CITYkeys

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Deliverable 3.2
New business opportunities

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PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
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Deliverable administration										
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Description of the related task and the deliverable in the DoW	Participants: AIT (leader), TAM, ROT, ZGZ, ZAG Estimated effort: 3.1 person months. Time schedule: m13 -m21 This task will strive to identify new business opportunities based on the use of the developed KPIs, smart city performance measurement system, data collection methods, and/or user interfaces. First, the business models underlying the existing smart city KPI systems will be mapped and their applicability with the CITYKEYS performance measurement system analysed. Possible new business opportunities will be identified for providers of services and technologies required by the development of smart cities and deployment of the CITYKEYS KPIs. The role of cities is here important since cities act as platforms for new business opportunities. In addition some cities, like Zaragoza, have public business incubators in their start-up ecosystem. The new business opportunities can also be related to open data applications or smart city certification processes. Business opportunities will be analysed both for existing companies to extend their service portfolio and for new actors that will be needed in the deployment of smart city solutions (e.g. start-ups). The potential benefits of certified smart city projects for investors, users and general public will be evaluated.									
Planned resources PM	VTT	AIT	TNO	EUR	TAM	ROT	VIE	ZGZ	ZAG	Total
		0,6			0,3	0,3		1,6	0,3	3,1
Comments										

V	Date	Authors	Description
0.1	2016-06-08	BI	Setup of the deliverable
0.2	2016-06-23	BI	Update of the structure
0.3	2016-12-20	BI	Working document
0.4	2017-01-25	BI	Version for review
1.0	2017-01-30	BI	Final version

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EXECUTIVE SUMMARY

The Strategic Implementation Plan of The European Innovation Partnership on Smart Cities and Communities states that òé measuring a cityôs progress can raise societal awareness for a low-carbon lifestyle, support industry in identifying new business opportunities, and help city administration in coordinating and monitoring the transformation process.ò[1] CITYkeys performance measurement system provides a solution for this challenge. The aim of this report is to identify new business opportunities for new and existing enterprises. Especially service and technology providers can make use of gaps in the current setup to offer new solutions and meet the needs of stakeholders involved.

Since market for performance measurement is already established to a certain extent the identification was based with the assessment of currently available services and frameworks. Established neighbourhood and city certification services offer a simple and widely understood solutions. Most of the services are however only available for the project level or for a certain policy field of the local authority. Services using developed standards are often limited to either city or project level. This leaves out one of the main needs of municipalities to assess the contribution of a certain project or site development to the city strategy. CITYkeys provides sets of Key Performance Indicators for both levels allowing to show the impact of projects.

Indices and assessment frameworks have easy-to-understand results and allow for the comparison of different environments. City representatives noted that these systems are of low importance for their daily work since they do not provide a level of detail that can be utilised by a municipal administration. Many cities participate in public funded research and demonstration projects. Research projects require the establishment of a performance measurement system (monitoring of performance and impact). The main disadvantage is the short-term duration and difficulties in replicability of the developed frameworks to other cities. Solutions for open data management can be used to apply the CITYkeys performance measurement framework or they can serve as basis for the development of further applications for citizens and businesses.

Cities need a performance measurement system that can be used for the assessment of strategies, projects but also to see what is the contribution of a certain project to the city strategy. The implemented system should be flexible, user-friendly, secure, compatible and comprehensive.

Several new opportunities that arise from the deployment of the CITYkeys framework are related to consulting and assessment services. Especially in the planning phase for new developments and in the assessment of the contribution to city strategies new services can be offered. Such services can be offered either by a start-up or by established service providers like consultancies. If an open data platform is in place the CITYkeys indicator framework can be used to develop new applications that make use of the data and of the developed indicator set. The main outcome of CITYkeys is the performance measurement system. This is an overall solution combining IT infrastructure and the indicator framework. The implementation can require too much efforts to be implemented by a small company. Alternative solution would be a cooperative project, consortium or a use case in a business incubator.

[1] see EIP-SCC Strategic Implementation Plan
http://ec.europa.eu/eip/smartcities/files/sip_final_en.pdf

1. INTRODUCTION

1.1 Purpose and target group

The expected impact of a framework for common data and performance measurement collection system includes the stimulation of market for data-enabled services and solutions, thus supporting entrepreneurship. (European Commission 2013) This is why the CITYkeys consortium set up the Task 3.2 to identify new business opportunities for service and technology providers. The underlying assumption is that the creation of such a framework provides opportunities for existing or new businesses that make use of gaps in the implementation of smart city development.

The European Innovation Partnership on Smart Cities and Communities (EIP-SCC) lists Metrics and Indicators as one of its priority areas. The Strategic Implementation Plan of EIP-SCC states that òé measuring a cityôs progress can raise societal awareness for a low-carbon lifestyle, support industry in identifying new business opportunities, and help city administration in coordinating and monitoring the transformation process.ò (EIP-SCC 2013: 16) This shows the importance of measurement for an active involvement of citizens and businesses into the smart city transformation process. A business model needs to be developed by companies for the provision of a certain service or product. The opportunity where such business model could fill a gap can however be outlined based on the experience collected so far by municipal administrations. Especially urban planning and development departments in municipal administrations take on the role to coordinate transition process towards smart city and have thus good overview.

Since the market for performance measurement in smart cities on project as well as on city level is already established to certain extent, the starting point is the analysis of existing services and platforms. First experiences with the implementation of measurement systems have been collected already. Needs for performance measurement in smart city developments serve as a basis to see if such systems are able to satisfy all requirements for performance measurement in the coordination and monitoring of smart city development. If this is not the case gaps occur. These are seen as opportunities for existing or new businesses to put a new service in place.

The report should therefore serve technology and service providers as basis for the development of a new business or improvement of an existing one. It is also of interest to municipal administrations that face missing links in smart city performance measurement and would like to stimulate local entrepreneurship.

1.2 Contributions of partners

The deliverable has been elaborated by AIT. The methodology and (intermediate) findings have been discussed with project partners of CITYkeys during regular project meetings. Sessions for business opportunities have been organised during these meetings to acquire requirements, recommendations and remarks. Especially remarks from the city representatives involved in the CITYkeys project (Rotterdam, Tampere, Vienna, Zagreb and Zaragoza) were of significant importance.

1.3 Baseline

Baseline for the assessment is the description of work for the project CITYkeys. According to this description the identification should be based on:

- the use of KPIs,
- smart city performance measurement systems,
- data collection methods and/or
- user interfaces.

The opportunities should consider possible business of service and technology providers of both existing and new businesses. In order to take into consideration also the stimulation of a local market the business uptake is focused on small and medium enterprises. The identification was based on the perspective of city administration. Cities play a key role in the development process towards smart cities and have an overview on missing links and opportunities for stakeholders. Work in other tasks is used as basis for the assessment. The scope of the assessment is determined by the scope that has been set in earlier stages of the project within these tasks, e.g. inventory of KPI systems in Task 1.2.

1.4 Relations to other activities

The following relations to other tasks of the CITYkeys project can be highlighted:

- **Task 1.1 Requirements of cities/citizens**: A survey has been performed to identify the needs of cities with regards to a performance measurement system. The outcomes have been summarised for the use in this task.

- **Task 1.2 Evaluation and integration of existing frameworks and gaps to smart city requirements**: This task produced very valuable contents as inputs for T3.2 since it deals with an overview of the state of the art. This was of added value for the Chapter on Assessment of existing systems.

- **Task 2.2 Methodology for data collection and indicator calculation**: Within this task existing data platforms for smart cities and indicator visualisation systems have been assessed. This assessment is taken as a basis for the assessment of IT services.

- **Task 3.3 Recommendations for SCC index**: The work in this task included a review of existing indices and certification frameworks for neighbourhoods and cities. The focus of the assessment in this task was rather on the aggregation methods and scaling used in existing systems. Even if the focus of this review is different, it was a valuable input for the work on this task.

2. METHODOLOGY

The method consists of a sequence of steps that result in an outline of new business opportunities. First step is the assessment of existing services and frameworks allowing the application of Key Performance Indicators (KPIs). The list of frameworks has been derived from the assessment in Task 1.2 Overview of the current state of the art[2]. Each assessment is completed with an overview of the underlying business model. At the end of this exercise the applicability of the investigated frameworks for the use of CITYkeys performance measurement is discussed.

To find out how existing systems and frameworks support the process of smart city development the needs of municipal administration are outlined. This assessment is based on findings of Task 1.1[3]. A survey has been performed in this task to see which needs cities and citizens have with regards to performance measurement in smart cities. Additionally discussions with city representatives about their needs and gaps that they see were performed during regular project meetings. To get an overall picture also the role of other stakeholders and their needs in smart city performance measurement are outlined. All these steps are basis to identify gaps in the current setup. Gaps are then taken as basis for the identification of business opportunities. An overview of this process can be seen in Figure 1.

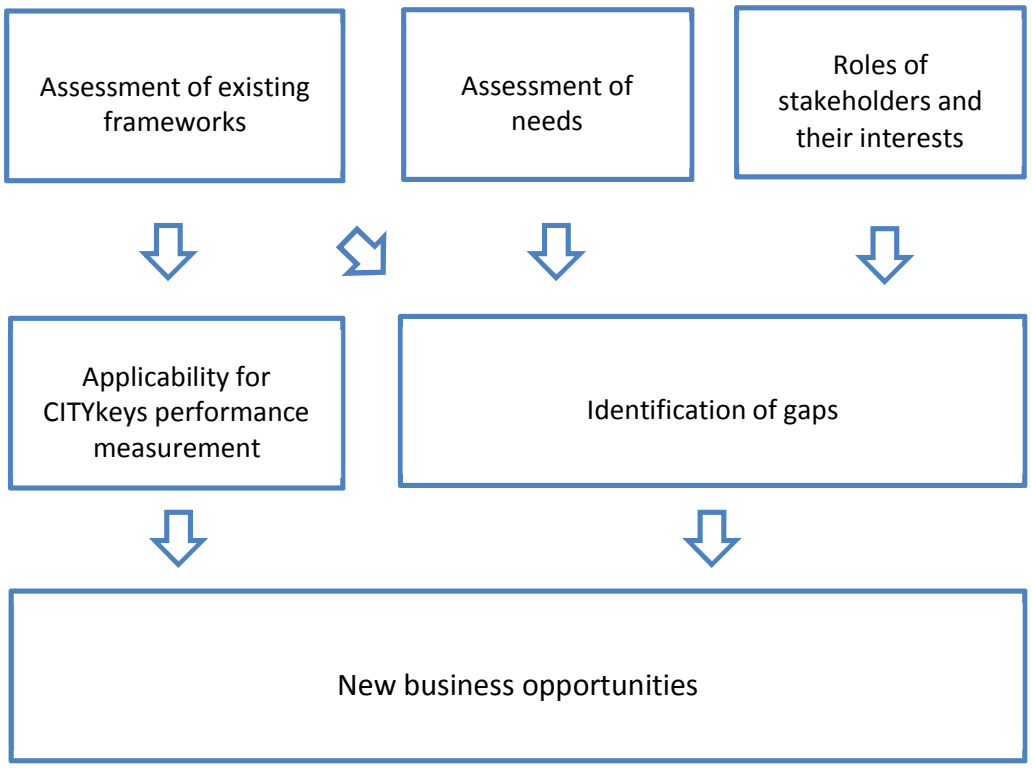

Figure 1 Methodological process to identify new business opportunities

[2] Deliverable D1.2 Overview of the Current State of the Art can be downloaded from the CITYkeys website http://www.citykeys-project.eu/citykeys/resources/general/download/CITYkeys-D1-2-Overview-of-the-Current-State-of-the-Art-WSWE-A47KPG

[3] Deliverable D1.1 Cities and citizens needs can be downloaded from the CITYkeys website http://www.citykeys-project.eu/citykeys/resources/general/download/CITYkeys-D1-1-Cities-and-citizens-needs-WSWE-9X4HNA

The business model Canvas is being used as the method to outline business models underlying current frameworks. This model has the advantage of simplicity so that it can be understood by a broad range of stakeholders and it facilitates discussion and description. Basis for the exercise are so-called building blocks representing different parts of the business strategy logic. (Osterwalder & Pigneur 2010: 15) The scheme that is derived from this model can be seen in Figure 2.

<table>
<tr><td rowspan="2"><u>Key partners</u></td><td><u>Key activities</u></td><td rowspan="2"><u>Value propositions</u></td><td><u>Customer relationships</u></td><td rowspan="2"><u>Customer segments</u></td></tr>
<tr><td><u>Key resources</u></td><td><u>Channels</u></td></tr>
<tr><td colspan="3"><u>Cost structure</u></td><td colspan="2"><u>Revenue streams</u></td></tr>
</table>

Figure 2 Canvas-scheme used for business modelling (based on a figure in Osterwalder & Pigneur 2010: 18-19)

As an outline for the business model in each of the frameworks a general business model is created for the service. This model does not intent to show the status of a certain framework or society since differences exist and the aim is not to judge but to show a model that could be applicable for the CITYkeys framework. Each assessment is completed with an overview using the Canvas-template followed by an explanation for each building block.

Building blocks composing the overall scheme are defined as follows (block descriptions come from Osterwalder & Pigneur 2010: 20-42):

- **Key partnerships**: Partnerships represent other institutions in the value chain (e.g. supply) or in a business network. Reasons to get into a partnership are of different kind and range from risk reduction, optimisation or obtaining resources. Osterwalder & Pigneur distinguish four kinds of partnerships
    - Strategic partnership between competing companies
    - Strategic partnership between non-competing companies
    - Joint ventures for business development
    - Relationships between buyers and sellers to ensure reliable supply

- **Key activities**: This block includes the work that a company needs to perform in order to be able to offer value for its customers. Key activities need to be done in order to operate the business.

- **Key resources**: Resources are needed to provide value to customer segments, maintain channels and generate revenues. Different resources are needed based on a particular business model. While some companies need mostly human resources, others are dependent on a large share of initial capital. Companies can use internal resources or external resources from partnerships.

- **Value propositions**: Solving customer problem or satisfying customer need is the reason why customers select one business over another. A product or service needs to create value for the customer and be thus reason to choose it.

- **Customer relationships**: This block describes the type of relationship that is established with the customer. Relationships can have a different range ï from personal to automated relations. The motivation for the relationship can differ as well. While some companies target new customers, others are focused on customer retention.

- **Channels**: Channels are used for communication, distribution and sales towards customers. They are particularly important in order to reach customer segments for value proposition.

- **Customer segments**: This block defines the different groups of organisations and people that the business aims to reach as customers. Customers are grouped into segments according to their common needs and behaviour. The segmentation is necessary to see which segments should be served and which should be ignored.

- **Cost structure**: This includes all costs that a company has to drive its business. For some companies the cost structure can be more important than for others, e.g. low-cost airlines are strongly focused on cost structure.

- **Revenue streams**: Revenue represents the money that a company gets from its customers. It is not to be confused with earnings that are created by the subtraction of costs. Revenue streams can be set up as one-time payments or recurring payments.

3. ASSESSMENT OF EXISTING SERVICES AND FRAMEWORKS

The chapter builds on the desk research performed within Task 1.2[4]. Its survey of services provides the scope of available applications. The assessment was focused on the identification of possible settings that can be opportunity for SMEs to provide services.

3.1 Neighbourhood and city certification schemes

Neighbourhood certification schemes evolved from established certification systems for buildings. These systems do not necessarily require the establishment of a KPI framework however the application of KPI framework will follow a similar process. The assessment is performed by checking the fulfilment of certain criteria used to determine the achievement in a particular field.

These frameworks have been established to proof a certain quality level. They are targeting project developers or municipalities. Advantages include high profile that most of these frameworks have (e.g. from building certification activities), the simplicity of an established system that comes along with clear guidelines and the involvement of small and medium enterprises (SMEs, usually consultancies performing the assessment). The main disadvantage is the fixed framework which is not always flexible enough to consider different environments and situations that occur on local level.

Table 1 Overview of neighbourhood and city certification frameworks

Shortcut	Name	Scope	Website
BREEAM Commmunities	Building Research Establishment Environmental Assessment Method - Communities	quarter	www.breeam.com
CASBEE-UD CASBEE for cities	Comprehensive Assessment System for Built Environment Efficiency – Urban Development / Cities	quarter/ city	www.ibec.or.jp/casbee/english
DGNB	Deutsche Gesellschaft für nachhaltiges Bauen (German Society for Sustainable Construction)	quarter	www.dgnb-system.de/en
EEA	European Energy Award	city	www.european-energy-award.org
LEED-ND	Leadership in Energy and Environmental Design – Neighborhood Development	quarter	usgbc.org/leed

The overview in Table 1 lists selected certification frameworks. Most of them are available for the assessment of quarters. These are in their scope comparable to the project level of CITYkeys. Two frameworks deal with assessment on city level (CASBEE for Cities and EEA).

[4] Deliverable D1.2 Overview of the Current State of the Art can be downloaded from the CITYkeys website http://www.citykeys-project.eu/citykeys/resources/general/download/CITYkeys-D1-2-Overview-of-the-Current-State-of-the-Art-WSWE-A47KPG

Given criteria are being checked and assessed during the certification process. The outcome is a sum of points or a percentage of fulfilment. A certain success is necessary to obtain a certification which can be reached on different levels. The certification process involves three parties. On the example of the DGNB these include the customer, DGNB-auditor and the DGNB society. The customer gets in contract with an auditor of own choice. This can be selected from a list of certified auditors on the website of the society. A certification contract with DGNB is established as well. During the certification process there is no contractual link between an auditor and the society. (DGNB 2017: DGNB System) This setup is in summarised in Figure 3. Additionally to the two contractual links also the relationship between the society and auditor or assessor is indicated. Even if there is no direct relationship in the certification process as such, the provision of the certification framework by the society and the inclusion of auditors / assessors in a list shows an indirect relationship between these parties.

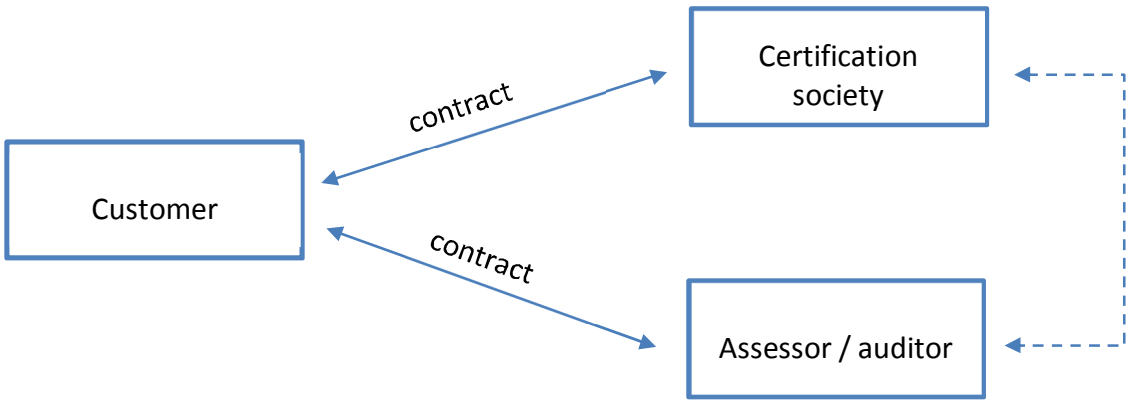

Figure 3 General setup of a certification framework

Even if the model behind the selected neighbourhood and city certification schemes is very similar, it does not mean that all schemes have similar aims, structure and purpose. Also the existence of a certain business model does not necessarily mean that associations or other actors involved are profit-oriented.

In contrast to other certification frameworks the European Energy Award does not use a fixed set of criteria for the assessment of a community but an overall set is being adapted at the beginning of the assessment process to find the maximum amount of points that can be reached. (EEA 2012) This allows for the consideration of different environments and possibilities the city is in. Another difference is that the EEA is focused on energy policy of a municipality. (EEA 2012)

Customer segments for certification schemes are site / project developers or municipal administrations in case of certification on city level, e.g. BREEAM supports planners, local authorities, developers and investors in the master planning process (BRE 2017). These can be either new customers or existing ones. The frameworks use established web-portals with references to get in touch with customers. Alternatively customers can be reached also through local assessors. The main value for the customer is the assurance of a certain quality level that can (and should) also be communicated for marketing purposes of the site. This is a simple way to show that a site meets certain high criteria assessed by third party. Key resources necessary to perform the business is a developed certification framework, guidebooks and a web-portal. Key partners for the business include consultants accredited to perform assessment. Another key partners are members or volunteers, who provide their expertise in setting the framework or its criteria. The cost structure consists of cost for the IT equipment to run the portal, human resources for coordination and costs of publication of schemes and guidebooks. Revenues come from registration or certification fees, sales of literature and eventually exam fees for auditors /

assessors. A feature of this setup is the allowance of revenues also on the side of the assessor who can be a consultant company or person, usually SME. Figure 4 provides an overview of this setup.

<table>
<tr>
<td rowspan="2"><u>Key partners</u>
Members
Auditors</td>
<td><u>Key activities</u>
Framework and guideline development
Award</td>
<td rowspan="2"><u>Value propositions</u>
Quality assurance
Marketing</td>
<td><u>Customer relationships</u>
Acquisition of new customers
Retention</td>
<td rowspan="2"><u>Customer segments</u>
Project developer
Municipal administration</td>
</tr>
<tr>
<td><u>Key resources</u>
Certification framework
Guidebooks
Web-portal</td>
<td><u>Channels</u>
Online presence
Advertisement
Via consultant</td>
</tr>
<tr>
<td colspan="3"><u>Cost structure</u>
Web-portal maintenance
Human resources for framework development and maintenance
Coordination efforts</td>
<td colspan="2"><u>Revenue streams</u>
One-time & recurring revenues (re-certification)
Fees (registration, certification, membership)
Exam fees
Sales of guidebooks</td>
</tr>
</table>

Figure 4 Business outline of certification frameworks

3.2 Standardisation services

The establishment of different frameworks for indicator systems lead to standardisation processes for the assessment as well as for the underlying indicators. The main aim is to find a unified methodology and a common set of KPIs that allows the results to be comparable. Standards can either be directly applied or serve as a basis for initiatives and projects using an own system. In the development of the CITYkeys indicator framework several of these standards have been considered and used as reference. Since smart cities is still a novel area, some of the standard frameworks are still under development. All standards are subject to regular updates.

Standards are published by international organisations who take care of coordination and organisation issues. Expert working groups provide scientific and engineering knowledge. As an example the International Organisation for Standardisation ISO published 21.350 standards and organises 238 technical committees. (ISO 2016)

The main target group are professionals. However standards for smart city applications are designed in a way that also other stakeholders are able to apply them. As an example the ITU-T lists (Sang 2014: 4):

- cities and municipal administrations,
- city residents and non-profit citizen organisations,
- development and operation organisations of smart and sustainable communities and
- evaluation and ranking agencies

as potential users.

Advantages of standardised indicator sets and their methodology include the comprehensiveness, comparability, and consideration of usually available data sets, independence of indicators and their simplicity. (Sang 2014: 5) Disadvantage is the need for adaptation of the indicator set for the implementation. The assessment can be performed by the municipal administration or via consultant.

Published standards for smart cities include:

- ISO 37120: This standard establishes a KPI framework to assess sustainable development of communities. It is focused on city services and quality of life. It can be applied by local government to measure the performance. (ISO 2014)

- ISO 37151: The standard does not provide a given indicator inventory. It was made to establish principles and requirements for performance metrics. It can rather be seen as process guideline for the establishment of an own assessment system. (ISO 2015)

- ITU-T FG-SSC: The standard has been published by the International Telecommunications Union. It identifies a set of KPIs to show the success of smart city ICT developments. (Sang 2014: 2)

A general outline of standardisation services can be seen in Figure 5. A standardisation organisation sets up expert working groups that provide contents for the standards. These are available for purchase to customers. An alternative way is the involvement of a consultant that applies the standard and provides a tailor-made setup for the customer.

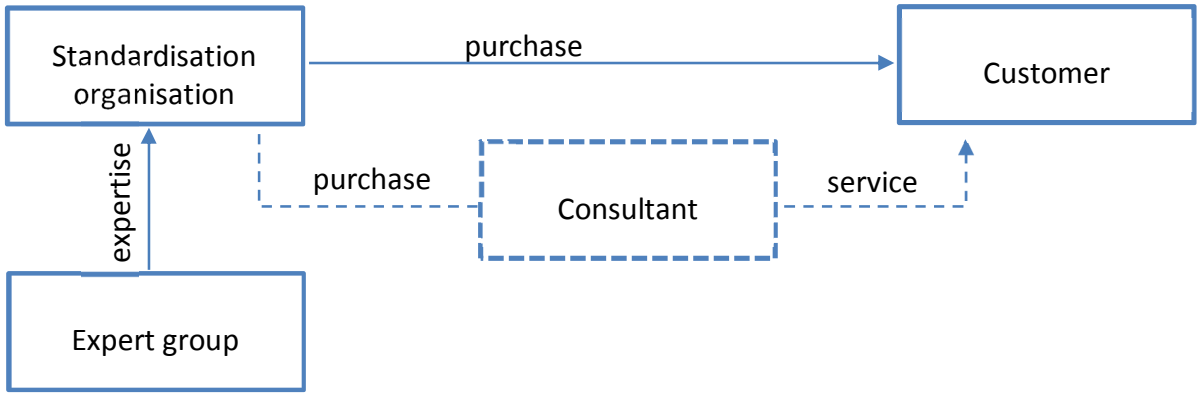

Figure 5 General setup of standardisation services

Standardisation targets professionals and consultants, in case of smart city standards also municipal administrations. Standards are available for purchase on web-portals or online libraries of standardisation organisations. Standards can be purchased once but more likely the customer acquires updates when these are published. The value proposition is the quality assurance if measures or services are being in line with standards but also the knowledge as such. Key activities for the value proposition include the coordination of the development of standards and the publication of the documents (either online or as a print version). Key resources on the internal side is staff for coordination, organisation and publication. External key partners include experts working together in groups to provide the contents of standards and national standardisation bodies. These can provide expertise as well but more importantly they are adapting standards considering national requirements. Costs occur for human resources (organisation and coordination) and for IT infrastructure and publication. Revenues are created

from standard sales or payments for access. In case a consultant is necessary to adapt the standard, this person or organisation also generates revenue from the provision of service.

<table>
<tr>
<td rowspan="2"><u>Key partners</u>
External experts
National standardisation bodies</td>
<td><u>Key activities</u>
Coordination of standard development
Publication</td>
<td rowspan="2"><u>Value propositions</u>
Quality assurance
Knowledge</td>
<td><u>Customer relationships</u>
Retention</td>
<td rowspan="2"><u>Customer segments</u>
Professionals
Municipal administration
Consultant</td>
</tr>
<tr>
<td><u>Key resources</u>
Human resources
Platform / IT equipment</td>
<td><u>Channels</u>
Online platform</td>
</tr>
<tr>
<td colspan="3"><u>Cost structure</u>
Staff costs
IT infrastructure maintenance</td>
<td colspan="2"><u>Revenue streams</u>
Payments for the access to standards</td>
</tr>
</table>

Figure 6 Business outline for standardisation services

3.3 International indices and other frameworks

This category consists of commercial and non-commercial services and it can include also services that are produced by commercial institutions offered free of charge. Their aim can be:

- to provide an index of cities based on certain criteria,
- to provide an assessment framework that can be applied by a municipality or
- to award cities with the best performance.

The purpose of this assessment is not to judge or compare them. The assessment should show which kinds of services for municipalities are available: The outcomes of this assessment is rather an extraction of certain aspects to see which kinds of services are being provided to municipalities than an overall picture of services in scope. Therefore not all results are applicable to each of the frameworks.

The organisations designing these frameworks are of different kinds ï it includes public institutions, consultancies and other enterprises. Target groups are municipalities in most of the cases. The advantages of city indices is their simplicity and comparison of different environments. These advantages can also turn out to be disadvantages since a deeper assessment is necessary to assess the state of the art of a municipality and comparison is often dependent on the composition and aggregation methods (see also D3.3 of CITYkeys for an overview of aggregation methods). Assessment frameworks have similar advantages as standards ï their established scheme can be applied to assess a municipality. The disadvantage is the necessary effort that is often required for the application. Awards have mostly the purpose to motivate cities to follow the example of awarded cities.

Table 2 provides an overview of city indices, assessment frameworks and awards along with the website for further information.

Table 2 Overview of city indices and assessment frameworks

Framework	Type	Organisation	Website
Arcadis Sustainable Cities Index	City index	Arcadis	www.arcadis.com
City Protocol	Assessment framework	City Protocol Society	cityprotocol.org
European Green Capital Award	Award	European Commission	ec.europa.eu/environment/europeangreencapital/
European Smart Cities	City index	Vienna University of Technology	www.smart-cities.eu
Innovation Cities™ Index	City index	2thinknow®	www.innovation-cities.com
WCCD Global Cities Registry™	Indicator framework / award	World Council on City Data / Global City Indicators Facility	www.dataforcities.org/wccd/
IUME Integrated Urban Monitoring in Europe	Assessment framework	European Environment Agency	iume.pbe.eea.europa.eu/about-1
Networked Society City Index	City index	Ericsson AB	www.ericsson.com/networked-society/
Siemens Green City Index (Europe edition)	City index	Siemens AG	www.siemens.com/entry/cc/features/greencityindex_international/all/en/pdf/report_en.pdf
UNECE United Smart Cities	Assessment framework	United Nations Economic Commission for Europe	www.unece.org/housing/smartcities.html

Due to the heterogeneity of assessed frameworks in this category no overall outline is provided. Instead the following results of a desk research give an overview:

- The Arcadis Sustainable Cities Index is publicly available as a document for download (e.g. the version for 2015 can be downloaded from the following link https://s3.amazonaws.com/arcadis-whitepaper/arcadis-sustainable-cities-index-report.pdf). The access to the index is public. The organisation offers support for municipalities in masterplanning and sustainable urban development. (Arcadis 2017)

- The City Protocol offers memberships with annual fees. The membership allows to get access to workshops, trainings, tools, models, publications and other advantages (City Protocol 2017)

- The European Green Capital Award is an initiative of the European Commission. The organisation is managed by a secretariat. It aims to reward cities achieving high environmental standards and motivate other cities to follow the example. (European Commission 2017)

- European Smart Cities is an initiative of the Vienna University of Technology that has been developed together with partners in different projects. The different versions (for mid-sized and large cities) are publicly available and are free of charge. (TU Wien 2017)

- The Innovation CitiesÊ Index can be publicly accessed on the website. The access to the index is public. The analysis report as well as data sets can be purchased. (2thinknow 2016: Indexes)

- The WCCD Global Cities RegistryÊ is based on the ISO 37120 standard. A certification is available on different levels depending on how much data is provided by the municipality. The standard was developed and tested by the Global City Indicators Facility an organisation associated to WCCD. (WCCD 2017)

- IUME Integrated Urban Monitoring in Europe is an assessment framework initiated by the European Environment Agency in cooperation with partners. The organisations work together and organise common workshops to develop an integrated approach. The methodology is available at the website for download. (European Environment Agency 2017)

- Networked Society City Index is being developed by Ericsson AB in cooperation with Sweco. The index ranks cities on the basis of their ICT maturity and sustainable urban development performance. The index and the methodology are publicly accessible. (Ericsson AB 2016) Other services (fees for data provision or extensive handbooks purchases) have not been found on the website.

- Siemens Green City Index is a development of the Economist Intelligence Unit in cooperation with Siemens. There are several indices for different regions of the world. The indicators differ based on the region they are being applied. Its results (the indices) and method behind are publicly available as a document for download. (Siemens AG 2012:4) Other services (fees for data provision or extensive handbooks purchases) have not been found on the website.

- UNECE United Smart Cities is a project of the United Nations Economic Commission for Europe targeting medium-sized cities that are located in transition economy countries. The guidelines used as well as the list of used indicators are available on the website of the project. (UNECE 2017)

In the following a collection of different aspects the underlying business models is provided. The overview is not to be referred to one of the selected services or organisations above but is to be seen as summary of aspects. The customer segment is the municipal administration that is looking for an assessment framework or wants to use the result as marketing feature (e.g. award). Revenues are not always aimed, e.g. in the case of publicly offered services. If so the revenues come from fees or sales of data, publications etc. Key activities to run the business include the development of the framework / methodology, publication of guidelines and the analysis that leads to the result. Staff and IT equipment are seen as the key costs/resources.

Partnerships include data providers, municipalities that co-develop the framework, experts and consultancies providing knowledge. An overview can be seen in Figure 7.

<table>
<tr>
<td rowspan="2"><u>Key partners</u>
Data owners
Municipalities
Experts
Consultants</td>
<td><u>Key activities</u>
Framework development
Analysis
Publication</td>
<td rowspan="2"><u>Value propositions</u>
Different, e.g. third party assessment, visibility or marketing</td>
<td><u>Customer relationships</u>
One-time
Retention</td>
<td rowspan="2"><u>Customer segments</u>
Municipal administrations</td>
</tr>
<tr>
<td><u>Key resources</u>
Human resources
IT infrastructure</td>
<td><u>Channels</u>
Web-portal, publications, ev. other channels</td>
</tr>
<tr>
<td colspan="3"><u>Cost structure</u>
Staff costs
IT infrastructure maintenance</td>
<td colspan="2"><u>Revenue streams</u>
Not applicable in all cases, revenues can be of different kind, e.g. data and guideline sales, adjacent consultation services, membership fees</td>
</tr>
</table>

Figure 7 Collection of different business aspects used in indices and frameworks

3.4 Data platforms and interfaces

Open data platforms meet the needs of a public policy that requires to release certain sets of data for public use. The value of this data lies in the combination of data from different sources. In case the data can be found easy and is in a common machine readable format, the value can be even increase since third parties (e.g. service providers) can analyse the performance of smart city areas. (ISO/IEC 2015: 17)

Organisations offering the service can be of different kind. There are non-profit associations developing data platforms but also commercial solutions of companies. In CITYkeys an assessment has been performed in Task 2.2. The scope for Task 2.2 has been selected to include open data platforms for publishing, sharing, finding, using and visualising, platform ecosystems, service development kits for cities and city-specific APIs for city data. (Piira et al. 2016: 6) The selection used in this chapter is based on the selection performed in Task 2.2[5]. An overview of open data systems can be seen in Table 3. Additionally also a wide range of commercial services for data management in cities is available. The integration of additional services and applications into these systems is however often not possible or requires additional costs. The license setup needs to be taken into consideration in any case. The extent to which the platform can be directly applied is very different and needs to be considered before the application.

[5] Deliverable D2.2 Methodology for data collection and indicators calculation can be downloaded from the CITYkeys website http://www.citykeys-project.eu/citykeys/resources/general/download/CITYkeys-D2-2-Methodology-for-data-collection-and-indicators-calculation-WSWE-A9NK4H

Advantages of non-commercial applications include the flexibility in the setup and the possibility to allow for third-party developments. The main disadvantage is the necessity for further development and adaptations. Target groups for open data platforms are governmental organisations. In the case of the CITYkeys application this includes municipal administration or other local administrations that want to provide public access to data.

Table 3 Overview of data platforms

Shortcut	Name	Organisation	Website
CKAN	Comprehensive Knowledge Architecture Network	The Open Knowledge Foundation	ckan.org
CitySDK	City Service Development Kit	Partner consortium in an EU-funded project	www.citysdk.eu
FIWARE	Future Internet Core Platform	Project consortium	forge.fiware.org/plugins/mediawiki/wiki/fiware/index.php/Main_Page
Socrata	Socrata Publica™ Open Data	Socrata	socrata.com
SCIS	Smart Cities and Communities Information System	European Commission	smartcities-infosystem.eu

In the following a short overview of data platforms is provided. To receive more information please refer directly to the website of each solution or see the assessment in D2.2.

- CKAN: CKAN is an open-source data platform developed by the non-profit Open Knowledge Foundation. It provides a bundle of tools to enable publishing, sharing, finding and using data. It is a modular system that allows for the development of additional features and connection of third-party applications. (OKF 2017)

- CitySDK: CitySDK was developed in an EU-funded project to allow cities to release their data sets so that developers are able to re-use it. The project was focused on the areas of smart participation, smart mobility and smart tourism. (CitySDK 2014)

- FIWARE: This platform was developed in the FIWARE project to come up with a core platform for the future internet. It should provide a sustainable ecosystem for innovative service providers developing new applications and end-users/consumers actively participating in content/service consumption and creation. The platform consists of cloud hosting, data management, application framework, interfaces, security mechanisms and others. (FIWARE 2017)

- Socrata: This is a commercial service offered by a company of the same name. The platform allows to provide data in a way that it can be found by all interested parties. Also tools for visualisation and sharing of data (APIs) are provided. (Socrata 2017)

- SCIS: The Smart Cities and Communities Information System is an initiative of the European Commission that aims to collect data generated in ongoing and future smart cities and energy efficiency projects funded by the European Union. Its aim is to

highlight best practices, identify barriers and lessons learned and provide recommendations for policy (SCIS 2017) The initiative operates a database of monitoring data that is provided by the use of APIs.

The setup of application is similar to the setup of standardisation services. The solution can be directly applied by municipal IT department or an IT provider takes the setup and maintenance of the solution (see also Figure 8).

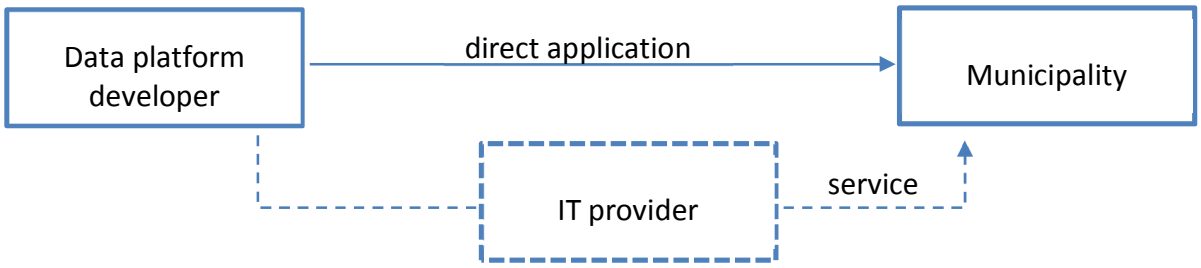

Figure 8 Application of a data platform in municipality

The following business outline is not focused on data platform developers but rather on the application of a data platform in a city. To do so the indirect application through an IT provider is described. The value proposition in this case is an outcome based service for the municipality. The relationship can be one-time based (setup of the platform) or long-term in case maintenance is required as well. The customers (municipal administrations) can be accessed via online presence but more likely in public procurement procedures that are mandatory to acquire service provision. Key resources include costs for staff and infrastructure to perform setup and/or maintenance. Revenues are generated from the service payment in a contract. Costs can also include license fees if these are required by the association that developed the platform. Key partners are stakeholders owning the data (to agree on interfaces, data for testing etc.). The overall outline of such business can be found in Figure 9.

<table>
<tr><td rowspan="2"><u>Key partners</u>
Stakeholders owning data</td><td><u>Key activities</u>
Setup
Maintenance</td><td rowspan="2"><u>Value propositions</u>
Outcome based service</td><td><u>Customer relationships</u>
Long-term relationship in case of maintenance</td><td rowspan="2"><u>Customer segments</u>
Municipal administrations</td></tr>
<tr><td><u>Key resources</u>
Human resources
IT infrastructure</td><td><u>Channels</u>
Web-platforms
Procurement</td></tr>
<tr><td colspan="3"><u>Cost structure</u>
License fees
Maintenance costs</td><td colspan="2"><u>Revenue streams</u>
Service payment</td></tr>
</table>

Figure 9 Business outline for the application of data platforms

3.5 KPI development in public-funded research and demo projects

Public initiatives and research projects on European or international level

Many KPI frameworks were established within public funded research projects or coordination and support actions (CSAs). The need for impact assessment and performance proof makes the use of KPIs in projects necessary. Reasons for this need are declaration of the impact that public funding caused and the use of this information for the replication and upscaling of the demonstrated measure. The main challenge in this regard is the existence of several parallel frameworks that are not always aligned to each other. For the proof of impact of one single project the choice of a particular scheme is not of big relevance. There are several ways that could show an overall picture. However when it comes to bring results of several projects in one way the existence of different frameworks can be a barrier even if the aim is not benchmarking.

The desk research in CITYkeys reviewed 53 such projects and identified 19 out of them which were taken into consideration during the development of the indicator system. The selection was based on the review of assessment fields. Only few of the selected frameworks were suitable for further consideration since their scope is limited to a certain field (the one that was subject to the demonstration in the project). (Neumann et al. 2015: 25-26)

Few projects are suitable to be used for a comprehensive assessment of the state of the art of a city as well as for the project level, e.g. EU-funded projects PLEEC, TRANSFORM. Cities which were involved in these projects received technical assistance from research partners or consultancies to adjust such framework for the specific environment and strategy of a city. Other cities which would like to apply such framework will need to perform this with own resources since there are no public funds available for adaptation or application. In more recent European research projects business modelling is being included to ensure the results can be applied after the end of the project. In such case the developed business model should be applied and eventually amended along with the developed performance measurement system.

National frameworks

Results of national frameworks are similar to research projects on international or European level. Their aim is to develop approaches and performance measurement systems that can be replicated after the end of the project. In case such frameworks exist and have a suitable scope for application they can be recommended for use. The advantage is that these frameworks consider national differences in legislation or national standards (e.g. area definitions differ among Europe which requires additional step to convert the data). Also, these frameworks are more suitable for small and medium sized cities. Conditions for the application are similar to European or international initiatives and research projects ï organisation of financing, dedication of human resources for adaptation and application etc.

3.6 Applicability for CITYkeys performance measurement system

This section outlines how the CITYkeys performance measurement system could be applied to the groups of services assessed above. The categories of services were set according to the structure used before. Each of the following points shows how the developed performance measurement system could be incorporated for the use in existing services.

- **Neighbourhood and city certification frameworks** usually use criteria to perform an assessment. A contribution of CITYkeys in this case is possible but unlikely. In case a

new certification framework is being developed and indicators are used for performance measurement, CITYkeys can be applied.

- **Standardisation services** do usually include an indicator framework (CITYkeys is based on several standards). CITYkeys can in this case provide inputs/contents in the updating process or in case these standards need to be extended with indicator sets that are already covered by CITYkeys but not by the respective standard.

- **International indices and other frameworks** often developed an own performance measurement or assessment system already. The CITYkeys system can thus be used to extend existing frameworks or provide a repository of indicators in new developments.

- **Open data platforms and interfaces**: The CITYkeys performance measurement system can be applied using existing open data platforms. The assessment of possible applications has been investigated in Task 2.2.

- **Public-funded research and demo projects**: The use of the CITYkeys performance measurement system in international, European or national research and demonstration projects is highly recommended. Since CITYkeys developed its system in cooperation with cities working in such projects the development was based on experience cities gained in past projects.

4. IDENTIFIED NEEDS AND GAPS

This chapter explains the needs of stakeholders involved in transformation processes and implementation of smart city neighbourhoods with regards to performance measurement and impact assessment. The identification of gaps combines the assessment of existing frameworks and needs of municipalities. Also the role of other stakeholders and their expectations regarding performance measurement in a smart city process are being explained.

4.1 Needs of municipalities

The needs of municipalities and their role in a smart city development process differ in each city. In most cases municipalities take care of the organisation of the process and cooperation between stakeholders. In CITYkeys the assessment of city needs has been performed within Task 1.1. The survey that has been performed includes a set of questions regarding the opinion of city representatives as well as the usage of performance measurement at the time being. The summarised results of this survey are enhanced with needs that municipalities expressed during discussions at project meetings. In case they have not been identified within the survey of Task 1.1 these are additionally provided at the end of this section.

Out of 18 cities 2 use smart city performance measurement (Rotterdam uses ISO 37120 and Barcelona an outcome based city transformation). Seven cities use performance measurement partly for one or several of key areas. (Kontinakis & De Cunto 2015: 17) Also the expectations for the use of performance measurement system have been asked in Task 1.1. To sum up the results of this survey it can be concluded that cities use performance measurement on the city level for (Kontinakis & De Cunto 2015: 20):

- the development of strategies, policies and evaluation of progress to reach them,
- support of decision making,
- promotion and encouragement,
- identification and dissemination of successes.

The reasons for the use of performance measurement on project level are of different kind (Kontinakis & De Cunto 2015: 23):

- assessment of contributions to the municipal strategy and ev. adaptation (interaction between city and project level),
- assessment of success of a project,
- upscaling and progress from experimental projects towards large-scale implementation,
- management of resources.

Despite obstacles in the implementation municipalities are in general interested to adopt such systems. In the survey performed in T1.1 over 80% of municipalities expressed the interest for a tool or platform to measure and process date. Requirements for the platform include (Kontinakis & De Cunto 2015: 27):

- integration of several functions in one system
- compatibility with existing systems,
- user-friendliness.

In discussions with municipalities during project meetings the following points have been raised additionally:

- Security and privacy: Privacy requirements are different in every country, e.g. in the Netherlands all data assessed by a municipality needs to become open data. The municipal administration needs to ensure that the data is accurate.
- Every city starts from a different point.
- A tool is needed that fits the availability of data in certain city.
- A system should be able to consider KPIs that are already used in the city and are part of city strategy.
- A system needs to take into consideration the given organisation of a municipality which is different in every case.
- Identification of alternative sites for development: Models are needed that bring together various indicators and allow for basic planning of a use case.

Cities need a performance measurement system that can be used for the assessment of strategies, projects, contribution of projects to strategies. Basic requirements are to be:

- flexible,
- user-friendly,
- secure,
- compatible and
- comprehensive.

4.2 Other stakeholders' roles and interests

The smart city development process is a long-term interdisciplinary process including several groups of stakeholders with different professions working in different thematic fields. The process and its setup differs in each city. For the purpose of this assessment the needs of stakeholders in the existing services have been taken into consideration. This allows to show how the application of the CITYkeys performance measurement system can be of use for these stakeholder groups and if it can meet their interest in future developments.

- **Data owners:** Data owners are key partners in the application of open data platforms and in assessment services using standards. It includes different departments of a municipal administration but also external partners like (municipal) utilities or governmental organisations on different levels. Their interests with regards to performance measurement include security and privacy requirements and minimisation of efforts (of human resources) to implement interfaces for the data provision. Data owners can also be interested in the results of an applied CITYkeys system for own purposes.
- **Project or site developers**: Project developers are one of the customer segments for neighbourhood certification schemes. In a smart city development process they take care of implementation of concrete measures in a quarter (e.g. group of buildings and adjacent services). Their interest in a service is a third-party proofed quality assurance. CITYkeys performance measurement for the project level can be useful to show the performance or impact of the final solution and steer the implementation of the project. Another value added is the advertisement effect that a certification status or award can provide. This helps in sales of the real estate that is being developed. In this case the CITYkeys is not applicable (at least not directly). It will require a development of a certification system based on CITYkeys to meet this interest. An applied CITYkeys system in a municipality would allow them to consider its results in the selection and planning of possible sites and with the consideration of the needs/targets of a municipality.

- **Service providers**: In existing services this group consists of consultancies that perform an assessment or apply standardised KPI framework in a city, and assessors/auditors in certification schemes. To provide a service consultancies are interested to identify the possibility or opportunity where their service is required. In the application of a performance measurement system they can take the role of advisor in the implementation with regards to available data sets or use the system or its results to perform an assessment for the municipality.
- **Technology providers**: With regards to data management and performance measurement this group includes IT providers. They play a key role in the implementation of data platforms and interfaces in case this is not directly implemented by a municipal department. Their main interest is to offer a solution that is needed and that is within their scope of expertise. This means that the data sets are identified and the contractor has a clear picture of how the outcomes need to be presented. A performance measurement system like the one developed in CITYkeys provides data requirements and output (KPI) outline that can be applied by an IT provider. An advice or coordination of this application by the municipality and/or an expert will be necessary as well.
- **Experts**: Expert provide knowledge and advice. This stakeholder category includes universities and research organisations but other stakeholders are possible as well (e.g. professionals). In existing setups experts provide knowledge and contents for the development of standards, certification frameworks (they are often members) and they play a key role in research and demonstration projects. With regards to the application of the CITYkeys system experts can provide knowledge in the application and adaptation to a certain environment considering local conditions.

Service and technology providers are already able to offer their services. They are involved in existing services outlined in Chapter 3. The CITYkeys performance measurement framework can be used to extend their services and find new fields of application.

4.3 Identified gaps

The identification of gaps was performed based on the assessment of needs and survey of existing frameworks. Additionally the direct feedback of city representatives was used to identify gaps that could be used by existing or new businesses. This was especially valuable source of information. Urban planners working in municipalities play a central role in smart city development and implementation. Due to their role as coordinators they have an overview on missing links and services in smart city development.

Based on the assessment performed in Chapter 3 it can be concluded that municipalities do have already possibilities for the implementation of a performance measurement on different levels. These systems however do not entirely cover the needs that municipalities have at the time being:

- **Neighbourhood and city certification frameworks** are already established systems. Their main advantage for the municipality is the simplicity (since they are fully developed systems), the involvement of (local) consultancies performing the assessment or audit and the high profile (established frameworks are well recognised). Disadvantages include the scope ï most systems are available only on quarter level, missing flexibility (defined set of criteria) and costs that occur for every assessment and certification.
- **Standardisation services** have similar application like the CITYkeys performance measurement system. Advantages include the standardised set of indicators that are commonly used. This can however be also a disadvantage in case the municipality

wishes to integrate other indicators. A consultant might be necessary to provide an assessment. Another disadvantage is the scope of these systems. They can either be used on project or on city level. Thus the requirement to show contributions of a project to city targets can proof to be difficult.

- **International indices and other frameworks**: This includes city indices, awards and assessment frameworks. The advantage of these systems is the simplicity of the results and the possibility of comparison of different environments. In discussions city representatives noted that city indices are of low use for their daily work. While they might be of use on higher governmental levels or for politicians they do not provide the necessary detail of assessment results that can be used by the administration. Often they lack flexibility because a fixed set of indicators or criteria is being used.
- **Open data platforms and interfaces**: Both commercial and non-commercial solutions exist on the market. Their implementation can be done directly by the IT department of a municipality or via IT provider. CITYkeys can be applied to define the outcome of the system. A large part of the work performed in CITYkeys was the development of a KPI framework and identification of possible data sources. Despite the IT developments in WP2 any open data system can be adapted to incorporate a comprehensive KPI set such as the one developed by CITYkeys.
- **Public-funded research and demo projects**: Many cities participate in public funded projects which come together with an establishment of a performance measurement framework. The advantage of projects is the availability of funding and expertise provided by academic institutions. The main disadvantage is the short-term duration of these projects. While the development for municipalities involved in these projects might be easy it can proof to be difficult if the framework is to be applied for other cities.

Gaps occur in the following fields of application:

- **Assessment services:** There is no performance measure system that is comprehensive and includes both city level and project level. Therefore also the assessment of the contribution of a project to targets set in the municipal strategy is not easy to do.
- **IT platform implementation:** Open Data Platforms are already available but they do not include a comprehensive KPI set that can be used to visualise the results (although visualisations are available to some extent).

CITYkeys can provide an opportunity to fill both gaps. CITYkeys has advantages of being comprehensive and flexible. User-friendliness, compatibility, security and privacy issues need to be addressed during the planning phase to be effective.

Direct feedback was collected during surveys performed in Task 1.1 and during discussions and feedback rounds organised within regular CITYkeys project meetings. In the survey performed in Task 1.1 city representatives indicated a missing set of indicators on project level that is transversal and would allow for the assessment of the contribution to city strategy or smart city agenda. Further obstacles and gaps include the lack of integration of the measurement process in the municipality, uncomplete performance measurement chain (missing strategy, common vision, data or infrastructure to obtain data), missing interdepartmental structures to share costs/savings or increased work load caused by the measurement process. (Kontinakis & De Cunto 2015: 24)

At the city level city representatives see several obstacles in the implementation of performance measurement. Most of these refer to the missing experience or interest in such systems or smart city strategies as their basis. A huge problem for cities is the collection of data. The necessary data is either not available or scattered over several municipal departments. The cooperation between departments is difficult due to the complexity of coordinating so many persons and

moreover through the initial fear of being tracked. As in the case of the project level assessment a crucial issue is the lack of resources. (Kontinakis & De Cunto 2015: 19)

In discussions during project meetings city representatives expressed the following gaps that could be utilised for a business uptake:

- support during the implementation phase,
- service and maintenance,
- support of procurement on the project level,
- informed co-creation process on the city level,
- business development ï ensuring transparency and accessibility of municipal strategies so that itôs evident which services are needed,
- comparison of data sets between two dates ï assessment of progress and reasons behind,
- comparison between a certain project and the city level.

On the contrary the comparison between two cities is not seen as essential. The survey of Kontinakis and De Cunto lists additionally improvements of different kinds that would improve significantly the implementation of performance measurement. These improvements need to become subject to additional assessments. It however provides one issue that cannot be solved only by cities and brings up a business opportunity for the private sector: ñTechnical guidance on how to select, set-up and run such a frameworkò. (Kontinakis & De Cunto 2015: 19)

Based on these inputs the following business opportunities have been identified:

- **Assessment and consulting services** ï considering data and targets on project and city level.
- **IT services based on open data solutions** ï utilising the CITYkeys performance measurement system.
- **Performance measurement platform** ï used for support of business development, local market alignment and support of procurement procedures

5. NEW BUSINESS OPPORTUNITIES

The following chapter outlines the setup of the identified business opportunities for new and existing companies. Each service is described with a scheme and the Canvas template. The scheme has been designed to support discussions with cities.

5.1 Assessment and consulting services

Many new opportunities that arise from the application of the CITYkeys performance measurement system are related to assessment and consulting. New services can occur on city level to support the development and evaluation of strategies and support decision making. On project level new services should be developed to allow for assessment of the success of projects, support their planning, allow upscaling and show the contribution to city strategies and targets.

A large amount of data and extensive assessment are necessary before a proper development process for a site can start. This includes data from the municipality that can already be available in a data platform but also project specific-data for the site. Municipalities often lack resources to perform detailed assessment of such kind. This role can be taken over by a consultancy (either established or new). The available CITYkeys performance measurement system can be used as developed solution and applied for the needs of the assessment. Target group of such service depends on the particular setup of the project or of stakeholders involved in the development process. Customer can be the municipal administration, a group of stakeholders lead by the municipality or a private enterprise such as project developer. Institutionalisation of this setup can be reached by establishing an umbrella association training the consultancies. Based on the situation in the city this setup can differ. A scheme of this setup is shown in Figure 10.

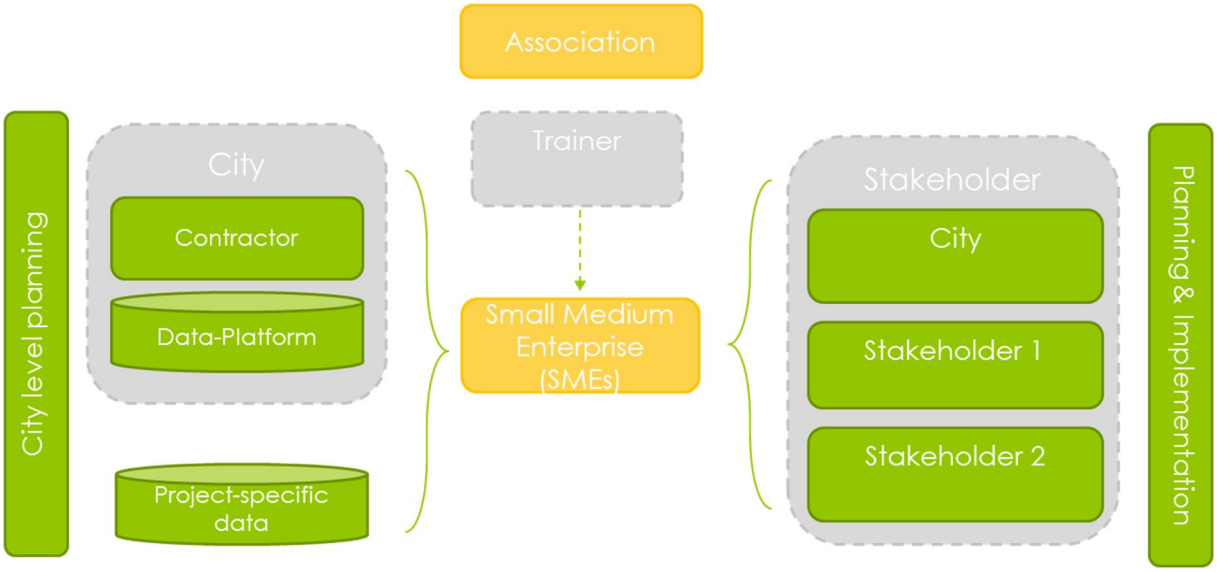

Figure 10 Setup of assessment or consulting services with the involvement of SME

Figure 11 outlines elements of the business outline for assessment and consultation services. The main value propositions for the municipality or the project developer are tailored assessment and development of scenarios. The service can be subject to public procurement. If this is not legally required an online inventory or web-presence can be used to reach customer

segments. The service can be offered once or regularly depending on the needs. An application of the CITYkeys framework can be necessary if flexibility (e.g. due to specific KPIs in the municipal strategy) is required. The SME will need human resources and IT equipment to perform the assessment. Key partners (apart from municipalities) are other stakeholders owning the data that is necessary to perform the assessment. Revenues come from the contracting party for the assessment service. Costs include staff costs and IT infrastructure (mainly as investment, maintenance costs should not be too high).

<table>
<tr><td rowspan="2"><u>Key partners</u>
Stakeholders owning data</td><td><u>Key activities</u>
Assessment
Application of KPIs</td><td rowspan="2"><u>Value propositions</u>
Tailored assessment
Scenario development</td><td><u>Customer relationships</u>
One-time service
Retention</td><td rowspan="2"><u>Customer segments</u>
Municipal administrations
Project developers</td></tr>
<tr><td><u>Key resources</u>
Human resources
IT equipment</td><td><u>Channels</u>
Web-presence
Procurement</td></tr>
<tr><td colspan="3"><u>Cost structure</u>
Staff costs
IT infrastructure costs</td><td colspan="2"><u>Revenue streams</u>
Payment for the assessment service</td></tr>
</table>

Figure 11 Business outline for assessment or consulting services

5.2 IT services based on open data solutions

The application of open data solutions can be performed directly by the municipal department responsible for IT or via IT provider. Either way offers opportunities for SMEs to take over a part of this development process. Outsourcing IT implementation can solve resource problems and stimulate the local economic value creation. CITYkeys provides data set definitions and KPIs that can be applied for the outcome visualisation of an open data platform. Requirements on the development of data platforms and information management systems include compatibility, stability, safety and user friendliness.

Another service possibility occurs after the implementation of the platform. An open system provides the possibility for SMEs offering software development to develop applications that make use of the data in the platform. By docking applications to APIs solutions on top of the system can be created offering services to citizens, businesses or the municipal administration. For this purpose also the CITYkeys performance measurement system with its KPIs can be used as basis to develop applications. A setup for this business is shown in Figure 12. An involvement of SME in this case creates or increases the local economic value. The used technology, data sources and the setup of the platform depend on the use case. The SME takes

care of the development and operation of the platform and can contribute on the further development of the platform or give feedback on the improvement of data sources.

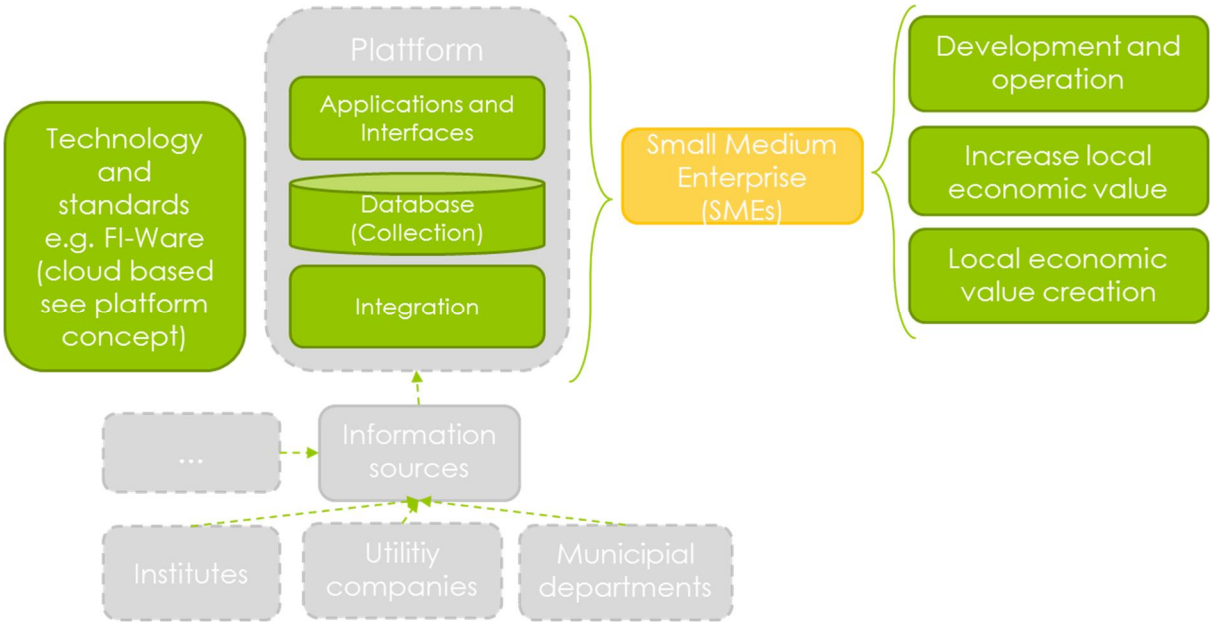

Figure 12 Setup of the involvement of SME in the application open data solutions

Different business models are possible (see also Figure 13). The SME can use revenue stream from advertisement in the application, from usage fees or access to premium / advanced contents. Customers can be citizens, local companies or the municipality. Key partners are platform operator, municipality and stakeholders owning the data if this is the case. Human resources and IT equipment are necessary to perform software development, coding and user experience testing. Business incubators are very suitable platform to support this setup.

<table>
<tr>
<td rowspan="2"><u>Key partners</u>
Stakeholders owning data
Platform operator
Municipality</td>
<td><u>Key activities</u>
SW development
Coding
UX testing</td>
<td rowspan="2"><u>Value propositions</u>
Tailored applications of different kind</td>
<td><u>Customer relationships</u>
Retention</td>
<td rowspan="2"><u>Customer segments</u>
Citizens
Businesses
Public administration</td>
</tr>
<tr>
<td><u>Key resources</u>
Human resources
IT equipment</td>
<td><u>Channels</u>
Web-presence</td>
</tr>
<tr>
<td colspan="3"><u>Cost structure</u>
Staff costs
IT infrastructure costs</td>
<td colspan="2"><u>Revenue streams</u>
Advertisement
Usage fees
Premium content access fees</td>
</tr>
</table>

Figure 13 Business outline of IT services based on open data solutions

5.3 Overall performance measurement system

The main business opportunity arising from CITYkeys is the implementation of an overall performance measurement system. Such system requires combination of several approaches (data collection and maintenance, calculation and provision via visualisation) and technologies (IT). Since the effort and requirements on expertise are quite high it can be applied in a project or by a consortium of several SMEs. The system can be used for services described above (assessment, basis for the development of new application) but it brings also a variety of additional services:

- **Support of business development**: Municipalities receive numerous queries from companies offering services or solutions. Often these solutions are already in place but this is not visible to companies since they do not have deep insight into city needs and strategies. A publicly accessible performance measurement system would allow to see what is required in a city.

- **Local market alignment**: Stakeholders involved in a smart city development come from different expert fields and are of different professions. Not all of them have technical skills to understand which performance or impact certain measures will have or how the status in the city looks like. A performance measurement system can be used as an application to establish common language between stakeholders.

- **Support of procurement procedures**: A performance measurement system can be used by municipalities to provide requirements for procurement procedures based on the actual situation and the need to meet city targets.

The main question that arises is to which extent the municipality should take care, implement and maintain the developed system. In Figure 14 the system is operated by the municipality but set up by a private company. It is also possible that the whole system is set up by the municipality or that the operation is done by a private enterprise (e.g. by having revenues from usage fees). This depends on the local needs and conditions and should be decided before the design phase. Criteria that should be taken into consideration are security and privacy issues, available resources, operational strategies and aimed setup of the usage model.

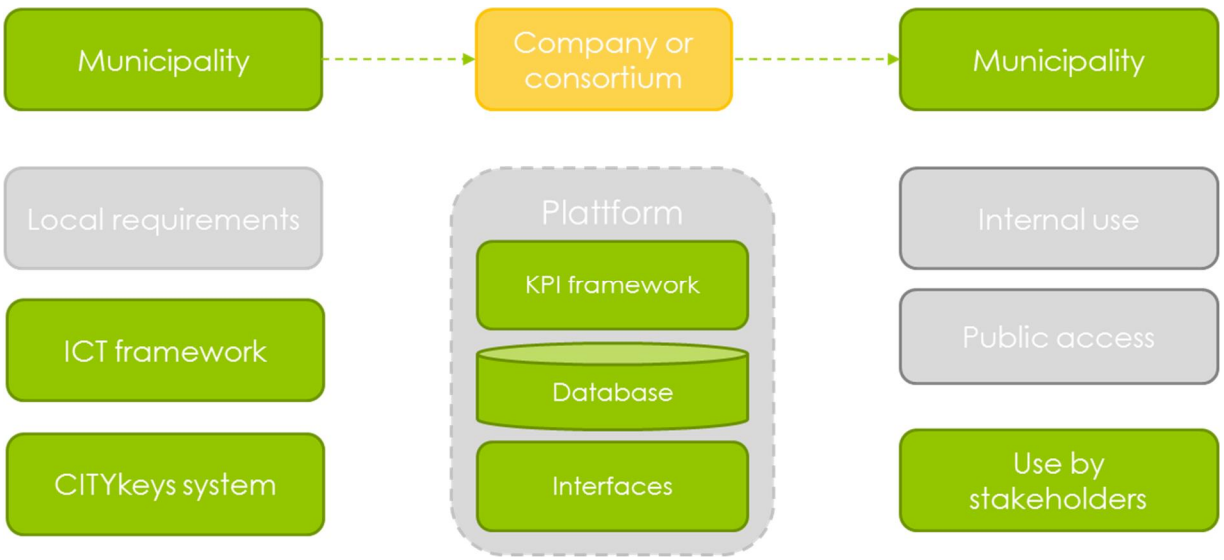

Figure 14 Setup of the overall performance measurement system

Figure 15 shows the business outline for an overall performance measurement system. As stated before variations are possible and should be designed based on the situation and needs. The presented structure shows a mixed model of private and public services. For the implementation of the solution the main customer segment is the municipality who is interested in an integrated platform. The company or consortium of companies provides consulting services for the identification of data sets, implementing the KPI framework and providing IT infrastructure for the system. Key partners include (as in previous cases) stakeholders owning the data in case not all data is owned by the municipality. Resources consist of staff of different professions and IT equipment. Revenues come from the setup contract or from maintenance payments.

The development of this service / technology can also be subject to work of startups in business incubators. Several fields of expertise can be combined into one project and startups can develop service parts that can be offered also to other customers.

<table>
<tr>
<td rowspan="2"><u>Key partners</u>
Stakeholders owning data</td>
<td><u>Key activities</u>
Consulting
IT infrastructure
SW development</td>
<td rowspan="2"><u>Value propositions</u>
Integrated platform</td>
<td><u>Customer relationships</u>
Long-term maintenance
Setup only</td>
<td rowspan="2"><u>Customer segments</u>
Municipal administrations</td>
</tr>
<tr>
<td><u>Key resources</u>
Human resources
IT equipment</td>
<td><u>Channels</u>
Procurement</td>
</tr>
<tr>
<td colspan="3"><u>Cost structure</u>
Staff costs
IT infrastructure costs</td>
<td colspan="2"><u>Revenue streams</u>
Payment for the setup
Maintenance service payments</td>
</tr>
</table>

Figure 15 Business outline for the performance measurement system

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Summary of achievements

The work that lead to this deliverable consisted of the assessment of existing systems and their applicability to performance measurement in a city. The CITYkeys performance measurement framework can be used to extend existing services and find new fields of application. Among others, cities use performance measurement system for the assessment of strategies, projects and contribution of projects to strategies. Basic requirements include flexibility, user-friendliness, security, compatibility and comprehensiveness.

Gaps occur in the field of assessment services and IT platform implementation. Currently there is no performance measure system that is comprehensive and includes both city level and project level. Therefore also the assessment of the contribution of a project to targets set in the municipal strategy cannot be easily performed. Open Data Platforms are already available but they lack a comprehensive KPI set. CITYkeys can provide an opportunity to fill both gaps. CITYkeys has advantages of being comprehensive and flexible. User-friendliness, compatibility, security and privacy issues however need to be addressed during the planning phase to be effective. The gaps in combination with the application of the CITYkeys performance measurement system bring new business opportunities for service and technology providers.

Opportunities for assessment services occur on city level by supporting the development and evaluation of strategies. On project level new services can be provided for the assessment of the success of projects, for project planning and to show the contribution of a project to city strategies and targets. This role can be taken over by a consultancy (either established or new). The available CITYkeys performance measurement system can be used as developed solution and adapted for the needs of a municipality.

An open data platform provides opportunities for SMEs offering software development of applications that make use of data stored in the platform. This way, additional services can be offered for citizens, businesses or for the municipal administration. In this case also the CITYkeys performance measurement system with its KPIs can be used as basis.

The main business opportunity arising from CITYkeys is the implementation of an overall performance measurement system. Development of an overall system requires different professions to combine several approaches and technologies. The result is an implemented open data platform providing visualised results from calculated KPIs. The system can be used for services described above (assessment, basis for the development of new application). I can also offer a variety of additional services. An overall CITYkeys performance measurement system can be used to support business development ï publicly accessible results allow to see what is required in a city. Another possible application is the alignment of local market. The performance measurement system can be used as an application to establish common language between stakeholders (using KPIs that can be understood by most of the stakeholders). For the municipal administration such system can support the procurement procedures. In this case performance measurement is used as one of the information sources for the setup of procurement procedures. This way procurement requirements can be adjusted on the actual situation and the need to meet city targets.

This deliverable outlines which opportunities for businesses occur. A concrete business model should be developed by companies wanting to offer a service based on local conditions and needs. All three settings are suitable for startups and can be provided as possibilities for project teams in business incubators.

6.2 Relation to continued developments

This task was scheduled at the end of the CITYkeys project to show how the developed system or parts of it can be used in future applications. It can also serve as baseline for future research projects that deal with the demonstration of smart city solutions or information management in cities.

6.3 Other conclusions

With regards to the future change in the service provision by municipalities the UK Department for Business, Innovation & Skills performed a survey on how these services are likely to change in the future. The survey investigated challenges for municipal administrations and how they will most probably have to rethink and innovate their services. The survey expects that future services of municipalities will change (BIS 2013: 5-6):

- by outsourcing to outcome-based service contracts,
- integration of services (backoffice and front line service),
- online service provision,
- provision of data to enable new services and
- reduction of service demand.

The service settings that can be developed based on CITYkeys are suitable for the change in municipal service provision but also fit the existing setups. In any case a consideration of how municipality aims to organise its services and set up business environment to support smart city development needs to be considered in an early stage to adjust the development.

7. ACRONYMS

API.....Application Programming Interface

IT/ICT.....Information (and Communication) Technologies

KPI.....Key Performance Indicator

SME.....Small and Medium Enterprise

SW.....Software

UX.....User Experience

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