Inspire Policy Making with Territorial Evidence

FINAL REPORT //

DIGISER

Digital Innovation in Governance and Public Service Provision

Annex 1.2.4 Change Management Report // April 2022

EUROPEAN UNION

Coordination
ESPON EGTC: Martin Gauk, Caroline Clause

Authors
OASC: Martin Brynskov, Geni Raitisoja, Margarida Campolargo,
IS-practice: Hugo Kerschot
Politecnico di Milano: Prof. Grazia Concilio, Dr. Irene Bianchi, MSc. Francesco Fagiani, Dr Matteo Fontana, Dr. Ilaria Mariani, Dr. Michelangelo Secchi, with the support of MSc Mathyas Giudici, MSc Giulia Mussi, MSc Federico Rita
CPC: Dr. Isaac Sserwanja, Bin Guan, Dr. Reza Akhavan
Deloitte: Diogo Santos, Jean Barroca, Ana Vaz Raposo, Ana Robalo Correia, Andreas Steinbach, João Carvalho Fachada

Advisory group
Kadri Jushkin (Ministry of Finance Estonia), Eedi Sepp (Ministry of Finance Estonia), Akim Oural (Lille Metropole), Paulo Calçada (Porto Digital), Markku Markkula (Helsinki-Uusimaa Region), Lodewijk Noordzij (Eurocities), Wim De Kinderen (ENoLL), Olli Voutilainen (Finnish Ministry of Economic Affairs and Employment), Tanguy Coenen (imec), Martin Brynskov (Aarhus University), Gianluca Misuraca (Krems University), Serge Novaretti and Stefanos Kotoglou (EC-DG Connect), Bert Kuby (Committee of the Regions), Paresa Markianidou (Technopolis Group)

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Abbreviations

API	Application Programming Interface
DESI	Digital Economy and Society Index
DIGISER	Digital Innovation in Governance and Public Service Provision
DIGISURVEY	The survey deployed during DIGISER with 255 respondent cities
DPSVI	Digital Public Value Service Index
EAB	European Advisory Board
EDCI	European Digital City Index
EIF	European Interoperability Framework
ESPON	European Spatial Planning Observation Network
EU	European Union
EU ODP	European Union Open Data Portal
FUA	Functional Urban Areas
GDC	Green Digital Charter
GDP	Gross Domestic Product
GDPpc	Gross Domestic Product per Capita
GDPR	General Data Protection Regulation
ICC	Intelligent City Challenge
ICT	Information and Communications Technology
KPI	Key Performance Indicator
LAU	Local Administrative Units
LEA	Learning Technology Accelerator
NUTS	Nomenclature of Territorial Units for Statistics
OASC	Open and Agile Smart Cities
OECD	Organisation for Economic Co-operation and Development
OGD	Open Government Data
PA	Public Administration
PCP	Pre-Commercial Procurement
Q_	Question (in Digiser Survey)
R&D	Research and Development
SAB	Scientific Advisory Board
SAG	Scientific Advisory Group
SDGs	Sustainable Development Goals
SEM	Structural Equation Modelling
SI	Service area Index
T-LL	Triple-Loop Learning
ToR	Terms of Reference
UNDP	United Nations Development Programme
Reference Sample	It refers to 156 cities intended to be the best approximation attainable that could be considered as representative of the variety of European cities.

1   Introduction

This document present one part of the results of the analysis of the DPSVI, the Digital Public Service Value Index.

One of the main goals of DIGISER has been indeed the development of indicators capable of capturing and synthetically describing the performance of cities in the digital transition and their ability to drive this transition towards the creation of public value. This work resulted in the development of the DPSVI, Digital Public Service Value Index (DPSVI), that is reported in detail in the *Annex 1.1 Extended Methodology.*

In summary, the DPSVI is conceived as a multi-level composite index, nourished by primary data collected through a questionnaire (DIGISURVEY) targeting European cities.

These data have been processed and combined to feed a system of composite indicators that provide a synthetic assessment of the performance of cities in relation to complex phenomena underlying digital transformation in European cities.

1.1   DPSVI Definition and structure

The DPSVI and its other sub-indices are meant to be a concise **measurement of the performance of each city** with respect to several phenomena, that are explored through the combination and cross-checking of the answers to several single questions.

The core data model for the computation of the DPSVI, developed on top of the conceptual framework described in the *Annex 1.1 Extended Methodology,* is represented in the following picture:
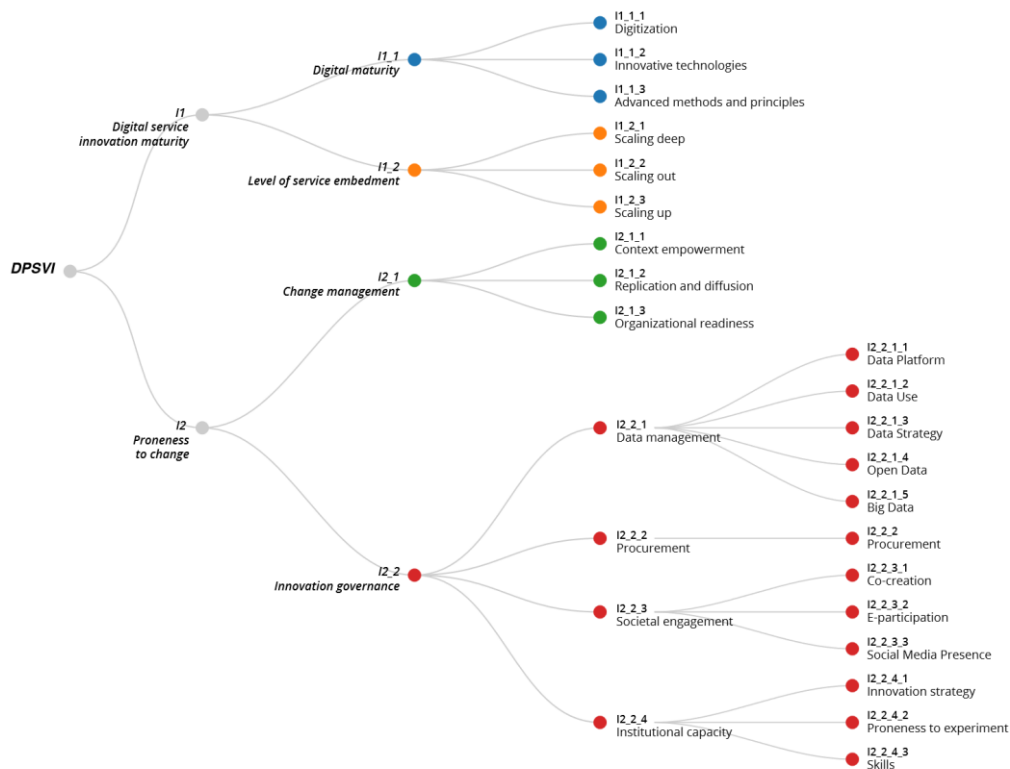

Figure 1 - DPSVI Structure

Overall, the DPSVI is composed of 31 Composite indexes that are organized in three groups (cfr. Table 1 - Composite indexes of DPSVI:

- 3 Top Indexes: are the apical indexes including the DPSVI itself and the two pillars (I1 DIGITAL SERVICE INNOVATION MATURITY and I2 PRONENESS TO CHANGE)

- 21 Bottom Indexes: the indexes directly generated on top of DIGISURVEY data

- 7 Intermediate Indexes: the other indexes in intermediate positions

Code	Label	Level	Description
I1	**DIGITAL SERVICE INNOVATION MATURITY**	**Top**	**It explores the degree of penetration and maturity of technical and organizational innovation in public service delivery**
I1_1	Digital maturity	Intermediate	It assesses the level of digitalization of the public authority, intended not only as shift toward digital technologies, but also encompassing the related organizational change, namely the delivery of innovative public services
I1_1_1	Digitization	Bottom	It focuses on the degree of digitization of pre-existing internal procedures either ancillary or directly related to public service delivery
I1_1_2	Innovative technologies	Bottom	It explores the degree of adoption of innovative technologies (AI, blockchain, wearables, etc.)
I1_1_3	Advanced methods and principles	Bottom	It analyses the level of consistency of methods and principles used to increase the digitalization level of the public authority
I1_2	**Level of service embedment**	Intermediate	It indicates the extent to which the innovation of services is pervasive and has already generated changes
I1_2_1	Scaling deep	Bottom	It indicates the extent to which the innovation of services is pervasive and has already generated changes in the local context, at societal level
I1_2_2	Scaling out	Bottom	It indicates the extent to which the innovation of services has already generated changes either by replicating successful innovations from other contexts or exported elsewhere the innovations experimented locally
I1_2_3	Scaling up	Bottom	It indicates the extent to which the innovation of services is pervasive and has already generated changes within the organization of the public authority
I2	**PRONENESS TO CHANGE**	**Top**	**It assesses the inclination or readiness of the public authority to change and alter its behaviour, vision, procedures, and its preparedness to integrate and amplify innovations**
I2_1	Change management	Intermediate	The capacity of public administrations to put in play a set of actions, norms, policies, and tools either to proactively support innovation in digital service development and provision, or to increase its capacity to detect and adopt innovation dynamics developed in different contexts (within the context, or towards or from other contexts).
I2_1_1	Context empowerment	Bottom	It measures the effectiveness of the strategies, developed by the public authority, to ensure impacts of innovation within in the local context, at societal level, e.g. instillation of cultural values oriented to innovation and change; encouragement for the development of sustainable relationships
I2_1_2	Replication and diffusion	Bottom	It measures the effectiveness of the strategies developed to ensure replicability in other contexts to the innovations experimented locally, so to impact a larger number of citizens or communities
I2_1_3	Organizational readiness	Bottom	It measures the effectiveness of the strategies developed to ensure impacts of innovation within the organization of the public authority
I2_2	Innovation governance	Intermediate	It refers to the way in which the public authority uses transversal administrative processes (data management, societal engagement, public procurement, capacity building) as a leverage to promote cross-sectoral digital innovation
I2_2_1	Data management	Intermediate	It assesses the innovation capacity of data management strategies used by the public organization
I2_2_1_1	*Data Platform*	Bottom	It assesses the features of the data platform and the consistency between data management strategy and its underlying technical infrastructure
I2_2_1_2	*Data Use*	Bottom	It explores, from an operational perspective, how data are used by the public administration for the purposes of evaluation and monitoring, delivery, and anticipation and planning.

Code	Label	Level	Description
I2_2_1_3	*Data Strategy*	Bottom	It investigates whether the definition and the embrace of govern-ance models effectively set appropriate and favorable conditions for data-driven, data-informed, or data-aware decisions and ser-vices for creating public value.
I2_2_1_4	*Open Data*	Bottom	It provides an overview of the degree of application of open data principles, practices, and framework, that are meant to improve performance and efficiency of government services in general
I2_2_1_5	*Big Data*	Bottom	It refers to the capacity of the city to generate, manage and use big data
I2_2_2	Procurement	Bottom	It assesses the level of digitalization of the public procurement processes within the public authority and their orientation to digi-tal innovation
I2_2_3	Societal engage-ment	Intermediate	It provides an overview of the intensity and level of digitalization of societal engagement policies, and their impact on public service design and innovation
I2_2_3_1	*Co-creation*	Bottom	It gives the level of involvement of the citizens in service design and innovation
I2_2_3_2	*E-participation*	Bottom	It refers to the level reached by the municipality in involving citi-zens and/or communities through digital platforms
I2_2_3_3	*Social Media Pres-ence*	Bottom	It provides information about how pervasive is the communication via social media by the municipality
I2_2_4	Institutional capac-ity	Intermediate	It refers to the institutional capacity of the public authority in rela-tion to the experimentation and consolidation of digital innovation
I2_2_4_1	*Innovation strat-egy*	Bottom	It provides information about the agenda setting and pursuing ca-pacity in relation to digital innovation strategies
I2_2_4_2	*Proneness to ex-periment*	Bottom	It analyses the readiness to experiment new organizational set-tings and methods within the public authority
I2_2_4_3	*Skills*	Bottom	It assesses the availability, within the public authority, of skills as key to the management of digital innovation

Table 1 - Composite indexes of DPSVI

1.2 DPSVI Methodology

The computation of indexes followed three steps.

- **Mapping** In this first step the DIGSURVEY's questions and answers are mapped to the indexes

- **Standardization**: this second step aims at transforming each question mapped to an index in a standardized value on the scale 0,00-1,00, converting the raw answers provided by the cities into numerical values via data coding and/or standardization techniques.

- **Aggregation**: in this final step the standardized numerical values obtained from the questions are aggregated and combined into indexes according to the hierarchy established in the Data Model. The value of indexes corresponds to a weighted average of the values of the questions aggregated.

1.2.1 Mapping questions and answers

The first step of data processing has been the detailed mapping of questions to the 21 Bottom Indexes, that are the ones directly generated on top of the raw data collected with the Digisurvey, while the other indexes are resulting from a successive aggregation between composite indexes.

Figure 2 maps the detailed relation between the questions of the DIGISURVEY and the DPSVI structure and represents the logical basis for the statistical aggregation of data. Chapter 2 includes a detailed description of the branch analysed in this document.

It is important to clarify that in several cases only a limited number of answers (of a given questions) have been mapped to indexes. In this manner the same question could have been used more than once but considering each time only a limited set of possible answers to which has been attributed a different meaning (and consequently a different numeric value). In summary the same question could have been standardized in different manners according to the indexes to which it is associated.
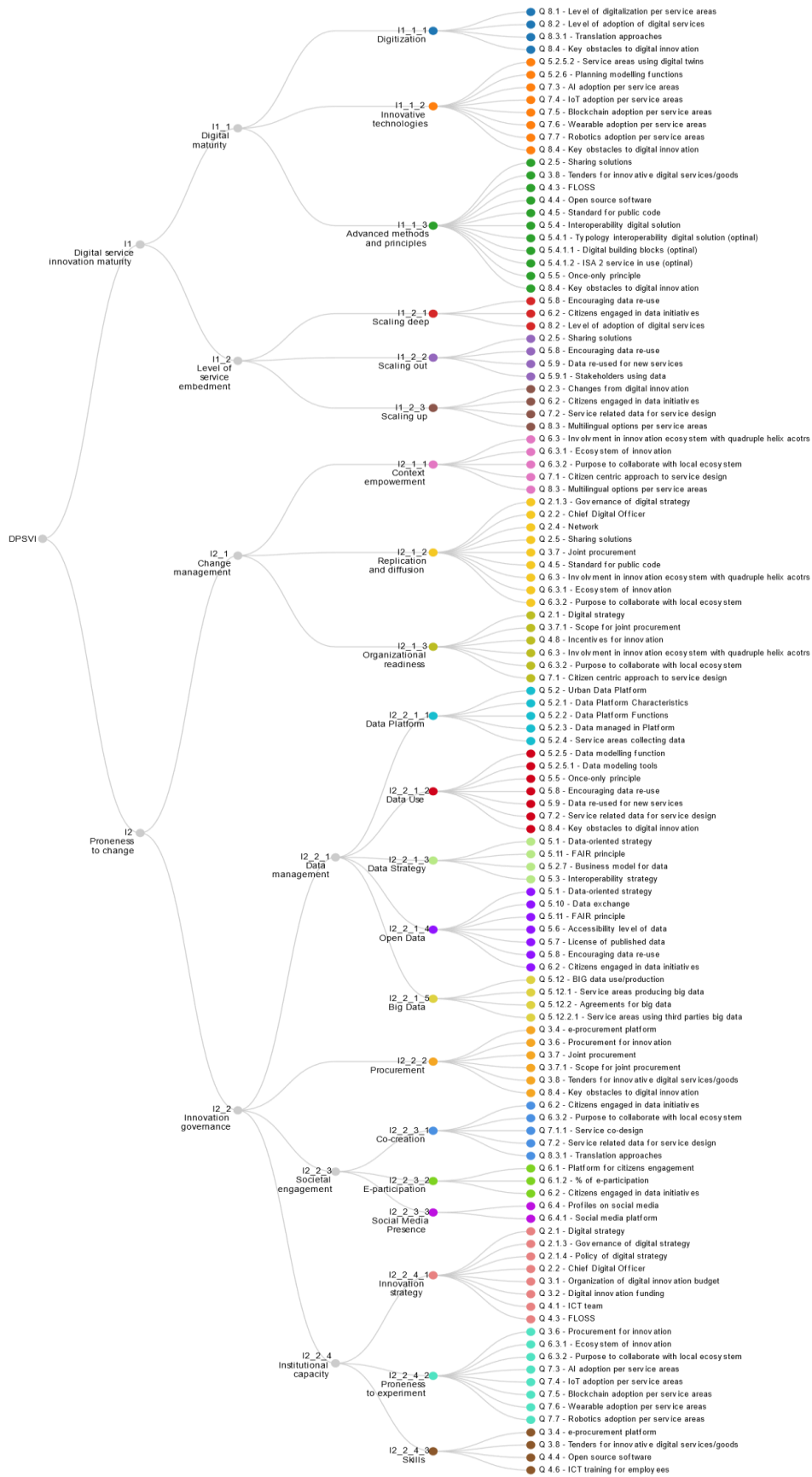
Figure 2 - DPSVI detailed structure – Questions

1.2.2   Standardization

To render the information gathered via the questionnaire processable via computational methods, each question, or group of answers, has been transformed into a number.

In practice, raw data have been replaced by a set of numerical values x_p, where $p = 1, …, P$ and P is the total number of questions, or groups of them.

This operation is usually performed in an ad-hoc way, given the specificities of each item of the questionnaire. Nevertheless, the following table provides a synthesis of the methods for data standardization adopted for each category of question.

Type of question	Standardization methods
Binary	Converted into dummy (0-1)
Single Choice	Converted to cardinal value (e.g., answer A = 1, answer B = 3, Answer 3 =0)
Likert Scales	Converted to correspondent ordinal (e.g., Low = 1, Medium-Low = 2, Medium-High = 3, High = 4)
Multiple Choice / Matrix	Converted into dummies, then (weighted) sum, propaedeutic yes/no are dropped.
Scalars	Normalised using external values (population, size of municipality) if representative of relative phenomena
Matrix – Service Level	Converted into dummies, then summed by column (i.e., process level), finally normalised over number of digitalised services

Table 2 - Standardization methods overview

The *Annex 1.1 Extended Methodology i*ncludes all the information related to the standardization process underlying the DPSVI, including the detailed map of answers to indices and the weight attributed to each answer for standardization purposes.

Before aggregating the numeric answers, these have been rescaled into a 0.00 –1.00 range, so to make them comparable. The mathematical operation that needs to be performed to move these different scales into a unique one, where 0 is the worst possible value and 1 is the best possible one, is the following:

$$x_p^{IT} = \frac{x_p - x_p^{min}}{x_p^{max} - x_p^{min}}$$

Where x_p^{IT} is the rescaled value, x_p is the original value mapped on a generic scale and x_p^{min}, x_p^{max} are, respectively, the minimum possible and the maximum possible value of datum x_p.

1.2.3   Aggregation

In this final phase the standardized values computed on top of the answers to DIGISURVEY questions, are aggregated via a mathematical procedure, with the goal of finally creating the indexes.

After having refined the data to be taken as input, in accordance with the standard literature for this kind of dimensionality reduction task, the indices are introduced as linear combinations of data, that is:

$$I = \frac{\alpha_{n_1^I} x_{n_1^I}^{IT} + \alpha_{n_2^I} x_{n_2^I}^{IT} + … + \alpha_{n_{N_I}^I} x_{n_{N_I}^I}^{IT}}{\alpha_{n_1^I} + \alpha_{n_2^I} + … + \alpha_{n_{N_I}^I}}.$$

The table published in chapter 2 illustrates the different relative weight attributed to each of the question composing the indexes presented in this document.

1.3 Technical note: how to read charts

This report includes a large number of charts and maps that are generated on top of the indexes that make up the DPSVI and in some cases referred to the same underlying questions. This chapter explains how to interpret the legend that accompanies the publication of charts and maps.

1.3.1 Key info for DPSVI charts and Maps

The charts used to represent DPSVI indexes are relatively simple, being limited to radars, columns, box plots. All charts include a legend reporting the following key information:

Index observed	Index type	Index level	Data Sample	Cluster
Indicates the code and the label of the index observed	*Indicates the type of index as either:* • DPSVI • SI	*Indicates the Index position in its Data model:* • Top • Intermediate • Bottom	*Indicates the sample that the data refers to* • All respondents • Reference sample	*Indicates the series showed in the charts and listed in the legend* • Capital cities • Reference sample • Population • GDPPC • Country

Table 3 – Index charts legend

1.3.1.1 Index type

This information identifies the family of index, being either part of the DPSVI tree (Digital Public Value Service Index) or of the SI tree (Service Areas Index)

1.3.1.2 Index level

This information identifies the position of the index in its data model (cfr. Figure 1 - DPSVI Structure)

- **Top**: refers to the three apical indexes, built on top of all the other indexes:

  - DPSVI
  - Digital Service Innovation Maturity
  - Proneness to Change

- **Bottom**: refers to all the indexes generate directly from questions (cfr Figure 2 - DPSVI detailed structure – Questions)

- **Intermediate**: all the other indexes composed by indexes

1.3.1.3 Data sample

This information identifies the sample on top of which data are computed:

- The "**All respondents" sample** is composed by **all the 255 respondent cities** with the exclusion of duplicate questionnaire coming from the same authority (same city at the same administrative level).

- The "**Reference" sample** is composed by a **selection of 155 respondents**. The reference sample is intended to be the best approximation attainable that could be considered as representative of the variety of European cities.

1.3.1.4 Cluster

Data can be grouped in clusters showed as series in the charts and listed in the legend. The cluster considered in the report could be the followings:

- **None**: no cluster, the data refers to the entire sample
- **Capital cities**: comparing the results of capital cities with all the other respondents.
- **Reference sample**: compared results of reference sample and all other respondents.

- **Population**: compared results among cities by population size
- **GDPPC**: compared results among cities by GDP per capita size
- **Country**: compared results among countries
- **Authority Type**: compared results among different types of local government
- **Case Studies**: 10 selected cities also surveyed through qualitative methods

In few cases cluster and possible answers can be switched, in this case the chart visualizes cluster class on the y-axis and the possible answers as chart series.

1.3.2 Key info for Q charts

In few cases the report presents charts referring to some of the questions that make up the indices. The charts used to present questions are relatively simple, being limited to bars and columns, represented in simple, stacked and 100% stacked formats.

All charts include a summary table reporting the following key information:

Question observed	Question type	Data Sample	Clusters	Value
Indicates the code and the label of the question observed	*Indicates the question typology and whether it is a matrix*	*Indicates the sample that the data refers to*	*Indicates the series showed in the charts and listed in the legend*	*Indicates the units in which the data are represented*
	• Single choice • Single choice - Binary • Single choice - Likert • Multiple choice • Matrix - Single choice • Matrix - Likert • Matrix - Multiple choice	• All respondents • Reference sample	• Capital cities • Reference sample • Population • GDPPC • Country	• Count • Percentage

Table 4 – Question charts legend

1.3.2.1 Question type

Within the two macro-categories of simple and matrix questions it is possible to further distinguish between the following kind of questions, each one collecting data in a different manner:

Simple questions typologies:

- *Single choice – Binary*: One single choice between "Yes" or "No"
- *Single choice – Likert*: One choice among items in a Likert scale
- *Single choice*: One choice among all the possible answers
- *Multiple choice*: Possibility to select multiple answers

Matrix question typologies:

- *Matrix - Single choice*: Possibility to select just one answer (column) per row
- *Matrix – Likert*: Possibility to select just one answer per row. The columns are organized as a Likert scale
- *Matrix - Multiple choice*: Possibility to select multiple answers per row.

1.3.2.2 Data sample

This information identifies the sample on top of which data are computed. The samples used for the question charts are the same used for the Indexes (cfr. 1.3.1.3)

1.3.2.3   Cluster

Data can be grouped in clusters showed as series in the charts and listed in the legend. The cluster explored by the report are the same used for the Indexes (cfr. 1.3.1.4).

1.3.2.4   Value

The value indicates the units in which the data are represented along the x-axis.

The data could be represented as:
- *Count*: DPSVI number that select a particular answer
- *Percentage*: relative number of respondents that select that answer.

In the case of clustered bar charts, the percentage is based on the number of respondents to that specific question. In the case of 100% stacked bar, the percentage is based on the total number of selections received by that answer (row 's percentage). The percentage could also be based on the total number of selections received by the question.

2   Change management of European Cities

2.1   Definition of the indices and exploration of its structure

Change management refers to the capacity of public administrations to put in play a set of actions, norms, policies, and tools either to proactively support innovation in digital service development and provision, or to increase its capacity to detect and adopt innovation dynamics developed in different contexts. The notion implicitly acknowledges that innovation can originate either within the institution or within specific service domains. Accordingly, it relies upon the capacity of the organisation to adapt its procedures adjusting to internal and external circumstances, and to create spaces for other agents to engage in processes of governance innovation. Moreover, it is relevant the capacity to include and implement innovative bottom-up initiatives in a strategic way, considering and coordinating different levels of governance that nurtures new interactions and cycles of learning. Encouraging a knowledge economy that spreads across university, industry, government, civic society, and environment, favours the development of a rooted orientation to innovation.

In measuring the inclination or readiness of the public authority to evolve and alter its behaviour, vision, procedures, and its preparedness to integrate and amplify innovations, three key features are examined:

- **I2.1.1 - Context empowerment**, as the capacity to apply logics of replication and dissemination, increasing the quantity of people or communities impacted;
- **I2.1.2 - Replication and diffusion**, as the capacity to impact relationships, cultural values and beliefs, since change is deeply rooted in people, relationships, communities and cultures; and
- **I2.1.3 - Organizational readiness**, as the capacity to change at the level of policy, rules and laws.

Looking at these three features together, it is possible to gain an understanding of the complex, complementary and systemic nature of the strategies involved in advancing large and multi-level structural change. Strategies which require flexibility, adaptiveness, and proneness to learning while being context-aware and context-sensitive.

2.1.1   Mapping Details

The following figure and table include the detailed list of the questions that have been mapped to this index and its sub-indexes, according to the methodology explained in Chapter 1.2.1.
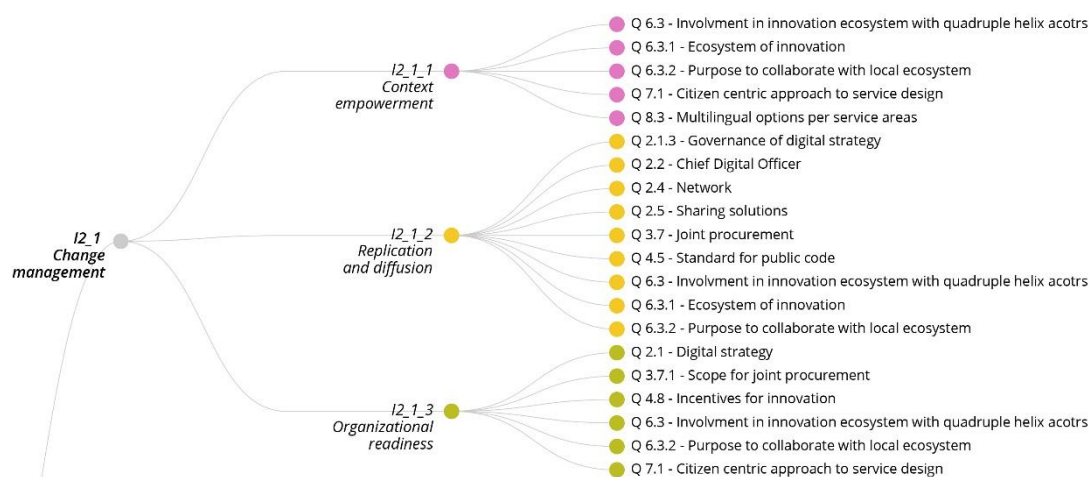
Figure 3 – Change management index composition (questions tree)

The following table includes the text of all questions used to create the Change Management Indexes and information about the type of questions.

Question number and text	Question Type
2.1 Has your public authority formally approved and published a digital innovation strategy (also digital transformation strategy, smart city strategy or similar)?	Single choice
2.1.3 What is the governance of the digital innovation strategy?	Multiple choice

Question number and text	Question Type
2.2 Does your public authority have a Chief Digital Officer (or similar position such as Chief Information Officer / Chief Innovation Officer, etc) coordinating the implementation of the digital innovation strategy?	Single choice
2.4 Is your public authority part of a (local, regional, national, EU) network of cities sharing operational digital solutions or open source code?	Matrix - Multiple choice
2.5 Does your public authority benefit from sharing digital solutions, services or products with other public authorities?	Matrix - Multiple choice
3.7 Does your public authority procure innovative digital services/goods together with one or more public authorities (i.e. Joint Procurement)?	Single choice
3.7.1 What is the main reason to opt for Joint Procurement Procedures?	Single choice
4.5 In the case of open source software code, particularly its development and maintenance, is your public authority applying the Standard for Public Code	Single choice
4.8 If applicable, does your public authority provide incentives (e.g. monetary, internal competitions / awards, etc) encouraging cooperation across service areas:	Multiple choice
6.3 Is your public authority directly involved in ecosystems for innovation together with other actors of the quadruple helix (Academia/Research, Industry, Public Sector, Civic Society)?	Single choice - Binary
6.3.1 If yes, please select as many organisations as apply from the list below	Multiple choice
6.3.2 What is the purpose for your public authority to collaborate with the local ecosystem?	Multiple choice
7.1 Does your public authority adopt a citizen-centric approach when planning new services or updating existing ones as part of the innovation process?	Single choice - Binary
8.3 Indicate the availability of comprehensive multilingual options in the service interfaces of the public authority used by the following service areas	Matrix - Multiple choice

Table 5 – Change Management related Questions in DIGISURVEY

The *Annex 1.1 Extended Methodology* to the DIGISER Final Report hosts a dedicated Appendix (Appendix I) with all the information related to the standardization process underlying the DPSVI, including the detailed map of answers to indices and the weight attributed to each answer for standardization purposes.

2.1.2   Aggregation details

The following table provides information regarding the weights attributed to each question in computing the value of the indexes presented in this report, according to the methodology presented in Chapter 1.2.3.

Q_#	I2_1_1	I2_1_2	I2_1_3
Q_2.1	-	-	100%
Q_2.1.3	-	100%	-
Q_2.2	-	50%	-
Q_2.4	-	100%	-
Q_2.5	-	100%	-
Q_3.7	-	100%	-
Q_3.7.1	-	-	100%
Q_4.5	-	100%	-
Q_4.8	-	-	100%
Q_6.3	6%	10%	20%
Q_6.3.1	27%	45%	-
Q_6.3.2	27%	45%	80%

Q_#	I2_1_1	I2_1_2	I2_1_3
Q_7.1	20%	-	100%
Q_8.3	20%	-	-

Table 6 – Change Management - Relative weight of underlying questions

An extensive overview of the weights used to calculate the DPSVI is available in *Annex 1.1 Extended Methodology.*

2.2 Index overview
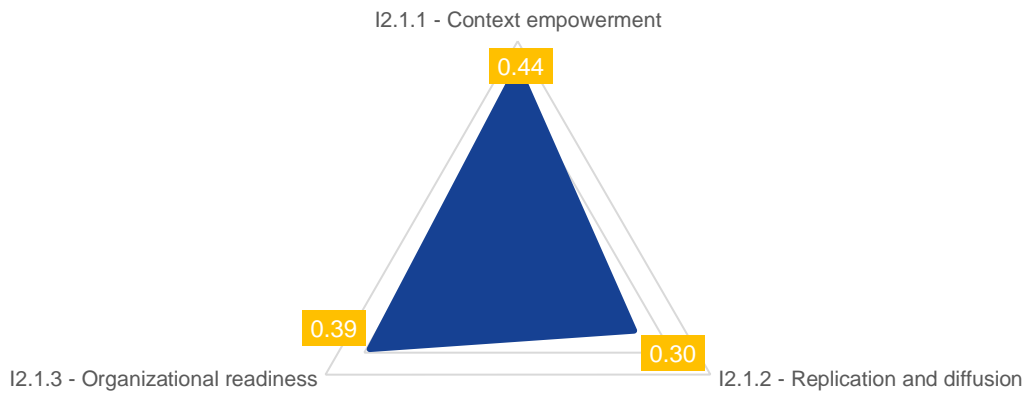
Index observed	Index type	Index level	Data Sample	Clusters
I2.1 - Change management	DPSVI	Intermediate	Reference Sample	na

Figure 4 – Change management overview

Figure 5 - Change management composition

Index observed	Index type	Index level	Data Sample	Clusters
I2.1 - Change management	DPSVI	Intermediate	Reference Sample	na
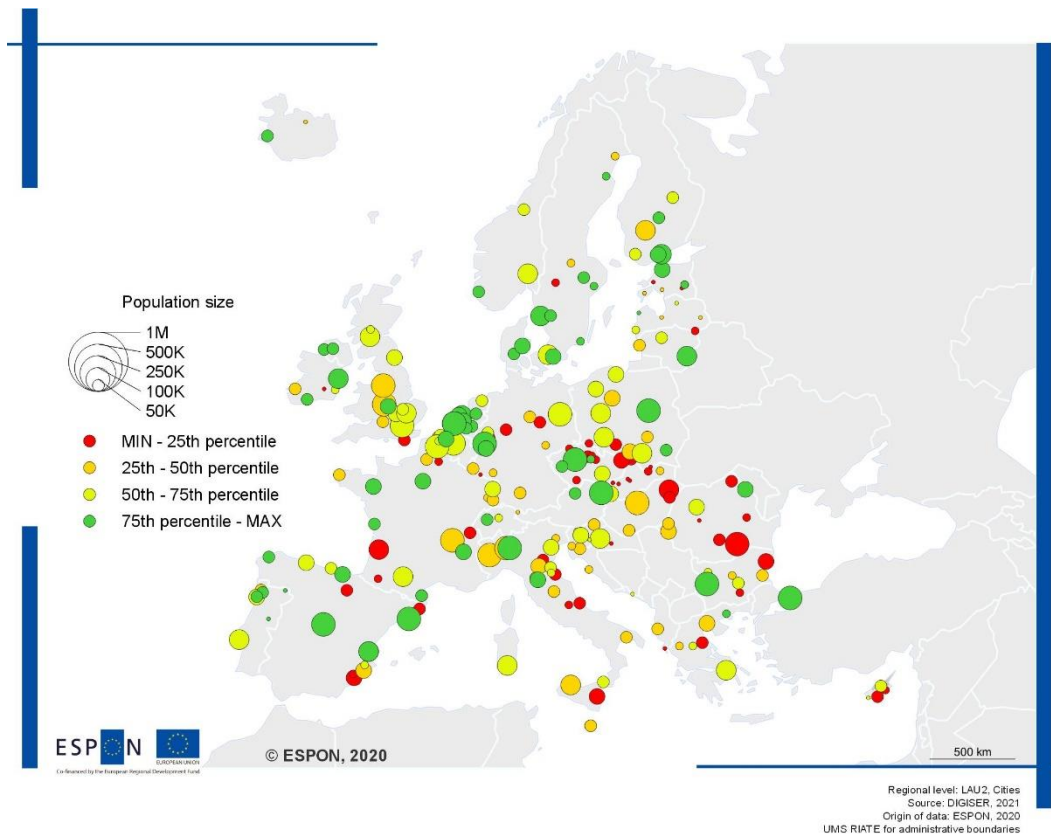
Map 1 – Change management and population size
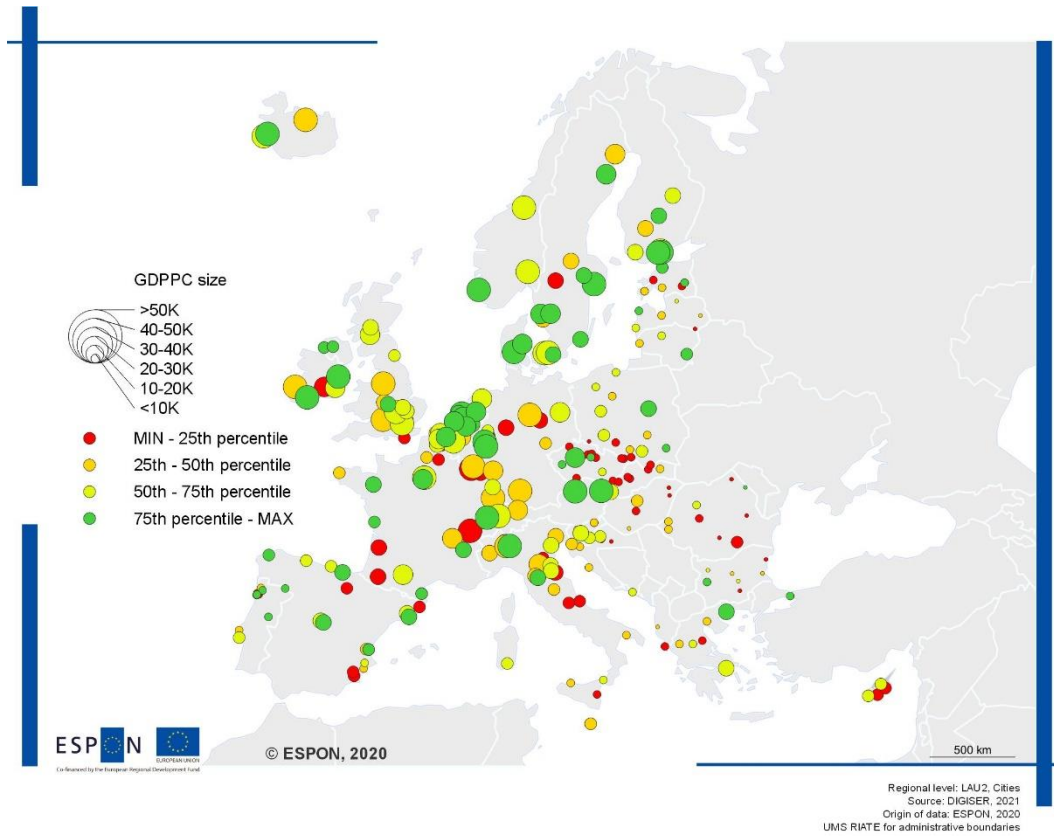
Map 2 – Change management and GDPPC size

2.3   Population
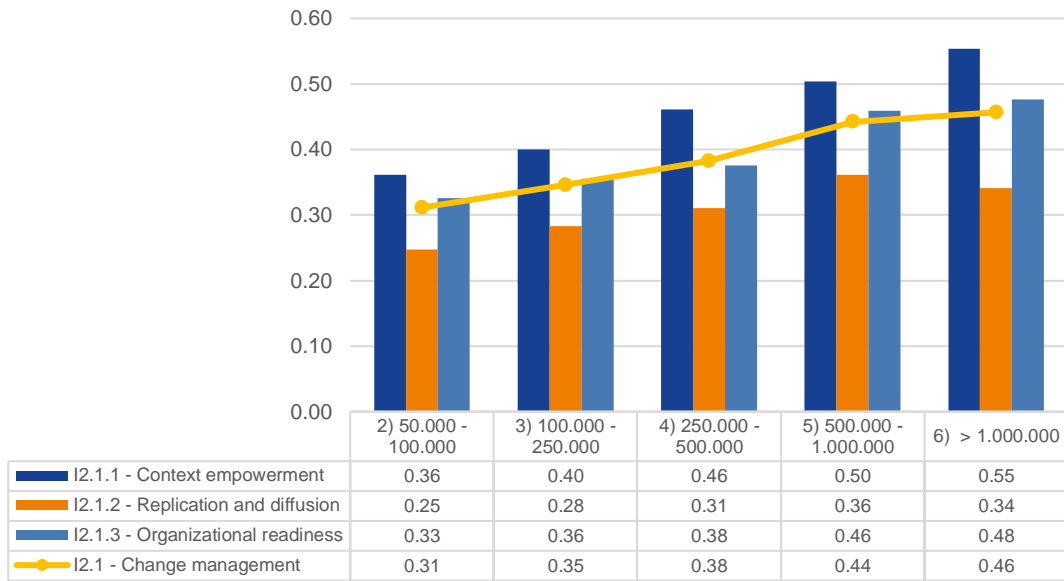
Index observed	Index type	Index level	Data Sample	Clusters
I2.1 - Change management	DPSVI	Intermediate	Reference Sample	Population

Figure 6 - Change management by population

2.4   GDP per Capita
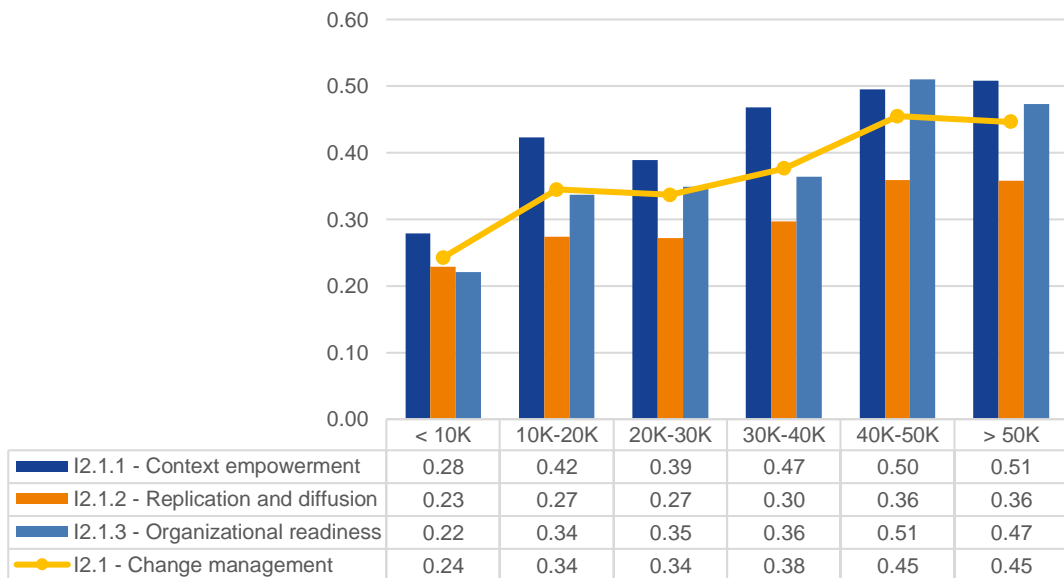
Index observed	Index type	Index level	Data Sample	Clusters
I2.1 - Change management	DPSVI	Intermediate	Reference Sample	GDPPC

Figure 7 - Change management by GDPC

2.5   Authority Type
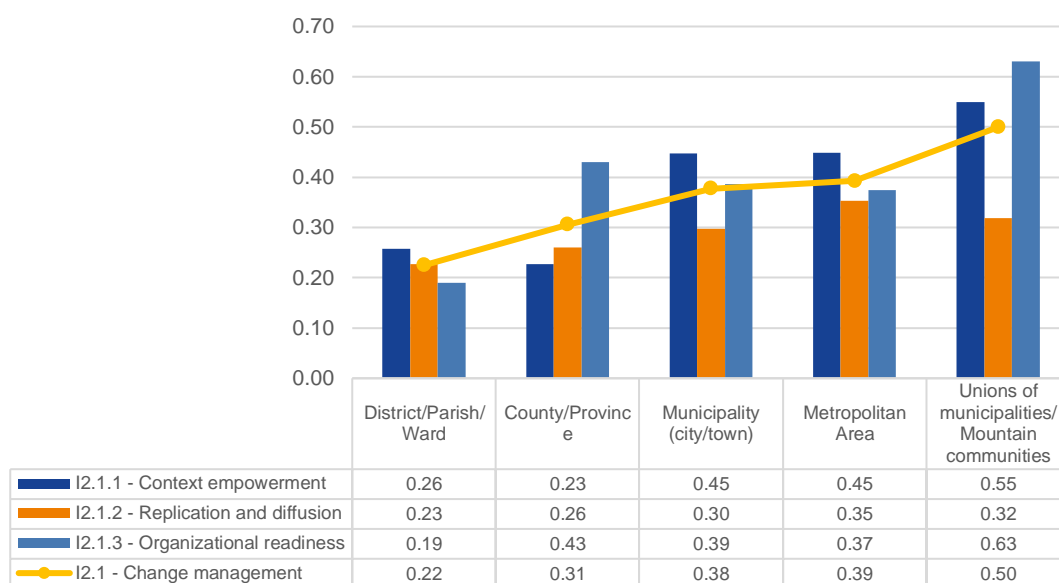
Index observed	Index type	Index level	Data Sample	Clusters
I2.1 - Change management	DPSVI	Intermediate	Reference Sample	Authority type

Figure 8 - Change management by authority type

2.6   Case Studies
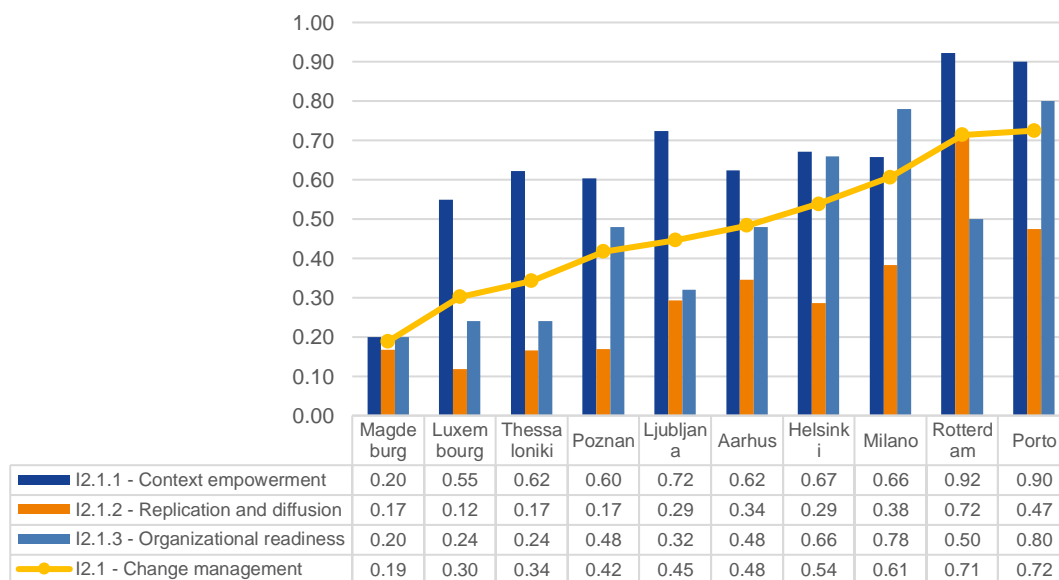
Index observed	Index type	Index level	Data Sample	Clusters
I2.1 - Change management	DPSVI	Intermediate	Case studies	na

Figure 9 - Change management, case studies

2.7   Highlights

- This indicator investigates the strategies for managing the transition of innovations through three dimensions that have a different weight:

  o As **Context empowerment**, the ability to transfer innovation into local society and reports values on average higher than the other two sub-indicators, indicating at least in the intentions, a focus on impacts

  o **Replication and diffusion** investigates the activity of collaboration beyond the local contest, generally framed as collaboration within international processes and networks of innovation circulation and represents a more critical point especially for the heavily dependent entities and hinged in the traditional interinstitutional hierarchies

  o **Organizational readiness** measures the initiatives that predispose the organizational structure to the transposition of innovations and its cross-silo dissemination. This third indicator seems to highlight a greater dependence also on the richness of the contest and on the scale of public organizations

- Spatial trends show a concentration of particularly advanced cities in the Scandinavian, Baltic and Netherlands, while critical areas can be observed in the south-east countries and in the heart of Central Europe

3   Context empowerment of European Cities

3.1   Definition of the indices and exploration of its structure

Context empowerment refers to the ability of the public authority to instil cultural values oriented to innovation and change and encourage the development of sustainable relationships among the actors of the local eco-system.

Figure 10 – Context empowerment index composition (questions tree)

This is a *Bottom Level* index, composed by five questions, each one computed for a limited number of possible answers:

- **Q_6.3** Is your public authority directly involved in ecosystems for innovation together with other actors of the quadruple helix (Academia/Research, Industry, Public Sector, Civic Society)?

- **Q_6.3.1** If yes, please select as many organisations as apply from the list below

- **Q_6.3.2** What is the purpose for your public authority to collaborate with the local ecosystem?

- **Q_7.1** Does your public authority adopt a citizen-centric approach when planning new services or updating existing ones as part of the innovation process?

- **Q_8.3** Indicate the availability of comprehensive multilingual options in the service interfaces of the public authority used by the following service areas
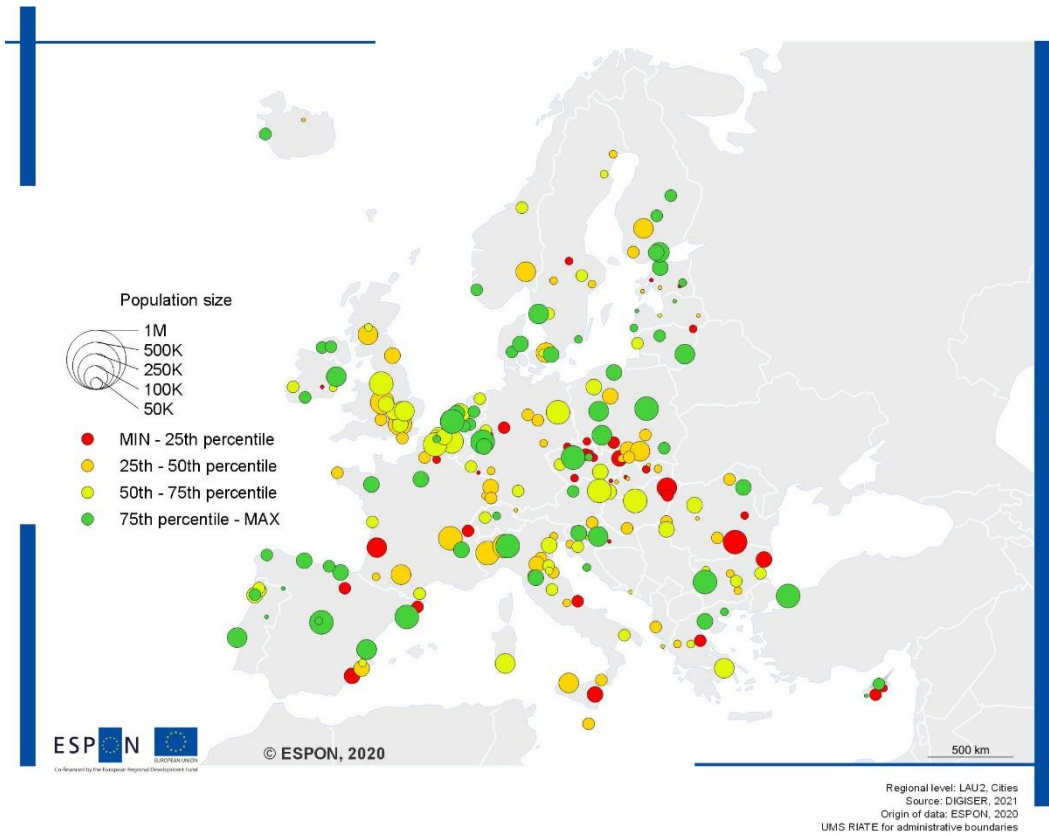
Map 3 – Context empowerment and population size
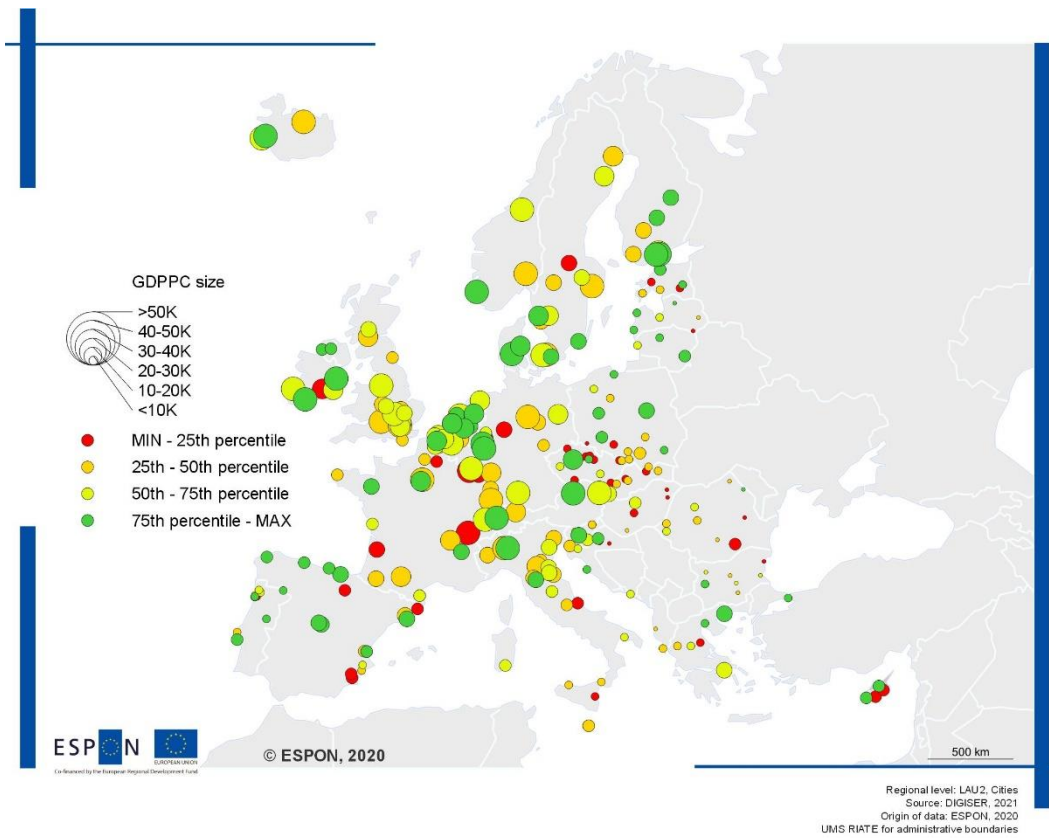
Map 4 – Context empowerment and GDPPC size

3.2   Population

	2) 50.000 - 100.000	3) 100.000 - 250.000	4) 250.000 - 500.000	5) 500.000 - 1.000.000	6) > 1.000.000
I2.1.1 - Context empowerment	0.36	0.40	0.46	0.50	0.55

Index observed	Index type	Index level	Data Sample	Clusters
I2.1.1 - Context empowerment	DPSVI	Bottom	Reference Sample	Population
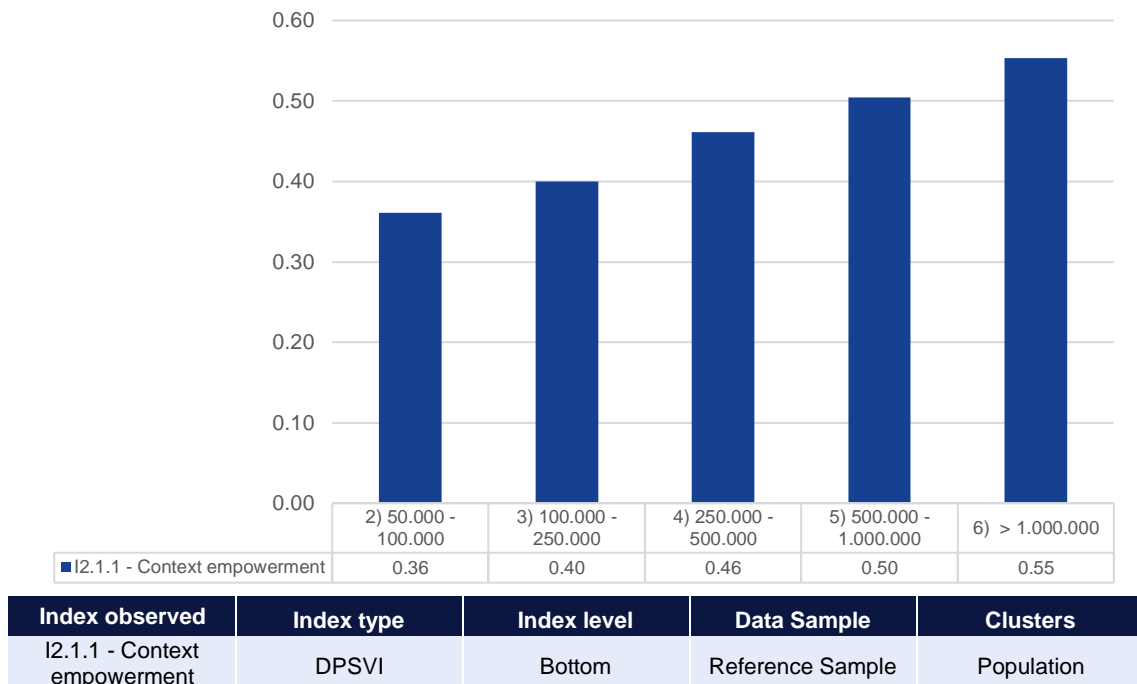
Figure 11 - Context empowerment by population

3.3   GDP per Capita

	< 10K	10K-20K	20K-30K	30K-40K	40K-50K	> 50K
I2.1.1 - Context empowerment	0.28	0.42	0.39	0.47	0.50	0.51

Index observed	Index type	Index level	Data Sample	Clusters
I2.1.1 - Context empowerment	DPSVI	Bottom	Reference Sample	GDPPC
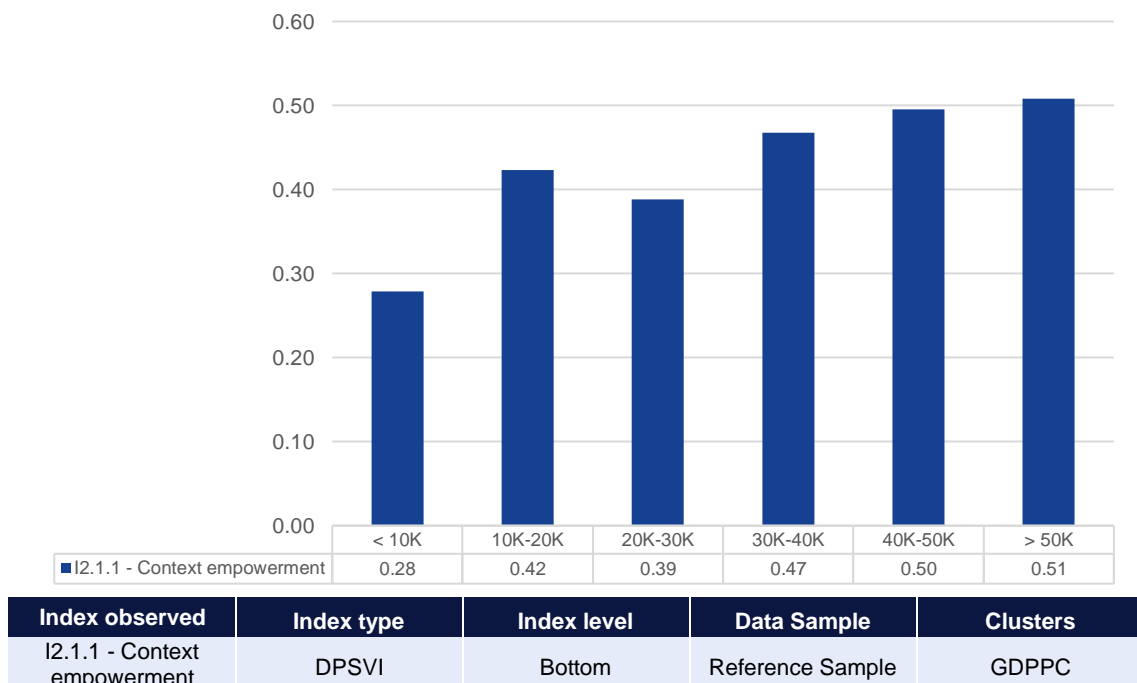
Figure 12 - Context empowerment by GDPC

3.4   Authority Type
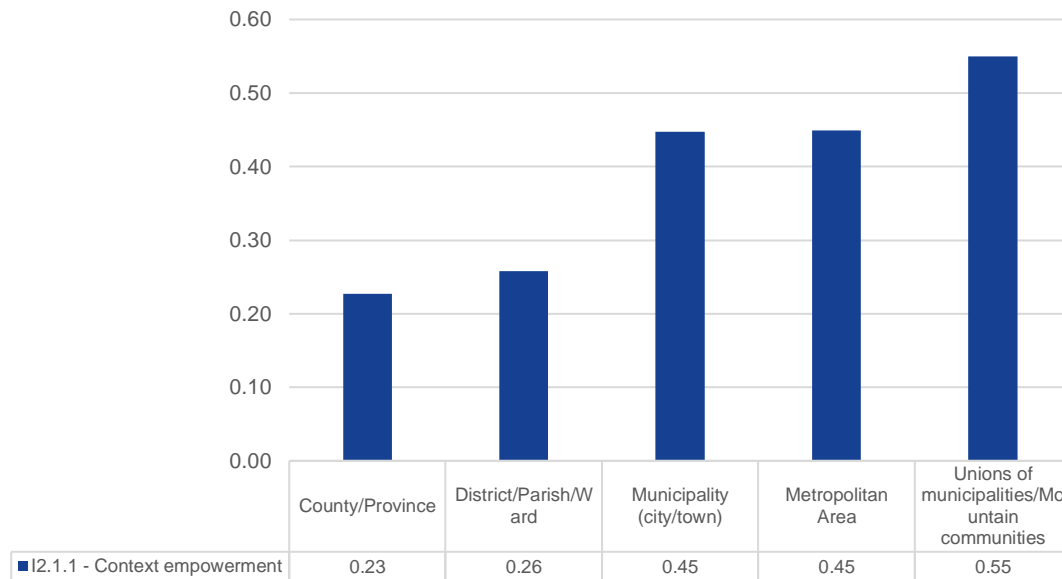
	County/Province	District/Parish/Ward	Municipality (city/town)	Metropolitan Area	Unions of municipalities/Mountain communities
I2.1.1 - Context empowerment	0.23	0.26	0.45	0.45	0.55

Index observed	Index type	Index level	Data Sample	Clusters
I2.1.1 - Context empowerment	DPSVI	Bottom	Reference Sample	Authority type

Figure 13 - Context empowerment by authority type

3.5   Case studies
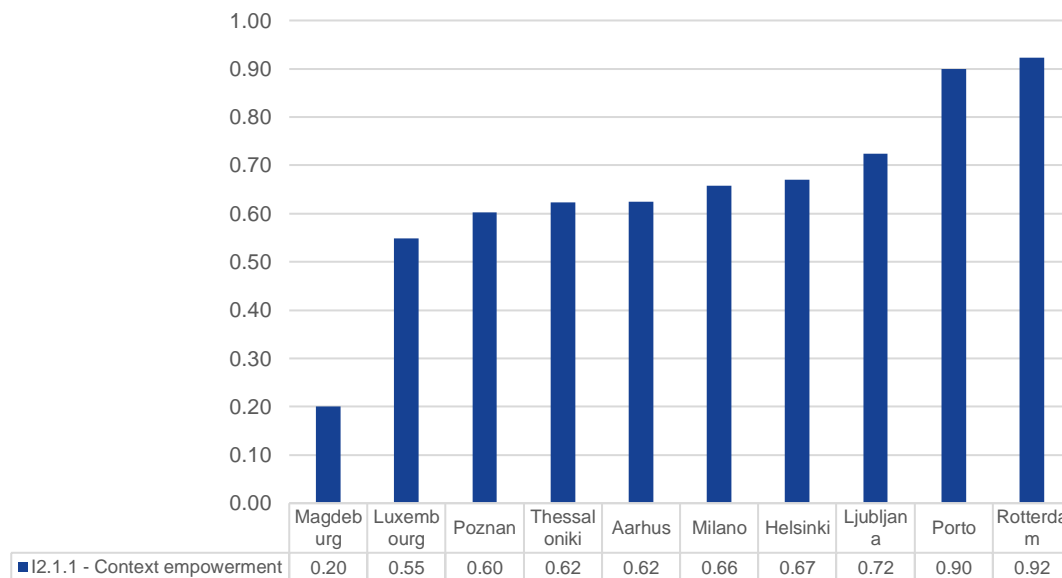
	Magdeburg	Luxembourg	Poznan	Thessaloniki	Aarhus	Milano	Helsinki	Ljubljana	Porto	Rotterdam
I2.1.1 - Context empowerment	0.20	0.55	0.60	0.62	0.62	0.66	0.67	0.72	0.90	0.92

Index observed	Index type	Index level	Data Sample	Clusters
I2.1.1 - Context empowerment	DPSVI	Bottom	Case studies	na

Figure 14 - Context empowerment, case studies

3.6   Relevant question results

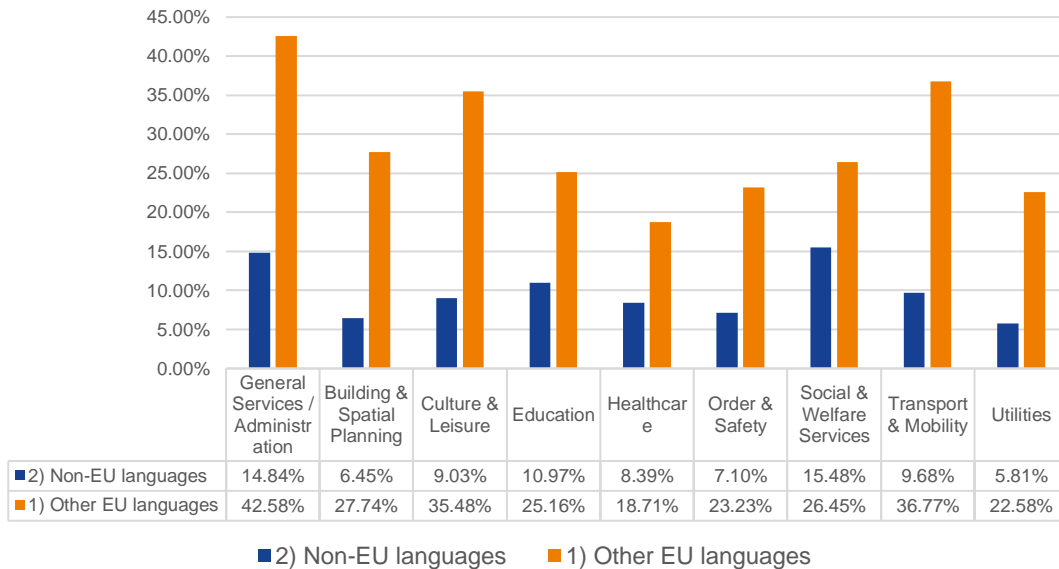### 3.6.1   Is your public authority directly involved in ecosystems for innovation together with other actors of the quadruple helix (Academia/Research, Industry, Public Sector, Civic Society)?
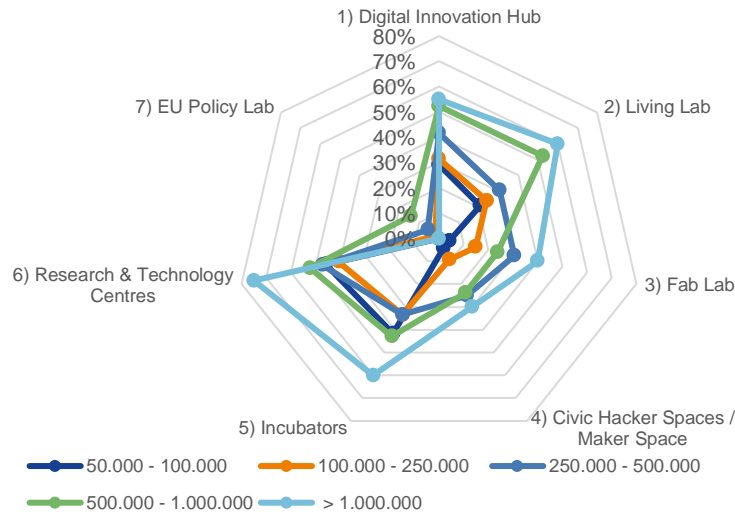
Question observed	Question type	Data Sample	Clusters	Value
Q_6.3.1	Multiple choice	Reference Sample	Population	Percentage

Figure 15 – Involvement of New Organizations

3.6.2   Indicate the availability of comprehensive multilingual options in the service interfaces of the public authority used by the following service areas

	General Services / Administration	Building & Spatial Planning	Culture & Leisure	Education	Healthcare	Order & Safety	Social & Welfare Services	Transport & Mobility	Utilities
2) Non-EU languages	14.84%	6.45%	9.03%	10.97%	8.39%	7.10%	15.48%	9.68%	5.81%
1) Other EU languages	42.58%	27.74%	35.48%	25.16%	18.71%	23.23%	26.45%	36.77%	22.58%

■ 2) Non-EU languages   ■ 1) Other EU languages

Question observed	Question type	Data Sample	Clusters	Value
Q_8.3	Matrix – multiple choice	Reference Sample	Authority type	Percentage

Figure 16 – Context empowerment of public services

4 Replication and diffusion of European Cities

4.1 Definition of the indices and exploration of its structure

Replication and diffusion is related to the ability to replicate and disseminate innovation, succeeding in the attempt to impact a larger number of citizens or communities. This mechanism lies on the fact that innovations developed by one public body can grow and be adopted by other public organisations, facilitating a digital innovation on a broader scale. A digital innovation strategy can indeed be instructed with different governance policies, from a strategy covering a single public administration, to a joint strategy serving multiple cities, also going beyond the county borders.

Specific strategies can be put in place to manage digital innovation, also considering the possibility to cover more administrations in the attempt of sharing solutions and benefitting from expertises otherwise not present within the body.
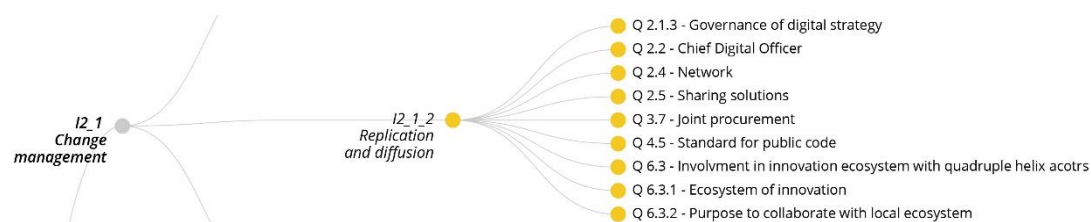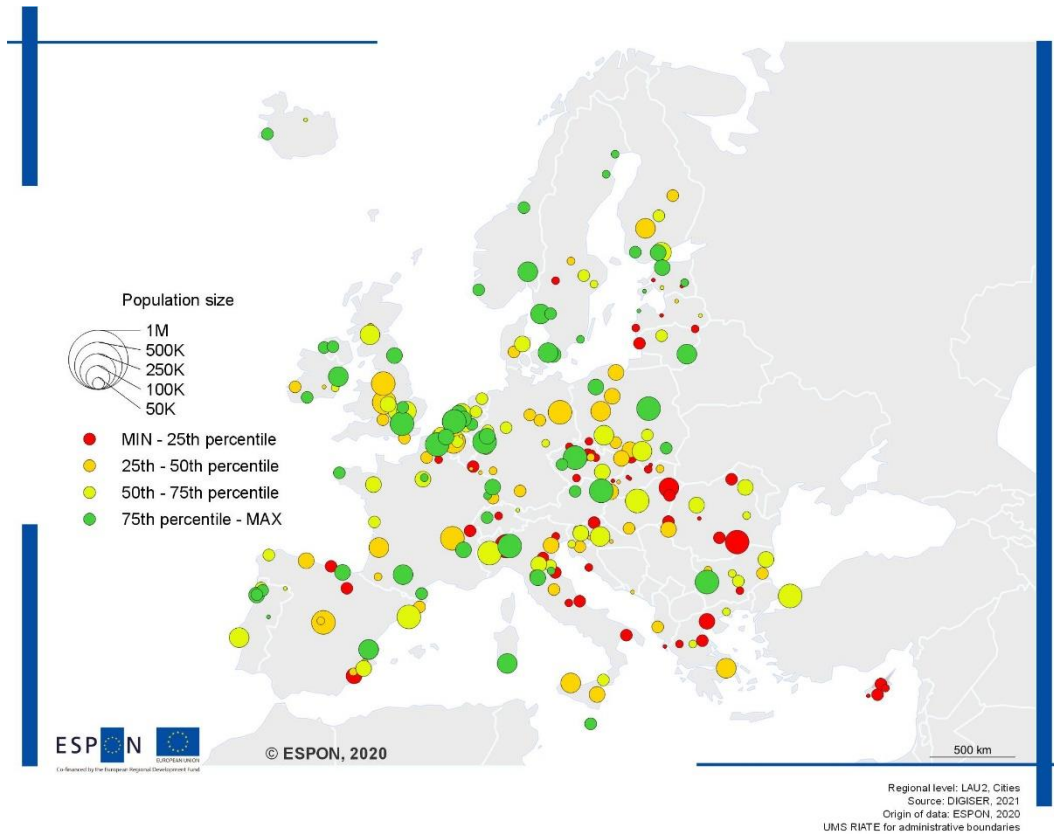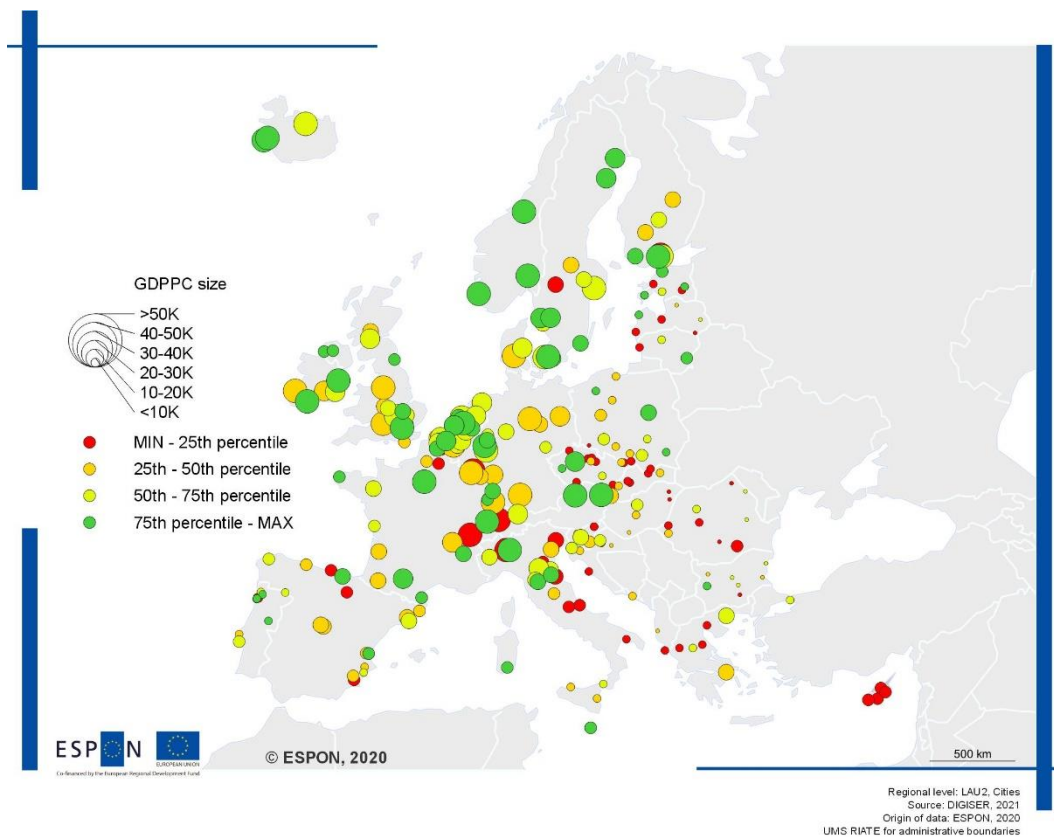

Figure 17 – Replication and diffusion index composition (questions tree)

This is a *Bottom Level* index, composed by nine questions, each one computed for a limited number of possible answers:

- **Q_2.1.3** What is the governance of the digital innovation strategy?

- **Q_2.2** Does your public authority have a Chief Digital Officer (or similar position such as Chief Information Officer / Chief Innovation Officer, etc) coordinating the implementation of the digital innovation strategy?

- **Q_2.4** Is your public authority part of a (local, regional, national, EU) network of cities sharing operational digital solutions or open source code?

- **Q_2.5** Does your public authority benefit from sharing digital solutions, services or products with other public authorities?

- **Q_3.7** Does your public authority procure innovative digital services/goods together with one or more public authorities (i.e. Joint Procurement)?

- **Q_4.5** In the case of open source software code, particularly its development and maintenance, is your public authority applying the Standard for Public Code

- **Q_6.3** Is your public authority directly involved in ecosystems for innovation together with other actors of the quadruple helix (Academia/Research, Industry, Public Sector, Civic Society)?

- **Q_6.3.1** If yes, please select as many organisations as apply from the list below

- **Q_6.3.2** What is the purpose for your public authority to collaborate with the local ecosystem?

Map 5 – Replication and diffusion and population size

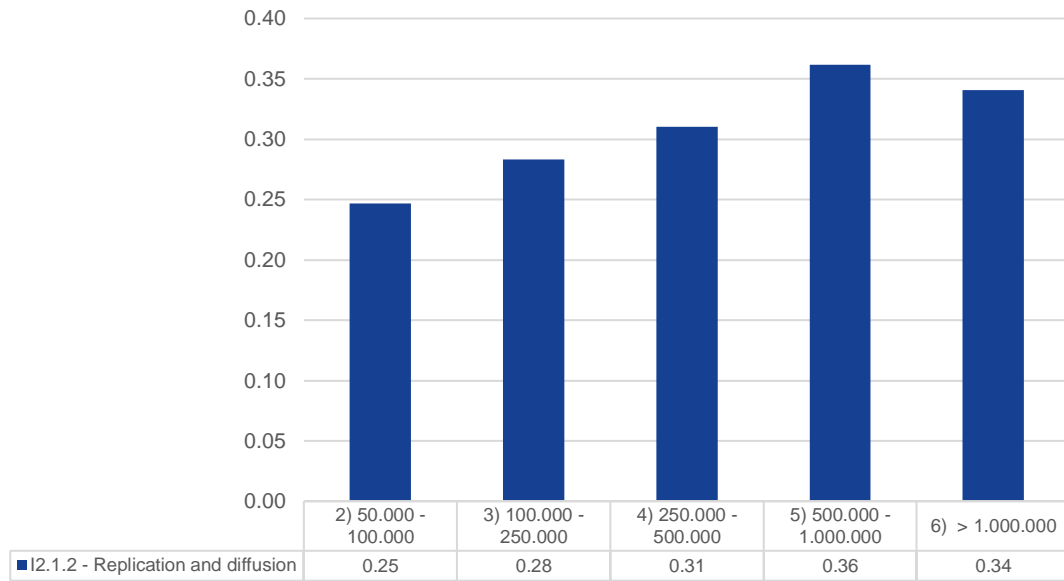## Map 6 – Replication and diffusion and GDPPC size

4.2   Population

Index observed	2) 50.000 - 100.000	3) 100.000 - 250.000	4) 250.000 - 500.000	5) 500.000 - 1.000.000	6) > 1.000.000
■ I2.1.2 - Replication and diffusion	0.25	0.28	0.31	0.36	0.34

Index observed	Index type	Index level	Data Sample	Clusters
I2.1.2 - Replication and diffusion	DPSVI	Bottom	Reference Sample	Population

Figure 18 - Replication and diffusion by population

4.3   GDP per Capita

Index observed	< 10K	10K-20K	20K-30K	30K-40K	40K-50K	> 50K
■ I2.1.2 - Replication and diffusion	0.23	0.27	0.27	0.30	0.36	0.36

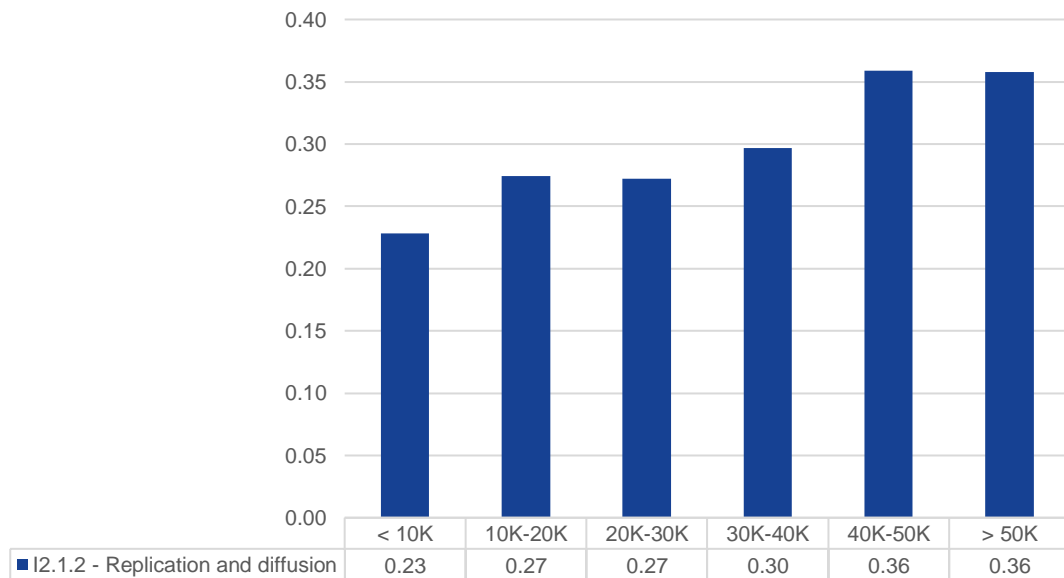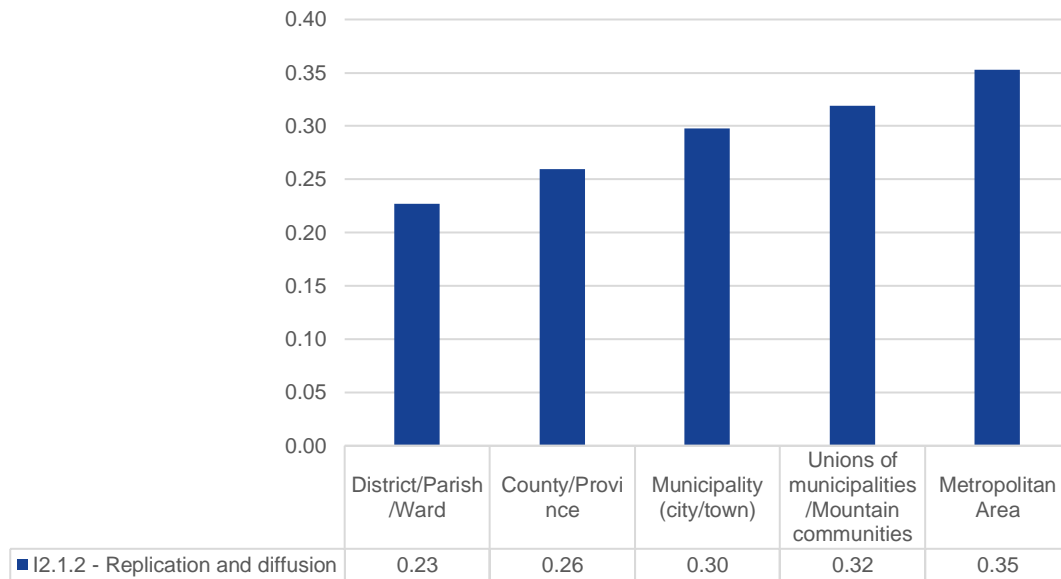| Index observed	Index type	Index level	Data Sample	Clusters
I2.1.2 - Replication and diffusion	DPSVI	Bottom	Reference Sample	GDPPC

Figure 19 - Replication and diffusion by GDPC

4.4   Authority Type

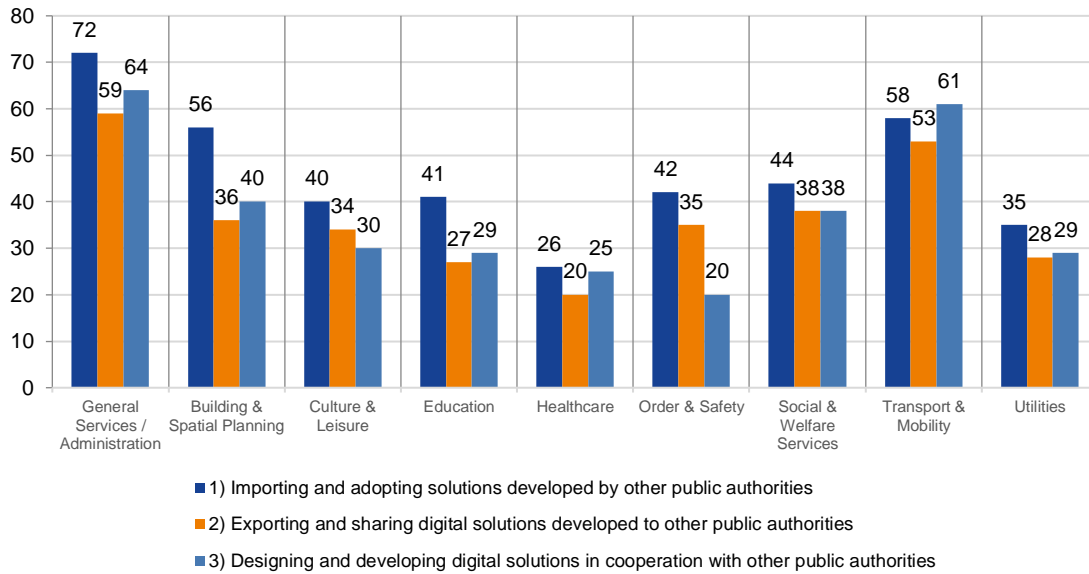| Index observed	Index type	Index level	Data Sample	Clusters
I2.1.2 - Replication and diffusion	DPSVI	Bottom	Reference Sample	Authority type

Figure 20 - Replication and diffusion by authority type

4.5   Case studies
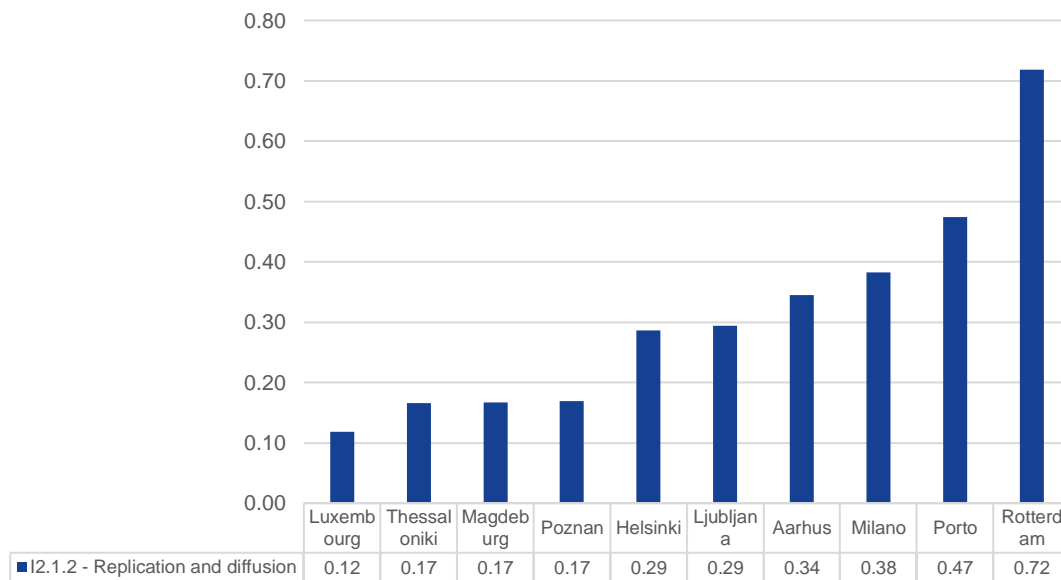
Index observed	Index type	Index level	Data Sample	Clusters
I2.1.2 - Replication and diffusion	DPSVI	Bottom	Case studies	na

**Figure 21 - Replication and diffusion, case studies**

4.6   Relevant question results

4.6.1   Does your public authority benefit from sharing digital solutions, services or products with other public authorities?

- ■ 1) Importing and adopting solutions developed by other public authorities
- ■ 2) Exporting and sharing digital solutions developed to other public authorities
- ■ 3) Designing and developing digital solutions in cooperation with other public authorities

Question observed	Question type	Data Sample	Clusters	Value
Q_2.5	Multiple choice	Reference Sample	Matrix option	Count

Figure 22 – Adoption of Advanced Technologies

4.6.2   Does your public authority procure innovative digital services/goods together with one or more public authorities (i.e. Joint Procurement)?

- ■ 1) Yes
- ■ 2) Yes, but rarely
- ■ 3) Not at all
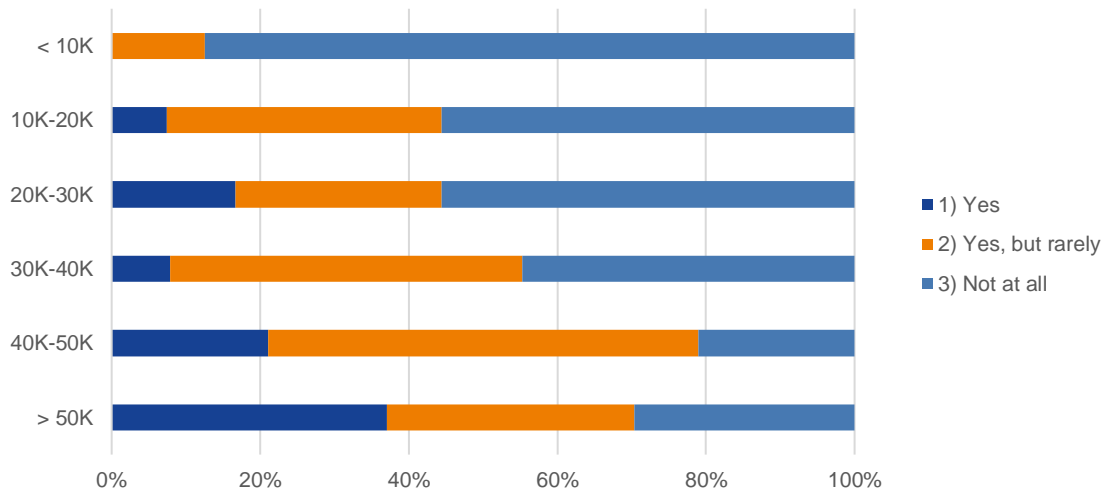
Question observed	Question type	Data Sample	Clusters	Value
Q_3.7	Single choice	Reference Sample	GDPPC	Percentage

Figure 23 – Digital Twins Integration

5 Organizational readiness of European Cities

5.1 Definition of the indices and exploration of its structure

Organizational readiness refers to the institutional capacity to change for better including and nurturing digital innovation in the public sector, leading the way to greater impact that impacts on law and policy. It is based on the fact that the digital transformation of the public services impacts the public authority and requires adaptation, adjustment and renovation of its organisational structure. To support and manage innovative service development and provision, public authorities need to master digitalisation and innovation governance processes. As such, digital transformation is a driver of change that is bound to long-term organisational change within public sector organisations.
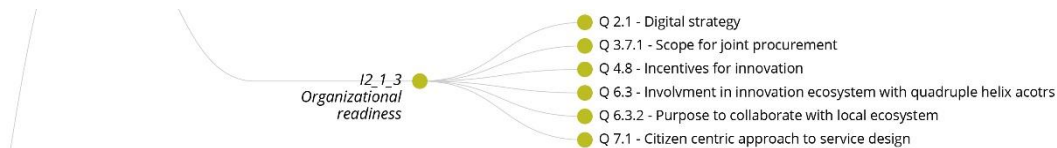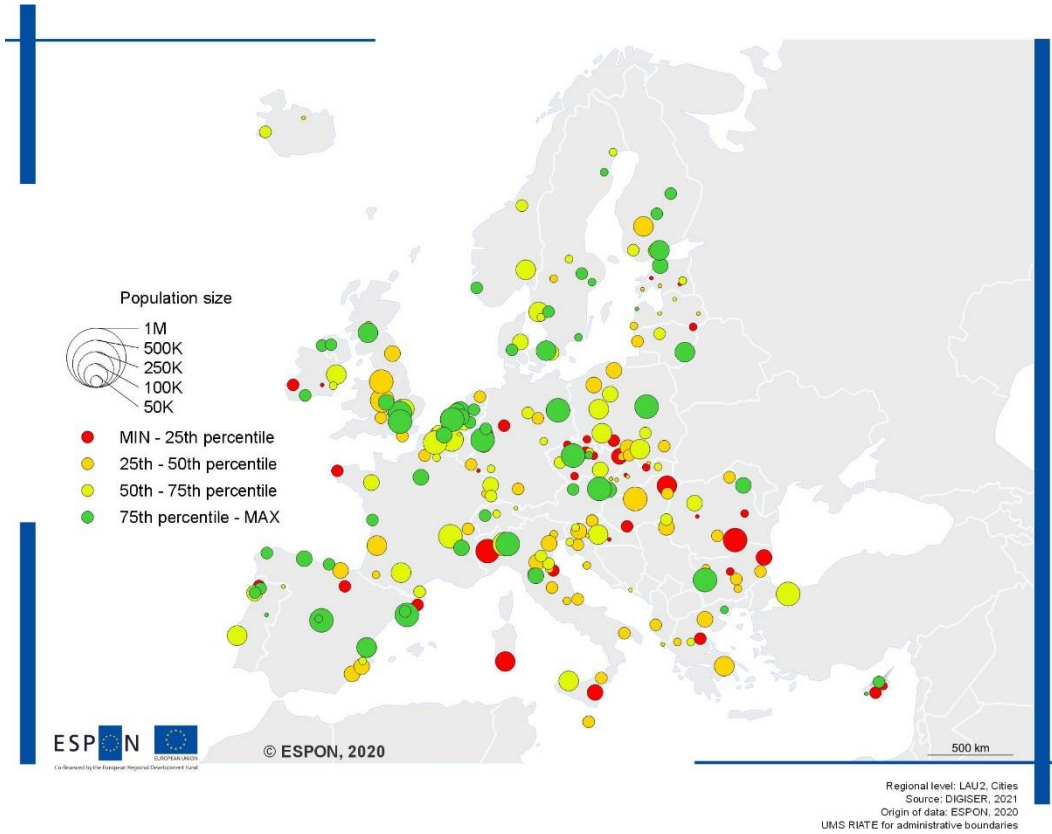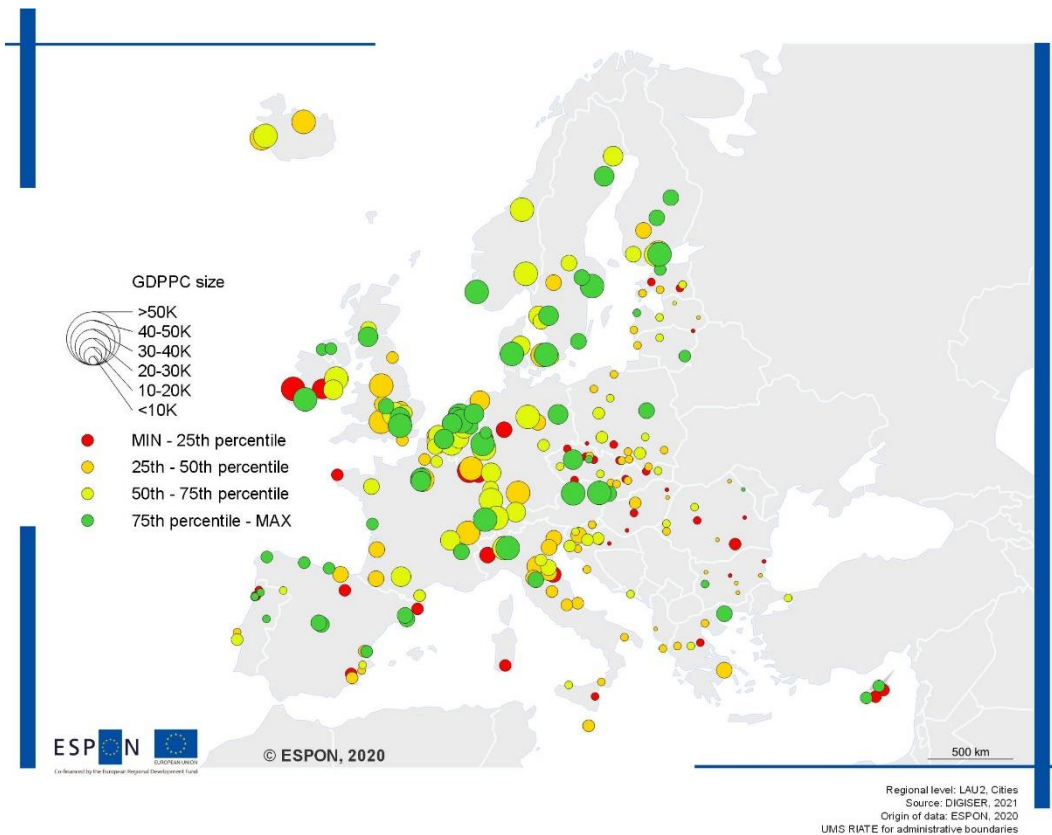

Figure 24 – Organizational readiness index composition (questions tree)

This is a *Bottom Level* index, composed by six questions, each one computed for a limited number of possible answers:

- **Q_2.1** Has your public authority formally approved and published a digital innovation strategy (also digital transformation strategy, smart city strategy or similar)?

- **Q_3.7.1** What is the main reason to opt for Joint Procurement Procedures?

- **Q_4.8** If applicable, does your public authority provide incentives (e.g. monetary, internal competitions / awards, etc) encouraging cooperation across service areas:

- **Q_6.3** Is your public authority directly involved in ecosystems for innovation together with other actors of the quadruple helix (Academia/Research, Industry, Public Sector, Civic Society)?

- **Q_6.3.2** What is the purpose for your public authority to collaborate with the local ecosystem? Note: Please select as many as apply

- **Q_7.1** Does your public authority adopt a citizen-centric approach when planning new services or updating existing ones as part of the innovation process?

Map 7 – Organizational readiness and population size
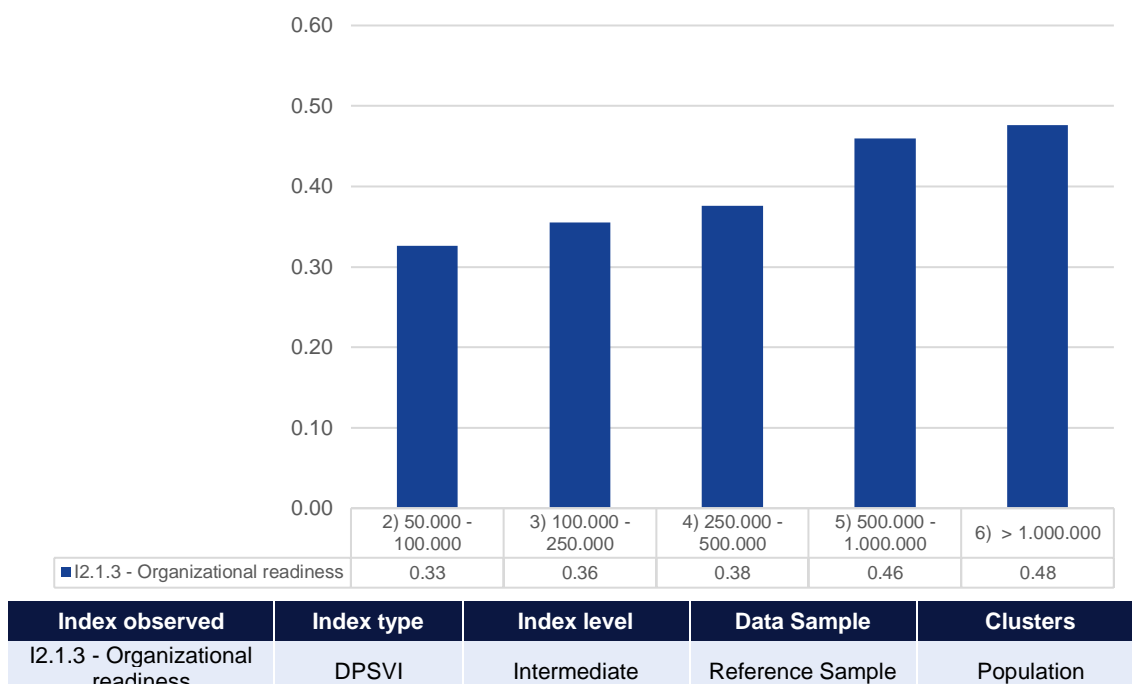

Map 8 – Organizational readiness and GDPPC size

5.2   Population

Index observed	Index type	Index level	Data Sample	Clusters
I2.1.3 - Organizational readiness	DPSVI	Intermediate	Reference Sample	Population

Figure 25 - Organizational readiness by population

5.3   GDP per Capita

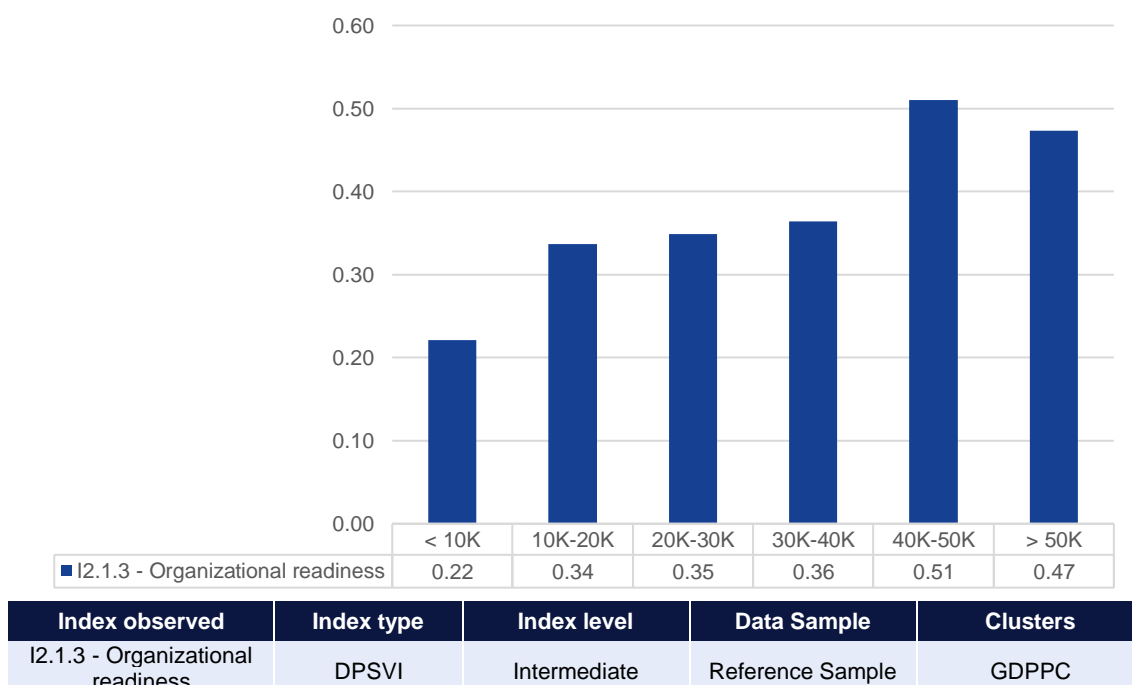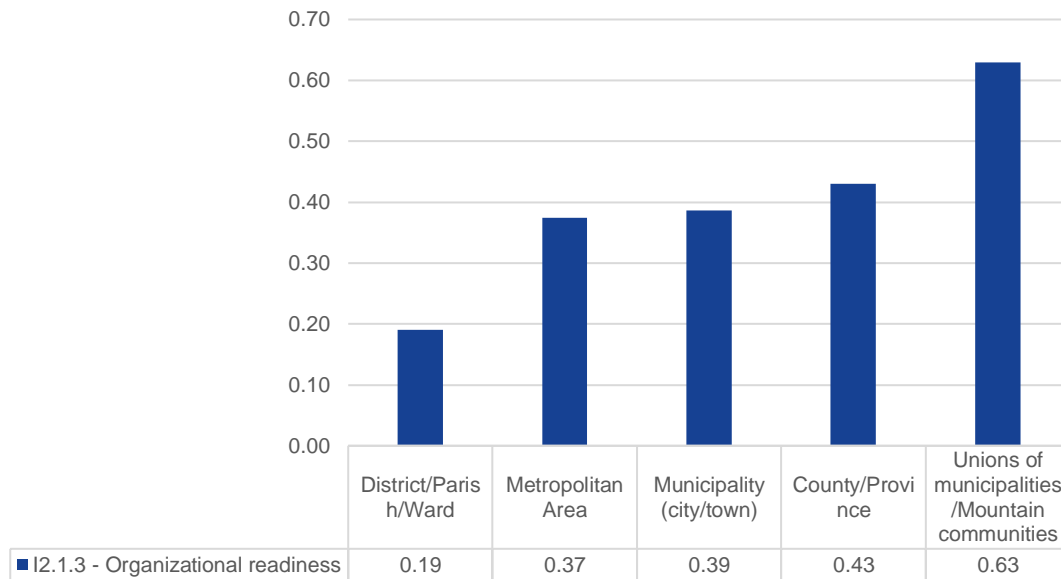| Index observed	Index type	Index level	Data Sample	Clusters
I2.1.3 - Organizational readiness	DPSVI	Intermediate	Reference Sample	GDPPC

Figure 26 - Organizational readiness by GDPC

5.4   Authority Type

Index observed	Index type	Index level	Data Sample	Clusters
I2.1.3 - Organizational readiness	DPSVI	Intermediate	Reference Sample	Authority type

Figure 27 - Organizational readiness by authority type

5.5   Case studies
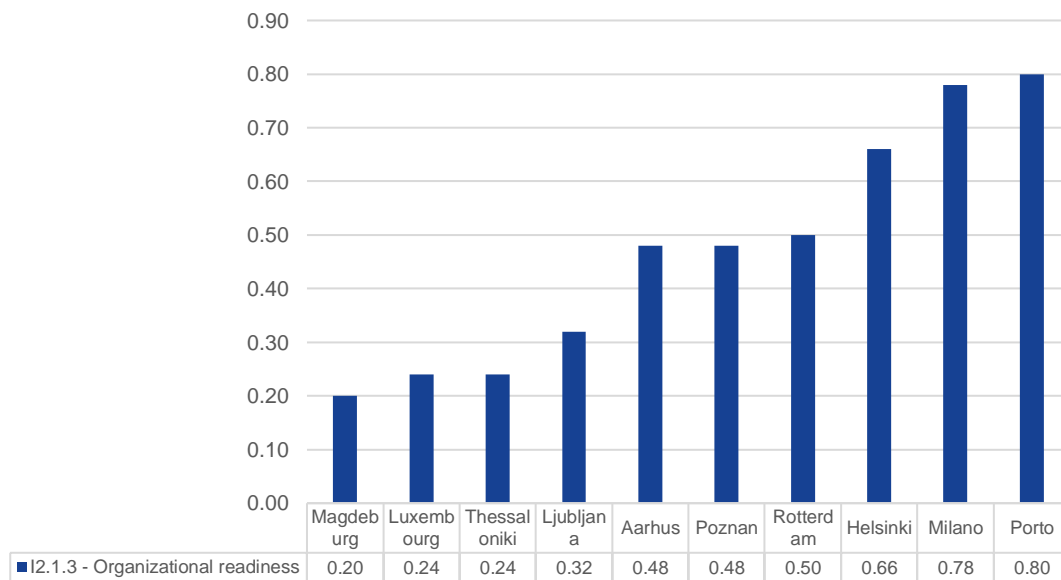
Index observed	Index type	Index level	Data Sample	Clusters
I2.1.3 - Organizational readiness	DPSVI	Intermediate	Case studies	na

Figure 28 - Organizational readiness, case studies

5.6 Relevant question results

5.6.1 What is the purpose for your public authority to collaborate with the local ecosystem?

	50.000 - 100.000	100.000 - 250.000	250.000 - 500.000	500.000 - 1.000.000	> 1.000.000
3) Guaranteeing complementary education and training to public employees	4%	17%	31%	19%	35%
5) Affecting policy making for innovation	21%	20%	33%	48%	45%
7) Getting support for innovation procurement	17%	19%	14%	29%	40%
10) Co-creating city services and outcomes with business and citizens	29%	43%	53%	57%	75%

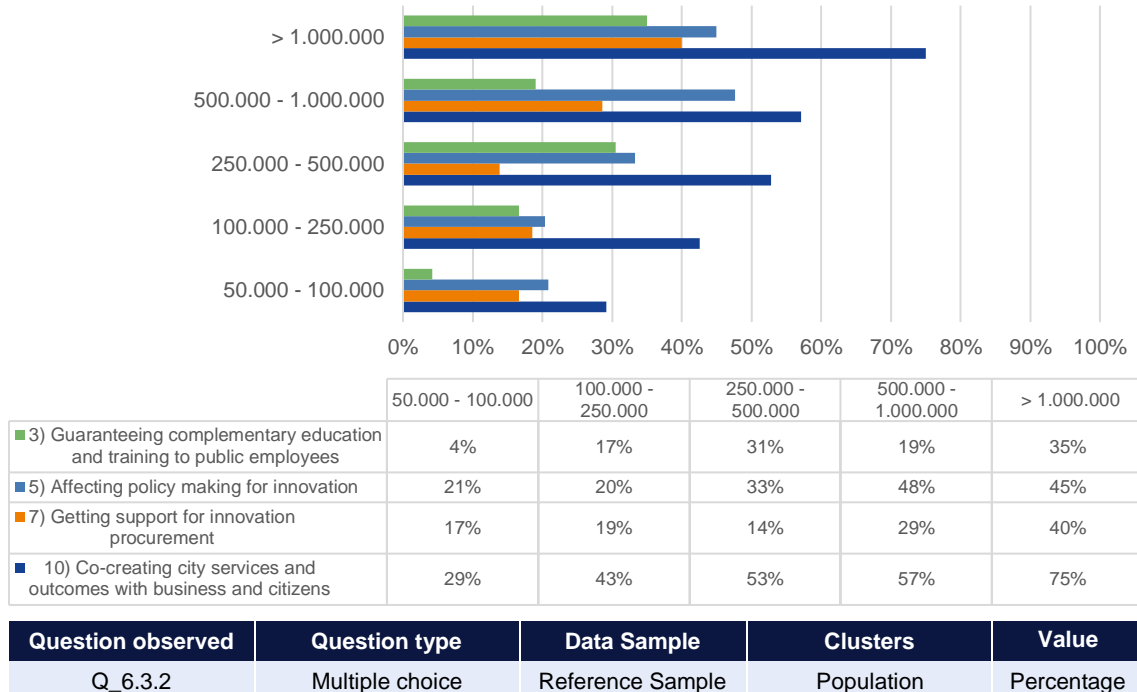| Question observed	Question type	Data Sample	Clusters	Value
Q_6.3.2	Multiple choice	Reference Sample	Population	Percentage

Figure 29 – Organizational Goals of External Collaboration

5.6.2 If applicable, does your public authority provide incentives (e.g. monetary, internal competitions / awards, etc) encouraging cooperation across service areas:
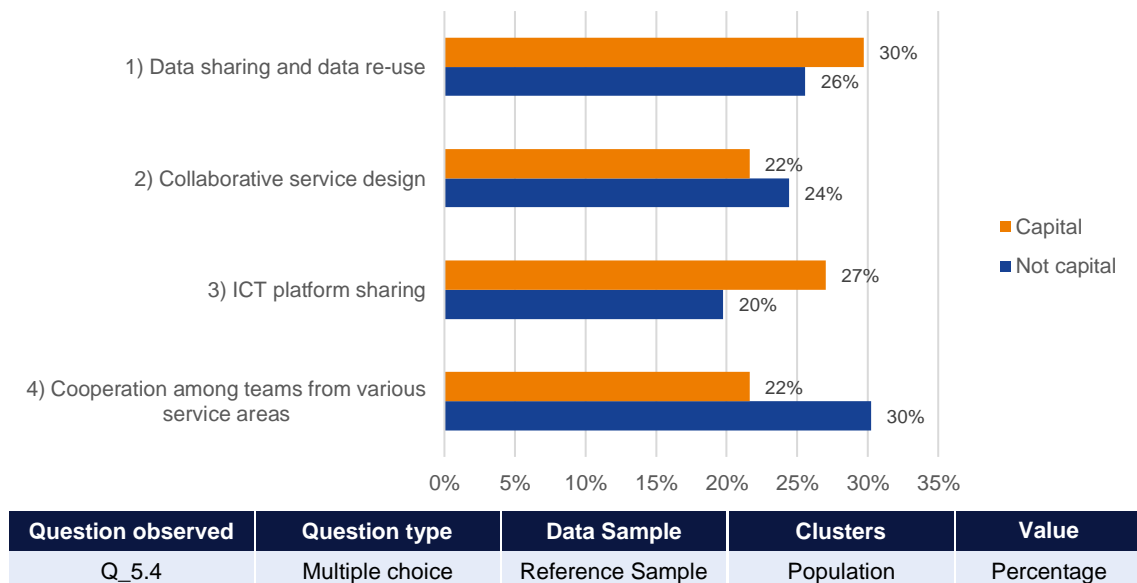

Question observed	Question type	Data Sample	Clusters	Value
Q_5.4	Multiple choice	Reference Sample	Population	Percentage

Figure 30 – Incentives to Internal Cooperation

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