



Inspire Policy Making with Territorial Evidence

DIGISER

Digital Innovation in Governance and Public
Service Provision

Annex 1.2.8 Innovation Governance Report // April 2022

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FINAL REPORT //

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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 presents 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:

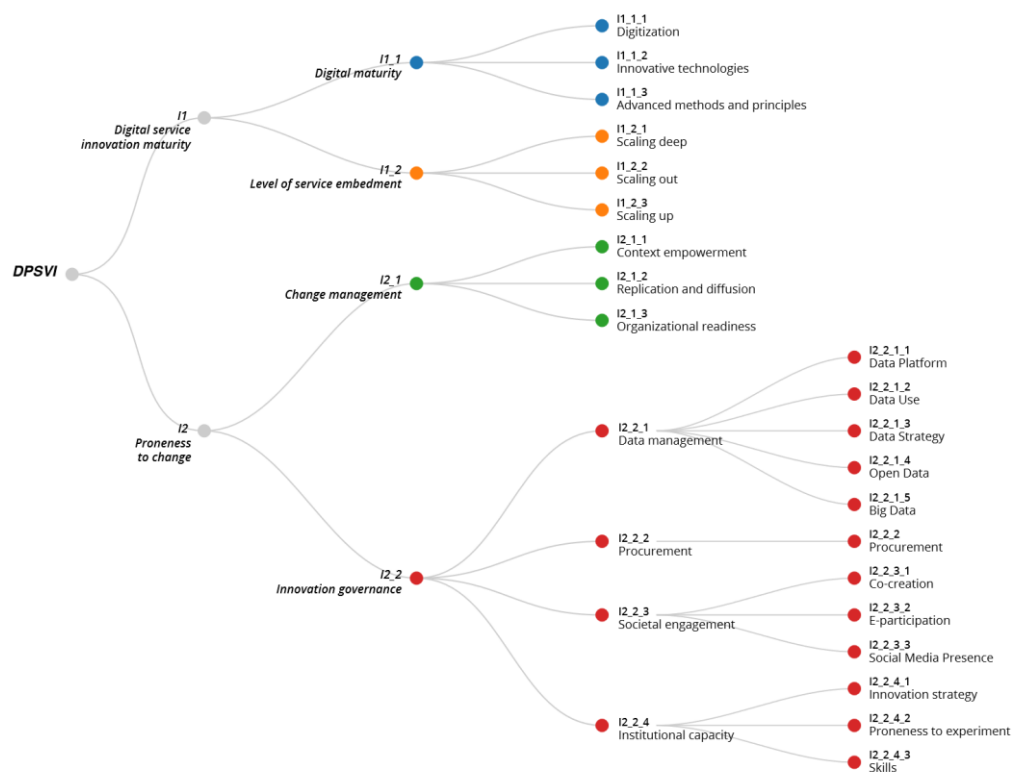


Figure 1 - DPSVI Structure

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	<i>Data Platform</i>	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	<i>Data Use</i>	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 governance models effectively set appropriate and favorable conditions for data-driven, data-informed, or data-aware decisions and services 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 digital innovation
I2_2_3	Societal engagement	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 citizens and/or communities through digital platforms
I2_2_3_3	Social Media Presence	Bottom	It provides information about how pervasive is the communication via social media by the municipality
I2_2_4	Institutional capacity	Intermediate	It refers to the institutional capacity of the public authority in relation to the experimentation and consolidation of digital innovation
I2_2_4_1	Innovation strategy	Bottom	It provides information about the agenda setting and pursuing capacity in relation to digital innovation strategies
I2_2_4_2	Proneness to experiment	Bottom	It analyses the readiness to experiment new organizational settings 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 DIGISURVEY'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.

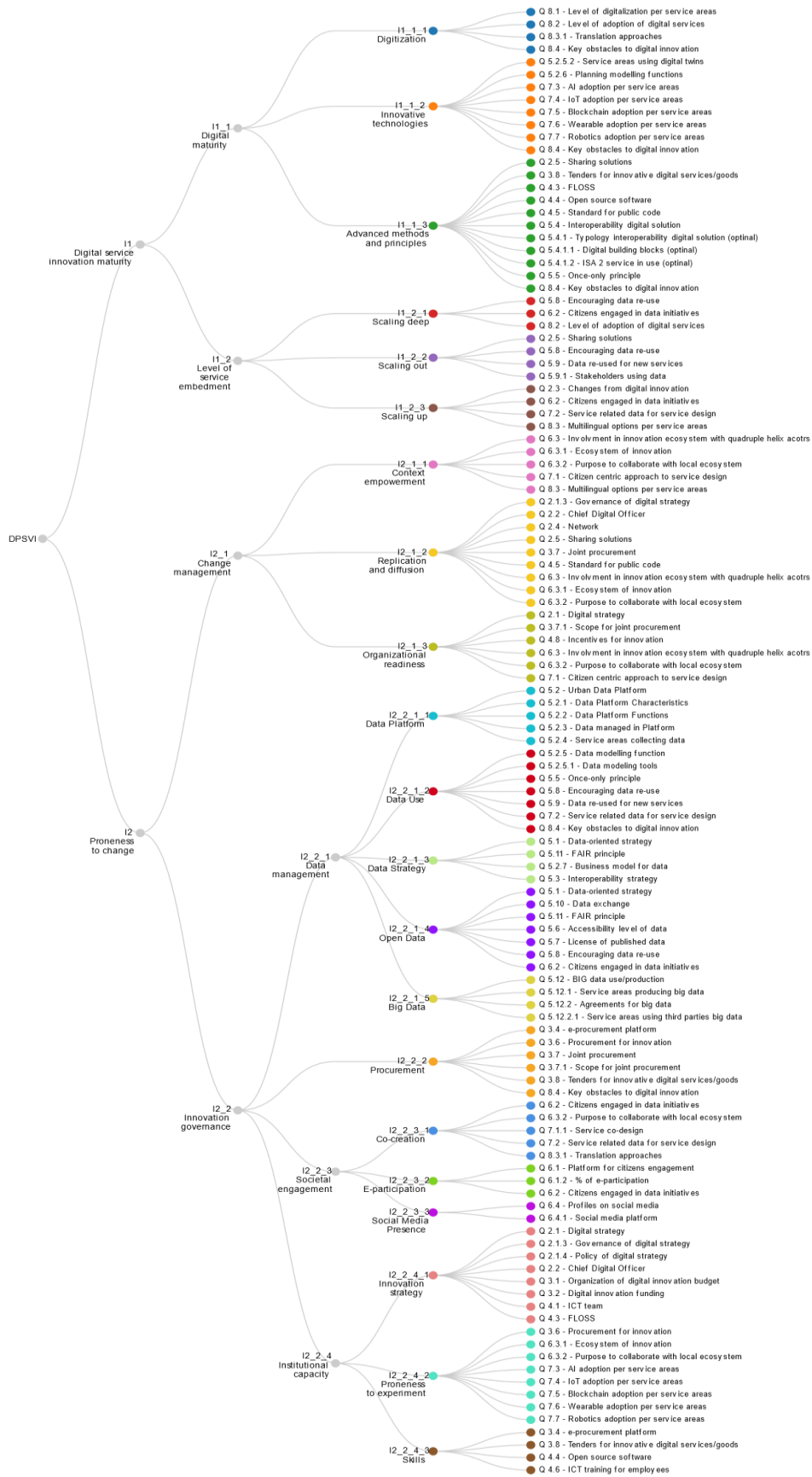


Figure 2 - DPSVI detailed structure – Questions

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 $p = 1, \dots, P$ 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* includes 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:

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

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
<i>Indicates the code and the label of the index observed</i>	<i>Indicates the type of index as either:</i> <ul style="list-style-type: none"> • DPSVI • SI 	<i>Indicates the Index position in its Data model:</i> <ul style="list-style-type: none"> • Top • Intermediate • Bottom 	<i>Indicates the sample that the data refers to</i> <ul style="list-style-type: none"> • All respondents • Reference sample 	<i>Indicates the series showed in the charts and listed in the legend</i> <ul style="list-style-type: none"> • 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 type

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
<i>Indicates the code and the label of the question observed</i>	<i>Indicates the question typology and whether it is a matrix</i>	<i>Indicates the sample that the data refers to</i>	<i>Indicates the series showed in the charts and listed in the legend</i>	<i>Indicates the units in which the data are represented</i>
	<ul style="list-style-type: none"> • Single choice • Single choice - Binary • Single choice - Likert • Multiple choice • Matrix - Single choice • Matrix - Likert • Matrix - Multiple choice 	<ul style="list-style-type: none"> • All respondents • Reference sample 	<ul style="list-style-type: none"> • Capital cities • Reference sample • Population • GDPPC • Country 	<ul style="list-style-type: none"> • 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.

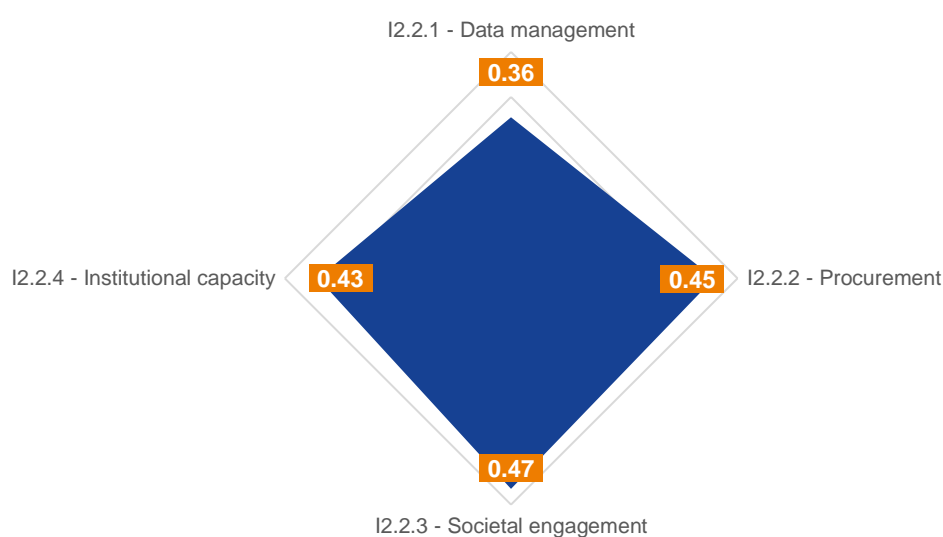
2 Innovation Governance of European Cities

2.1 Definition of the indices and exploration of its structure

Innovation governance refers to the way in which the public authority uses transversal administrative processes as leverages to promote cross-sectoral digital innovation. The dimension is looked through four lenses: societal engagement, institutional capacity, public procurement, and data management.

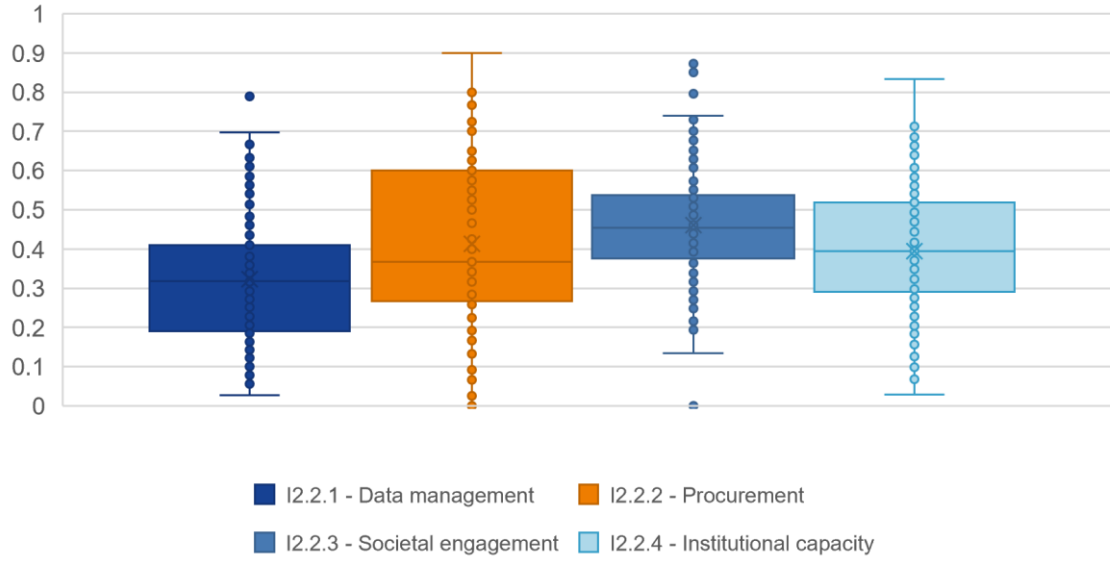
This is an *Intermediate Level* Index, composed by four *Intermediate Level* Indexes:

- **I2.2.1 - Data management:** It assesses the innovation capacity of data management strategies used by the public organisation
- **I2.2.2 - Procurement:** It assesses the level of digitalisation of the public procurement processes within the public authority and their orientation to digital innovation
- **I2.2.3 - Societal engagement:** It provides an overview of the intensity and level of digitalisation of societal engagement policies, and their impact on public service design and innovation
- **I2.2.4 - Institutional capacity:** It refers to the institutional capacity of the public authority in relation to the experimentation and consolidation of digital innovation



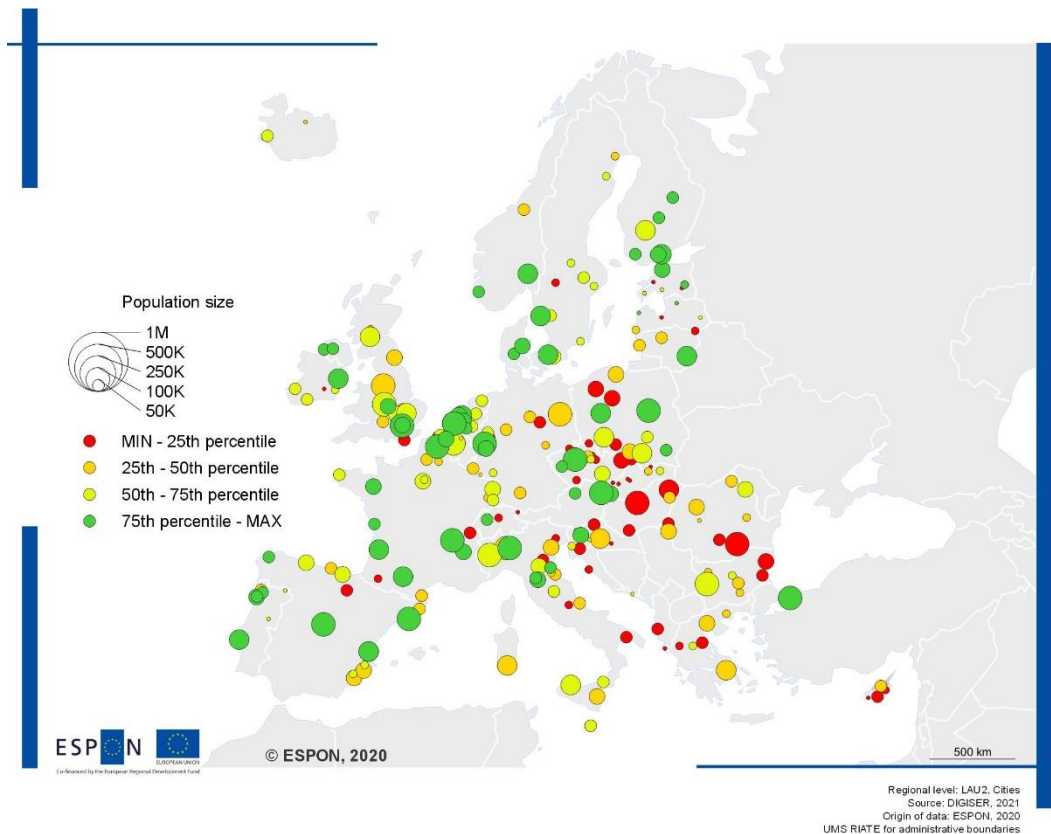
Index observed	Index type	Index level	Data Sample	Clusters
I2.2 – Innovation Governance	DPSVI	Intermediate	Reference Sample	na

Figure 3 – Innovation Governance overview

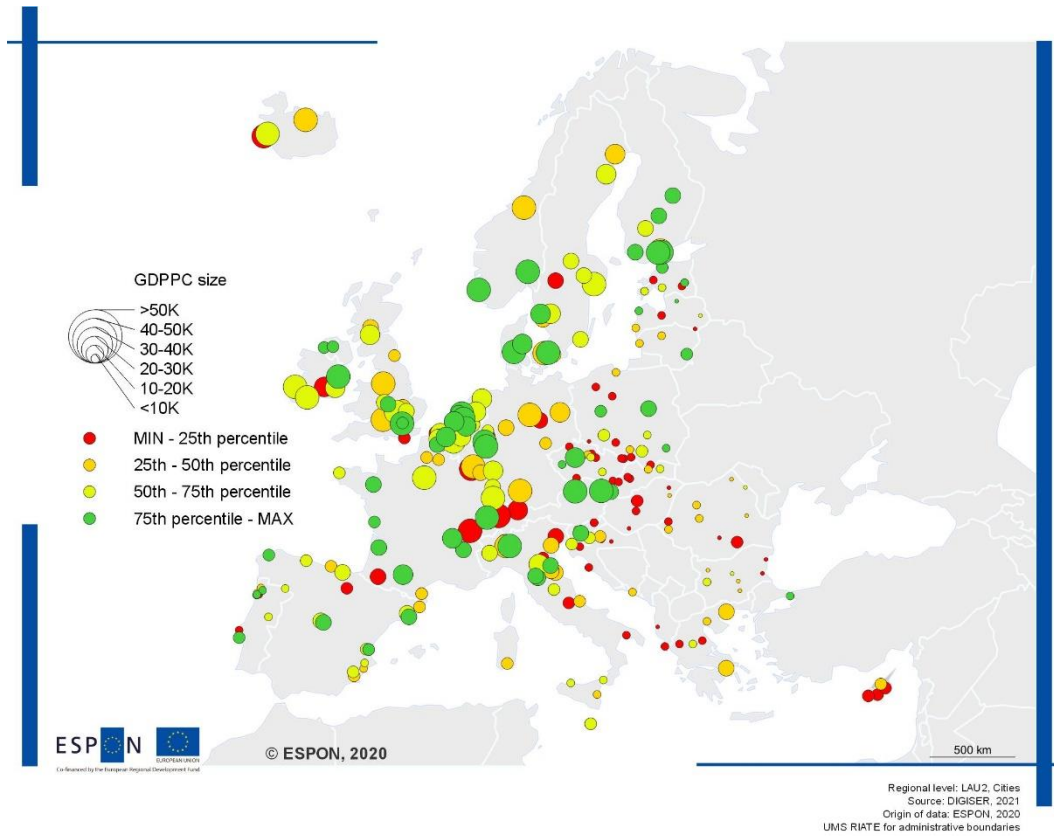


Index observed	Index type	Index level	Data Sample	Clusters
I2.2 – Innovation Governance	DPSVI	Intermediate	Reference Sample	na

Figure 4 - Innovation Governance composition

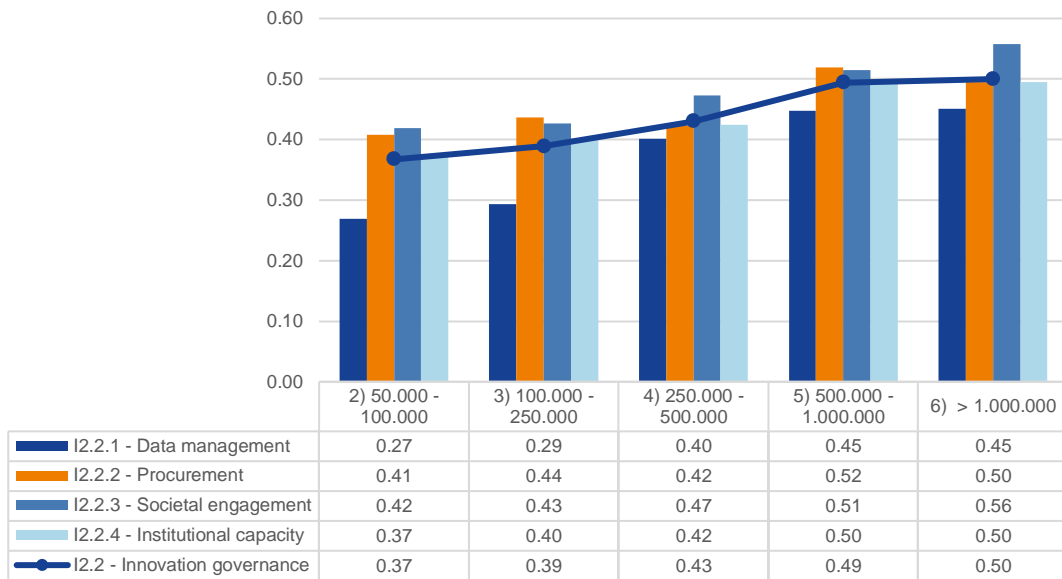


Map 1 – Innovation Governance and population size



Map 2 – Innovation Governance and GDPPC size

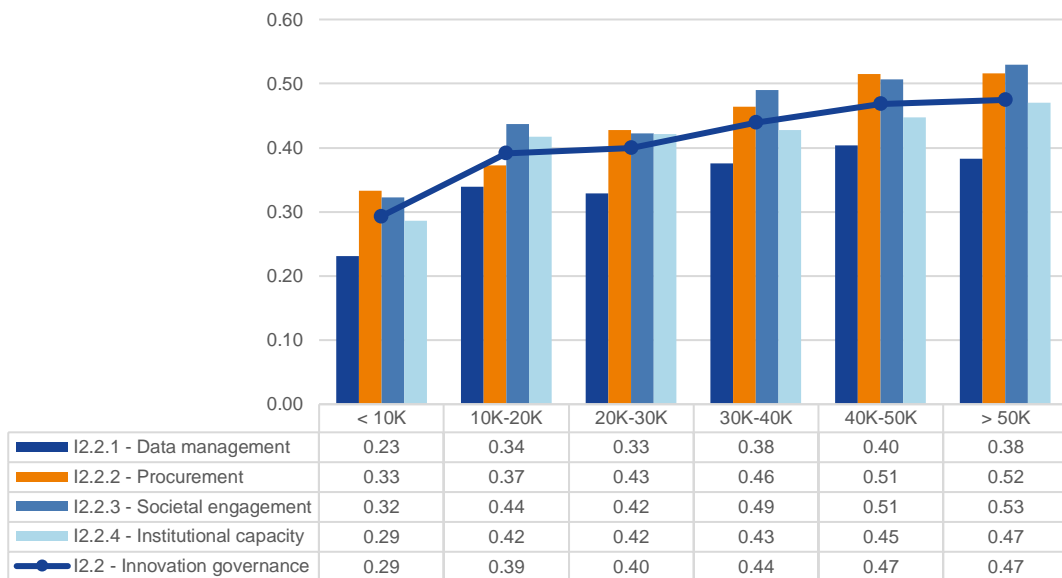
2.2 Population



Index observed	Index type	Index level	Data Sample	Clusters
I2.2 – Innovation Governance	DPSVI	Intermediate	Reference Sample	Population

Figure 5 - Innovation Governance by population

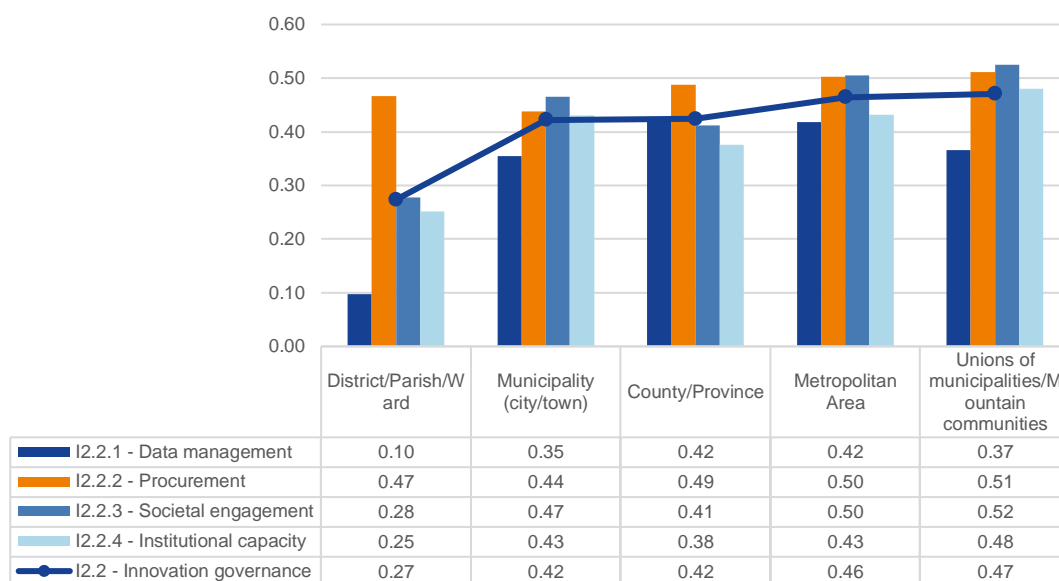
2.3 GDP per Capita



Index observed	Index type	Index level	Data Sample	Clusters
I2.2 – Innovation Governance	DPSVI	Intermediate	Reference Sample	GDPPC

Figure 6 - Innovation Governance by GDPC

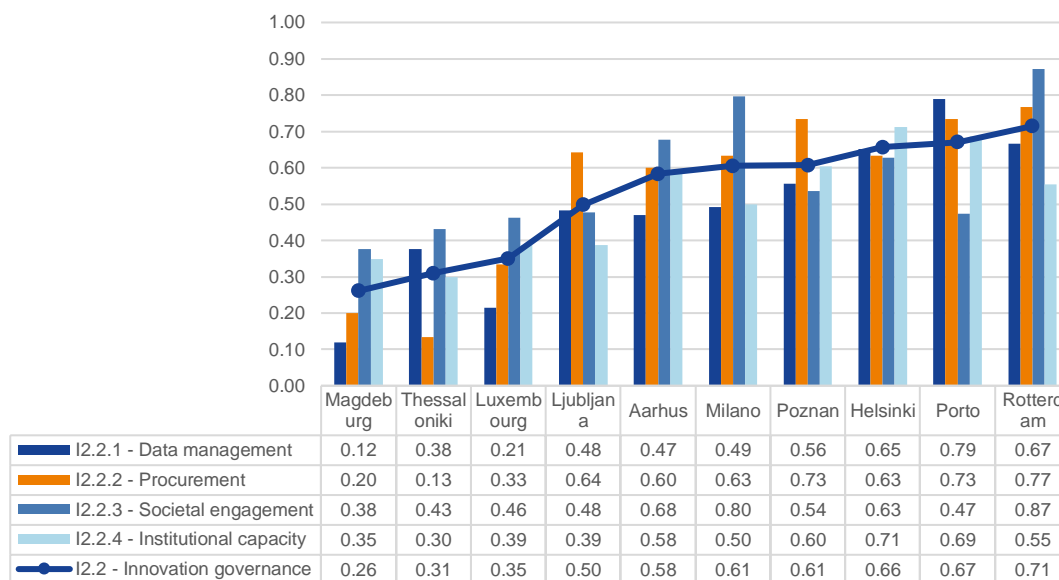
2.4 Authority Type



Index observed	Index type	Index level	Data Sample	Clusters
I2.2 – Innovation Governance	DPSVI	Intermediate	Reference Sample	Authority type

Figure 7 - Innovation Governance by authority type

2.5 Case Studies



Index observed	Index type	Index level	Data Sample	Clusters
I2.2 – Innovation Governance	DPSVI	Intermediate	Case studies	na

Figure 8 - Innovation Governance, case studies



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