- National, LXHabidata is a housing data platform with permanent updates relating to the municipalities and parishes of the Metropolitan Area of Lisbon: https://lxhabidata.iscte-iul.pt/
- National: Co-creation in the region - Systemic and innovative transfer development (Co-Site) (BMBF; work package head "green infrastructure")
- PUCA: Nadia Arab, funding: PUCA, national program.
- SENOVIE: Myriam Baron, Léa Prost, funding: Institut National du Cancer (InCa), national program.
- SHAPES project launched: harnessing digital services to support the well-being of ageing individuals - Laurea-ammattikorkeakoulu
- STILL MAP: Jennifer Buyck, funding: ANR, national program.
  Stronger - Stronger Peripheries: A Southern Coalition (DINÂMIA'CET-Iscte as partner). It gathers 14 organizations from 10 countries: all to some extent identifying with a loosely defined 'Southern Europe', all committed to foster local community engagement in the arts and all devoted to overcoming the obstacles in their specific contexts by increasing mutual cooperation. It is mainly a cultural concept instead of a geographical one, where "South" is broadly understood. It refers particularly to those affected by the political and economic crisis, interested in collaborative strategies based on a set of common values and needs that derive specifically from working in the peripheries.

- [Sus2Trans](#) - Sustainable Transformative Transitions (DINÂMIA'CET-Iscte as leader). Sus2Trans conciliate Accelerated Low Carbon Transitions with System Transformations. The project investigates the types of decarbonisation strategies that comply with the Paris Agreement, whose implementation requires the transformation of several sectors in addition to energy, such as mobility, construction, food and industry. This sectoral transformation raises challenges for the development of countries and regions, which have become particularly pressing as states will have to accelerate the low-carbon transition with more fragile finances and the need for economic recovery after the pandemic crisis. The research combines theories of socio-technical transitions and economic geography to identify low-carbon transition pathways with the greatest transformative potential and to investigate how countries and regions are preparing for such transformation. The focus of this research is on the type of transition strategies that are most beneficial to the economy, that is, that have the capacity to generate changes in other sectors.
- Sustainable energetic Transitions and public policies on the green transition
  The project Care (4) Housing - A care through design approach to address housing precarity in Portugal (DINÂMIA'CET-Iscte as leader). Newly started, Care (4) Housing intends to understand how Architecture, as a discipline, can rethink and integrate the idea of care of/in the built environment, contributing to the construction of better and urgent answers to the current housing precarity. Care (4) Housing explores four dimensions on care through design. The first (Spatial) is rooted on the idea that we need to Care for Space. The second (Social), follows the awareness that we need to Care for People. The third dimension, (Technical), it's strongly related to Building with Care, consonant on how we, as a collective, care for the planet.
- SPLACH - Spatial planning for change (DINÂMIA'CET-Iscte as partner). Recently finished, SPLACH focused on the proactive role of planning to constitute a transformative device in our cities in Europe and elsewhere, particularly in the present times and with a view into the long term. Indeed, current changes seem far deeper within the existing urban tissues experiencing profound recompositions of functions and activities, than in physical terms, strictly speaking, where past investments in infrastructures and in the built environment seemed to have exceeded the real demand and generated a surplus of the building stock that, some years later, still remains partially empty or underused.
- UCCRN-EDU: Bruno Barroca, Margot Pellegrino, funding: Erasmus + program, Coord. University Federico II of Naples.
- Urban[Food](#) systems and sustainability under the green transition
- URBA-RE (Urban issues of energy renovation): Margot Pellegrino, funding: i-site Future, local project.
- VARAVA Receptive UAS, nationwide against racism 2021-22. The aim of the VARAVA project is to increase the receptiveness of universities of applied sciences. The project identifies, acknowledges and intervenes in the phenomena of structural racism and promotes the adoption of an anti-racist operating culture as a guiding value of Finnish universities of applied sciences. Fundi EU's Asylum, Migration and Integration Fund.
- VIHTA – Digital Solutions for Green Work project will cultivate green and digital work for the future. Project is created to support and educate advisors who work in counselling for unemployed or entrepreneurs. Some of them are immigrants thar are a huge potential for Helsinki-Uusimaa region. Project focuses on contents, innovations, facilitation, service design, anticipation, counselling, and guiding that will increase and improve digital and

green work in the society. Funding European Regional Development Fund 2021-2027. National funding for Helsinki-Uusimaa Region.

- VITALISE Virtual Health and Wellbeing Living Lab Infrastructure. Funding H2020.
- VoimaProfi: Empowering people Towards socially inclusive society, national funding (Ministry of Education RDI development funding).
- What about us, Europe: An international project about European values and demoratic participation in European cities (Germany: Cologne; France: Paris; Portugal: Aveiro; Estonia:Talinn pus more).

9. Conclusion

The InCITIES WP2, in a step-by-step pathway, plans incrementally HUBs implementation to co-create research strengths starting from knowledge co-creation around small groups of multidisciplinary researchers (public policies sciences, social sciences, engineering, and informatics) of each HEI partner (internal involvement) and progressively engaging more researchers, students, and partner organisations from the surrounding ecosystems (external involvement). Within WP2 this deliverable concerned the work package 2 Research and Innovation InCITIES thematic HUBs and more particularly the task 2.1 Knowledge HUB building.

A step-by-step approach has been proposed to set the basis of the knowledge HUBs on research and innovation; a survey has been launched in each HEI partner to collect current "hot" research topic and relevant research topic for the next 5 years for each one of the 7-thematic areas chosen to structure the InCITIES project.

The contributions received have been processed and aggregated when relevant in a co-construction process using email exchange and consolidation workshops.

Globally, it can be said that the approach was successful with more than 230 contributions received coming from 60 researchers working in the 5 HEI partners.

The second positive point is that most of the contribution received have been aggregated in relevant subtopic and involved at least two project members; this will be a good basis for developing collaborative work in the follow up of this task (work to be done in task 2.2).

A third positive point is that during the survey, a huge collection of scientific references and relevant projects has been gathered and will be shared between the partners to extend their cross knowledge.

Of course, this approach has also some limitations: the survey has been conducted among a limited number of researcher and the list of research topics identified could not be considered as exhaustive, but more as a "sample" of the research activities conducted by the HEI partners. This was mainly due to the limitation in term of time and resources; it is clear that in a next step it will be necessary to enlarge the circle of research concerned.

Another remark is that the approach followed leads to a structure which seems to be more "system and technical" oriented than organisational and societally oriented, with difficulties for some social sciences researchers to find their way in the subtopics. This is the result of a more important presence of engineering researchers than social sciences in the sample, but also of the overlapping between the 7 topic areas used.

Synthesis of the research contribution

It is quite difficult to synthetise shortly all the contributions received; so, we will present here the sub-topics identified.

- <u>Questioning urban transition</u>: welfare futures, democracy enhancement, justice and inclusion by spatial design, circular economy, citizen's behaviour, needs and expectations, enablers of change.
- <u>Nature in the city</u>: sustainable production from nature, adaptation (mitigation) connected to climate changes risks, cross cutting: Governance, citizen engagements.
- <u>Energy in the City</u>: energy management, decentralized production, sustainability assessment of energy systems; energy communities, energy modelling and prediction.
- <u>Digital transition</u>: cybersecurity and security, sensors in smart cities, business models for smart cities, metrics and analytics, urban planning and management, digital twins, inclusive digitalisation, RFID and radio-wave propagation in smart cities, AI impacts on humans.
- <u>Vulnerability, inclusion, and health in the city</u>: multidimensional inequalities and vulnerabilities, pollution and health impacts, accessibility and disability situations, vulnerable groups and healthcare solutions, wellbeing economy, vulnerability, and crisis management.
- <u>Mobility</u>: travellers' needs toward inclusive mobility, first and last mile urban logistics, cycling systems design, transport operations modelling, intelligent transport systems and transformation of mobility, monitoring travel behaviour, interventions in public spaces.
- <u>Sustainable and resilient cities</u>: environmental wellbeing impacts analysis, role of cities in circular economy implementation, infrastructure and territorial resilience, transformative policies analysis, understanding risks.

Various dimensions appeared in several sub-topics:
- Inclusivity
- Citizen needs and behaviour
- Modelling from different data sources, in order to plan, to assess or to develop
- Definition of policies based on case studies

Next steps

The WP2 step-by-step pathway, plans incrementally HUBs implementation to co-create research strengths starting from knowledge co-creation around small groups of multidisciplinary researchers (public policies sciences, social sciences, engineering, and informatics) of each HEI partner (internal involvement) and progressively engaging more researchers, students, and partner organisations from the surrounding ecosystems (external involvement).

In the next task of WP2, the research contributions identified will be consolidated by a second round of discussion between researchers; scientific online workshops will be organized to give the opportunity to make presentation of the research done and to open also the possibility to present research project to get some new collaboration. Launching common publication will be also done as well as the analysis of the upcoming Horizon Europe call for proposals.

In parallel, the research document will be shared with some stakeholders identified in the project proposal by online meeting or taking opportunities of conferences like TRA 2024 or POLIS conference 2023 and 2024.

10. ANNEX

10.1 Annex 1: Template used

Hub topics (please tick the topic you are concerned with):

Questioning urban transitions (Critically assessing urban transitions including the role of the cities in society and citizen participation)

Nature in the city (Assessing greening to capture CO2 and cool areas, Cultivations in urban areas, Developing biodiversity in urban areas)

Energy in the city (Power supply, Energy consumption, Energy production, Innovative energy management)

Vulnerability, inclusion, and health in the city (Studying exposure to pollution, critically assessing inequalities, inclusion, exclusion; Services and their accessibility for vulnerable population)

Mobility (Sustainable and smart mobility, Shared mobility)

The Digital transition (Addressing the effects of digitalization, Business transformation, Transformation of uses)

Sustainable and resilient cities (Management mode at city level, strategic vision; Adaptability to natural and social crises: climate change, health crisis, terrorism)

Question 1: please indicate three "hot topics" that are considered currently in your organization-research department-laboratory in relation with the Hub topic
Nb: for each "hot topic", please develop in 5-10 lines, and indicate the approach used; if publications are available, please put the more significant one at the end of the paper

Question 2: please indicate three "hot topics" that should be considered in a 5 five years period by your organization-research department-laboratory in relation with the Hub topic
Nb: for each "hot topic", please develop in 5-10 lines, and indicate the approach that could be used and the potential needs for partnership with cities, local authorities, or other stakeholders

Publications (not only academic papers, all categories of publications are welcome, but in English):

Current projects related to the topic (please indicate if it is a local, national, or European project):

10.2   Annex 2: Photos from online workshops
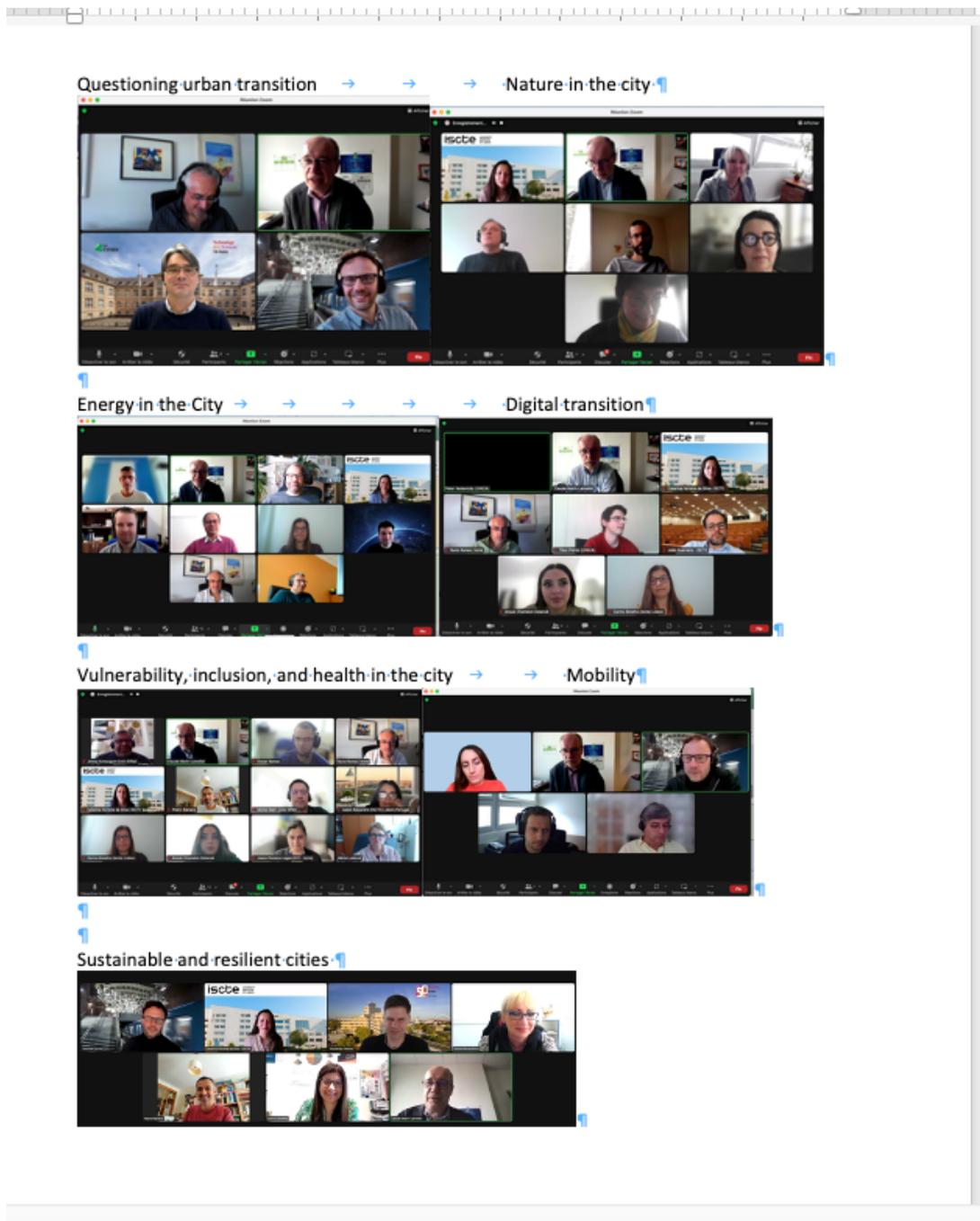
Key stakeholders review on urban issues
Associated partners, local stakeholders, and technology transfer offices

The InCITIES project aims to achieve the transformations of HEIs (Higher Education Institutions) and their surrounding ecosystem both centred on **cities' needs of inclusion, sustainability and resilience**. Its specific focus on widening countries (Portugal and Slovakia) will allow overcoming structural, sociocultural, economic, political, and institutional barriers.

The InCITIES project identified research contributions to be shared with some stakeholders identified in the project proposal.

It is in this context that we need your support; **please check the seven following tables and for each thematic Hub indicate if a subtopic is clearly missing according to your expectations** and what should be for you the **top three "subtopics for the next 5 years" to select for inclusion in a research roadmap.**
In the InCITIES workpakage 2, a step-by-step approach has been proposed to set the basis of the knowledge HUBs on research and innovation; a survey has been launched in each HEI partner to collect current "hot" research topic and relevant research topic for the next 5 years for each one of the 7-thematic areas chosen to structure the InCITIES project.

The contributions received have been processed and aggregated when relevant in a co-construction process using email exchange and consolidation workshops.
The approach was successful with more than 130 contributions received coming from 60 researchers working in the 5 HEI partners. Another point is that most of the contributions received have been aggregated in relevant subtopic and involved at least two project members; this will be a good basis for developing collaborative work in the follow up of this task (work to be done in task 2.2).

If you have any question, please ask your InCITIES contact point in your country.

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Thematic HUB 1 - Questioning urban transition

Your input here:
-   Do you think that a subtopic is clearly missing according to your expectations? If yes could you give us a short description?

………..

………..
-   What should be for you the top three subtopics to select for inclusion in a research roadmap? (*example: 3-5-6*)

……………………………………………………………………………………………

Subtopic	Hot Research topic	Research topic in 5 years
1. Welfare futures	• Welfare Infrastructures • Versatile and sustainable healthcare research	• Community-Wellbeing • Future topics for Sustainable and Versatile social and healthcare
2. Democracy enhancement	• Housing, Neighbourhoods and Public Spaces • Citizen Participation • Pan-European Living Labs / Democracy interventions • Self-organisation • Coherent Security research	• The Digital City • Citizen participation in the design of the built environment • The Democratic City
3. Justice and inclusion by spatial design	• Just and Inclusive city • New Perspectives for an inclusive future of roças in São Tomé and Príncipe • Land Use and Transport Integration (LUTI)	
4. Citizen's behaviour, needs and expectations	• Mobility and Transports • Psychology & Sustainability &narratives to support behavioural change	
5. Enablers of change		• Transition management • Psychology & Sustainability • Rapid / radical change • Divided cities and communities • Insider Activism in Organisations and communities

Thematic HUB 2 - Nature in the city

Your input here:
- Do you think that a subtopic is clearly missing according to your expectations? If yes could you give us a short description?

………..
- What should be for you the top three subtopics to select for inclusion in a research roadmap? (*example: 3-5-6*)

………**

Subtopic	Hot Research topic	Research topic in 5 years
1. Protection of nature	• Good practice to increase the biodiversity in cities	• Integrating the natural world into urban life
2. Sustainable production from nature	• Food security and transitions towards sustainability: Diagnosis in urban contexts • Food security: public policies in urban contexts • Agriculture in metropolitan areas: case studies • Home farming of macroalgae • Proximity Food Systems • Food growing in urban gardens • Recycled materials for urban gardens	• Distributed Ledger Technologies for food provenance • Proximity food systems: empowering smallholder farming & local stakeholders • Nexus soil-water-food for gardening in resilient cities
3. Adaptation (mitigation) connected to climate changes risks	• Nature as transformative power in the day-to-day production and management of the city (to be confirmed) • Living Walls • Nature-based solutions (NbS) • Climate resilience of cities • Social-ecological vulnerability and resilience • Ecosystem services for hazard mitigation	• The main challenges regarding food security within urban and metropolitan contexts • Detection of plant response to determine the health status • Biomonitoring of green walls • Potential of green-blue infrastructure in urban landscapes • Evaluation of green-blue urban infrastructure measures • Modification of plant-related microbiota • Identify innovative models (formal and informal) of naturalization of the habitat in its various scales
4. Cross cutting: Governance, citizen engagements		• Nature as new agent in the production of the city • Urban farming

Thematic HUB3 - Energy in the City

Your input here:
- Do you think that a subtopic is clearly missing according to your expectations? If yes could you give us a short description?

………..

- What should be for you the top three subtopics to select for inclusion in a research roadmap? (*example: 3-5-6*)

…….

Subtopic	Hot Research topic	Research topic in 5 years
1. Energy management	• Energy demand • Optimal Energy management of vehicles and transport systems	• Sustainable power supply • Energy consumption and environment • Energy management of local and global smart grids for integrated housing and mobility use
2. Decentralized production	• Local Clean-Energy • Individual Energy production	• Energy production • Distributed ledger technologies for energy empowerment
3. Sustainability assessment of energy systems	• Life cycle assessment of electric and hybrid vehicles • Battery modelling and testing for a better understanding and prediction of lifetime • Energy and environment • Policy for Sustainable power supply, Energy consumption	• Energy and the transformation of services • Life cycle assessment consolidation • How digital transition affects the production and consumption of services • Natural resources (strategic perspective)
4. Energy communities	• The energy supply in the cities • The renewable energy use for charging storage batteries and green hydrogen production • Decentralised charging management of electric vehicles/Decentralised power grid control • Collecting best practices for citizens collaboration using electric energy, e.g. common district battery storage • Sector-Coupling of Electricity, Heat & Cold and Transport including Energy Storage • Roaming service for electric vehicle charging using blockchain-based digital identity	• Introduction of local electricity generation grids using renewable energy at the scale of a district in European cities • 100% power supply with renewable energies • Organisation and market introduction of long-term storages • Citizen involvement in regional power generation with renewable energies.
5. Energy modelling and	• Artificial intelligence to classify the energy performance • Prediction of future energy consumption demand	• Future's energy generation • Energy Poverty

prediction	• Predictive modelling of building energy consumption	

Thematic HUB 4 - Vulnerability, inclusion, and health in the city

Your input here:
- Do you think that a subtopic is clearly missing according to your expectations? If yes could you give us a short description?

…… …………………………………………………..
……..

- What should be for you the top three subtopics to select for inclusion in a research roadmap? (*example: 3-5-6*)

………………………………………………………………………………

Subtopic	Hot Research topic	Research topic in 5 years
1. Multidimensional inequalities and vulnerabilities	• Vulnerability of people in their mobility • Territorial inequalities • Place-based inequalities • Understanding vulnerability (different types of vulnerability) and assessing the degree of vulnerability of the population (society) in the city • "How I Feel" - Europeans' perceptions of well-being • Energy crisis and mobility inequalities	• New vulnerable people in their mobility • Inequality reduction • Links between income inequality and increase in inequality in mobility
2. Pollution and health impacts	• Effect of pollution (noise, air pollution) on health • Studying exposure to pollution • Air pollution • Environmental inequalities • Automated measurement of negative environmental factors • Data analysis and visualisation applied to pollution	• Effect of air pollution and noise on populations in urban areas • Air quality
3. Accessibility and disability situations	• Mobility and disability situations • Services and their accessibility for vulnerable population	• Services and their accessibility for vulnerable population • Mobility and disability situations • Inclusive Mobility - Accessibility for the Disabled - Design

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			of a Barrier Free Environment
4. Vulnerable groups and healthcare solutions	• Inequalities in access to city resources (health, housing…), and specifically for vulnerable populations • Ambient assisted living • Versatile and sustainable healthcare research		• The health - mobility – sustainability tryptic • Health-oriented planning • Promoting an ambient assistant living for elderly people • Sustainable and Versatile social and healthcare
5. Wellbeing economy	• Health issues and their economic and societal impact • Urban housing affordability • Economic and social costs of mobility related casualties		• Assessment of the developments and impact of DLT and blockchains for social good and inclusiveness • The impact of technological development, globalisation and ageing
6. Vulnerability and crisis management			• Reducing the vulnerability of the population and increasing the preparedness of the population for crisis situations

Thematic HUB 5 - Mobility

Your input here:
- Do you think that a subtopic is clearly missing according to your expectations? If yes could you give us a short description?

……..

……..
- What should be for you the top three subtopics to select for inclusion in a research roadmap? (*example: 3-5-6*)

……………………………………………………………………………………

Subtopic	Hot Research topic	Research topic in 5 years
1. Travellers needs toward inclusive mobility	• Transport systems design and planning for social equity • Researches on vulnerable categories and dependency on mobility • Travel experience and worthwhile travel time	
2. First and last mile urban logistics	• Last-mile logistics urban delivery using e-cargo bikes • Last-mile	• Urban Freight Logistics
3. Cycling systems design	• Bike-sharing systems in urban settings • The design of the bicycle infrastructure	

4. Transport operations modelling	• Public transportation disruption: how to prevent it • Mobility in the field of Urban Engineering • Mobility in the Transport modelling • Travel time • Accessibility of ordinary destinations	• Accessibility of ordinary destinations, Mobility in the Transport modelling • Impact assessment of mobility services • Explicitly internalise the quality of the travel experience in transport planning
5. Intelligent Transport Systems and transformation of mobility	• Services for intelligent transport applications • Technological innovation and their place in the transformations of the mobility services and practices	
6. Monitoring travel behaviour	• Consideration of citizens´ views to plan new mobility services • Continuous travel surveys • Mobility knowledge tools (observation techniques, data, models) • Latest and future mobility trends • Demand and capacity forecasting for transport systems • TrendAuto2030plu**s**	• Urban Mobility of Citizens • Sustainable city tourism mobility • Mobility and Transports • Continuous travel surveys
7. Interventions in public spaces	• Greencity4Aging • Traffic calming in cities • Sustainable Urban Mobility Planning	• Capacity building for Local Authorities to plan and implement new mobility services • Complementarities of transport modes and promotion of more sustainable service for first and last-mile mobility

Thematic HUB 6 - Digital transition

Your input here:
- Do you think that a subtopic is clearly missing according to your expectations? If yes could you give us a short description?

………..
………..
- What should be for you the top three subtopics to select for inclusion in a research roadmap? (*example: 3-5-6*)

……………………………………………………………………………………………

Subtopic	Hot Research topic	Research topic in 5 years
1. Cybersecurity and security	• What is a cyber-secure smart city? • Coherent Security research • Identification and analysis of vulnerabilities potentially enabling cyber attacks	• Coherent Security • Classification and definition of the characteristics and functionalities of methods and tools for semi-automated and automated testing of potential vulnerabilities
2. Sensors in smart cities	• Smart Cities • Environmental smart cities, environmental low-carbon mobility • Sensors and micro-systems for the analysis of complex environments	• Sensing cities: Using sensors for environmental data through citizen sensing
3. Business models for smart cities	• The impact of Artificial Intelligence for Businesses in an integrated and Smart Society • A new landscape of Extended Realities and its implications for businesses and society • TrendAuto2030plus • Service Business and Circular Economy Research-digitalisation in business development	• Development of new business models for the digital services that are offered by a smart city • Distributed Ledger Technologies
4. Metrics and Analytics	• Metrics • Urban Data and Analytics • The University as a driver of innovation, transformation and relations between stakeholders	• Digital Transition and Data Uncertainty • Analysis of data from highly innovative cities and local data collection Digital Transition and Data Privacy • Speed, veracity, data protection, storage and sharing
5. Urban planning and management	• How can the digital footprint of citizens and smart cities infrastructure be used to develop sustainable, new and more satisfying experiences for all the stakeholders in the society • Artificial Intelligence to increase process efficiency • Services and Digital transition • Distributed Ledger Technologies (also related with HUB 4) • Transport in buildings, especially Rope-Free, Linear Driven Elevators • Revolution in architecture and urban planning	• How digital transition affects the production and consumption of services • the use of home digital platforms to manage energy consumption and domestic tasks (cooking, cleaning) • the impacts of the use of digital media in the households uses/appropriation of the several domestic spaces • Simulation and optimization of new transport systems for the last-mile. • Connecting cities and rural areas

6. Digital twins	• Digital Twins • Communication technologies and digital infrastructure for CCAM	• Communication technologies and digital infrastructure for CCAM • Self-Sovereign Personal Digital Twin Wallet
7. Inclusive Digitalisation	• Assessment of the impact of the Digital Transition on vulnerable population • Inclusive digital transition	• Acceptability of the Digital Transition • Assessment of the impact of the Digital Transition on vulnerable population • Innovative and inclusive practices of telecare
8. RFID and Radio-wave propagation in smart cities	• Radio-wave propagation and radiating devices in complex electromagnetic media and environments • Monitoring of civil engineering infrastructures based on RFID technologies and machine learning • Radio frequency identification (RFID) devices for applications in transport and civil engineering	• Information security of RFID systems
9. AI impacts on humans		• Human vs. AI creativity • Transhumanism (integrating the technology in human beings) • Technology to drive pro-environmental behaviours

Thematic HUB7 - Sustainable and resilient cities

Your input here:

- Do you think that a subtopic is clearly missing according to your expectations? If yes could you give us a short description?

………..

………..

- What should be for you the top three subtopics to select for inclusion in a research roadmap? (*example: 3-5-6*)

………………………………………………………………………………………

Subtopic	Hot Research topic	Research topic in 5 years
1. Environmental wellbeing impacts analysis	• Climate-health problems • The benefits of reducing the emission load of the environment • Environmental inequalities	• Urban air quality • Increasing the energy efficiency of the wastewater treatment considering greenhouse gas emissions
2. Role of cities in circular economy implementation	• Sustainable circular economy • Service Business and Circular Economy Research	• Implementation of a sustainable circular economy for inner city's waste streams focusing on the production of secondary raw materials • Service Business and Circular Economy • Management of urban waste under the new imperative of circular management
3. Infrastructure and territorial resilience	• The importance of the site and optimising the potential of localisation • How smarts buildings can contribute to the protection and conservation of energy and hydric resources • Analysis of interdependent critical infrastructures • Spatial risk and rescue analyses • Affordable housing • Design phase for sustainable building exploration	• How a smart/intelligent building can contribute to the development of smart cities • The use of new technologies for the management of smart cities • Urban Design against Climate Change
4. Transformative policies analysis	• Transition, adaptation and resilience • Sustainable policies • Transitions in the mobility system, transformation of the system of actors • Energy sobriety and the implementation of the transition	• Big data and knowledge-based democracy (to be confirmed) • Public policies in the path towards making cities and buildings smarter • Evaluation of city-sustainable development • Climate-Digital Development Policies

		• Territorial trajectories and mobility	
5. Understanding risks	• Social vulnerability and resilience • Adaptivity & Resilience • Consensus Modelling		• Inventory of hazards, exposure and vulnerability of population and assets, potential hazard impacts and a ranked risk profile