D7.2: Reporting to the SCIS system

+CityxChange | Work Package 7, Task 7.2
Final delivery date: 28-06-2019

Deliverable version	v.1.5
Dissemination level	Public (OR Confidential)
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This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 824260.

Document Information

Project Acronym	+CityxChange
Project Title	Positive City ExChange
Project Coordinator	Annemie Wyckmans, Norwegian University of Science and Technology
Project Duration	1 November 2018 - 31 October 2023
Deliverable Number	D7.2: Reporting to the SCIS System
Dissemination Level	PU-Public
License	CC-BY4.0 Creative Commons Attribution, except where otherwise noted. https://creativecommons.org/licenses/by/4.0/
Status	Completed
Due Date	28-06-2019
Work Package	WP7 – Monitoring and Evaluation
Lead Beneficiary	FAC, James Sweeney

Revision History

Date	Version	Author	Substantive changes made
17.03.2019	V1.1	James Sweeney, Daniel Rood, William Hynes (FAC)	Initial version
12.04.2019	V1.4	James Sweeney, Daniel Rood, William Hynes (FAC)	Draft version
29.04.2019	V1.5	James Sweeney(FAC)	Final Version

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List of Acronyms

API	Application Programming Interface
BEST	Building Energy Specification Table
CO_2	Carbon Dioxide
CSO	Community Systems Operator
DA	Demonstration Area
DER	Distributed Energy Resource
DoA	Description of Action
DP	Demonstration Project
DPEB	Distributed Positive Energy Block
DPED	Distributed Positive Energy District
DS	Demonstration Site
DST	Decision Support Tool
EC	European Commission
eMaaS	e-Mobility as a Service
EU	European Union
FoA	Fields of Action
GHG	Greenhouse Gasses
GWh	Giga-watt hour
ICT	Information Communication Technologies
KPI	Key Performance Indicator
kWh	Kilo-watt hour
LHC	Lighthouse City
MERT	+CityxChange Monitoring and Evaluation Reporting Tool
MWh	Mega-watt hour
NOX	Nitrogen Oxides
RES	Renewable Energy Source
ROI	Return on Investment
SCIS	Smart Cities Information System
SRT	Self-Reporting Tool
UFA	Usable Floor Area

1 Executive Summary

This deliverable constitutes the initial outline report to the Smart Cities Information System (SCIS) for the +CityxChange project (824260). This is the first of 10 reports to be completed which will be carried out at 6-month intervals across the project. At this early stage the primary aim of this first report is to present the work carried out to date to prepare the +CityxChange SCIS instance for data input, to understand the divergence from the SCIS with respect to our project Key Performance Indicators, and, in order to set out the process for further reporting over the coming months and years. It is anticipated that future data points will be added to the SRT and summary reports will be generated via the SCIS system.

The month 6 delivery of the Deliverable 7.1 Standardised Approach to Monitoring and Evaluation is a prerequisite for cities in collecting data that adheres to an agreed single approach for data collection across the project in relation to KPIs. As such the report focuses more on what baselines have been established to date and what data has been collected by month 6.

When data collection or processing is started, the SCIS Reports will be updated accordingly to include updated KPI data points, data summaries, metadata, compliance, an export output from Self-Reporting Tool (SRT) where possible. Processing of personal data will respect data protection principles.

This document provides an overview of data handling with respect to the SCIS and provides the initial guidelines for the project. The inputs to the SRT will support openness according to the EU principle "as open as possible, as closed as necessary" together with the project ambition of “Open by Default”.

This is the first +CityxChange monitoring report, which provides a snapshot of the trends and development of the +CityxChange project and its Lighthouse and Follower cities and are based on evidence collected through the Key Performance Indicators (KPIs), which were developed to reflect the progress on activities carried out under the various work packages on the project.

In accordance with the guidance from the SCIS on timeframes for reporting and key milestones, the +CityxChange project at month 6 has completed most of the year objectives set out by SCIS. Specifically, upskilled on usage of SRT, principal actors identified, and credentials assigned, Field of Actions built for SCIS KPIs. Usage of the SCIS as a monitoring tool can now begin as early as month 7 on the project.

As of the 7th of June 2019, the SCIS SRT does not have a functional reporting tool to export/generate a report on KPI progress. Due to this limitation on reporting ability, and the non-alignment of a number of project KPIs to the SRT’s fields of action, an approach has been

followed where project data will primarily be collated in the +CityxChange M&E Reporting Tool (MERT) from where reports, visualisations and insights will be derived.

2 Introduction

The +CityxChange Monitoring and Evaluation work package will set up the methodologies, collection frameworks, and technologies necessary to collect relevant data points for 33 specified Key Performance Indicators for the +CityxChange project. These frameworks will also be designed to conform to the reporting requirements of the Smart Cities Information System (as specified in the KPI table). Where self-reporting features or automation are not implemented, data will be collected via data collection sheets, online surveys, or other appropriate measures.

Subsequent revisions of this deliverable will not be presented in a written report but instead an output report from the SCIS system and the +CityxChange MERT.

2.1 Measuring impact in +CityxChange

The +CityxChange project provides a performance measurement framework for the monitoring, comparison and evaluation of European cities activities during the implementation of Smart City solutions. The development and use of meaningful Key Performance Indicators (KPI) in the measurement of the impact that prescribed projects have on the establishment of energy efficiency systems in the Lighthouse Cities is key to the success of the project. The methodology is based on extensive collaboration and communication with European cities in order to develop a set of KPIs specifically for Smart City initiatives' evaluation and comparability. The selection process was based on many criteria including relevance, completeness, availability, measurability, reliability, familiarity, non-redundancy, and independence.

Experiences and initiatives in previous projects were reviewed and the research developed and validated a performance evaluation framework, including KPIs definition, guidelines for data collection, a performance system prototype and testing in case-cities. In the DoA, the project has defined 33 KPIs which will be used to measure the impact over time of Demonstration Projects and interventions over the 5 years of the project and beyond. Each of these KPIs can be seen below alongside their respective *baseline* (if available at this time) and the *target* for the project:

Table 1: KPI Overview of Expected Impacts and Baselines

Theme	KPI ID	KPI Type	KPI Definition	Expected Impact (Target)	Baseline
Integrated Planning and Design	1	Decision / planning support	No. of APIs connected to the Decision Support Tool (DST)	20	0
	2	Decision /planning support	No. of use case stories in the repository/catalogue	15	0
	3	Training and skills development	No. of municipal staff trained to use the Decision Support Tool	40	0
	4	Enabling DPEB /DPEDs	No. of new DPEB/DPED-enabling prototypes	30	0
	5	Enabling DPEB /DPEDs	No. of study visits by regulatory authorities	60	0
	6	Enabling DPEB /DPEDs	No. of politically approved Bold City Visions with guidelines, roadmaps, and action plans	7	0
	7	Impact on regulation	No. of changes in regulation	15	0
Common Energy Market	8	Greenhouse gas (GHG) emissions	Tonnes of CO_2-equivalent emission reduction per year	12.801 tonnes/ year	N/A*
	9	Air quality	Tonnes of Nitrogen Oxides (NOX) emissions reduction per year	6.2 tonnes/ year	N/A
	10	RES share	The percentage of total Renewable Energy Sources self-supply	Limerick: 100 Trondheim: 75	N/A
	11	RES Integration	Increase in new renewable energy system integration	4.538 GWh/year	N/A
	12	District level optimized self-consumption	Percentage district level production versus total energy consumption	47.7 % new production	N/A

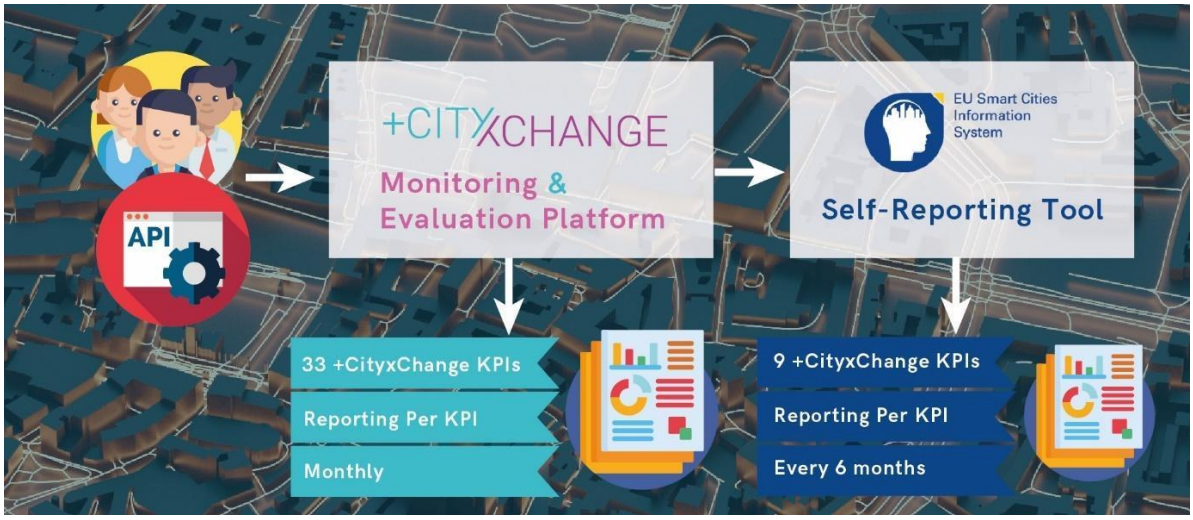
Theme	KPI ID	KPI Type	KPI Definition	Expected Impact (Target)	Baseline
	13	Replication	No. of new DPEBs realised	7	0
	14	RES efficiency	kWh/m² (UFA) per year improved energy efficiency (final energy demand)	62 kWh/m² / year	N/A
	15	RES efficiency	Net useful thermal recovery/year (GWh)	2.134 (GWh) net increase/year	N/A
	16	Reduction in energy grid investment	€M reduction compared to planned investment	€20M	0
	17	RES curtailment	Reliability of RES systems and the curtailment of failures	<1%	0
	18	RES traded	Percentage of the total Distributed Energy Resources capacity utilized	10%	0
	19	RES flexibility	Percentage of peak load reduction (<30 hours)	20%	N/A
	20	RES storage	Increase in installed RES storage capacity	1.65 MWh	0
	21	Increased uptake of e-mobility solutions	Percentage modal shift from fossil-fuel vehicles to eMaaS (vehicles/bikes)	24 % increase	N/A
	22	Replication	No. of new and/or existing buildings participating in the energy markets	60	0
	23	Investment	Total new investments generated (€M)	€40M	0
	24	Investment	Percentage reduction in simple payback periods (years)	20% decrease	N/A
	25	Investment	Annual return on investment (%)	10% annual ROI	N/A
	26	Investment	No. of new jobs created	900	0

Theme	KPI ID	KPI Type	KPI Definition	Expected Impact (Target)	Baseline
Communityx Change	27	Community participation	No. community participation events organized across all +CityxChange cities	15	0
	28	Community participation	No. citizen observatories established	5	0
	29	Community participation	No. of community participation events/actions	55	0
	30	Innovation	No. of innovation labs/playgrounds contributing to the creation of DPEB	5	0
	31	Training and skills development	No. of Positive Energy Champions trained	20	0
	32	Behaviour influence	No. of organisations with new sustainable energy approaches	60	0
	33	Replication	No. of demonstration projects implemented in Follower Cities	35	0

*Where baselines have not been established/finalised yet they have been left as N/A.

2.2 Monitoring Impact in +CityxChange

In order to ensure a consistency of approach and collection of data points on +CityxChange, the project will utilise two web-based monitoring tools, the SCIS SRT system (EU Smart Cities System) and MERT system (+CityxChange system). As much is possible these systems will employ the same standardisation techniques, however the +CityxChange project will collect data points relating to a wide range of KPIs that are not monitorable within SCIS. Thus, we see the MERT being the parent system to collect all project data which will then provide the data point requires to report bi-annually or annually to the SCIS.



2.3 SCIS SRT and +CityxChange

The SCIS is a web-based platform bringing together projects in and for Smart Cities. Smart Cities and Communities are defined by their intelligent use of integrated energy, transport and IT technologies to reduce their environmental impact and offer citizens better lives. Citizen engagement plays an important role in most Smart City projects.

In practice the SCIS self-reporting system (SRT) is built to measure building level interventions (i.e. the performance of new/refurbished buildings, information and communication technologies (ICT) or mobility interventions). It was created by the SCIS to serve as a point for collection and analysis of project data defined by and within the scope of the SCIS. The main objective behind the creation of this tool was to ensure that all the relevant outputs, learnings, experiences and insights derived from SCIS project interventions could be collected, safeguarded, analysed and used to inform the replication of smart city initiatives in other regions. The SRT therefore forms a connection between crucial project information (results, measurements, progress, interventions) and the stakeholders that interpret the information for their own use.

The core functions of the tool provide project partners and data providers with pre-defined templates for their specific project data inputs, which will be stored and managed within the SCIS database. The automated analysis of data points with key insights highlighted through reports, summaries and visualisation

Many of the +CityxChange indicators are not collected or representative at that level. Thus, 9 +CityxChange KPIs will be reported to the SCIS SRT. This will be periodically evaluated as/if changes are made subsequently to the SRT in the coming years.

2.4 MERT and the +CityxChange

As the SCIS only makes provision for data capturing of the certain set of KPIs defined by the SCIS, the remaining project defined KPIs monitoring data will be captured using a similar, but separate reporting tool. The Project Specific M&E Reporting Tool (MERT) will be developed by Future Analytics Consulting using a web-based platform.

All relevant project partners who are involved with KPIs (either as KPI owners or data owners) that are project defined will have access to the online platform where data measurements can be submitted for analysis and reporting. The MERT will specify the relevant KPIs and areas of data reporting according to the KPI themes of the project. The partners will be able to select the project demonstration area, the KPI, timeframe and specific metric to be reported on.

The MERT will capture, store, and model the data inputs, after which it will be made available for download. Each KPI owner, as defined by the KPI framework, will be responsible for sourcing data from the relevant data sources and the timeous inputs of the monitoring data according to the theme, unit of measurement, spatial scale, and frequency of reporting related to each individual indicator. The format for each input will depend on the unit of measurement, and whether the KPI is defined by the SCIS or the project itself.

In the same fashion as the SCIS SRT, the intention of the system is to define a common approach and standardised methodology which could be applied to any project to ensure a comparable presentation, evaluation, assessment, analysis and dissemination of the individual measures realised in project. The system introduces an appropriate structure for gathering relevant types of data and provides guidance on the inclusion of potential non-quantitative parameters in the monitoring process. Change within the MERT will be measured against the baseline and target for that KPI but also against set intervals. This will allow cities to understand their individual progress toward the target at any given point in-time (i.e in month 22 of the project is the city broadly in line with where it should be by that point).

3 Reporting Initialisation and Approach

3.1 SCIS System Configuration

The setup and configuration of the +CityxChange Lighthouse Cities on the SCIS SRT began in month 2 (December 2018) of the project. Initially, this was to establish the extent to which the +CityxChange KPI monitoring data could be captured and reported on through the SRT. Data point requirements were guided by SCIS Technical Monitoring guide (2018), SCIS KPI guide (2018) and SCIS SRT guides (2017, 2018) to ensure monitoring in line with the EU requirements and a replication of methodological approach and standards, where applicable.

The responsible organisation for SRT update and usage were then assigned with credentials. Initial tests were run on the various Field of Action[1] (FOA) combinations and the required data inputs for each of the thematic fields. FoA's were created in the demonstration site, based on Description of Actions (DoA), Building Energy Specification Tables (BEST) and most recent insights (The FoA are actual demonstrators in the demo site, e.g. a refurbishment project or a clean mobility project). Each of the project's KPIs were reviewed to determine in which thematic field would be the best fit and allow the most accurate data input that would provide accurate reporting at the designated reporting frequency. These monitoring forms were then designed and saved.

Depending on the type of intervention to be monitored by the KPI, the relevant technology, intervention, system, fossil fuel and/or renewable energy carrier, or type of energy source was selected within the FOA level. Each selection made in the FOA level then adds a specific data input layer with associated calculations in the design level of the SRT.

[1] A "Field of Action" represents the different interventions taken within a certain thematic field, which are:

- New Building(s) and their building integrated energy supply (= BIES, such as boilers, PV panels etc.).
- Refurbished Building(s) and their BIES
- Energy Systems Integration not integrated in the building (large biomass plants, etc.)
- Mobility and Transport
- Information and Communication Technologies (ICT)

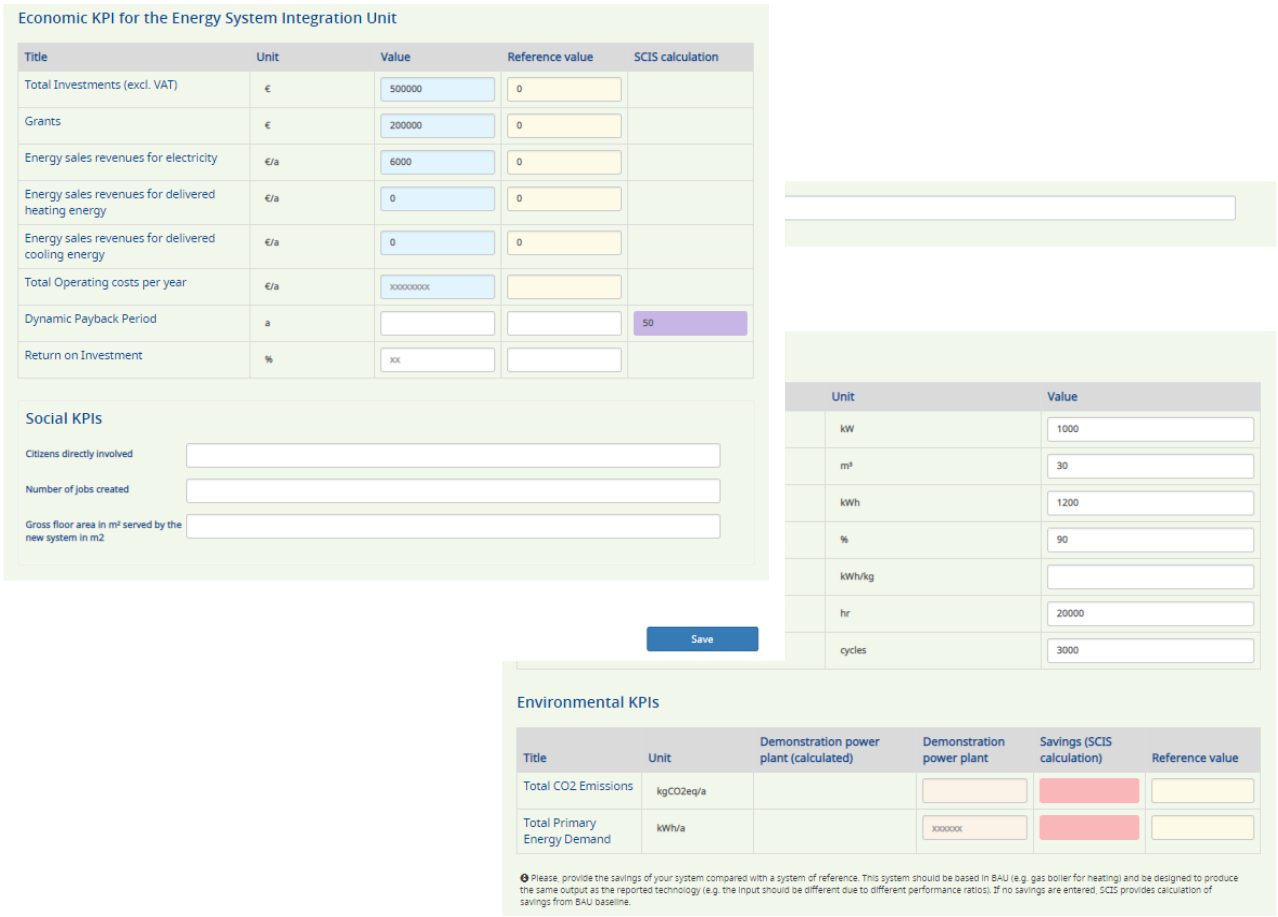


Figure 1 Example SRT Monitoring Form for Individual KPIs and FoAs

3.2 Initiating a Baseline

The +CityxChange project defines a baseline as an agreed set of parameter values describing the system and its ex-ante KPIs (i.e. performance of the system before the energy efficiency measures are carried out, or, in the case of social or regulatory changes, the status at the beginning of the project). With a proper baseline definition, the change and improvement on the system due to the energy efficiency measures can be identified and calculated. There are 2 defined types of monitoring data:

- KPIs which have been calculated from monitored energy data. This applies especially to buildings, groups of buildings where the actual performance of the system can be easily assessed by proper and common monitoring process and equipment. These are listed as Energy Efficiency KPIs below.
- KPIs that cannot be calculated directly from monitoring energy data. This applies in most cases to Social, Economic, Regulatory aspects. Such measures have to be assessed on an indirect (often qualitative) monitoring process. These are listed as Social, Economic and Regulatory KPIs below.

3.3 Energy Efficiency KPIs

Reporting on Energy Efficiency measures is defined by a bottom-up approach, starting from the individual units (buildings, small building integrated systems, e-cars, mobility infrastructure, and ICT projects), up to the city level. Baseline measurements for energy efficiency measures have been partially described within the BEST Tables and related impact sheets. These baseline figures will be finalised closer to the timelines relating to the work packages they relate to. Baselines will then be adjusted and finalised within the MERT and SCIS SRT systems.

3.4 Social, Economic and Regulatory KPIs

Baseline measurements for the social, economic and regulatory KPIs developed as part of the project will begin in year 1 at **zero**. These KPIs relate to new activities within specific Demonstration projects and although the unit might be different in certain cases, the first measurement should be considered zero. The information on KPI baselines that have been derived to date can be seen in Table 1 of this document. All KPIs relate to specific Demonstration Projects. Data collection and monitoring relating to these KPIs will very much correlate to the beginning of these interventions on the project.

3.5 Ensuring Consistency

In order to ensure consistent reporting on data there are several key principles impacting input data:

3.5.1 Data Quality

It is critical that data used in +CityxChange for baseline or otherwise is not be falsely generated, simulated or extracted from other technical guides. Monitoring data must be measured directly, reflecting the performance of a system. Values must conform to the methods of standardisation outlined in +CityxChange D7.1 KPI framework and all associated metadata must be collected and stored in relation to data points.

3.5.2 Temporal Consistency

This refers to the timeframes within the monitoring process. It is important across each of the KPIs that data is collected for them in specified periods to meet the overall project objectives for reporting. It also refers to a common monitoring period where all energy flows in the implementation area, for different themes or topics, are metered. If this criterion is met, the external condition variables that are not inherent to the metering data but may affect the final value are minimised and therefore the values for the different systems can be more easily compared.

3.5.3 Spatial Scale Accuracy

The SCIS uses a number of levels of spatial aggregation, or classification groups: buildings, energy supply units, ICT and mobility. SCIS focuses on collecting data from demonstration projects at entity and neighbourhood level depending on the scope of the demonstration projects (i.e. data is collected at level more disaggregated than the level it will be reported). Where applicable to the +CityxChange project the general classification follows the SCIS approach. It's critical that the definition of the intervention or spatial scale that is determined at the start of the project must be maintained for the lifetime of the project to ensure consistency of monitoring.

3.5.4 KPI Guidance

Deliverable D7.1 Approach to Monitoring and Evaluation of +CityxChange provides guidance notes and direction on how to complete individual metrics and specifies definitions for the fields contained within the return. This guidance includes information on, spatial scale, reporting frequency, definition, derivation/calculation and other data point requirements to clarify measurement parameters. Guidance also refers to specific SCIS direction where applicable with links back to various SCIS guides for more detailed assumptions.

If KPI owners have any queries in relation to the metrics or the content of this guidance, they should contact Future Analytics Consulting.

3.6 Reporting

The collection of monitoring data by the +CityxChange project will begin from month 7 (May 2019). The start date for data collection varies based on the individual indicators and when demonstration project interventions are set to begin, but updates on KPI progression will be made via SCIS bi-annually.

Responsibility to upload data to the SCIS system and SRT will be with FAC (with inputs on KPI data from each KPI owner on the project).

Until the completion of the demonstrator, +CityxChange will update and save the FoA definition and data in the created form as required. At completion of the demonstrator +CityxChange will finalise FoAs, save and create monitoring forms. From this point the design forms will not be changed as the monitoring form is derived from it.

4 Overlap, Issues and Divergence with +CityxChange

In the creation and configuration of the +CityxChange SRT environment a range unintended issues were identified with regards to creating alignment with SCIS SRT and +CityxChange KPIs. These issues are summarised below:

- The calculations for KPIs prescribed by the monitoring guides are not necessarily comparable to the calculations within the SCIS SRT. The monitoring guides provide a generic calculation of certain KPIs. The SRT, on the other hand, provides a specific set of calculations for the parameters as specified within each thematic field. In some cases, the data point requirements identified in the monitoring guides do not match those in the SRT. This created some initial discrepancy in ensuring the appropriate data points were identified.

- The SCIS does not currently allow for different spatial scales to be specified within the FoA level or thematic fields chosen. +CityxChange will use its own discretion to decide what the best way of reporting is on indicators at larger spatial scale (e.g. city or country level). In this regard, +CityxChange can make use of the SCIS's public site[2] to report on these indicators. The SRT is specifically designed to report on the results of specific actions. Reporting on city or country scale is not the purpose of the SRT.

- The relevant reporting period / frequency is set to years and does not allow for any monthly or bi-annual reporting of indicators. +CityxChange monthly and bi-annual project indicator monitoring will take on the MERT, with the data consolidated to annual figures and then reported through the SRT.

- +CityxChange reviewed all the possible iterations of the FoAs and thematic fields and found that just 9 of the 21 SCIS defined indicators can be captured using the SRT. The other indicators' specific measurement parameters do not fit within the SRT or would create the potential for inaccuracy and inconsistency in data capturing and monitoring. SCIS have reviewed +CityxChange entries on demo site level in the SRT. +CityxChange intend to report on a list of project-defined KPI in the SRT which is not how the SRT is currently configured. Reporting is on a specific pilot project basis defined with the SRT as FOA (field of action).

- As a wider integration issue, in its current form, it is not possible to push or pull data programmatically from another source to the SRT using Application Programming Interface (API) connections (or vice-versa). This will mean that manual reporting will be a requirement of the project.

[2] https://smartcities-infosystem.eu/scis-projects/demo-sites/cityxchange-limerick

- It is not possible to amend the SRT's FoA or thematic fields to better align with the KPIs defined in the KPI or monitoring guides. There is currently no plan to change this in the future and any changes would be driven by the desire from the EU to capture the results of different types of projects (e.g. like the recent positive energy district projects). This will be reviewed every 6 months by the +CityxChange team and can be actioned if changed.

As a result of the conclusions above, +CityxChange has modified its data somewhat to ensure consistency where possible but also a flexible external monitoring system that meets the specific needs of the +CityxChange project.

5 Dissemination and Exploitation

Two pillars of the +CityxChange project are dissemination and exploitation. The shared purpose of monitoring performance on Smart Cities projects using a consistent approach is that it assists the Smart City community for the dissemination of information and lessons learned, and for project task leaders to compare their own efforts with the SCIS project portfolio. This structure enables meaningful comparison of assessment results of projects and is one of the key objectives of these EU-funded projects is to create strategies, techniques, skills and developments that will live beyond SCIS-projects. An equally important aspect is also to identify the mistakes, issues encountered, or potential barriers to help future projects to avoid or overcome them.

Disseminating of the project outputs and results to the public is a key step in achieving the +CityxChange project goals. In order to communicate the measured performance of the interventions and Demonstration projects, aggregated KPI data will be openly and publicly reported to SCIS SRT, in line with the overall SCIS policy. Once the reporting functions of the SCIS SRT are available for export a retrospective monitoring report will be generated with relevant baseline data for the project. In addition, the +CityxChange project website will also provide access to the purpose-built MERT where additional KPI outputs can be interacted with or reports generated by the public.

In certain cases, limitations due to privacy and data policies may apply. For example, any raw data or supporting data and documentation (e.g. survey indicators or detailed personally identifiable data) will be kept confidential.

6 Conclusion

This deliverable constitutes the initial report of data to the SCIS system for +CityxChange at the 6-month milestone in April 2019. A more data-driven report will be generated from month 12 with relevant data points and KPI performance compared. This process is repeated at bi-annually over the next 5 years.

7 References

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