



Inspire Policy Making with Territorial Evidence

FINAL REPORT //

DIGISER

Digital Innovation in Governance and Public
Service Provision

Annex 1.2.3 Level of Service Embedment Report // April 2022

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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:

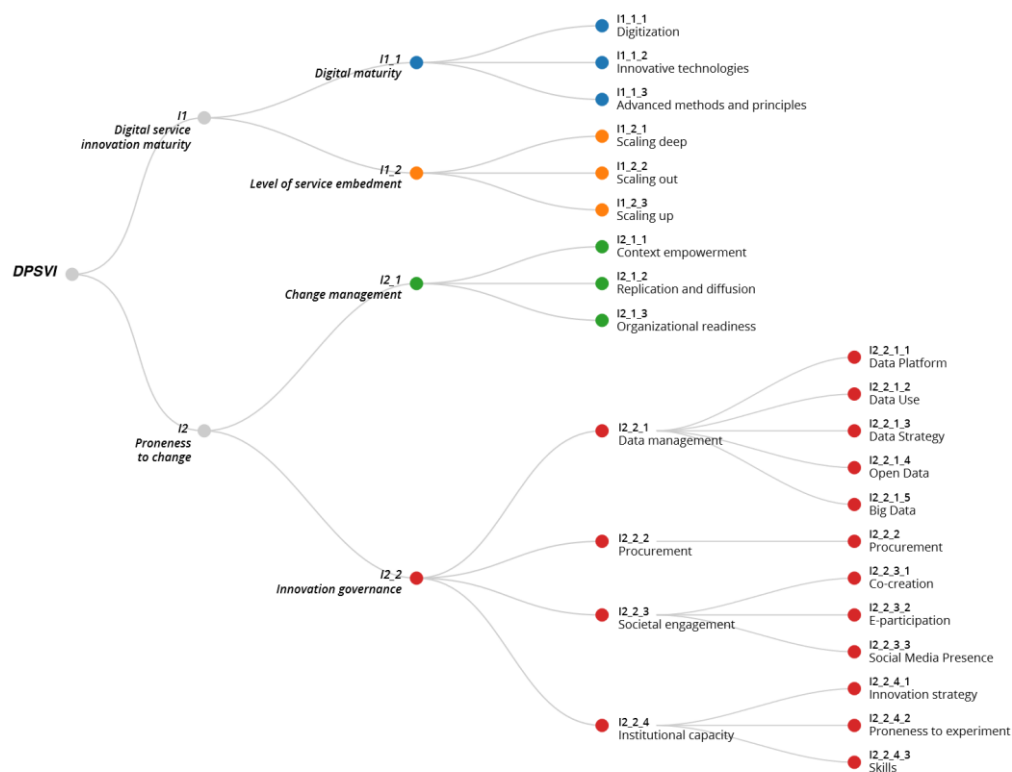


Figure 1 - DPSVI Structure

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.

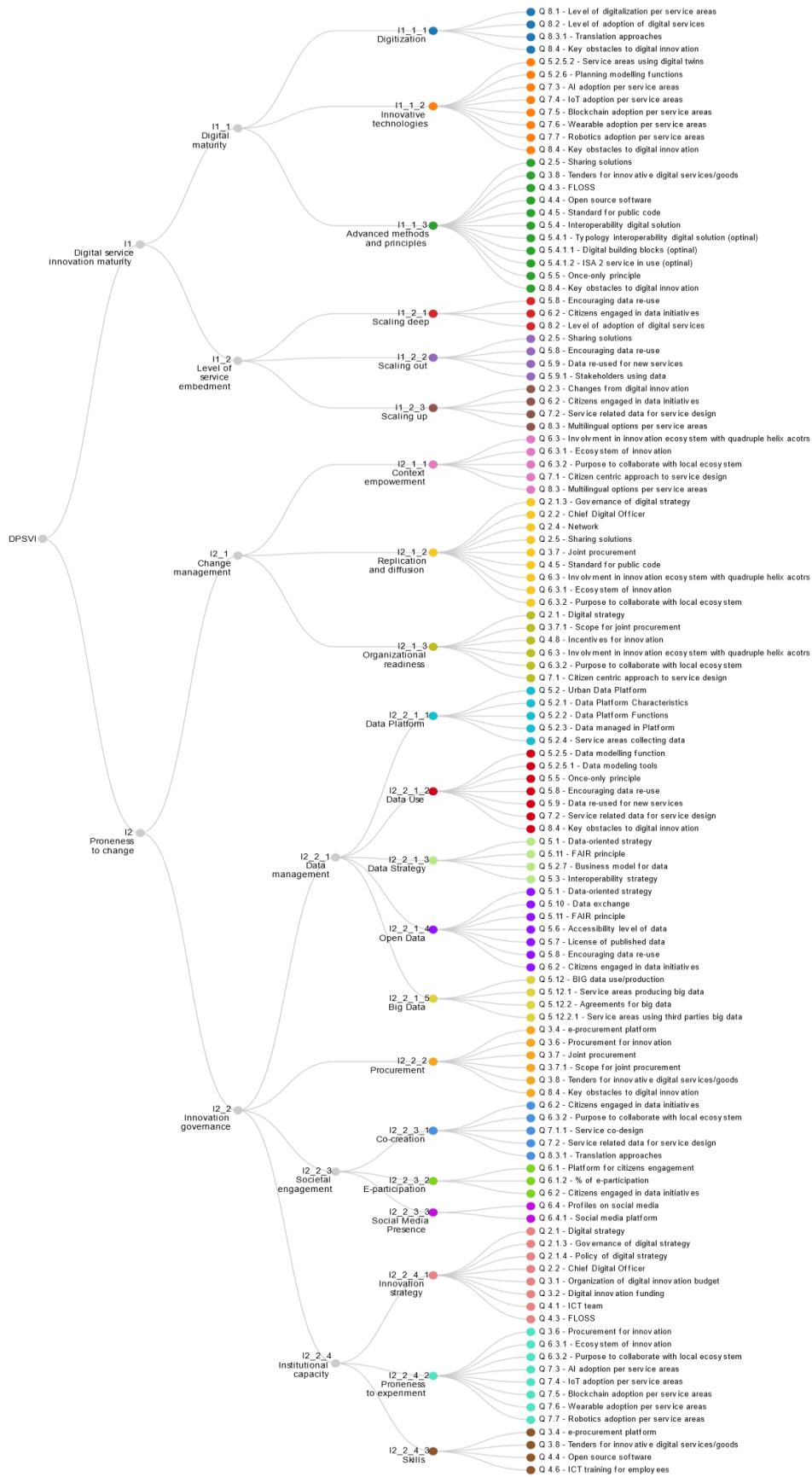


Figure 2 - DPSVI detailed structure – Questions

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 Level of service embedment of European Cities

2.1 Definition of the indices and exploration of its structure

The Level of service embedment reflects the role played by public services in driving changes in public authorities. In this context, three scaling mechanisms are relevant and return a specific view on how organisations can effectively embed innovation in their service provision. In short:

- **I1.2.1 - Scaling deep** reflects to what extent service innovation is widespread and ultimately able to foster behavioural and operational changes in the local context;
- **I1.2.2 - Scaling out** indicates the public authorities' ability either in replicating successful service innovation from different contexts or in exporting innovative solutions experimented locally;
- **I1.2.3 - Scaling up** assesses the reach of public authorities' intrinsic innovative potential in terms of service development.

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.

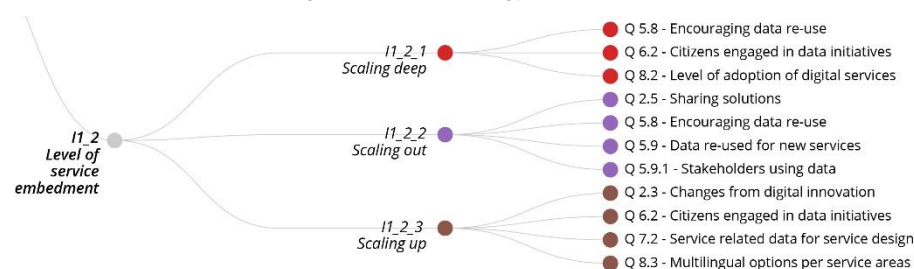


Figure 3 – Level of service embedment index composition (questions tree)

The following table includes the text of all questions used to create the level of service embedment Indexes and information about the type of questions.

| Question number and text | Question Type |
|---|--------------------------|
| 2.3 Please select the option that best represents the organisational and administrative changes enabled by digital innovation in your public authority: | Matrix - Single choice |
| 2.5 Does your public authority benefit from sharing digital solutions, services or products with other public authorities? | Matrix - Multiple choice |
| 5.8 How does the public authority encourage data re-use? | Multiple choice |
| 5.9 Has the shared data been re-used to create new services/solutions? | Single choice |
| 5.9.1 Which external stakeholders re-use the data? | Multiple choice |
| 6.2 Does your public authority engage citizens in (open) data initiatives? | Multiple choice |
| 7.2 Does your public authority use service-related data to improve your digital service offer in the following areas? | Matrix - Multiple choice |
| 8.2 When a public service is provided online as well as offline, how many users are choosing the digital option? | Matrix - Likert |
| 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 – Level of Service Embedment 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

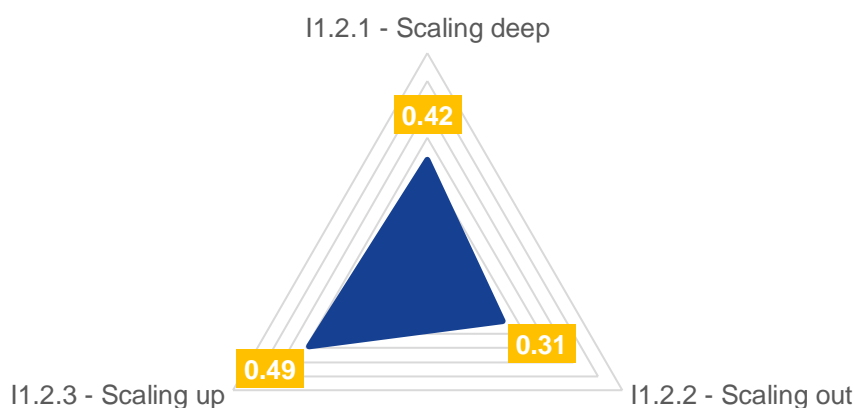
The following table provides information regarding the weights attributed to each question in computing the value of the indexes presented in this report, according to the methodology presented in Chapter 1.2.3.

| Q_# | I1_2_1 | I1_2_2 | I1_2_3 |
|---------|--------|--------|--------|
| Q_2.3 | - | - | 40% |
| Q_2.5 | - | 100% | - |
| Q_5.8 | 20% | 100% | - |
| Q_5.9 | - | 10% | - |
| Q_5.9.1 | - | 90% | - |
| Q_6.2 | 20% | - | 20% |
| Q_7.2 | - | - | 20% |
| Q_8.2 | 60% | - | - |
| Q_8.3 | - | - | 20% |

Table 6 – Level of service embedment - Relative weight of underlying questions

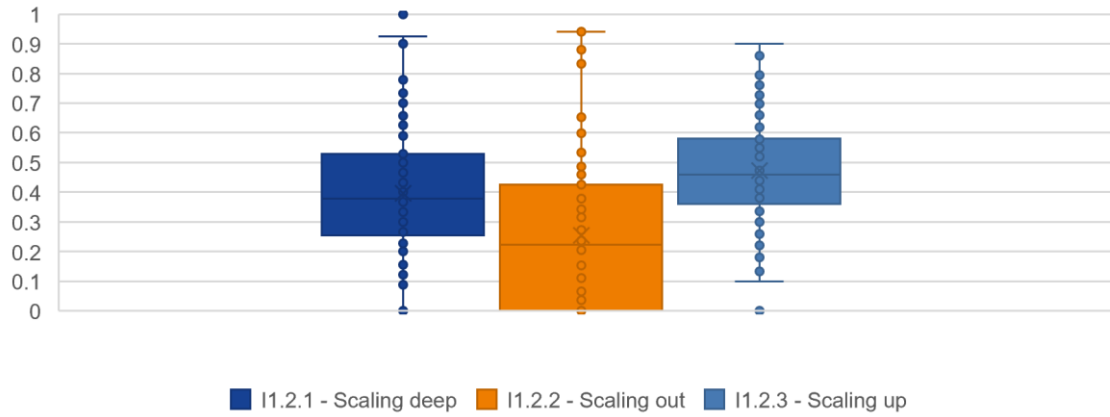
An extensive overview of the weights used to calculate the DPSVI is available in *Annex 1.1 Extended Methodology*.

2.2 Index overview



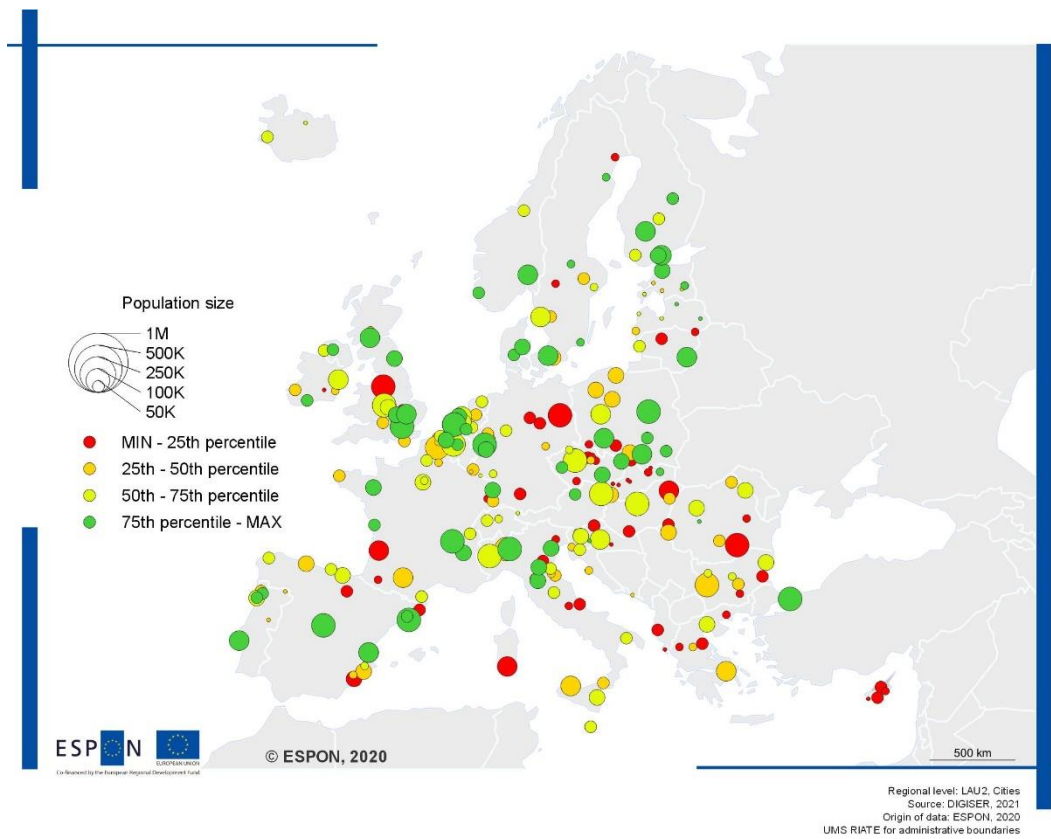
| Index observed | Index type | Index level | Data Sample | Clusters |
|-----------------------------------|------------|--------------|------------------|----------|
| I1.1 - Level of service embedment | DPSVI | Intermediate | Reference Sample | na |

Figure 4 – Level of service embedment overview

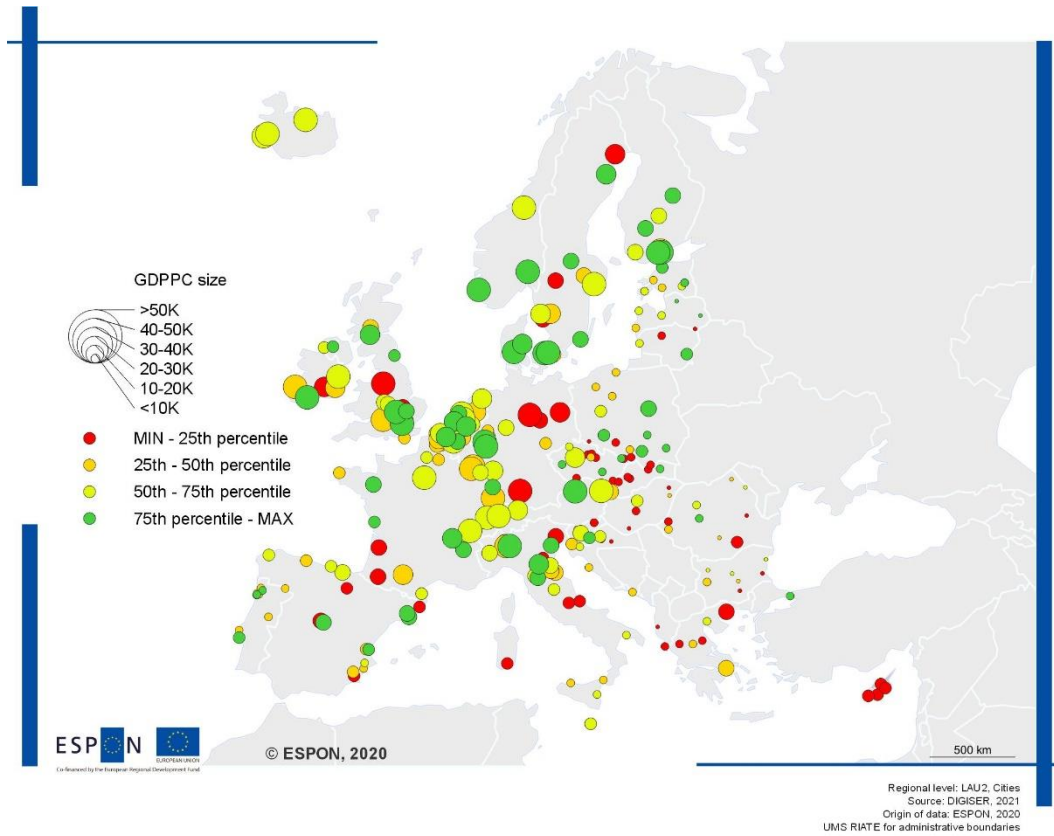


| Index observed | Index type | Index level | Data Sample | Clusters |
|-----------------------------------|------------|--------------|------------------|----------|
| I1.1 - Level of service embedment | DPSVI | Intermediate | Reference Sample | na |

Figure 5 - Level of service embedment composition

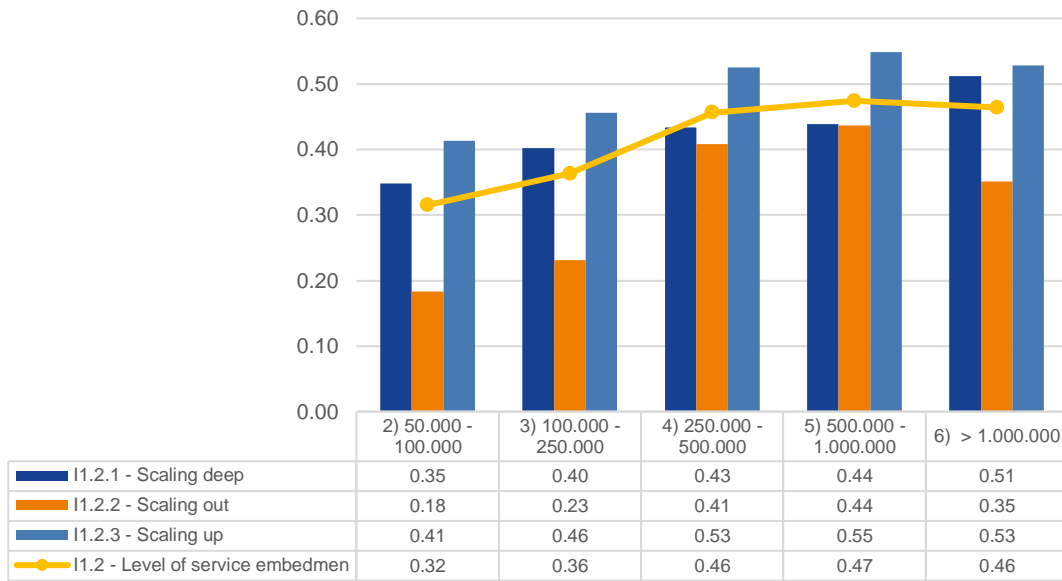


Map 1 – Level of service embedment and population size



Map 2 – Level of service embedment and GDPPC size

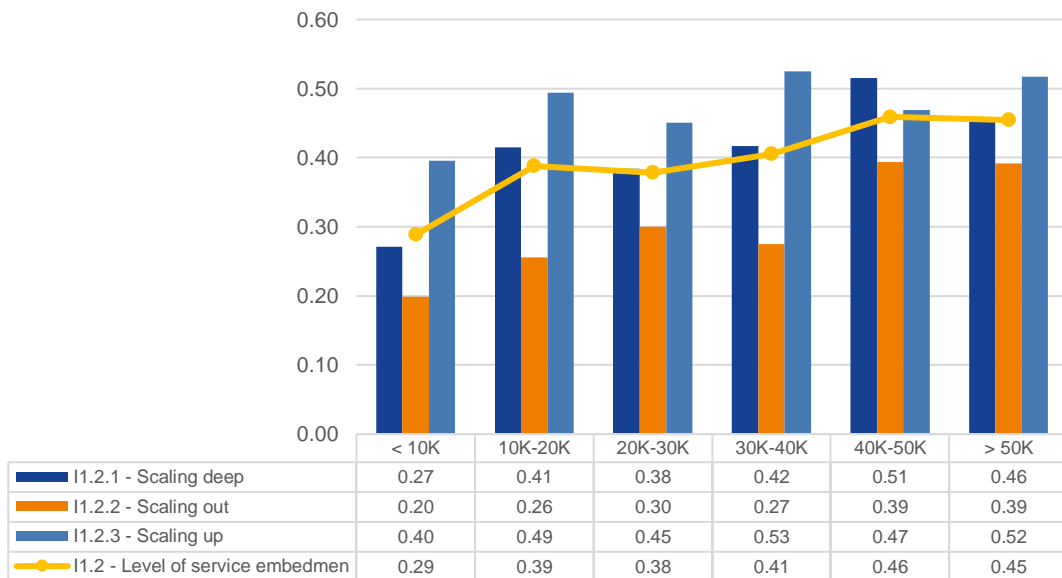
2.3 Population



| Index observed | Index type | Index level | Data Sample | Clusters |
|-----------------------------------|------------|--------------|------------------|------------|
| I1.1 - Level of service embedment | DPSVI | Intermediate | Reference Sample | Population |

Figure 6 - Level of service embedment by population

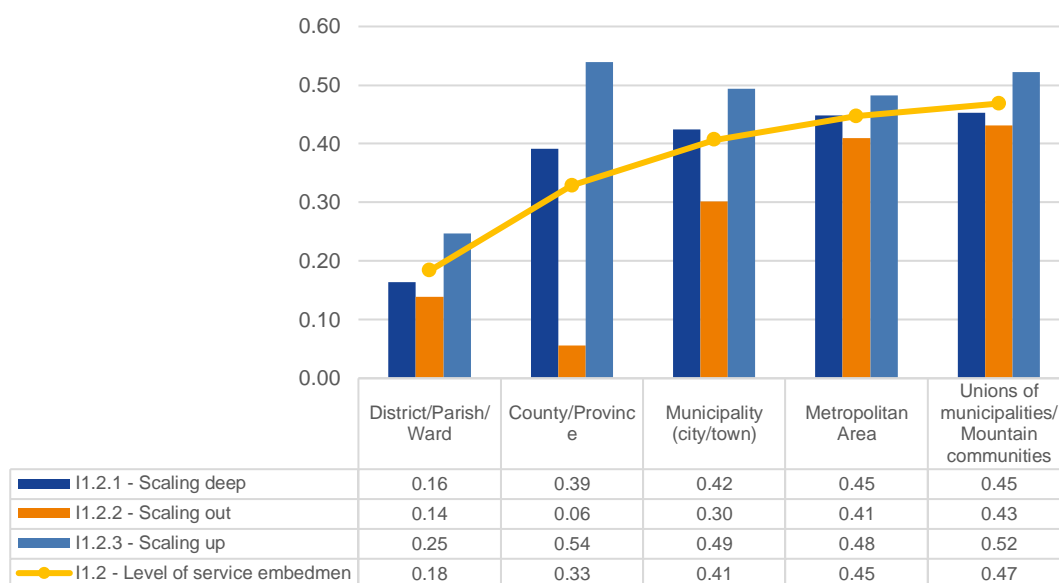
2.4 GDP per Capita



| Index observed | Index type | Index level | Data Sample | Clusters |
|-----------------------------------|------------|--------------|------------------|----------|
| I1.1 - Level of service embedment | DPSVI | Intermediate | Reference Sample | GDPPC |

Figure 7 - Level of service embedment by GDPC

2.5 Authority Type

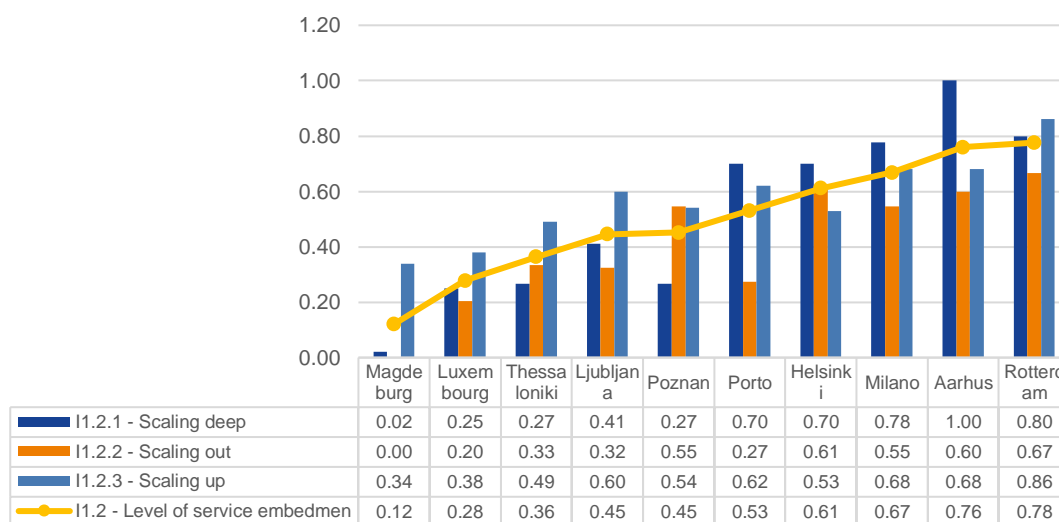


| Index observed | Index type | Index level | Data Sample | Clusters |
|-----------------------------------|------------|--------------|------------------|----------------|
| I1.1 - Level of service embedment | DPSVI | Intermediate | Reference Sample | Authority type |

Figure 8 - Level of service embedment by authority type

2.6 Case Studies

I1.2 - Level of service embedment



| Index observed | Index type | Index level | Data Sample | Clusters |
|-----------------------------------|------------|--------------|--------------|----------|
| I1.1 - Level of service embedment | DPSVI | Intermediate | Case studies | na |

Figure 9 - Level of service embedment, case studies

2.7 Highlights

This indicator seeks to measure the level of innovation that has been triggered by the digital transformation of public services in the local contest and on a higher scale, as well as within the organization itself. It is composed of three sub-indicators that show a different behavior.

- **Scaling Deep** explores the degree of transformation triggered in the local contest. It is positioned on high scores and shows a weak correlation with the size of the population, suggesting that larger and more articulated local societies can better understand the digital transformation, and in some cases also have the skills and resources to be promoters and translators.
- **Scaling out** explores innovation on a supralocal scale, investigating the capacity of local authorities to export innovation and replicate solutions in other contexts. This indicator is on average low and has a greater variability and is difficult to interpret because no clear spatial patterns or related to population and GDP variables seem to emerge.
- **Scaling up** measures the ability to transfer innovation through the organizational sectors and related utility companies and detects average high values, indicating that, at least in the perception of respondents, on this front, where the public authority has greater autonomy and independence from external variables, important results have been achieved.

As for the indicator "Change Management" also in this case the spatial patterns identify a concentration of cities of the first quartile in the Baltic area, Scandinavia and northern Europe, while in addition to the south-east area, which has lower average performances, also the cities of Franco-German Central Europe measure limited performance in this category, demonstrating some degree of resistance to change and innovation.

3 Scaling deep of European Cities

3.1 Definition of the indices and exploration of its structure

Scaling deep concerns the extent to which digital innovation has been integrated into service development resulting in actual adoption by users. This orientation comes with a level of changes in practices and behaviours that public authorities need to undergo in order to make service innovation effective in reaching the societal domain. This dimension is therefore related to the concept of context readiness, meaning that the public administration can effectively offer services able to answer context-related needs.

The scaling deep mechanism can be boosted by data and knowledge sharing practices with learning communities, facilitating and encouraging distributed learning through platforms and participatory approaches.

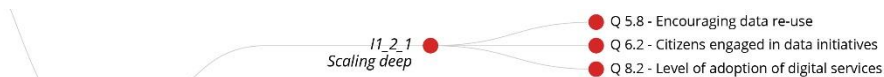
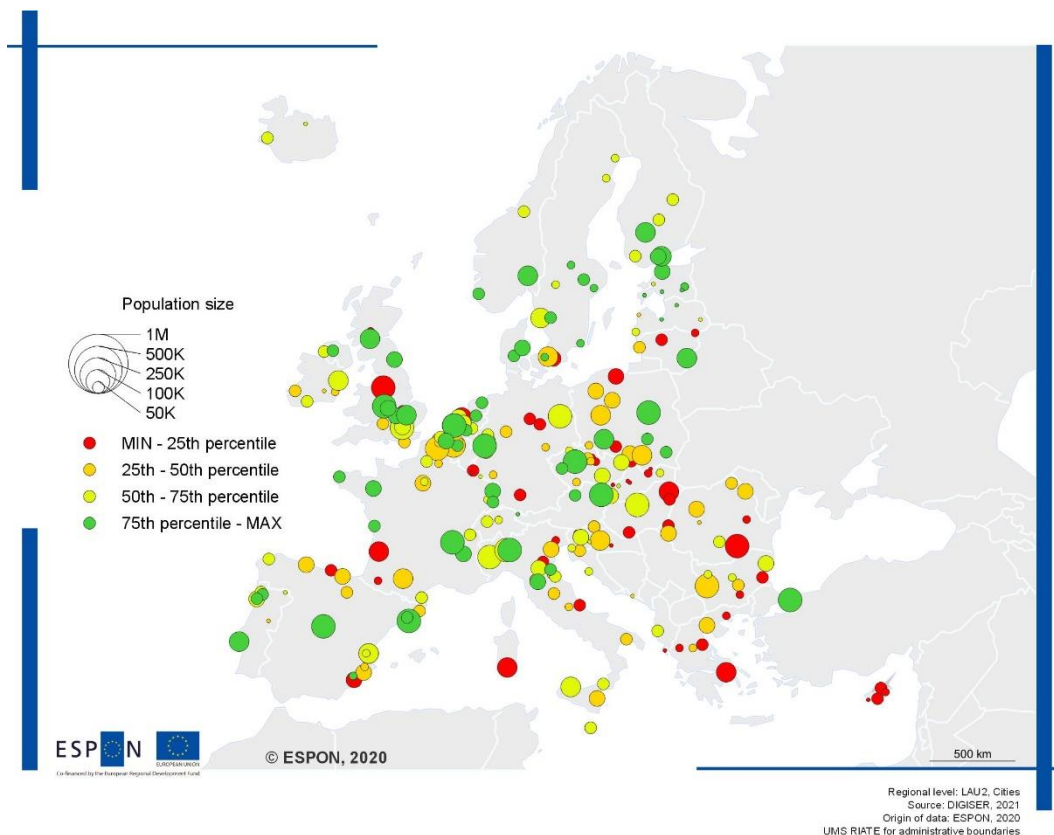


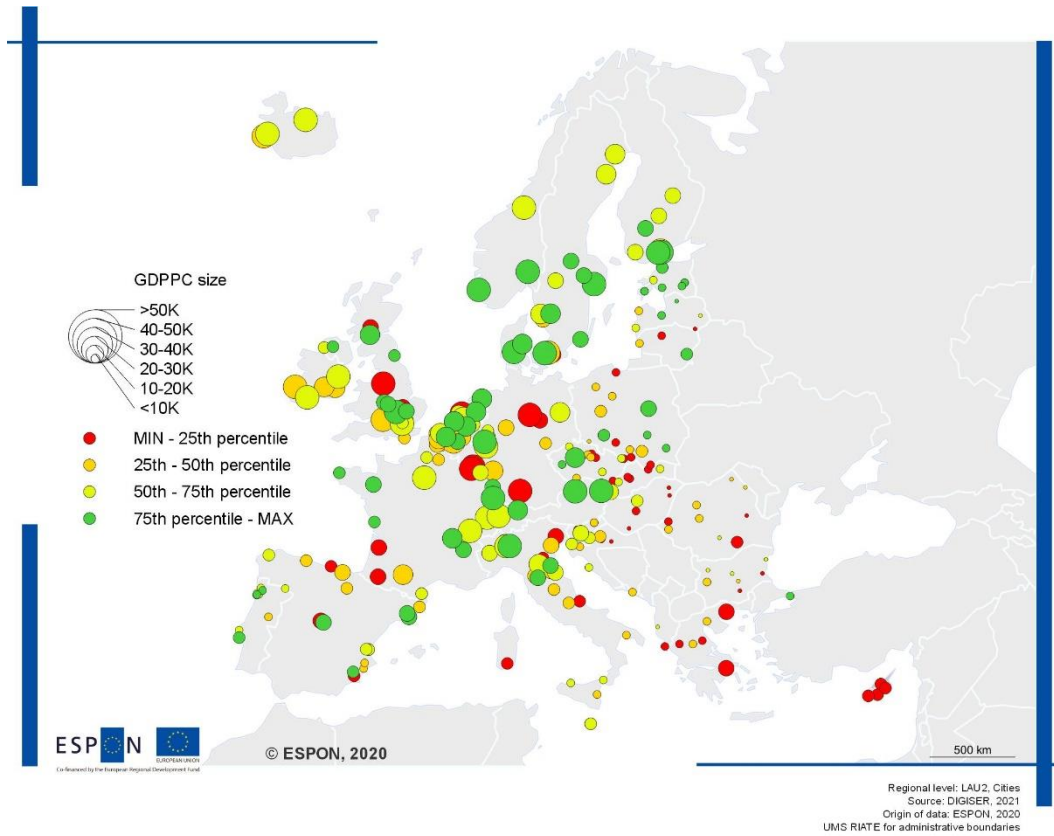
Figure 10 – Scaling deep index composition (questions tree)

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

- **Q_5.8** How does the public authority encourage data re-use?
- **Q_6.2** Does your public authority engage citizens in (open) data initiatives?
- **Q_8.2** When a public service is provided online as well as offline, how many users are choosing the digital option?



Map 3 – Scaling deep and population size



Map 4 – Scaling deep and GDPPC size

3.2 Population

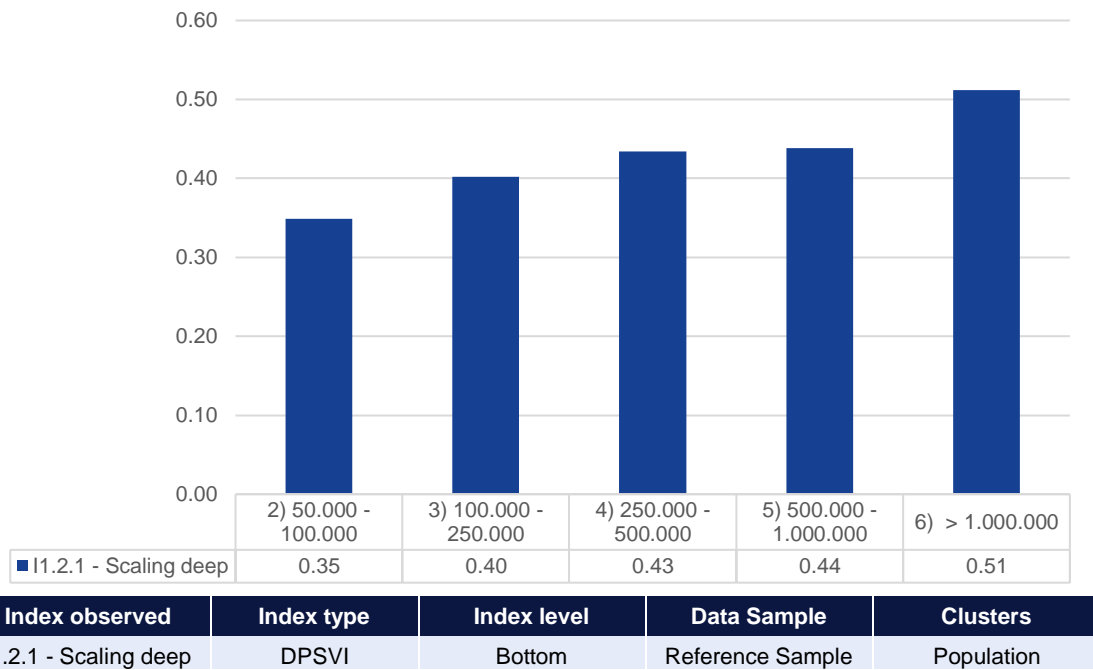


Figure 11 - Scaling deep by population

3.3 GDP per Capita

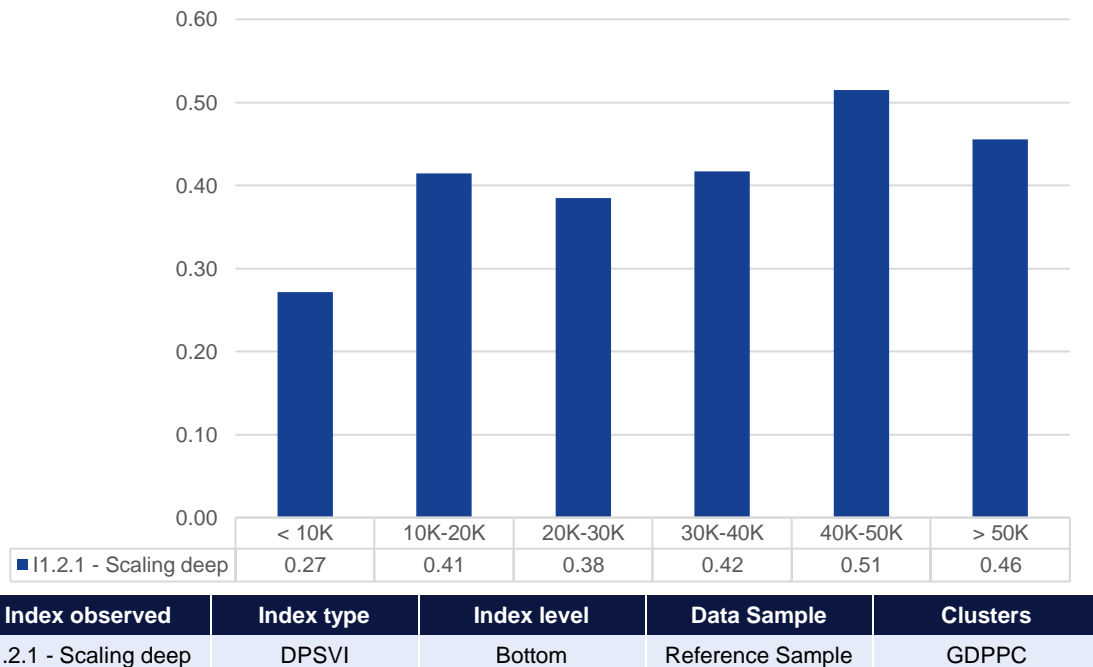
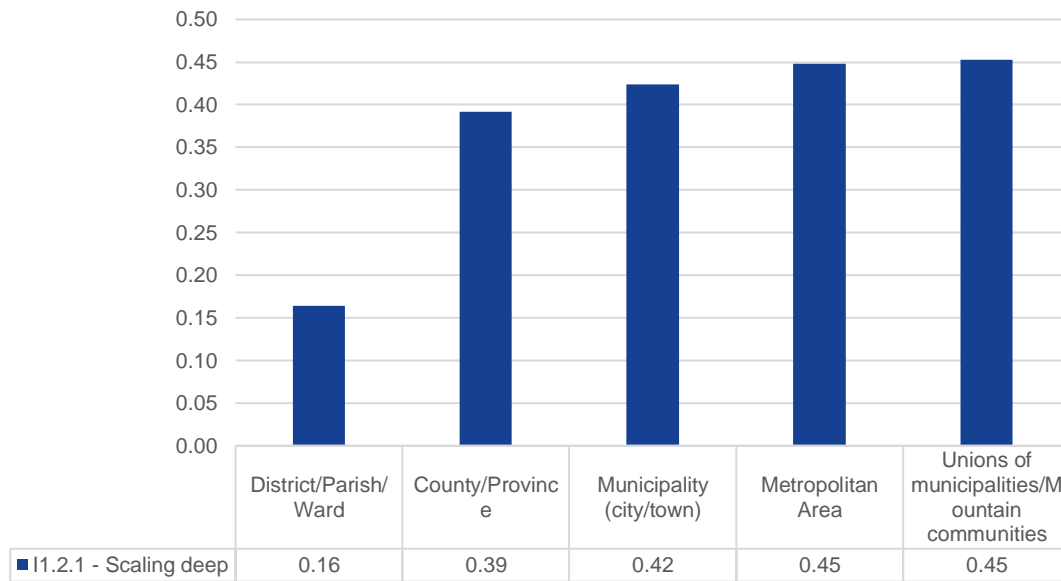


Figure 12 - Scaling deep by GDPC

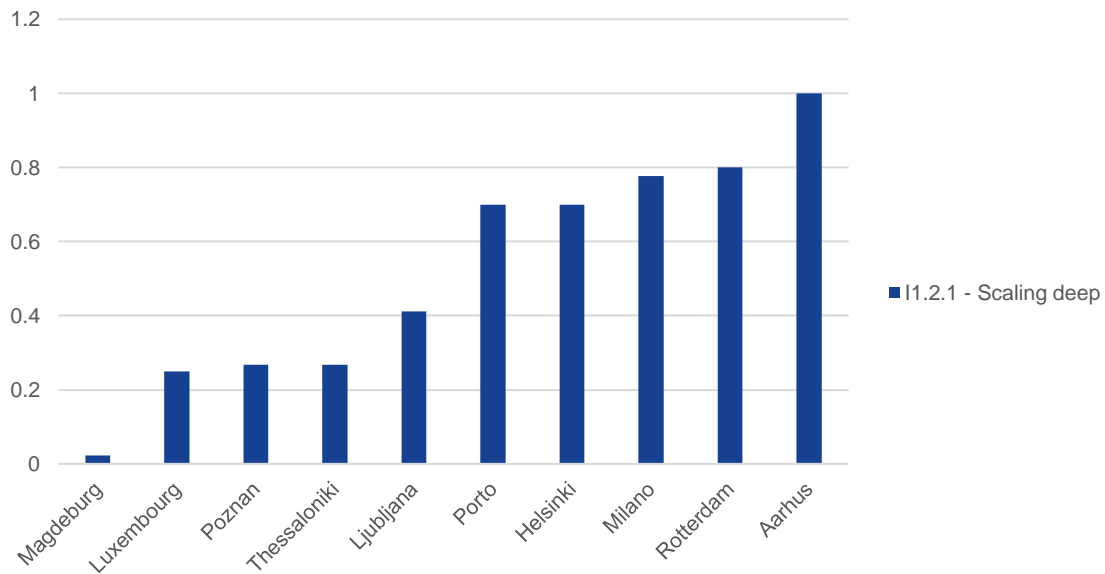
3.4 Authority Type



| Index observed | Index type | Index level | Data Sample | Clusters |
|-----------------------|------------|-------------|------------------|----------------|
| I1.2.1 - Scaling deep | DPSVI | Bottom | Reference Sample | Authority type |

Figure 13 - Scaling deep by authority type

3.5 Case studies

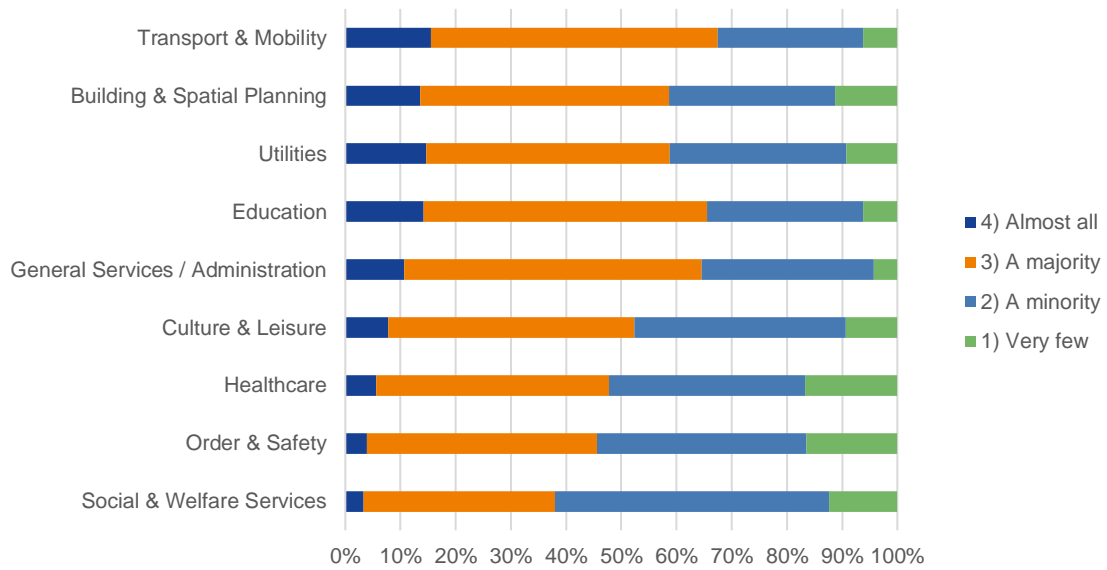


| Index observed | Index type | Index level | Data Sample | Clusters |
|-----------------------|------------|-------------|--------------|----------|
| I1.2.1 - Scaling deep | DPSVI | Bottom | Case studies | na |

Figure 14 - Scaling deep, case studies

3.6 Relevant question results

3.6.1 When a public service is provided online as well as offline, how many users are choosing the digital option?



| Question observed | Question type | Data Sample | Clusters | Value |
|-------------------|---------------|------------------|--------------|------------|
| Q_8.2 | Single choice | Reference Sample | Service area | Percentage |

Figure 15 – Online Services Usage

4 Scaling out of European Cities

4.1 Definition of the indices and exploration of its structure

Scaling out reflects the public authority's capacity to replicate and transfer innovation, becoming a driver to the adoption/replication/exportation of innovative solutions and services by/in/to other public organisations, either in case such solutions have been entirely and autonomously developed, or in case they are the result of a process of continuous improvement. In this respect, specific and dedicated experiences of sharing and collaborative networks play a crucial role, allowing public authorities to access a large variety of services and related solutions opportunities. The dimension of Scaling out is also related to the ability of the public authority to effectively and actively support and incentivise data re-use, going beyond the exploitation within the public organisation. This can occur at multiple levels by defining selected partnerships with other public or private stakeholders.

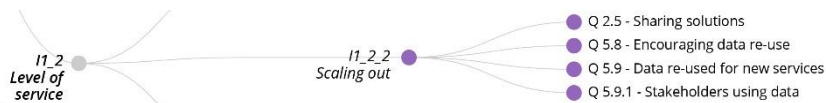
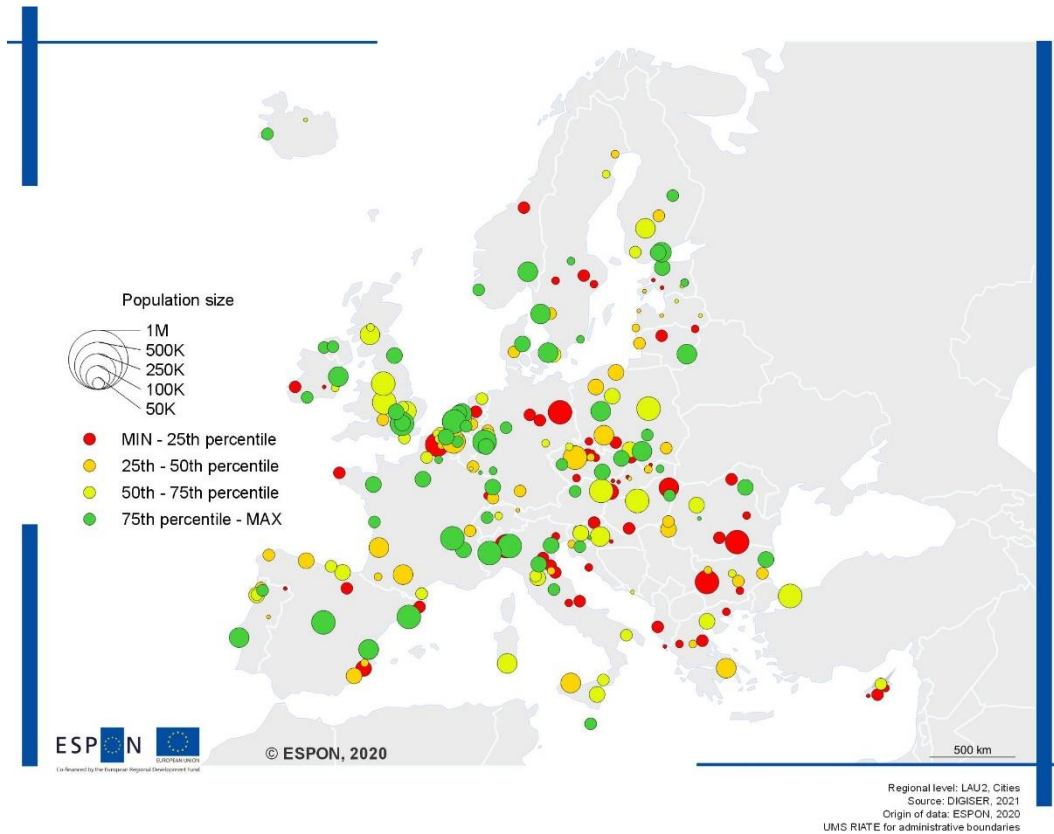


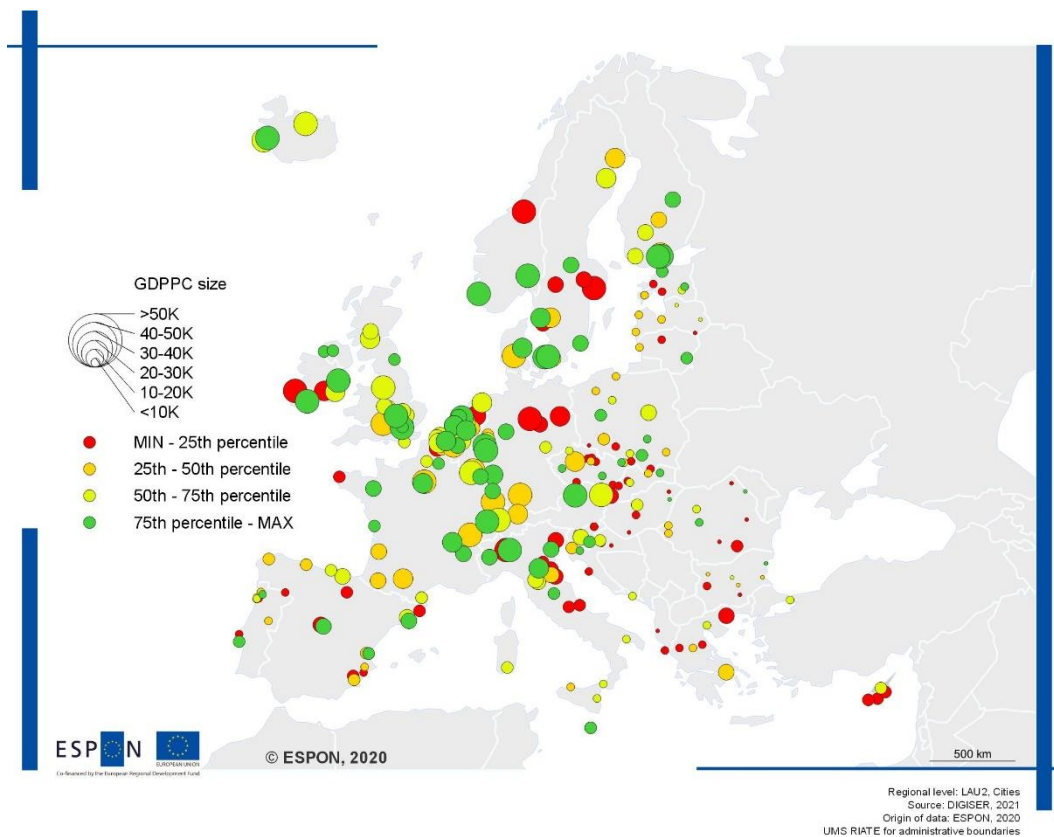
Figure 16 – Scaling out index composition (questions tree)

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

- **Q_2.5** Does your public authority benefit from sharing digital solutions, services or products with other public authorities?
- **Q_5.8** How does the public authority encourage data re-use?
- **Q_5.9** Has the shared data been re-used to create new services/solutions?
- **Q_5.9.1** Which external stakeholders re-use the data?



Map 5 – Scaling out and population size



Map 6 – Scaling out and GDPPC size

4.2 Population

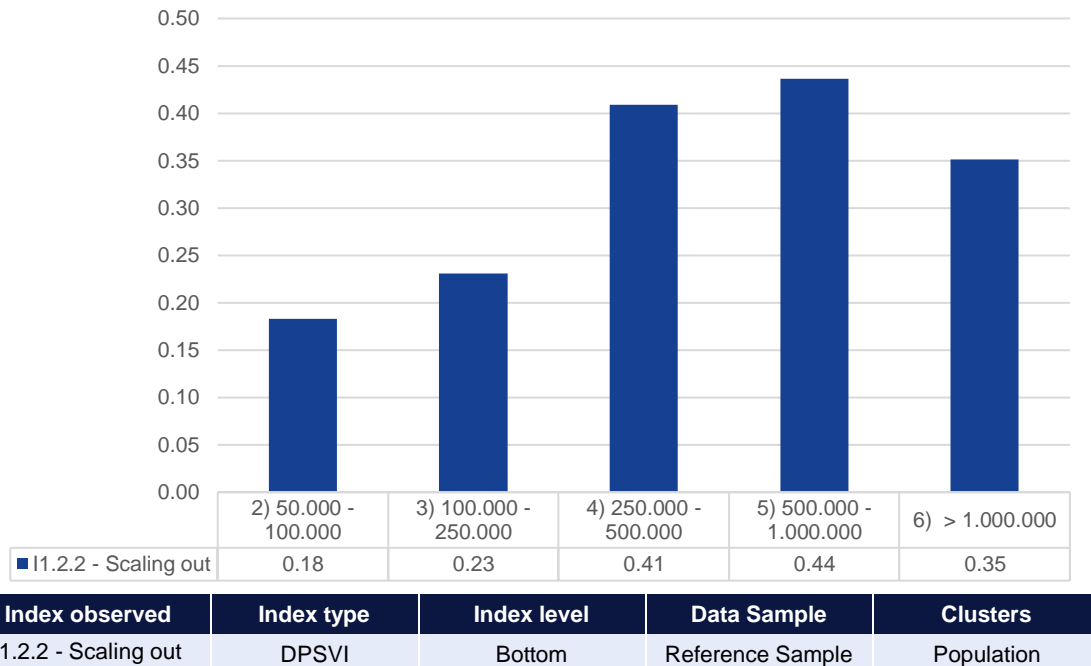


Figure 17 - Scaling out by population

4.3 GDP per Capita

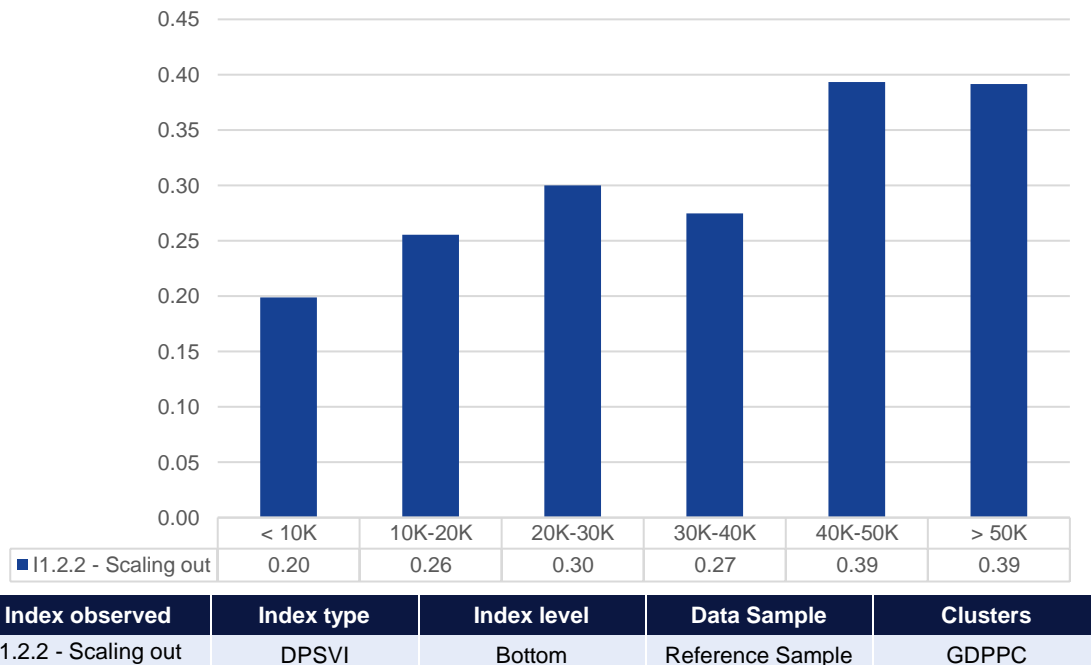
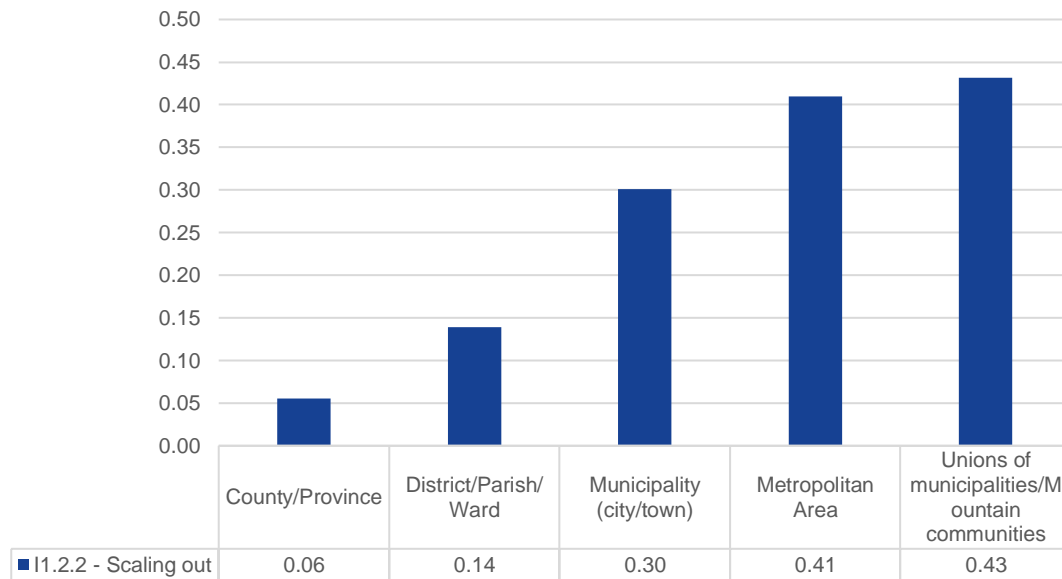


Figure 18 - Scaling out by GDPC

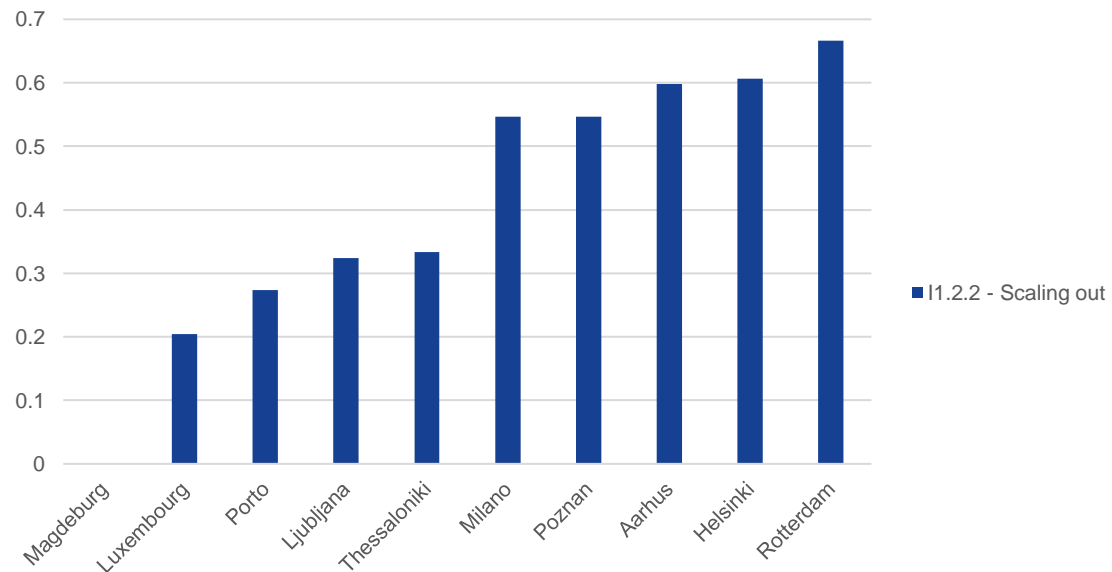
4.4 Authority Type



| Index observed | Index type | Index level | Data Sample | Clusters |
|----------------------|------------|-------------|------------------|----------------|
| 11.2.2 - Scaling out | DPSVI | Bottom | Reference Sample | Authority type |

Figure 19 - Scaling out by authority type

4.5 Case studies

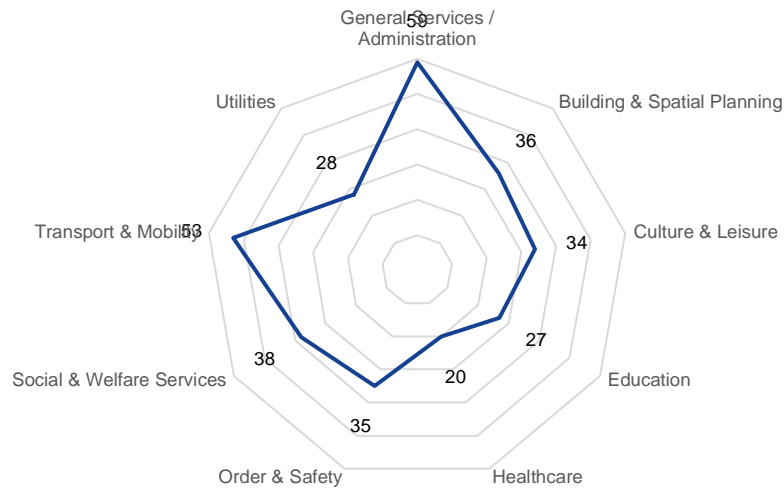


| Index observed | Index type | Index level | Data Sample | Clusters |
|----------------------|------------|-------------|--------------|----------|
| 11.2.2 - Scaling out | DPSVI | Bottom | Case studies | na |

Figure 20 - Scaling out, 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?

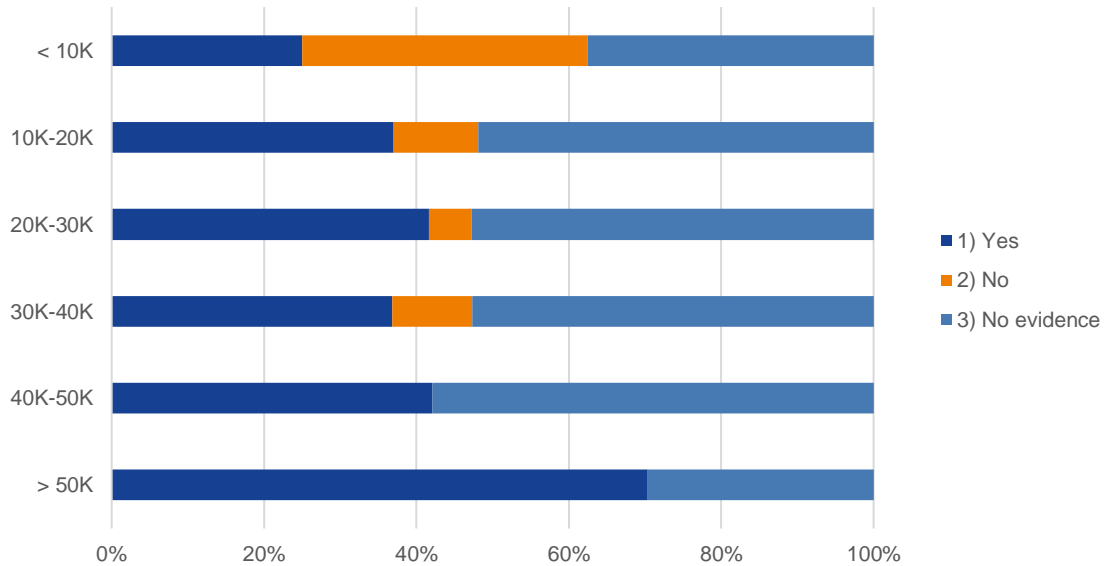


— 2) Exporting and sharing digital solutions developed to other public authorities

| Question observed | Question type | Data Sample | Clusters | Value |
|-------------------|-----------------|------------------|--------------|-------|
| Q_2.5 | Multiple choice | Reference Sample | Service area | Count |

Figure 21 – Exporting digital solutions

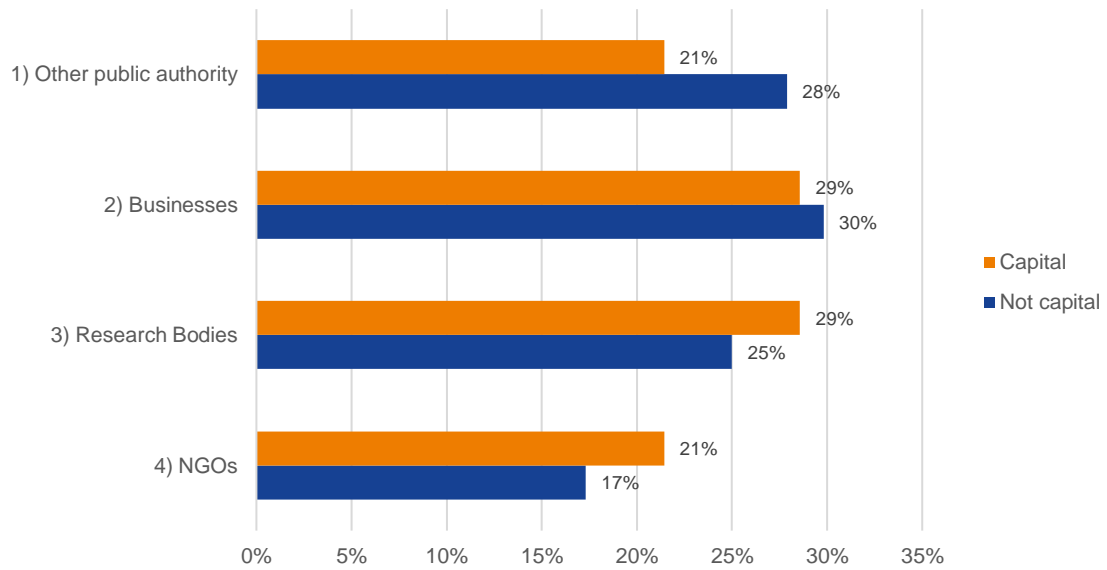
4.6.2 Has the shared data been re-used to create new services/solutions?



| Question observed | Question type | Data Sample | Clusters | Value |
|-------------------|---------------|------------------|----------|------------|
| Q_5.9 | Single choice | Reference Sample | GDPPC | Percentage |

Figure 22 – Reuse of shared Open Data

4.6.3 Which external stakeholders re-use data?



| Question observed | Question type | Data Sample | Clusters | Value |
|-------------------|---------------|------------------|----------|------------|
| Q_5.9.1 | Single choice | Reference Sample | Capital | Percentage |

Figure 23 – Who reuses the Open Data?

5 Scaling up of European Cities

5.1 Definition of the indices and exploration of its structure

Scaling up refers to how the embedment of digital innovation into services implies organisational change, requiring organisational structures modifications, and revision of previous routines, practices, and even policies. To reach and guarantee an autonomous supply and provision of such services, public administrations have to undergo a process of adaptation and renewal. Scaling up reflects the degree and extent of completion of such a process.

This mechanism implies that innovative solutions and approaches are codified in organisational policies and institutions, hence impacting the institution at higher levels.

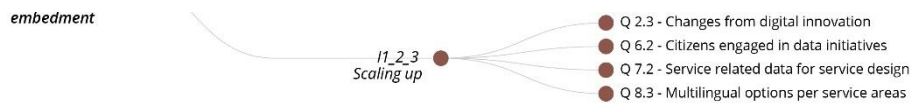
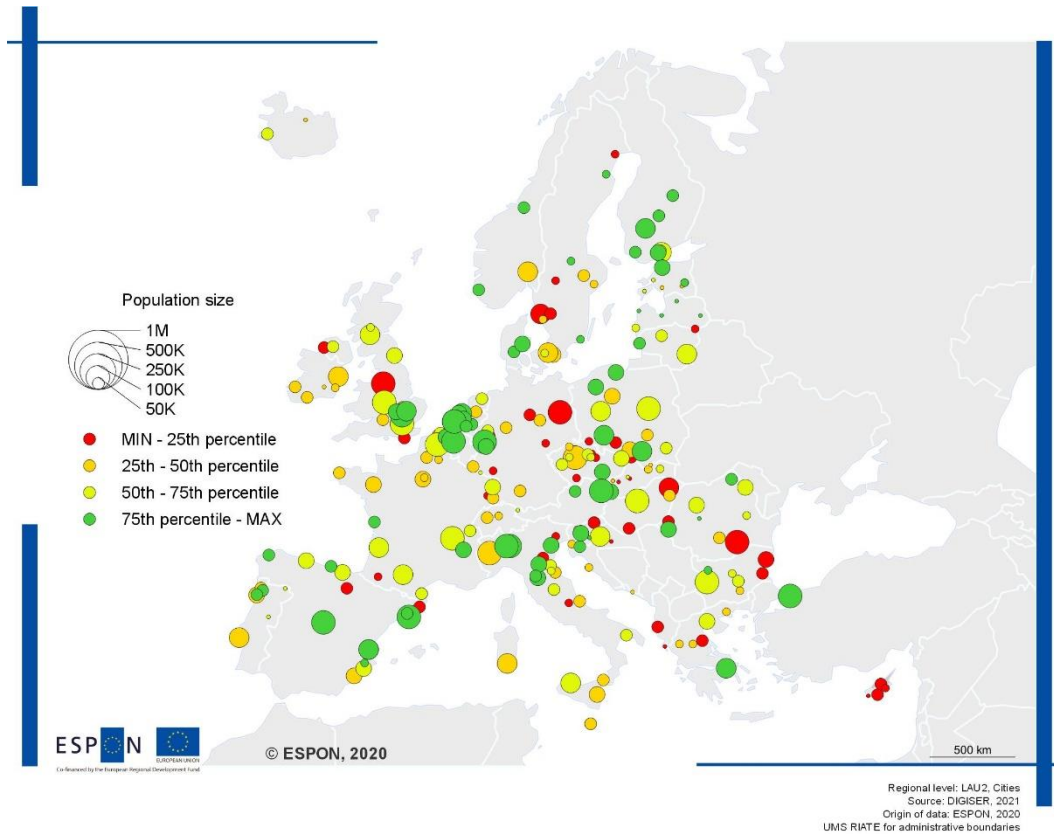


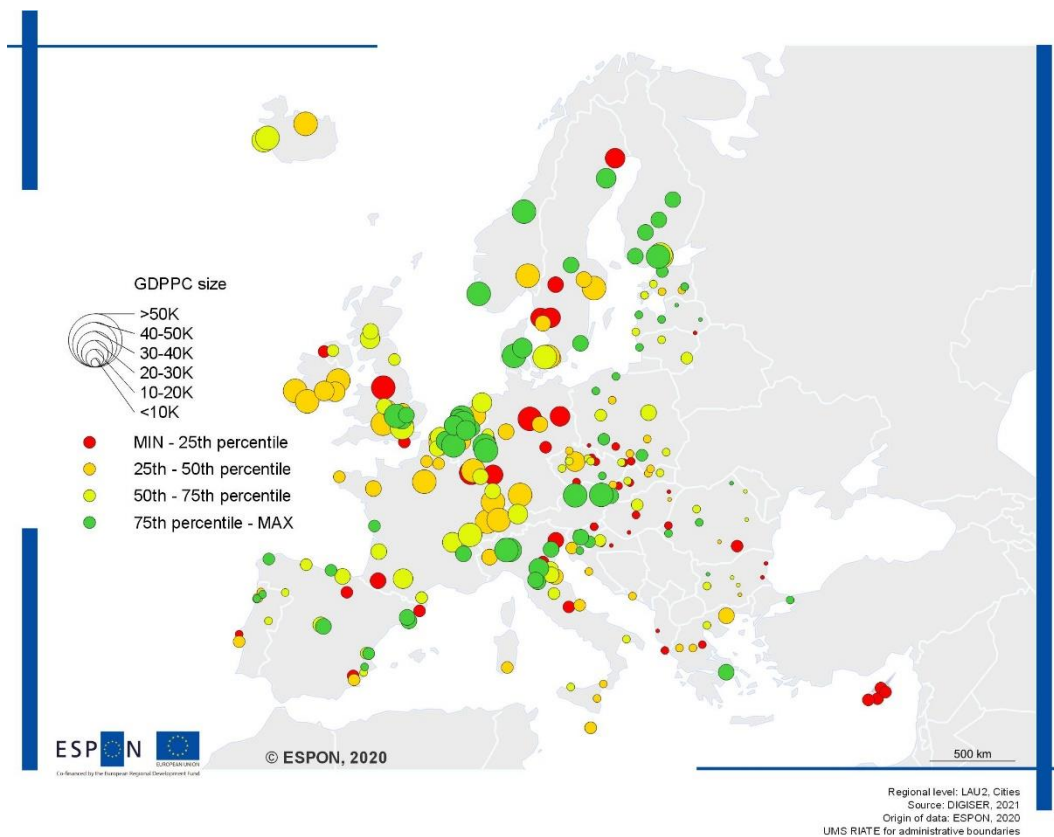
Figure 24 – Scaling up index composition (questions tree)

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

- **Q_2.3** Please select the option that best represents the organisational and administrative changes enabled by digital innovation in your public authority:
- **Q_6.2** Does your public authority engage citizens in (open) data initiatives?
- **Q_7.2** Does your public authority use service-related data to improve your digital service offer in the following areas?
- **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 7 – Scaling up and population size



Map 8 – Scaling up and GDPPC size

5.2 Population

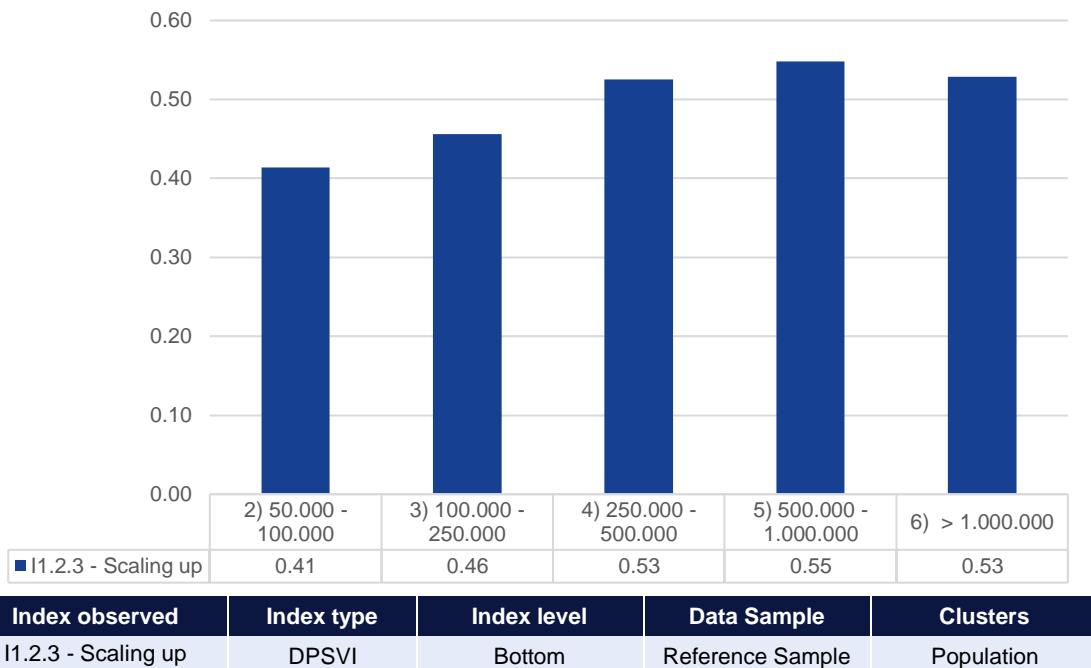


Figure 25 - Scaling up by population

5.3 GDP per Capita

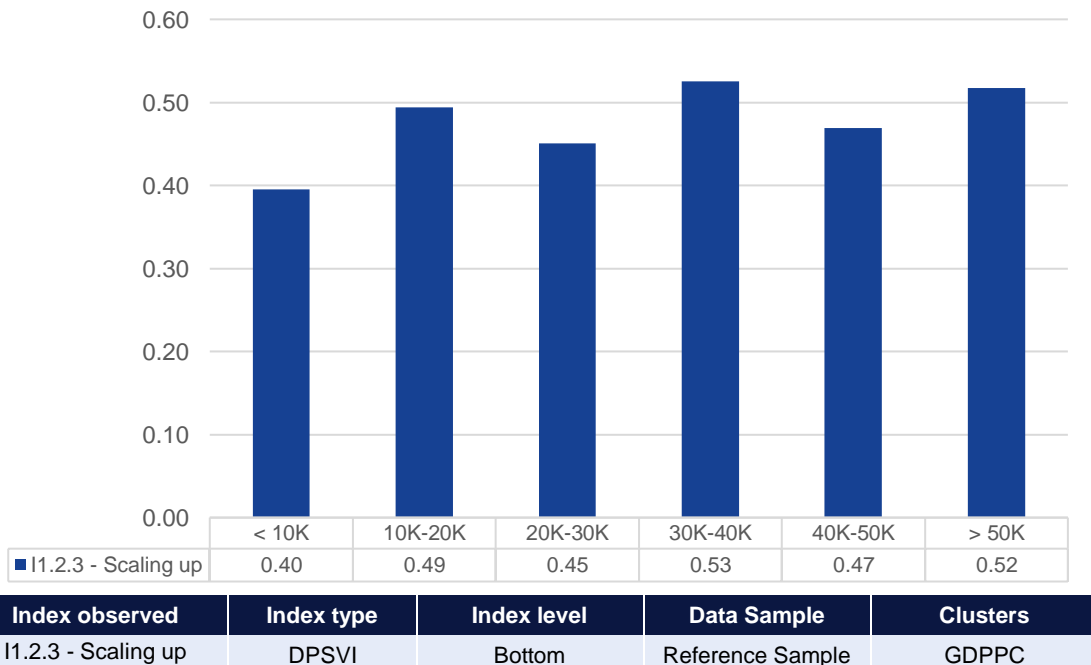
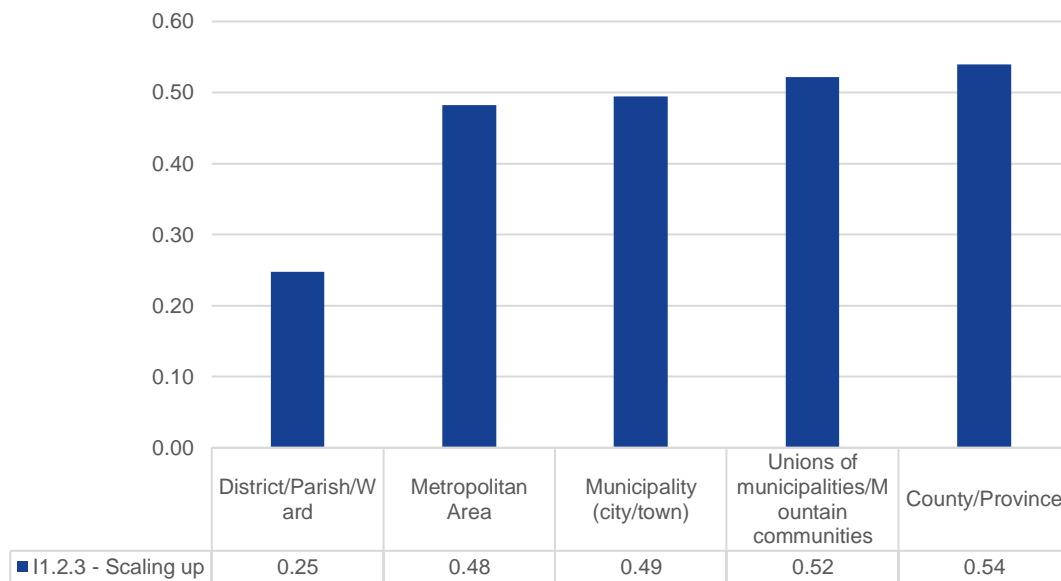


Figure 26 - Scaling up by GDPC

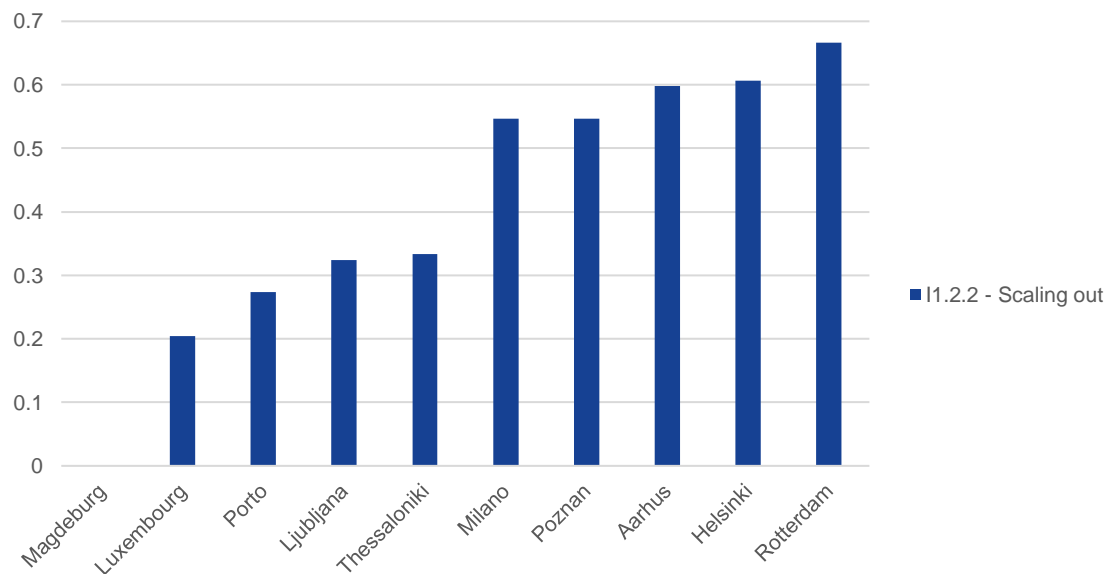
5.4 Authority Type



| Index observed | Index type | Index level | Data Sample | Clusters |
|---------------------|------------|-------------|------------------|----------------|
| 11.2.3 - Scaling up | DPSVI | Bottom | Reference Sample | Authority type |

Figure 27 - Scaling up by authority type

5.5 Case studies

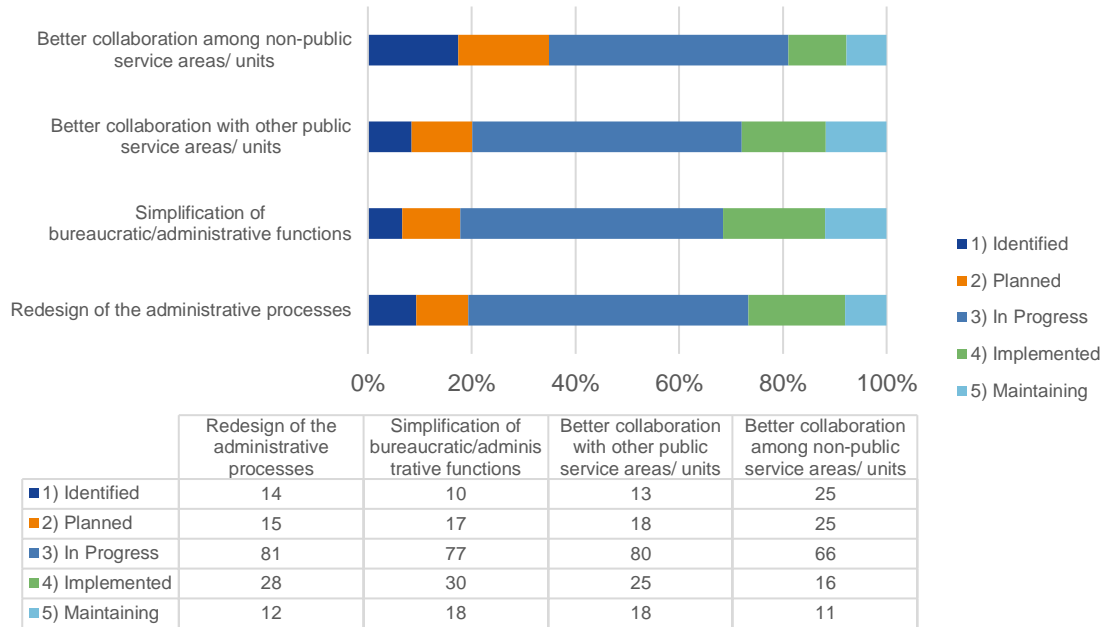


| Index observed | Index type | Index level | Data Sample | Clusters |
|---------------------|------------|-------------|--------------|----------|
| 11.2.3 - Scaling up | DPSVI | Bottom | Case studies | na |

Figure 28 - Scaling up, case studies

5.6 Relevant question results

5.6.1 Please select the option that best represents the organisational and administrative changes enabled by digital innovation in your public authority:



| Question observed | Question type | Data Sample | Clusters | Value |
|-------------------|------------------------|------------------|----------|------------|
| Q_2.3 | Matrix – Single choice | Reference Sample | na | Percentage |

Figure 29 – Organizational Change “in progress”



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